EXPERIMENTAL TEST CONCEPT FOR A CARGO DATA INTERCHANGE SYSTEM (CARDIS)
Volume II: Appendixes

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FINAL REPORT

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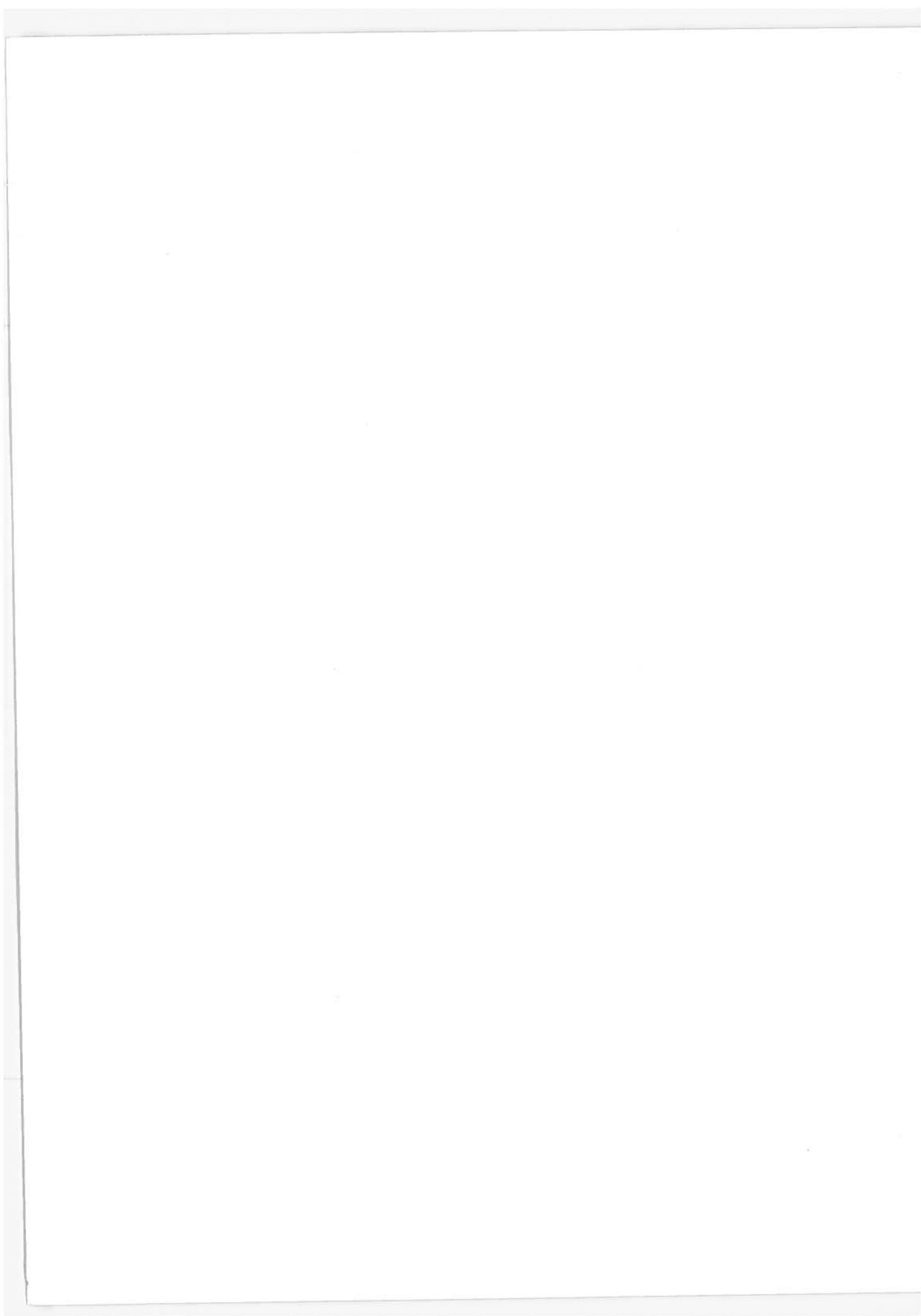for Environment, Safety and Consumer Affairs
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16. Abstract

This report includes the recommended CARDIS experimental test system functioncal capabilities. It identifies the CARDIS functions that are inherent to an information exchange capability and optional systems which are required by the transportation related industries.

The criteria to evaluate the various system functions selected for implementation by test participants are included as are the CARDIS test objectives.

Volume I contains the CARDIS test concept, functional analysis, and test objectives.

Volume II contains the details on CARDIS functional modules.

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PREFACE

Volume I of Computer Sciences Corporation's report on the CARDIS concept is concerned primarily with developing a test concept that can be used to evaluate various functions that are associated with a CARDIS-compatible computer facility. The three categories of CARDIS functions identified include those functions that perform basic operations required to transmit data between transportation industry participants, functions that are common to all, and functions that perform specific user operations required only by various segments of the transportation industry.

Volume I contains all of the test CARDIS concept information and recommendations.

Volume II is methodological in character and may be consulted to obtain details of CARDIS functions. Volume II includes the analysis and rating criteria of some candidate CARDIS functions.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

°F   -40   0   32   98.6   212
°C   -40   -20   0   20   37   40   60   80   100
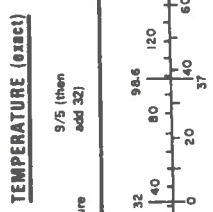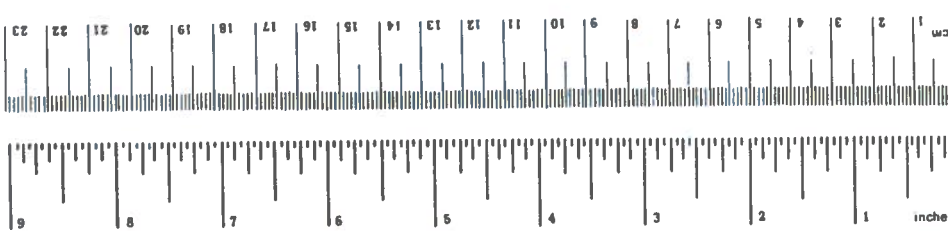
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APPENDIX A - CANDIDATE CARDIS FUNCTIONS

The functions chosen for possible CARDIS inclusion arise from the work done during the Phase I program by CSC, TDCC, and NCITD. Additions to the list have also been made as a result of subsequent conversations with potential CARDIS users. The following list cannot be considered exhaustive. However, it is hoped that the methodology and form of presentation will allow the analysis of additional functions as further research may indicate.

Each function is analyzed in accordance with the following outline. After the written analysis, each function is weighted in accordance with the benefit and system impact criteria developed in Appendix B.

In all, 31 functions have been proposed for inclusion within CARDIS comprising both system and application oriented modules. At this point it is somewhat difficult to define the point at which basic CARDIS system functions end and application begins. However, the impact on basic system standards and design parameters of application must be assessed, since many of these will, in fact, be implemented in participating CARDIS facilities. Thus, many aspects of system operation such as data security and integrity may well rest on the fact that data stored within CARDIS must be available for critical application functions.

Of the original 31 functions proposed, many have been consolidated and others eliminated to keep the list manageable. Accordingly, 18 functions have been selected for inclusion in this appendix.

1. DESCRIPTION

   A definition of the function to be performed with a description of its use within CARDIS.

2. GENERAL BENEFIT

   Description of the value of the function to expediting shipment or otherwise enhancing system performance.

3. UTILITY EVALUATION

   Where possible, the actual impact on the cost of paperwork is assessed by:

   a. Determining costs based on current manual operation where the function already exists.

   b. Determining the cost of manually performing the function under the assumption of a comprehensive CARDIS system minus the specific function under analysis.

   c. Determining the cost of performing the function under the assumption of comprehensive CARDIS operations including the function.

   Additionally, an assessment is made in qualitative terms by discussing other parameters concerning the functional utility to the shipment, e.g., Administration, Financial, Utilization, Control and Service.

4. SYSTEM IMPACT OR IMPLEMENTATION IMPLICATIONS

   When adding a function to CARDIS, determine impact on CARDIS business and utility, operational factors, managerial factors and technological aspects of CARDIS.

5. EVALUATION CRITERIA APPLIED TO FUNCTIONS

   Based on the preceding, work sheets are filled out using a scale of ± 5 to ascertain the relative impact of the function on evaluation criteria. These are then analyzed using the methods previously described to obtain category impacts.

A.1 ELECTRONIC DATA (MESSAGE) TRANSFER (TABLE A-1)

A.1.1 Description

This function is basic to CARDIS system operation. It provides for the electronic transfer of data between parties to the shipment process. The process can be briefly described as follows:

1. The originator of data, for any reason whatsoever, establishes the need to impact information to one or more parties to the shipment (the most likely data originator for most transactions will be either the shipper or the forwarder representing the shipper).

2. A message is prepared in CARDIS acceptable format at the CARDIS-compatible facility. Message formatting can be transparent to the user. The destination(s) is established by an appropriate address code which permits the system to properly route the message.

3. The message is transmitted to a CARDIS compatible facility where it is interrogated and then processed by the appropriate service program.

4. If the addressee is on-line in a receiving mode, the message is delivered. If not, it is stored at the addressee's CARDIS compatible facility for transmission when the receive terminal comes on-line. If the recipient facility provides automatic answer capability, CARDIS can deliver the data to the addressee automatically.

The result is message-switching in its classical sense. All parties to the shipment must have access to the CARDIS network to assure data interchange. An additional feature for this approach could be the introduction of shipment oriented addressing in which case a system directory would aid in routing messages.

Electronic data transfer between shipment parties may consititute virtually the entire system function or serve as an adjunct to a broader CARDIS concept. The benefits and impact assessment for this function is predicated on a data transfer CARDIS concept in which user system interface is the prime CARDIS goal. Within a limited CARDIS concept, some users may choose to utilize CARDIS solely for data transfer in which case the benefits derived herein would also apply.

With respect to the broader concept for CARDIS, it must be realized that CARDIS compatible facilities must be able to interchange data electronically as a prerequisite for many other functions performed.

A.1.2 General Benefit

The introduction of a message transfer capability between nodal elements will greatly facilitate the movement of goods and should serve to eliminate much of the paperwork associated with the shipping process, especially if the electronic messages are transferred between participants with an ADP capability. While actual preparation can fall out from data transfer, supposing the existence of appropriate EDP facilities, additional benefits can be obtained by virtue of data transfer. These might include:

1. Rapidity of data transfer.

2. Ability to interface messages directly with the computer, thus saving operator entry time. (It cannot be assumed, however, that documentation preparation is reduced by this technique unless the function of document preparation is included. However, where standard documents are employed, a degree of automatic preparation will result by virtue of the ability to reprint from an encoded document format).

3. Ability to provide specific user to user exchange which may answer many of the needs for inquiry and ultimately result in reduced data transmission.

4. Facilitation of in-house EDP which can perform many proposed industry functions for a single user.

A.1.3 Utility

Message transfer in itself derives its utility in the main from the speed and ease with which data is exchanged. Once data is captured electronically, it must somehow be stored (implying a data base capability apart from pure message switching) to allow replicated use for the purposes of fulfilling CARDIS documentation functions. Nevertheless, it is safe to assume that a minimum of 10 percent of shipment documentation can be saved by virtue of the introduction of a strictly message transfer capability without reference to storage or data base capabilities.

A.1.3.1 Direct CARDIS Benefits

If one assumes a 10 percent reduction in paperwork, then based on documentation costs outlined in "Paperwork or Profits," a savings of approximately $35.00 per shipment can be anticipated. Additionally, some reduction in paperwork preparation time may be anticipated along with significant reduction in transfer time (from days to hours or minutes if required).

Although electronic data interchange implies a degree of user sophistication, there is no real need to assume any implementation beyond terminals for users. However, one can estimate the charges for transferring data by referring to the tariffs and computing the number of characters to be transmitted.

Assuming all export and import documents are to be transmitted electronically, that out of 360 copies some 200 must be individually routed, and that an average message will contain 500 characters: then, each shipment will require 200 x 500 = 100,000 characters of transmission.

Under the assumption that Packet Communications Inc. (PCI) includes terminal costs, an approximate cost of $2.00 would result, assuming fully loaded packets with a more realistic figure of $4.00 assuming an average of 50 percent efficiency. However, costs have been dropping significantly and should be reevaluated.*

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* Using the TELENET value added rate of $0.60 per thousand packets of 128 characters, each shipment will cost $0.60 for data transmission (assuming these rates are current). Of course, terminal costs must be added to this figure.

Under these assumptions, a net per shipment documentation cost saving of $31.00 may be anticipated.

A.1.3.2 Administrative

Some impact may be expected in the areas of flexibility and the ability to handle peak loads.

A.1.3.3 Shipment Financial

By speeding paperwork, it should be possible to realize benefits in all of these areas.

A.1.3.4 Utilization

Some effect, though minor, may be anticipated based on reduced paperwork delays.

A.1.3.5 Control

Aside from some effect on progress checking, no benefits are foreseeable in this category.

A.1.3.6 Service

Based on speed of information transfer, one should expect concomitant benefits in service.

A.1.4 System Impact

System standards are necessary to implement a message transfer function for data interchange. This will imply a study and negotiating team effort to be followed by continued maintenance for update and foreign coordination.

A.1.4.1 Business and Utility

Based on the stated preference of many organizations for this mode of operation, provision of the data transfer function will have a significant beneficial impact on CARDIS.

A.1.4.2 Operational

The message transfer function presents few operational problems once suitable standards are in effect.

A.1.4.3 Managerial

Again, there seems to be little impact in this area.

A.1.4.4 Technological

Although the techniques are well known, the establishment of a series of CARDIS message switching facilities is a formidable task requiring intelligent application of modern computer and telecommunication technology.

TABLE A-1. ELECTRONIC DATA (MESSAGE) TRANSFER

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept [X]						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving [$35.00]						
DIRECT CARDIS BENEFITS		200			170	85
Reduced Paperwork: Preparation Time	10		5	50		
Reduced Paperwork: Transfer Time	10		5	50		
Reduced Paperwork: Filing	5		2	10		
Reduced Paperwork: Documents	8		4	32		
Reduced Paperwork: Copies	3		4	12		
Accuracy	4		4	16		
ADMINISTRATIVE		195			140	72
Improved Staff Productivity	10		3	30		
Lower Skill Levels (Rec. & Train)	7		3	21		
Flexibility re Changes	6		4	24		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5		5	25		
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			119	95
Faster Payment	6		5	30		
Reduced Demurrage	10		5	50		
Reduced Financing: "In Pipeline"	2		5	10		
"Buffer Stock"	4		5	20		
Improved Credit Control	3		3	9		
UTILIZATION		110			110	100
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		5	40		
Less Need for Additional Facilities	4		5	20		
Delay Avoidance at Ports	10		5	50		
CONTROL		120			48	40
Reduced Progress Checking	10		2	20		
Accurate Timely Statistics	8		2	16		
Decisions based on Better Info.	6		2	12		
SERVICE		115			92	80
Speedier Delivery	10		4	40		
Greater Delivery Reliability	8		4	32		
Market Impact (Based on Above)	5		4	20		

TABLE A-1. ELECTRONIC DATA (MESSAGE) TRANSFER (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_1$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			153	96
Broadens Participation	10		5	50		
Generates Revenue	7		4	28		
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			-62	-14
Transaction Rates	10		-1	-10		
Real Time Transactions	10		0	0		
Increases File Seeks	8		-1	- 8		
Per Message Processing	7		0	0		
Requires Special File Maintenance	7		-1	- 7		
Increases Frequency of Audit	6		0	0		
Increases Print Load	2		-1	- 2		
Requires Security Procedures	10		-1	-10		
Increases Complexity of On-Line Environment	9		0	0		
Creates Additional Communication Traffic						
User-Center	3		0	0		
Inter Center	5		-1	- 5		
Creates Maintenance Difficulties	5		0	0		
Complicates Facilities Management	5		-4	-20		
MANAGERIAL		225			-112	-50
Requires Special Standards Attention	3		-5	-15		
Decreases Need for Human Intervention	5		-2	-10		
Requires Specialized Skills	4		-3	-12		
Complicates Billing	6		-1	- 6		
Complicates Interfaces	9		-5	-45		
Increases Audit Trail Capability	8		-3	-24		
Complicates Man/Machine Interface	10		0	0		
TECHNOLOGICAL		240			-134	-56
Complicates System Design	10		-5	-50		
New Developments	10		-2	-20		
Hardware Impact: Main Frame	3		-1	- 3		
Front End & Switching	2		-5	-10		
Terminals	3		0	0		
On-Line Storage	2		-1	- 2		
Software: Operating System	4		0	0		
Files	3		-1	- 3		
On-Line Applications	2		-3	- 6		
Off-Line Applications	1		-3	- 3		
Financial - Development Costs	5		-5	-25		
- Financing (Incremental Costs)	3		-4	-12		

A.2 FOREIGN AND DOMESTIC INTERFACE (TABLE A-2)

A.2.1 Description

One of the major functions of CARDIS will probably be as a clearing house to interface with existing and planned shipment systems. To date, the foreign systems have been run by customs and require some means of on-line entry once the paperwork arrives at the destination country (LACES is a prime example). Plans exist to expand the capability of these systems to serve export and import needs for the coutries involved. Moreover, with various foreign ports contemplating similar systems, it is obvious that major benefits would accrue in processing paperwork if direct data transmission to these systems could be implemented.

This topic was treated in some detail in the Phase I Report. The general observations and choices presented there remain valid.

A.2.2 General Benefit

Automated interface with domestic and foreign systems should greatly facilitate the transfer of data during the shipping process. For example, once the shipment manifest is prepared in machine readable format, there is no reason why the data could not be sent directly to the overseas customs or port system for clearance processing. A number of options for foreign interface must be considered. These include:

> Existing and planned foreign systems achieving CARDIS compatibility
>
> A CARDIS 'Gateway Center" or facility function as a clearing house for domestic messages to and from foreign systems
>
> Founding of foreign CARDIS compatible facilities.

Some or all of these options may be implemented. Thus, if the economic viability of the CARDIS approach to providing services is demonstrated, each of these, as well as other approaches, will prove beneficial in facilitating data interchange with overseas locations.

A-10

The other area in which major benefits may be realized is in facilitation of import documentation. For the most part, CARDIS facilities within the United States will prove especially beneficial in originating and simplifying paperwork for exports. To obtain a corresponding benefit for imports, it becomes important to extend the CARDIS concept for data interchange, either through cooperating CARDIS compatible facilities abroad or by virtue of interface with similar systems operating abroad. Additionally, the mechanism for completing the data transfer process for exports must also be considered. Once goods leave the United States, automated transfer of data to foreign customs systems and/or cooperating foreign facilities will provide benefits abroad corresponding to those which can be realized during the initiation of the shipping process.

A.2.3 Utility

A.2.3.1 Direct CARDIS Benefits

Probably the best technique for evaluating utility for overseas interface is to relate it to potential savings based on domestic CARDIS operations. For example, with appropriate foreign locations, a similar savings for import can be achieved to that obtainable for export. For export itself, much of the manual paperwork abroad would have to be maintained without overseas CARDIS interface.

As a minimum, suitable CARDIS interface would eliminate data entry via CRT by an operator of a foreign customs system. In this case, assuming entry of 1000 characters per shipment, there are approximately 10 minutes of operator entry time or $2 including machine costs. At the upper limit, the entire CARDIS document savings (approximately $250 per shipment) may be attributed to having a suitable foreign interface. The answer, of course, lies somewhere in between. The net utility would then include the following.

1. Cost savings to U.S. parties probably averaging $10 per shipment for export and the same for import assuming immediate entry into the system.

2. Cost savings of up to $250 per shipment when foreign documentation for imports is considered.

3. Extension of essentially all CARDIS direct benefits to the entire shipping cycle.

A.2.3.2 Administrative

Suitable foreign and domestic interfaces will extend system benefits significantly in this area.

A.2.3.3 Shipment Financial

In this case one may assume that provision of interfaces will result in as much impact on imports as any functions provided domestically would have on exports. Also, by improving procedures, it should be possible to realize tremendous savings associated with documentation and other transportation-related functions.

A.2.3.4 Utilization

Again, the benefits are significant in this area.

A.2.3.5 Control

Some benefits in control may ensue, although the major impact would arise more from other functions than interface alone.

A.2.3.6 Service

Service should exhibit marked improvement as a result of foreign and domestic interface capability.

A.2.4 System Impact

Efficient system interface will require some ingenuity to be handled effectively. There are a number of approaches possible, each of which has merit. In all cases, however, significant groundwork must proceed with respect to international standards for cargo data communications prior to actually implementing the interface. Such interfaces already exist within many shipping companies; it now remains to extend this capability to other agencies and transportation companies.

One of the most promising overseas interface techniques is the establishment of a clearing house and message switch located, perhaps, at gateway communication points. With a single link to each major overseas system, it becomes possible to effect overseas interface for all CARDIS complexes within the United States. Alternately, a single foreign message switching facility could be used to concentrate traffic from multiple foreign interfaces.

A.2.4.1 Business and Utility

One should anticipate that this function may well be among the most important with respect to broadening participation in CARDIS and in all other aspects of this category as well.

A.2.4.2 Operational

Once procedures and standards have been set up, there should be relatively few operational problems.

A.2.4.3 Managerial

Managing and coordinating a spectrum of foreign and domestic interfaces will prove burdensome for government and industry groups working on the international scene.

A.2.4.4 Technological

Because of the diversity of interfaces encountered, one should expect some difficulties, at least initially, in development and implementation. In particular, the lengthy negotiating process may require significant design changes and modifications during the course of interface development.

BENEFITS	W_i	Max. Value $5 \sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5 \sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving $150						
DIRECT CARDIS BENEFITS		200			170	85
Reduced Paperwork: Preparation Time	10		5	50		
Reduced Paperwork: Transfer Time	10		5	50		
Reduced Paperwork: Filing	5		2	10		
Reduced Paperwork: Documents	8		4	32		
Reduced Paperwork: Copies	3		4	12		
Accuracy	4		4	16		
ADMINISTRATIVE		195			140	72
Improved Staff Productivity	10		3	30		
Lower Skill Levels (Rec. & Train)	7		3	21		
Flexibility re Changes	6		4	24		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5		5	25		
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			119	95
Faster Payment	6		5	30		
Reduced Demurrage	10		5	50		
Reduced Financing: "In Pipeline"	2		5	10		
"Buffer Stock"	4		5	20		
Improved Credit Control	3		3	9		
UTILIZATION		110			110	100
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		5	40		
Less Need for Additional Facilities	4		5	20		
Delay Avoidance at Ports	10		5	50		
CONTROL		120			48	40
Reduced Progress Checking	10		2	20		
Accurate Timely Statistics	8		2	16		
Decisions based on Better Info.	6		2	12		
SERVICE		115			92	80
Speedier Delivery	10		4	40		
Greater Delivery Reliability	8		4	32		
Market Impact (Based on Above)	5		4	20		

TABLE A-2. FOREIGN AND DOMESTIC INTERFACE (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			153	96
Broadens Participation	10		5	50		
Generates Revenue	7		4	28		
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			-62	-14
Transaction Rates	10		-1	-10		
Real Time Transactions	10					
Increases File Seeks	8		-1	- 8		
Per Message Processing	7					
Requires Special File Maintenance	7		-1	- 7		
Increases Frequency of Audit	6					
Increases Print Load	2		-1	- 2		
Requires Security Procedures	10		-1	-10		
Increases Complexity of On-Line Environment	9					
Creates Additional Communication Traffic						
User-Center	3					
Inter Center	5		-1	- 5		
Creates Maintenance Difficulties	5					
Complicates Facilities Management	5		-4	-20		
MANAGERIAL		225			-112	-50
Requires Special Standards Attention	3		-5	-15		
Decreases Need for Human Intervention	5		-2	-10		
Requires Specialized Skills	4		-3	-12		
Complicates Billing	6		-1	- 6		
Complicates Interfaces	9		-5	-45		
Increases Audit Trail Capability	8		-3	-24		
Complicates Man/Machine Interface	10					
TECHNOLOGICAL		240			-134	-56
Complicates System Design	10		-5	-50		
New Developments	10		-2	-20		
Hardware Impact: Main Frame	3		-1	- 3		
Front End & Switching	2		-5	-10		
Terminals	3					
On-Line Storage	2		-1	- 2		
Software: Operating System	4					
Files	3		-1	- 3		
On-Line Applications	2		-3	- 6		
Off-Line Applications	1		-3	- 3		
Financial – Development Costs	5		-5	-25		
– Financing (Incremental Costs)	3		-4	-12		

A.3 USER INTERFACE (TABLE A-3)

A.3.1 Description

It is a basic premise of the system that a range of interfaces will be required to allow ease of user access. This function of the system must then be considered in light of the range of specific formats and communication disciplines to be accommodated. The determination of the comprehensiveness of the interfaces to be provided will be of great interest in the definition of CARDIS standards, and these standards will in turn have a major impact on the requirements of operators of CARDIS compatible systems with respect to interface provision.

A CARDIS goal is to develop a set of codes and formats for inter-system message traffic. At this point, the provisions for terminal to system interface for individual centers is not certain. In fact, a recent recommendation by a SITPRO study group would leave the problem of individual system-user interface wholly at the discretion of the individual system (or system operator).

With this in mind, the CARDIS system operator is left with a two-faceted problem. A strict adherence to system standards will be required. However, depending on the course of CARDIS standards development, there may be a "menu" of defined user interfaces from which to choose with the choice left to individual user-operator negotiations to resolve.

A.3.2 General Benefit

A flexible set of user interfaces will greatly enhance the utility of the system by opening use to a wide range of large users. For users not currently automated, provision of a CARDIS terminal will probably be a function of the center operator, thereby minimizing most interface difficulties. When a participant uses a commercial facility for additional services, the design of a special interface may have to be considered.

The system standards effort must also consider those potential "in house" operators who will wish to become CARDIS compatible. In this case, the broadening of CARDIS standards may encourage such direct participation. The concept is not without precedence since Packet Switching and other value added facilities provide similar services for clients through use of a facility which translates to a system transmission standard. For CARDIS, however, the compatibility must go beyond transmission rates and protocols to encompass data formats and possibly other performance characteristics affecting system operation and integrity.

This issue must be considered central to the basic CARDIS concept.

A.3.3 Utility

A.3.3.1 Direct CARDIS Benefits

An adequate repertory of interfaces should significantly aid all direct CARDIS functions. The provision of flexibility with respect to terminal type can bring the paperwork processing interface closer to individual users with great impact on utility. Moreover, the elimination of indirect interfaces (e.g., cards and unnecessary document(s)) should result from a more liberal approach to interface provision.

A.3.3.2 Administrative

Again, the broader the interface provision, the more one can expect the system to provide in terms of these basic benefits.

A.3.3.3 Shipment Financial

The impact on these factors will result more from the rapidity with which paper is processed than by virtue of interfaces. However, there will be a strong indirect effect. Data controlling the movement of shipments can be processed by user application systems as soon as it is received from the CARDIS network, thus speeding the delivery processes.

A.3.3.4 Utilization

Much the same may be stated with respect to utilization as for shipment financial factors. Benefits are indirect but will still be significant.

A.3.3.5 Control

Control of the shipment will benefit in direct relation to the ease with which participating entities can exchange data. Accordingly, interfaces will play a major role in this factor.

A.3.3.6 Service

Again, service will improve as an indirect result of the interfaces provided.

A.3.4 System Impact

A.3.4.1 Business and Utility

The many advantages to the CARDIS business environment from broader interface capabilities are fairly obvious. The higher weighted factors under this category will benefit most while a somewhat lesser effect may be anticipated on Revenue Generation and Advertising.

A.3.4.2 Operational

Rather than adversely affect operations, it could be argued that a broader user interface capability will actually improve some aspects of the operation. Certainly, print loads and man/machine interface problems are alleviated.

A.3.4.3 Managerial

While presenting some increased difficulty in management, the impact should not be major.

A.3.4.4 Technological

Broadening the user interface capability will require that systems handle a repertory of communication protocols simultaneously. There can be expected to be significant impact on the architecture of individual CARDIS compatible facilities as the user

interface capability is is broadened. However, the techniques for accommodating
communication variability are well known and should not present any undue risk
in development.

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
<u>IMPORTANCE</u>						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
<u>DIRECT CARDIS BENEFITS</u>		200			141	71
Reduced Paperwork: Preparation Time	10		2	20		
Reduced Paperwork: Transfer Time	10		5	50		
Reduced Paperwork: Filing	5		3	15		
Reduced Paperwork: Documents	8		4	32		
Reduced Paperwork: Copies	3		4	12		
Accuracy	4		3	12		
<u>ADMINISTRATIVE</u>		195			107	55
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6					
Peak Handling Capabilities	7		5	35		
Reduced Demands on Data Recipients	5		4	20		
Managerial Efficiency	4		3	12		
<u>SHIPMENT FINANCIAL</u>		125			66	53
Faster Payment	6		3	18		
Reduced Demurrage	10		3	30		
Reduced Financing: "In Pipeline"	2		3	6		
"Buffer Stock"	4		3	12		
Improved Credit Control	3					
<u>UTILIZATION</u>		110			44	40
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		2	16		
Less Need for Additional Facilities	4		2	8		
Delay Avoidance at Ports	10		2	20		
<u>CONTROL</u>		120			82	68
Reduced Progress Checking	10		4	40		
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		3	18		
<u>SERVICE</u>		115			23	20
Speedier Delivery	10		1	10		
Greater Delivery Reliability	8		1	8		
Market Impact (Based on Above)	5		1	5		

TABLE A-3.   USER INTERFACE (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			148	93
Broadens Participation	10		5	50		
Generates Revenue	7		5	35		
Advertising Value	6		3	18		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			-187	-43
Transaction Rates	10		-3	-30		
Real Time Transactions	10		-3	-30		
Increases File Seeks	8		-3	-24		
Per Message Processing	7					
Requires Special File Maintenance	7					
Increases Frequency of Audit	6					
Increases Print Load	2		+2	+ 4		
Requires Security Procedures	10					
Increases Complexity of On-Line Environment	9		-5	-45		
Creates Additional Communication Traffic						
User-Center	3		-4	-12		
Inter Center	5		-4	-20		
Creates Maintenance Difficulties	5		-4	-20		
Complicates Facilities Management	5		-2	-10		
MANAGERIAL		225			-89	-40
Requires Special Standards Attention	3		-3	- 9		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4		-3	-12		
Complicates Billing	6					
Complicates Interfaces	9		-4	-36		
Increases Audit Trail Capability	8		-4	-32		
Complicates Man/Machine Interface	10					
TECHNOLOGICAL		240			-118	-49
Complicates System Design	10		-5	-50		
New Developments	10		-2	-20		
Hardware Impact: Main Frame	3		-4	-12		
Front End & Switching	2		-5	-10		
Terminals	3					
On-Line Storage	2		-4	- 8		
Software: Operating System	4		-2	- 8		
Files	3					
On-Line Applications	2					
Off-Line Applications	1					
Financial – Development Costs	5		-2	-10		
– Financing (Incremental Costs)	3					

A.4 CARDIS SYSTEM STATISTICS (TABLE A-4)

A.4.1 Description

Internal management statistics are needed for the efficient management, operation, control, and administration of the CARDIS facility. Included would be data relating to system usage, proper and improper attempts to access files resident in the network, billing data, relative amount of system utilization and other facts needed by the operator of a CARDIS network or a CARDIS service facility serving multiple customers.

A.4.2 General Benefits

The collection and analysis of internal management data will not produce any direct benefit to the users of CARDIS. There will be, however, a substantial secondary but intangible benefit in the form of an effectively managed CARDIS facility. Security and privacy of the data being transmitted via CARDIS system can be enhanced by monitoring system access. In addition, data relating to operations is necessary to guide planning for future improvements, expansion of system capacity and marketing CARDIS services.

A.4.3 Utility

With this single exception, all CARDIS functions analyzed in this appendix are concerned with benefits of direct interest to the user. Of course, the collection and analysis of internal management statistics should improve the quality of CARDIS service to users. Aside from this indirect benefit, the user will not derive any direct benefit of this function; for that reason, there has been no attempt to weight any of the expected CARDIS benefits in connection with this function.

A.4.4 System Impact

A.4.4.1 Business and Utility

Ostensibly, the inclusion of operating statistics will keep a CARDIS facility in tune with requirements as they develop. This should result in positive benefits for participation since a well run system will encourage broader use by the shipping community.

A.4.4.2 Operational

Instrumentation and statistical reporting will complicate on-line and off-line operations to some extent. On the other hand, one should anticipate benefits in facilities management as operations are tailored to actual use.

A.4.4.3 Managerial

One should anticipate benefits in this area although some time on the part of management will be required in administration. The net should be a gain as a result of system statistics.

A.4.4.4 Technological

Proper statistical data will have some impact on all developmental areas. The necessity for statistical information is apparent in the allocation of development funds.

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200				
Reduced Paperwork: Preparation Time	10					
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5					
Reduced Paperwork: Documents	8					
Reduced Paperwork: Copies	3					
Accuracy	4					
ADMINISTRATIVE		195				
Improved Staff Productivity	10					
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6					
Peak Handling Capabilities	7					
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4					
SHIPMENT FINANCIAL		125				
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
UTILIZATION		110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8					
Less Need for Additional Facilities	4					
Delay Avoidance at Ports	10					
CONTROL		120				
Reduced Progress Checking	10					
Accurate Timely Statistics	8					
Decisions based on Better Info.	6					
SERVICE		115				
Speedier Delivery	10					
Greater Delivery Reliability	8					
Market Impact (Based on Above)	5					

SYSTEM IMPACT	W_i	Max. Value $5\sum W_1$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			30	19
Broadens Participation	10		3	30		
Generates Revenue	7					
Advertising Value	6					
Facilitates use by Cooperating Systems	9					
OPERATIONAL		435			-34	-8
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8		-2	-16		
Per Message Processing	7		-2	-14		
Requires Special File Maintenance	7		-2	-14		
Increases Frequency of Audit	6					
Increases Print Load	2		-1	- 2		
Requires Security Procedures	10		-2	-20		
Increases Complexity of On-Line Environment	9		-2	-18		
Creates Additional Communication Traffic						
User-Center	3					
Inter Center	5					
Creates Maintenance Difficulties	5		5	25		
Complicates Facilities Management	5		5	25		
MANAGERIAL		225			109	48
Requires Special Standards Attention	3		-1	-3		
Decreases Need for Human Intervention	5		4	20		
Requires Specialized Skills	4		2	8		
Complicates Billing	6					
Complicates Interfaces	9		2	18		
Increases Audit Trail Capability	8		2	16		
Complicates Man/Machine Interface	10		5	50		
TECHNOLOGICAL		240			-11	-5
Complicates System Design	10		-1	-10		
New Developments	10					
Hardware Impact: Main Frame	3					
Front End & Switching	2					
Terminals	3		-1	-3		
On-Line Storage	2					
Software: Operating System	4		-1	-4		
Files	3		5	15		
On-Line Applications	2		5	10		
Off-Line Applications	1		5	5		
Financial - Development Costs	5		-3	-15		
- Financing (Incremental Costs)	3		-3	-9		

A.5 DATA ENTRY/UPDATE (TABLE A-5)

A.5.1 Description

This function is basic to most versions of CARDIS requiring file update during the shipment. It implies the ability to enter, add to, and modify records within the CARDIS compatible facility. The procedures for doing this must be carefully controlled to limit access and tampering. On the other hand, some ability for file maintenance is prerequisite to most of the functions envisaged for CARDIS.

A.5.2 General Benefit

On-line data entry will accomplish the following with respect to CARDIS operation:

1. Assure that file is a "living thing" containing all necessary current data concerning the shipment.

2. Allow expedient interface with other systems. ·

3. Provide the means for establishing and maintaining shipment records.

A.5.3 Utility

The utility of the update function is allied with the fact that it is a prerequisite for other functions, such as tracing and documentation preparation. It is possible to envisage a less capable CARDIS which could produce documentation and/or transfer messages by data entered into the system. However, the advantages of file maintenance would enhance other on-line functions such as inquiry and tracing.

A.5.3.1 Direct CARDIS Benefits.

The impact of this function on paperwork is profound, since most documentation associated functions cannot be performed without a capacity   for effective shipment file maintenance.

A.5.3.2 Administrative

Here again, the use of updated files will result in significant benefits for all evaluation criteria within this category.

A.5.3.3 Shipment Financial

Many of the applications which will result in significant savings will rely heavily on the ability to enter and update shipment records.

A.5.3.4 Utilization

Some benefits will accrue from use of files to assist in planning for and controlling utilization of capital equipment.

A.5.3.5 Control

The availability of a current shipment file including status, will be of enormous benefit in this area.

A.5.3.6 Service

Service which derives from control and other factors can be expected to show significant improvement by virtue of adequate shipment files.

A.5.4 System Impact

On-line data entry for file modification and update will, of course, be a major determining factor in system architecture.

A.5.4.1 Business and Utility

The maintenance of shipment files, by providing the means for performing many related applications, will encourage participation in CARDIS and provide subsidiary benefits in related business areas.

A.5.4.2 Operational

The problem of file maintenance in a generalized CARDIS network is fairly obvious. Many of the criteria in this category will require significant attention and support in the operational environment consisting of a network of CARDIS compatible systems tied together.

A.5.4.3 Managerial

Here too, one should anticipate a significant impact associated with file establishment and maintenance in an on-line environment.

A.5.4.4 Technological

Although most of the necessary techniques are well understood, a complicated system with an extremely rich environment of facilities and terminals may be anticipated with concomitant development difficulties.

TABLE A-5. DATA ENTRY/UPDATE

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200			164	82
Reduced Paperwork: Preparation Time	10		5	50		
Reduced Paperwork: Transfer Time	10		3	30		
Reduced Paperwork: Filing	5		4	20		
Reduced Paperwork: Documents	8		4	32		
Reduced Paperwork: Copies	3		4	12		
Accuracy	4		5	20		
ADMINISTRATIVE		195			173	89
Improved Staff Productivity	10		5	50		
Lower Skill Levels (Rec. & Train)	7		3	21		
Flexibility re Changes	6		5	30		
Peak Handling Capabilities	7		5	35		
Reduced Demands on Data Recipients	5		5	25		
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			94	75
Faster Payment	6		4	24		
Reduced Demurrage	10		4	40		
Reduced Financing: "In Pipeline"	2		3	6		
"Buffer Stock"	4		3	12		
Improved Credit Control	3		4	12		
UTILIZATION		110			66	60
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		3	24		
Less Need for Additional Facilities	4		3	12		
Delay Avoidance at Ports	10		3	30		
CONTROL		120			120	100
Reduced Progress Checking	10		5	50		
Accurate Timely Statistics	8		5	40		
Decisions based on Better Info.	6		5	30		
SERVICE		115			82	71
Speedier Delivery	10		3	30		
Greater Delivery Reliability	8		4	32		
Market Impact (Based on Above)	5		4	20		

SYSTEM IMPACT	W_i	Max. Value $5\sum_1 W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			110	69
Broadens Participation	10		4	40		
Generates Revenue	7		4	28		
Advertising Value	6		4	24		
Facilitates use by Cooperating Systems	9		2	18		
OPERATIONAL		435			−274	−63
Transaction Rates	10		−3	−30		
Real Time Transactions	10		−3	−30		
Increases File Seeks	8		−3	−24		
Per Message Processing	7		−4	−28		
Requires Special File Maintenance	7		−4	−28		
Increases Frequency of Audit	6		−2	−12		
Increases Print Load	2		+2	+ 4		
Requires Security Procedures	10		−5	−50		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		+3	+ 9		
Inter Center	5					
Creates Maintenance Difficulties	5		−4	−20		
Complicates Facilities Management	5		−4	−20		
MANAGERIAL		225			−134	−60
Requires Special Standards Attention	3		−5	−15		
Decreases Need for Human Intervention	5		−2	−10		
Requires Specialized Skills	4					
Complicates Billing	6		−2	−12		
Complicates Interfaces	9		−3	−27		
Increases Audit Trail Capability	8		−5	−40		
Complicates Man/Machine Interface	10		−3	−30		
TECHNOLOGICAL		240			−119	−50
Complicates System Design	10		−3	−30		
New Developments	10		−1	−10		
Hardware Impact: Main Frame	3		−2	− 6		
Front End & Switching	2		−2	− 4		
Terminals	3		−2	− 6		
On-Line Storage	2		−3	− 6		
Software: Operating System	4		−2	− 8		
Files	3		−5	−15		
On-Line Applications	2		−4	− 8		
Off-Line Applications	1		−2	− 2		
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3		−3	− 9		

A.6 INQUIRY (TABLE A-6)

A.6.1 Description

The inquiry function allows interfacing terminals and/or systems to retrieve
data interactively from CARDIS facilities. One obvious application for this function
is tracing lost shipments. An inquiry to the shipment file need yield only that data
relevant to the inquiry rather than a standard assemblage of data corresponding to
a standard shipment document.

A.6.2 General Benefit

The inquiry function could obviate the necessity for much data transmission in
advance of physical movement. For example, carriers or other parties to the
movement could be notified by summary shipment reference numbers and then
request necessary planning details as they are needed. The result could be
abbreviated transmissions replacing standard messages sent to parties of the
shipment. Reduction of redundant storage of data could also result from intelligent
use of the inquiry.

Unfortunately, much investigative effort directed toward the analysis of workflow
associated with the shipment process would be necessary of both manual and CARDIS
system of interchange, to accurately determine expected benefits from incorporation
of this function. The following are possible benefits:

- Facilitation of tracing

- Reduction in number of messages sent

- Reduced duplicate storage requirements

- Reduced message transmission time

A.6.3 Utility

The inquiry function will result in calculable benefits based on reducing the overall
cost of shipment paperwork as well as significant benefits through most documentation
and movement related criteria.

A.6.3.1 Direct CARDIS Benefits

Anticipated paperwork cost savings can be derived as follows:

1. Manual Costs (based on CARDIS Data Transfer System with documents received)

Number of reference to files per shipment	50
File references eliminated by on-line inquiry	25
Time to find document, dig out required data	10 min.
Total manual clerical time eliminated per shipment	250 min.
Equivalent cost	$40.00

2. CARDIS Costs

Operator time per inquiry	2 min
x 25 inquiries	50 min.
x $10.00 per hour	$8.00
System costs	negligible
Terminal rental	$2.00
Total CARDIS costs	$10.00

The net saving per shipment under these assumptions would be approximately $30.00-- a fairly substantial benefit.

In addition to the calculated paperwork cost saving, the inquiry function, by providing ready access to information, can have a significant impact on filing, the number of documents, and number of copies required.

A.6.3.2 Administrative

Provision of an inquiry capability will exhibit marked benefits in almost all criteria under this category. Provided the system is designed with adequate capacity, one should look forward to added flexibility and better peak handling capability by virtue of rapid access to shipment files by authorized parties to the shipment.

A.6.3.3 Shipment Financial

Up to date information availability should serve to improve the speed of actual cargo movement and to rapidly make available the status to those responsible for consummating financial transactions concerning the shipment. Accordingly, beneficial effects will be felt to a varying degree throughout this category.

A.6.3.4 Utilization

Some minor impact in this area may be anticipated by virtue of the indirect benefits to be gleaned from faster movement of goods with fewer snags or holdups due to a lack of current information.

A.6.3.5 Control

The benefits in this area are fairly obvious. With information readily accessible via on-line or other inquiry modes, it should be possible to much more closely control the shipment and derive associated decision making inputs.

A.6.3.6 Service

Through the indirect effects of more timely information on cargo movement, better service should result. Perhaps more important is the greater delivery reliability which should be in evidence as a result of better control.

A.6.4 Systems Impact

The inquiry function, because of its real-time or near real-time response time requirements, will have a significant impact on the design of CARDIS compatible facilities. The parameters to be developed as a part of the subsequent standards effort will require that a thorough understanding of their economic and technical implications be in hand. However, despite the evident difficulties in implementation, it is difficult to imagine a functioning CARDIS compatible facility without a means for inquiry to shipment and other data files.

A.6.4.1 Business and Utility

The ability to query the files interactively by those parties with a legitimate need to know will certainly enhance the general utility of CARDIS, thereby broadening participation,

advertising and facilitating interaction with cooperating systems. One cannot anticipate major revenue impact, since inquiries do not generally require much utilization of the central facility. However, some additional revenues can be anticipated by virtue of additional terminal connect time and the fact that in aggregate, inquiries will result in some increased utilization and hence billing.

A.6.4.2 Operational

The provision of inquiry carries with it an increased burden in almost every evaluation criterion in this category. Protection of data from unauthorized access becomes much more difficult when inquiries from diverse sources must be handled.

A.6.4.3 Managerial

Here too, many of the aspects of system management will be critical by virtue of including the inquiry function. Great care will be necessary in establishing standards and providing for effective audit to assure users of the privacy of their data.

A.6.4.4 Technological

Inquiry, especially of the interactive type, will dictate that CARDIS compatible facilities comply with many of the most demanding aspects of modern system architecture. Accordingly, one can anticipate that in almost every aspect of the development cycle there will be a significant impact as a result of including this function.

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving $305						
DIRECT CARDIS BENEFITS		200			124	62
Reduced Paperwork: Preparation Time	10		1	10		
Reduced Paperwork: Transfer Time	10		3	30		
Reduced Paperwork: Filing	5		5	25		
Reduced Paperwork: Documents	8		5	40		
Reduced Paperwork: Copies	3		5	15		
Accuracy	4		1	4		
ADMINISTRATIVE		195			118	61
Improved Staff Productivity	10		3	30		
Lower Skill Levels (Rec. & Train)	7		2	14		
Flexibility re Changes	6		4	24		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5		2	10		
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			72	58
Faster Payment	6		3	18		
Reduced Demurrage	10		3	30		
Reduced Financing: "In Pipeline"	2		2	4		
"Buffer Stock"	4		2	8		
Improved Credit Control	3		4	12		
UTILIZATION		110			34	31
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		2	16		
Less Need for Additional Facilities	4		2	8		
Delay Avoidance at Ports	10		1	10		
CONTROL		120			104	87
Reduced Progress Checking	10		5	50		
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		5	30		
SERVICE		115			75	65
Speedier Delivery	10		2	20		
Greater Delivery Reliability	8		5	40		
Market Impact (Based on Above)	5		3	15		

SYSTEM IMPACT	W_i	Max. Value $\sum_1^5 W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			123	77
Broadens Participation	10		4	40		
Generates Revenue	7		2	14		
Advertising Value	6		4	24		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			−343	−79
Transaction Rates	10		−5	−50		
Real Time Transactions	10		−5	−50		
Increases File Seeks	8		−5	−40		
Per Message Processing	7		−2	−14		
Requires Special File Maintenance	7		−3	−21		
Increases Frequency of Audit	6		−4	−24		
Increases Print Load	2		+3	+ 6		
Requires Security Procedures	10		−5	−50		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−5	−15		
Inter Center	5		−2	−10		
Creates Maintenance Difficulties	5		−3	−15		
Complicates Facilities Management	5		−3	−15		
MANAGERIAL		225			−102	−45
Requires Special Standards Attention	3		−3	− 9		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4					
Complicates Billing	6		−4	−24		
Complicates Interfaces	9		−3	−27		
Increases Audit Trail Capability	8		−4	−32		
Complicates Man/Machine Interface	10		−1	−10		
TECHNOLOGICAL		240			−194	−81
Complicates System Design	10		−5	−50		
New Developments	10		−3	−30		
Hardware Impact: Main Frame	3		−5	−15		
Front End & Switching	2		−5	−10		
Terminals	3		−5	−15		
On-Line Storage	2		−1	− 2		
Software: Operating System	4		−5	−20		
Files	3		−5	−15		
On-Line Applications	2		−5	−10		
Off-Line Applications	1		−1	− 1		
Financial − Development Costs	5		−4	−20		
− Financing (Incremental Costs)	3		−2	− 6		

A.7   SHIPMENT DOCUMENTATION (TABLE A-7)

A.7.1   Description

The document preparation function entails the capability
to create requisite documents from a basic set of shipment data which is entered
essentially once during the shipment cycle. In the evaluation of this feature, one
should consider that by virtue of the storage capability inherent within CARDIS
compatible facilities, it may no longer be necessary to actually produce a written
record. This feature of the system, along with the ability to transfer data elec-
tronically, is at the heart of the potential for savings in documentation of ship-
ments. Based on the NCITD Phase One study, the documents to be generated by
CARDIS compatible facilities will probably be drawn from the following list in
descending order of priority.

Ocean B/L
Dock Receipt
Delivery Permit
Arrival Notice
Air Waybill
Commercial Invoice
Shipper's Export Declaration
Ocean Manifest (requires additional system capability)
Bill of Lading Inland
Certificate of Origin
Delivery Instruction
Shipper's Letter of Instructions
Certificate of Insurance
Air Carrier Manifest (requires additional system capability)
Consumption Entry (Formal)
Letter of Credit
Special Customs Invoice

Consumption Entry (Informal)

Carrier Billing

U. S. Government B/L

A. I. D. Forms

Special Customs Invoice (U. S.)

Carrier's Certificate and Release Order

Drawback Notice

Temporary Import under Bond Certificate

Air Waybill Release

Hazardous Cargo Manifest (Coast Guard)

A. 7. 2   General Benefit

The document preparation function aims directly at the faults revealed
in "Paperwork or Profits". Essentially the following benefits should accrue:

One-time operator entry of shipment data with resulting savings
of clerical effort

Automated production with resulting accuracy

Rapid data transfer by routing from data bases to data recipients

Elimination of the necessity of much of the paperwork associated
with the shipment

Reduction in document storage requirements

Reduction in shipment storage times

Reduced damage and theft

with the elimination of many actual documents through their re-
placement with electronic messages, the document preparation function may evolve
to one which formats standard messages which serve the same function. However,
the basic ability of a CARDIS compatible facility to draw upon data elements in a
shipment file to derive a grouped set of data elements in universally accepted format
will continue to be required.

A.7.3   Utility

Extremely significant benefits can be expected to accrue for both the paperwork and cargo movement aspects of shipment facilitation.

A.7.3.1   Direct CARDIS Benefits

In addition to benefits in all subjective evaluation criteria in this category, this function provides the most by way of direct paperwork cost reduction. This may be computed as follows:

i.   Manual Costs (Paperwork or Profits)

Manual Documentation Costs	$350 per shipment
100% of shipments	$350 per shipment

ii.   CARDIS Costs

Operator and Clerical

Operator entry of 3×10^3 char.	1/2 hr.	
50 Operator inquiries at 2 min.	1-2/3 hr.	
Remaining paper handling	5 hrs.	
Total Operator and Clerical time	8 hrs @ $10/hr	$80.00

Computer Facilities

Processing time per shipment $.50 – $1

Storage 3×10^3 bytes x 90 days

$2 per 3330 pack per day =

$\frac{2}{7} \times 3 \times 10^3 = .06¢/\text{day} \times 90 \text{ days} =$ \$ 0.54
10

Total computer costs per shipment $ 1.00

Terminals and Communications

Transaction Type	Char. per Transaction	Fraction of Trans. Involved	
Interactive	1260	x 0.5	= 630
Computer-Computer	300	x 0.3	= 90
Bulk Input	1000	x 0.1	= 100
Document Preparation	2000	x 0.2	= 200

Average number of characters per transaction   1020

With 50 transactions per shipment, a total of 51,000 characters per shipment is transmitted, taking 160 seconds at 300 characters per second, for a total cost of approximately $1.00, assuming 2 minutes per transaction, $300 per month for terminal rental and 160 hours available usage per month.

The approximate terminal rental per shipment is $3.00

Total Terminal and Communication costs $ 4.00

Total CARDIS costs for Shipment Documentation $85.00

The net result is that CARDIS documentation costs under a full document preparation capability can be approximately $85 to $100 per shipment with a resultant potential saving of $250 per shipment under the full implementation. The marginal increase over just a data exchange approach is then $250 - $35, or $215 per shipment.

A.7.3.2   Administrative

Almost every administrative aspect of the shipment cycle should significantly benefit from automated document preparation.

A.7.3.3   Shipment Financial

The timely availability of required shipment documentation has long been cited as one of the most significant contributing factors to delays resulting in financial impact. Accordingly, one can logically expect significant benefits in this area.

A.7.3.4   Utilization

Some effect will be felt in this area by virtue of faster shipment movement with less idleness of capital equipment as a result.

A.7.3.5   Control

Documentation itself will not have a major impact on control. Other applications and systems packages will be required to provide significant benefits.

A.7.3.6   Service

Timely availability of documentation should speed delivery substantially.

A.7.4   Service Impact

To achieve these savings, CARDIS compatible facilities should be developed by industry or other groups to include the data base and software needed to produce all required freight documentation.

With potential savings, a reasonable budget can be structured. Estimates for the costs of running CARDIS are based on comparable charges by time-shared services for the functions described. The $5 to $6 per shipment for these costs should allow for design, development, implementation, and operation. The personnel savings are so great in comparison, however, that even a doubling of the estimate of system operational costs will have only minor impact on the system quantitative utility.

A.7.4.1   Business and Utility

Although the provision of documentation will be a major factor in the acceptance of CARDIS, this is mitigated to some extent by the fact that the actual preparation of documents is not a difficult task and could be provided by other data processing services. Accordingly, the impact weightings must reflect this.

A.7.4.2   Operational

There will be a significant impact on most aspects of system operation by virtue of loading and the care which must be exercised with respect to control of data for the many individual system outputs arising from this application.

A.7.4.3   Managerial

System management should not be particularly difficult by virtue of including this function.

A.7.4.4   Technological

Although there are no new developments, great care must be taken in the system design.   Storage and filing structure will have to reflect the necessity for assembling data in a variety of formats during various phases of the shipment cycle.

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving $215						
DIRECT CARDIS BENEFITS		200			164	82
Reduced Paperwork: Preparation Time	10		4	40		
Reduced Paperwork: Transfer Time	10		4	40		
Reduced Paperwork: Filing	5		4	20		
Reduced Paperwork: Documents	8		4	32		
Reduced Paperwork: Copies	3		4	12		
Accuracy	4		5	20		
ADMINISTRATIVE		195			167	86
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7		5	35		
Flexibility re Changes	6		4	24		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5		4	20		
Managerial Efficiency	4		5	20		
SHIPMENT FINANCIAL		125			94	75
Faster Payment	6		4	24		
Reduced Demurrage	10		4	40		
Reduced Financing: "In Pipeline"	2		4	8		
"Buffer Stock"	4		4	16		
Improved Credit Control	3		2	6		
UTILIZATION		110			62	56
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		3	24		
Less Need for Additional Facilities	4		2	8		
Delay Avoidance at Ports	10		3	30		
CONTROL		120			10	8
Reduced Progress Checking	10		1	10		
Accurate Timely Statistics	8					
Decisions based on Better Info.	6					
SERVICE		115			58	50
Speedier Delivery	10		4	40		
Greater Delivery Reliability	8		1	8		
Market Impact (Based on Above)	5		2	10		

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			69	43
Broadens Participation	10		3	30		
Generates Revenue	7		3	21		
Advertising Value	6		3	18		
Facilitates use by Cooperating Systems	9					
OPERATIONAL		435			−302	−69
Transaction Rates	10		−3	−30		
Real Time Transactions	10		−2	−20		
Increases File Seeks	8		−3	−24		
Per Message Processing	7		−3	−21		
Requires Special File Maintenance	7		−5	−35		
Increases Frequency of Audit	6		−3	−18		
Increases Print Load	2		−2	− 4		
Requires Security Procedures	10		−5	−50		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−5	−15		
Inter Center	5					
Creates Maintenance Difficulties	5		−3	−15		
Complicates Facilities Management	5		−5	−25		
MANAGERIAL		225			−38	−17
Requires Special Standards Attention	3		−4	−12		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4		+2	+8		
Complicates Billing	6					
Complicates Interfaces	9					
Increases Audit Trail Capability	8		−3	−24		
Complicates Man/Machine Interface	10		−1	−10		
TECHNOLOGICAL		240			−115	−48
Complicates System Design	10		−4	40		
New Developments	10					
Hardware Impact: Main Frame	3		−4	−12		
Front End & Switching	2					
Terminals	3		−3	− 9		
On-Line Storage	2		−5	−10		
Software: Operating System	4		−2	− 8		
Files	3		−5	−15		
On-Line Applications	2		−2	− 4		
Off-Line Applications	1		−2	− 2		
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3					

A. 8   SHIPMENT TRACING (TABLE A-8)

A. 8. 1   Description

This capability grows in capacity as the data entry function becomes more complete. Ideally, if a shipment file is maintained adequately, it will be possible to ascertain the latest consignment status by accessing the file to which has been appended the most current movement data. Even without complete data, significant aids to tracing arising from availability of shipment data can be foreseen.

A. 8. 2   General Benefit

Shipment tracing is a concern to many shippers. Current procedures for tracing often involve repeated calls, extended delays, and manual searches to locate shipments. A properly implemented CARDIS tracing function would greatly simplify this procedure. Some of the benefits would be:

- Rapid determination of shipment status

- Elimination of much stored paperwork at nodes with a con-comitant reduction in the number of copies of documents required.

- Reduction in lost shipments

- Reduction in cargo delays with savings in demurrage, other direct charges, and credit charges

- Reduction in insurance charges because of better control

- Improved customer relationships .

A. 8. 3   Utility

A. 8. 3. 1 Direct CARDIS Benefits

Both documentation costs and clerical costs arising from current tracing procedures should be significantly reduced as a result of including tracing within CARDIS. The cost savings would be computed as follows: (in this case it is possible to include some estimates for movement costs as well)

i.   Manually, assuming 10 percent of shipments require tracing, current tracing costs on a per shipment basis might be derived as follows:

Average manpower per trace – 1 man day = $80

Telephone calls   – 10 at 3   = 30

Total cost per traced shipment $110.00

Since 10% of the shipments are traced, it results in an average savings of $11 per shipment.

ii. Under CARDIS, interfaces have to be constructed and maintained with TRAIN II and other systems. Perhaps five additional manual entries have to be initiated at 1 minute apiece. The total cost would be under $5 per shipment, a net savings of $6 per shipment.

iii. Lost Shipments – If we could cut lost shipments by a factor of two, substantial savings would ensue. Perhaps this is best determined by assuming one-third reduction insurance cost per shipment. If insurance is 2 percent and an average of $500 per shipment is assumed, an additional savings of from $3 to $4 per shipment may be realizable.

iv. Cargo Delays – From the SITPRO report, one might anticipate a saving of $25 per day on the average for a single container delay. This should result in approximately $1 per shipment from reduction in delays for 10 percent of shipment, assuming two or two and one half shipments per container on the average.

A total net saving of $11 per shipment seems reasonable in view of the above assumptions. Better data should serve to provide a sounder basis for developing a more accurate estimate of savings throughout the shipment cycle.

A.8.3.2   Administrative

The impact throughout this category will be profound. Tracing will greatly simplify most aspects of administration associated with cargo movement.

A.8.3.3   Shipment Financial

Some of these benefits have already been calculated. By virtue of reducing delay in a significant fraction of shipments, substantial benefits should accrue.

A.8.3.4   Utilization

Benefits from the tracing function will mainly accrue to the shipment rather than the equipment, although in some cases pursuit of shipment whereabouts will also result in locating stray equipment.   However, the provision of the required system features for tracing will also provide the basis for incorporating equipment tracking, which should be considered in assessing implementation.

A.8.3.5   Control

The benefits of tracing for shipment control are self evident.

A.8.3.6   Service

There is no question that tracing will offer profound improvements in service and criteria in this category should be ranked accordingly.

A.8.4   Service Impact

A number of steps will be required to implement the tracing function. These include:

> Mechanism for update of files
>
> Interfaces with TRAIN II, SOIS, and other container tracing systems
>
> System for rapid entry of UCRN or other shipment identifier as shipment passes location points.

A.8.4.1   Business and Utility

Based on the stated preferences of many participants in the shipping process, tracing capability will be a major inducement for participation in CARDIS. The weightings in this category should accordingly reflect this fact.

A.8.4.2   Operational

Tracing, because of the interfaces required, will certainly have a significant impact on most operational parameters.

A.8.4.3   Managerial

Some of these same operational difficulties will be reflected in system management.

A.8.4.4   Technological

Implementation of effective tracing procedures will have a significant impact on system design and may also require some developmental work, especially where effective techniques for checking and/or entering status do not currently exist. The tracing and equipment tracking functions will require associated development of other procedures throughout the industry and eventual interface with CARDIS.

TABLE A-8. SHIPMENT TRACING

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving **$11**						
DIRECT CARDIS BENEFITS		200			145	73
Reduced Paperwork: Preparation Time	10		2	20		
Reduced Paperwork: Transfer Time	10		3	30		
Reduced Paperwork: Filing	5		4	20		
Reduced Paperwork: Documents	8		5	40		
Reduced Paperwork: Copies	3		5	15		
Accuracy	4		5	20		
ADMINISTRATIVE		195			156	80
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7		4	28		
Flexibility re Changes	6		4	24		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5		4	20		
Managerial Efficiency	4		4	16		
SHIPMENT FINANCIAL		125			66	53
Faster Payment	6		3	18		
Reduced Demurrage	10		3	30		
Reduced Financing: "In Pipeline"	2		3	6		
"Buffer Stock"	4		3	12		
Improved Credit Control	3					
UTILIZATION		110			20	18
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		2	16		
Less Need for Additional Facilities	4		1	4		
Delay Avoidance at Ports	10					
CONTROL		120			106	88
Reduced Progress Checking	10		5	50		
Accurate Timely Statistics	8		4	32		
Decisions based on Better Info.	6		4	24		
SERVICE		115			115	100
Speedier Delivery	10		5	50		
Greater Delivery Reliability	8		5	40		
Market Impact (Based on Above)	5		5	25		

TABLE A-8. SHIPMENT TRACING (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	W_iI_i	$\sum W_iI_i$	$\dfrac{W_iI_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			135	84
Broadens Participation	10		5	50		
Generates Revenue	7		4	28		
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		3	27		
OPERATIONAL		435			−211	−49
Transaction Rates	10		−1	−10		
Real Time Transactions	10		−2	−20		
Increases File Seeks	8		−1	− 8		
Per Message Processing	7		−1	− 7		
Requires Special File Maintenance	7		−4	−28		
Increases Frequency of Audit	6					
Increases Print Load	2					
Requires Security Procedures	10		−3	−30		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−1	− 3		
Inter Center	5		−4	−20		
Creates Maintenance Difficulties	5		−5	−25		
Complicates Facilities Management	5		−3	−15		
MANAGERIAL		225			−82	−36
Requires Special Standards Attention	3		−1	− 3		
Decreases Need for Human Intervention	5		+2	+10		
Requires Specialized Skills	4		+3	+12		
Complicates Billing	6		−2	−12		
Complicates Interfaces	9		−5	−45		
Increases Audit Trail Capability	8		−3	−24		
Complicates Man/Machine Interface	10		−2	−20		
TECHNOLOGICAL		240			−123	−51
Complicates System Design	10		−3	−30		
New Developments	10		−4	−40		
Hardware Impact: Main Frame	3		−3	− 9		
Front End & Switching	2		−5	−10		
Terminals	3					
On-Line Storage	2		−2	− 4		
Software: Operating System	4					
Files	3		−3	− 9		
On-Line Applications	2		−3	− 6		
Off-Line Applications	1					
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3					

A.9   EQUIPMENT TRACKING (TABLE A-9)

A.9.1   Description

The development of intermodal transportation has greatly increased the frequency of equipment interchange between carriers and between lessors and lessees of transport equipment.

Interchanging equipment between owners and various users creates two problems for the owner. First, there is the possibility that the equipment may be temporarily or permanently lost; resulting in diminished earnings or total loss of investment. Second, there is the problem and expense of billing and receiving payment from the user.

To a limited extent, the problem of locating rail cars has been addressed in the U.S. and Canada, via the TRAIN II system of the Association of American Railroads. However, no well organized system exists for tracking or locating interchanged highway equipment or containers that may move intermodally.

The present day method of billing for the usage of interchanged equipment is cumbersome, expensive and time consuming for all parties to the transaction, in comparison to what could be accomplished through CARDIS. For example, instead of the owner of each piece of equipment billing each user each month, within CARDIS a "clearing function" could be performed (similar to that of bank clearing houses) where debits and credits could be assigned--with only the net billings and receipts then being forwarded to the users and owners of equipment. This would significantly reduce present clerical costs and, in addition, would speed the transfer of funds, freeing vast sums for use elsewhere.

A.9.2   General Benefit

The value of being able to locate equipment easily and economically, and a better method of billing for the use of interchanged transport equipment, is generally recognized throughout the transportation world. Although subsidiary

to the direct thrust of CARDIS activities which are directed toward shipment data needs, equipment tracking has similarities in requirements to tracing so that a joint implementation of these two functions should be considered.

A. 9. 3   Utility

All parties to the transport process would derive tangible benefits from a system able to effectively manage the interchange function. Shippers would benefit in that the apparent size of the interchange fleet would be increased due to better control of equipment utilization. Carriers and owners of equipment would derive more earnings from their equipment investment due to better (and higher) potential utilization.

A quantitative utility evaluation for this function is really not possible with the data in hand. At some time in the future it might be of interest to model the result of such a system on usage and container inventories.

A. 9. 3. 1   Direct CARDIS Benefits

Aside from some impact on accuracy, few direct paperwork benefits can be anticipated.

A. 9. 3. 2   Administrative

Tracking of equipment whereabouts and condition would relieve management of many of the headaches associated with planning for available facilities and seeing to proper repair and maintenance.

A. 9. 3. 3   Shipment Financial

Delays could be avoided by virtue of better information as to the whereabouts and condition of containers.

A. 9. 3. 4   Utilization

By better management, it should be possible, at least to some degree, to improve utilization of existing equipment and to reduce the need for additional facilities.

A.9.3 5   Control

By effective equipment tracking, it should be possible to better control movement of shipments and to have better data on whereabouts as well as on equipment status.

A.9.3.6   Service

Through better equipments tracking it should be possible to eliminate some of the delays caused by lack of equipment. It should also be possible to improve the reliability since a check on the container condition can be made before utilization, avoiding faulty containers for critical shipments.

A.9.4   System Impact

A.9.4.1   Business and Utility

A container module might broaden CARDIS participation to include some carriers who cannot currently trace. The idea of a common inventory would also prove attractive to carriers, further encouraging their participation.

A.9.4.2   Operational

While the impact on transaction rates would be minor, maintenance of an equipment file will present difficulties, especially in assimilating current data on condition.

A.9.4.3   Managerial

Impact in this area would be minimal.

A.9.4.4   Technological

The main impact in this area will arise from the necessity to construct and maintain suitable files. Additionally, off-line applications will have to be developed to serve this function. Development costs could be moderate, although this may depend on the techniques chosen for data entry.

TABLE A-9. EQUIPMENT TRACKING

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200			140	70
Reduced Paperwork: Preparation Time	10		2	20		
Reduced Paperwork: Transfer Time	10		3	30		
Reduced Paperwork: Filing	5		3	15		
Reduced Paperwork: Documents	8		5	40		
Reduced Paperwork: Copies	3		5	15		
Accuracy	4		5	20		
ADMINISTRATIVE		195			116	60
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7		2	14		
Flexibility re Changes	6		3	18		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4		4	16		
SHIPMENT FINANCIAL		125			64	53
Faster Payment	6		2	12		
Reduced Demurrage	10		4	40		
Reduced Financing: "In Pipeline"	2		2	4		
"Buffer Stock"	4		2	8		
Improved Credit Control	3					
UTILIZATION		110			44	40
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		4	32		
Less Need for Additional Facilities	4		3	12		
Delay Avoidance at Ports	10					
CONTROL		120			68	57
Reduced Progress Checking	10		2	20		
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		4	24		
SERVICE		115			115	100
Speedier Delivery	10		5	50		
Greater Delivery Reliability	8		5	40		
Market Impact (Based on Above)	5		5	25		

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			107	66
Broadens Participation	10		1	10		
Generates Revenue	7		4	28		
Advertising Value	6		4	24		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			−208	−48
Transaction Rates	10		−1	−10		
Real Time Transactions	10		−3	−30		
Increases File Seeks	8		−5	−40		
Per Message Processing	7					
Requires Special File Maintenance	7		−4	−28		
Increases Frequency of Audit	6					
Increases Print Load	2		−2	− 4		
Requires Security Procedures	10		−1	−10		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−2	− 6		
Inter Center	5		−3	−15		
Creates Maintenance Difficulties	5		−2	−10		
Complicates Facilities Management	5		−2	−10		
MANAGERIAL		225			−96	−42
Requires Special Standards Attention	3		−2	− 6		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4					
Complicates Billing	6		−3	−18		
Complicates Interfaces	9		−4	−36		
Increases Audit Trail Capability	8		−2	−16		
Complicates Man/Machine Interface	10		−2	−20		
TECHNOLOGICAL		240			−97	−41
Complicates System Design	10		−2	−20		
New Developments	10					
Hardware Impact: Main Frame	3		−5	−15		
Front End & Switching	2		−4	− 8		
Terminals	3		−4	−12		
On-Line Storage	2		−2	− 4		
Software: Operating System	4		−2	− 8		
Files	3		−3	− 9		
On-Line Applications	2		−2	− 4		
Off-Line Applications	1		−5	− 5		
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3					

A.10 BOOKING (TABLE A-10)

A.10.1 Description

Carriers have expressed an interest in the booking function as a part of CARDIS. In general, this feature could prove to be extremely useful. Significant advantages could accrue to shippers and carriers in the facilitation of loading and planning as a result of assembling advanced booking information.

A.10.2 General Benefit

Many shipping companies have already implemented versions of booking systems for consignments, attesting to the benefits such a capability can ultimately provide. Booking files which could be accessed via CARDIS, if properly maintained, be used as the source for freight documentation such as the Dock Receipt, Bill of Lading, Manifest, etc.

As with all CARDIS applications, it would seem that functions, such as booking, which already exist, should be evaluated on pure economic terms in the marketplace to which they are addressed. It is quite conceivable that a service center CARDIS compatible facility, or for that matter, an in-house CARDIS facility at a carrier, may wish to incorporate booking or offer booking services as a part of the facility capability. In this case, the control over the interfaces and the manner in which a module such as booking affects other system requirements is a major concern.

A.10.3 Utility

A.10.3.1 Direct CARDIS Benefits

The booking system generally is considered the earliest time data on a shipment can be captured in machine readable format. A CARDIS interface will be extremely beneficial in terms of rapid information access for those systems actually performing booking. Also, booking could greatly benefit from the introduction of automation into the process as has been amply demonstrated by the success of airline and air cargo reservation systems.

The cost/benefit aspects of the booking function are probably beyond the scope of this study. It is a fairly complex issue which deserves a market analysis in its own right to ascertain the economic viability for implementation.

A.10.3.2 Administrative

The provision of or interaction with booking modules should produce significant administrative benefits during the processing of shipments. The ability to rapidly confirm bookings provides advantages to shippers and forwarders as well as carriers as is evidenced by the investment in existing booking systems.

A.10.3.3 Shipment Financial

Significant benefits are anticipated in this evaluation category as a direct result of the booking interface, in addition to significant indirect benefits.

A.10.3.4 Utilization

By more immediate and accurate booking (and load planning, which can be an adjunct), it should be possible to realize substantial benefits, particularly with respect to ship and aircraft utilization.

A.10.3.5 Control

A fairly major effect may be anticipated by virtue of automated data interchange and accessibility.

A.10.3.6 Service

Accurate timely bookings should assure better service to shippers, resulting in speedier access to required equipment and greater reliability.

A.10.4 System Impact

Implementation of booking or cargo reservations will vary in complexity, depending on the community of users served and the worldwide scope of the activity.

The booking function normally will remain in the control of the individual carriers with access to shippers and freight forwarders. Accordingly, it will concern CARDIS

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in the sense that interface and access must be established in accordance with CARDIS standards for format and security. The problem may be one of the incorporation of CARDIS functions into a system primarily designed for booking rather than the reverse. Many of the problems of access, files, and cross-indexing associated with other applications will apply to booking as well. Within the CARDIS operational format, much of the raw material for effective booking control may already exist (shipment and container parameters, cross-indexing by vessel, etc.), so that significant savings could result from performing booking functions.

A.10.4.1 Business and Utility

Most shipment paperwork cycles originate with the booking function. Accordingly, a means for interacting with a booking capability will be a major factor in the decision of many parties to join in CARDIS.

A.10.4.2 Operational

As one would expect, the automated interchange of data in order to place and confirm bookings will significantly complicate the CARDIS environment. Moreover, the CARDIS compatible facility within which booking is handled must anticipate much more complicated software requiring interaction between files in a controlled manner.

A.10.4.3 Managerial

Some impact on this aspect of system operation must also be anticipated although with a careful delineation of the file access and software boundaries, the requirements should not be overly stringent.

A.10.4.4 Technological

The booking function presents fairly significant problems in system architecture. One must contemplate interfaces with air cargo reservation systems as well as with existing and planned systems serving ocean and other carriers.

TABLE A-10. BOOKING

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact X						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200			74	36
Reduced Paperwork: Preparation Time	10		2	20		
Reduced Paperwork: Transfer Time	10		1	10		
Reduced Paperwork: Filing	5		2	10		
Reduced Paperwork: Documents	8		2	16		
Reduced Paperwork: Copies	3		2	6		
Accuracy	4		3	12		
ADMINISTRATIVE		195			141	72
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7		5	35		
Flexibility re Changes	6		5	30		
Peak Handling Capabilities	7		4	28		
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4		2	8		
SHIPMENT FINANCIAL		125				
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
UTILIZATION		110			90	82
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		5	40		
Less Need for Additional Facilities	4		5	20		
Delay Avoidance at Ports	10		3	30		
CONTROL		120			74	62
Reduced Progress Checking	10		2	20		
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		5	30		
SERVICE		115			100	87
Speedier Delivery	10		4	40		
Greater Delivery Reliability	8		5	40		
Market Impact (Based on Above)	5		4	20		

TABLE A-10. BOOKING (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	W_iI_i	$\sum W_iI_i$	$\dfrac{W_iI_i}{5\sum W_i}$
<u>BUSINESS AND UTILITY</u>		160			145	91
Broadens Participation	10		5	50		
Generates Revenue	7		5	35		
Advertising Value	6		4	24		
Facilitates use by Cooperating Systems	9		4	36		
<u>OPERATIONAL</u>		435			−269	−62
Transaction Rates	10		−3	−30		
Real Time Transactions	10		−3	−30		
Increases File Seeks	8		−4	−32		
Per Message Processing	7		−4	−28		
Requires Special File Maintenance	7		−5	−35		
Increases Frequency of Audit	6		−	−		
Increases Print Load	2		−1	−2		
Requires Security Procedures	10		−1	−10		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−4	−12		
Inter Center	5		−4	−20		
Creates Maintenance Difficulties	5		−2	−10		
Complicates Facilities Management	5		−3	−15		
<u>MANAGERIAL</u>		225			−92	−41
Requires Special Standards Attention	3		−1	−3		
Decreases Need for Human Intervention	5		−2	−10		
Requires Specialized Skills	4		−	−		
Complicates Billing	6		−3	−18		
Complicates Interfaces	9		−3	−27		
Increases Audit Trail Capability	8		−3	−24		
Complicates Man/Machine Interface	10		−1	−10		
<u>TECHNOLOGICAL</u>		240			−156	−65
Complicates System Design	10		−4	−40		
New Developments	10		−2	−20		
Hardware Impact: Main Frame	3		−3	−9		
Front End & Switching	2		−3	−6		
Terminals	3		−2	−6		
On-Line Storage	2		−4	−8		
Software: Operating System	4		−2	−8		
Files	3		−4	−12		
On-Line Applications	2		−5	−10		
Off-Line Applications	1		−3	−3		
Financial – Development Costs	5		−5	−25		
– Financing (Incremental Costs)	3		−3	−9		

A. 11   MANIFEST PREPARATION (TABLE A-11)

A. 11. 1   Description

The function will depend on assembling cross-indexes of shipments by carrier. To some extent the basic mechanisms for addressing shipment files may already exist as a result of some of the other functions to be included as part of CARDIS compatible system operation. With the files indexed by vessel or other unit of carriage, it is a simple matter to generate manifests based on the data elements already available and indexed within CARDIS. A tie-in with booking would be of obvious advantage.

Once CARDIS can provide automated access to those data fields necessary to build a manifest (which would be obtained with a properly maintained system of shipment files), manual manifest preparation would also become much simpler. For example, an operator with a CRT working with one CARDIS compatible facility would theoretically be able to call upon shipment records from a master list to build the manifest. Further automating this process would require an application program utilizing a "vessel" index of CARDIS shipment files to extract required manifest data.

A. 11. 2   General Benefit

Delayed delivery of manifests is often cited as one of the prime examples of a need for automating documentation. Manifests must be available in advance of a vessel's arrival to properly plan for unloading and as a prerequisite for entry of the vessel into harbor. Examples of ship delays given often include incidents such as the reported three-day delay in Logos due to a manifest not having arrived before the ship (SITPRO Preliminary Inquiry) or the assessment of a fine of $1. 8 million because of no manifest. While it is not certain just how often this type of delay occurs, those surveyed seem in agreement that cargo unloading is frequently delayed at great cost due to a late or missing manifest. Accordingly, direct and indirect financial benefit would accrue from automated manifest preparation.

A. 11. 3   **Utility**

A. 11. 3. 1   Direct CARDIS Benefits

Some benefits might include:

i.   Significant savings in preparation time

ii.   Greatly improved speed of transfer to foreign points of entry

iii.   Greater accuracy because of less human intervention

iv.   Less changes since one could safely await the sailing

v.   Savings in operator access requirements

A. 11. 3. 2   Administrative

The provision of a manifest capability, whether as a complete service or as an adjunct to existing in-house software, will be of significant benefit throughout this evaluation category.

A. 11. 3. 3   Shipment Financial

Since delayed manifests are often quoted as one of the most glaring examples of movement problems, the incorporation of this capability will almost certainly have a profound impact on movement speed and hence on financial aspects of the shipment.

A. 11. 3. 4   Utilization

By delay avoidance at ports and timely clearance for unloading, all major capital equipment required for movement should be more fully utilized.

A. 11. 3. 5   Control

The benefits in this area result from the improved accuracy and, hopefully, more consistent movement and handling of cargo.

A. 11. 3. 6   Service

Every criterion in this category will show maximum benefits from the manifest function.

A.11.4   System Impact

A.11.4.1   Business and Utility

Provision of this function will significantly encourage carrier participation if the design is flexible enough to serve as an adjunct as well as a complete service module.

A.11.4.2   Operational

One area of impact will be security. Manifest generation falls into the category of those modules which can access a large number of files. Great care must be taken to properly key the files so that when an element of the system engaged in manifest building initiates a search, it cannot access files for which there is no need. This problem is common to many of the other potential functions which will call on shipment files en masse to accomplish an objective.

A.11.4.3   Managerial

There seem to be few specific problems associated with incorporation of the manifest function.

A.11.4.4   Technological

If the preconditions for some of the other proposed functions are presumed (e.g., tracing), there should not be any additional system impact for automated manifest generation. The requirements for access are much the same with cross-indexes being required to key the manifest module to the appropriate records. Alternately, the data could be accumulated during the booking process and kept within the carrier's files.

If CARDIS, through one of its facilities, were to offer a manifest service, appropriate software modules would have to be written. The main system development impact would probably be in file management.

A.12   SHIPMENT FILE AUDIT (TABLE A-12)

A.12.1   Description

This function entails the process by which shipment files are monitored periodically for excessive retention or other circumstances which might require that some specific action be taken. Accompanying the monitoring function might be the generation of exception reports to system subscribers where cause has been established to seek review of file adequacy and/or inactivity. Other items within the shipment record could also be checked for inconsistency on a periodic basis, e.g., if a shipment file was not updated as to a vessel sailing when it is known that the vessel assigned to the shipment has sailed. Such checks might greatly facilitate tracing and contribute to the maintenance of accurate status information.

A.12.2   General Benefit

Benefits arising from this feature would primarily accrue to the system subscriber. Costs for system utilization would be minimized as a result of file auditing. To some extent, automatic notification of unaccounted for shipments would be forthcoming, aiding in control of shipments.

A.12.3   Utility

A.12.3.1   Direct CARDIS Benefits

Some file auditing will be necessary to prevent accumulation of "dead" shipment files ad infinitum. Time checking the files will probably best serve this function. Estimated savings might be a percentage, i.e., 25 percent of on-line storage requirements, depending on the frequency of checking. These procedures would be more evident in the system operation (and its cost to the user) rather than as a direct CARDIS benefit.

A.12.3.2   Administrative

Some minor impact may be anticipated in this area by virtue of automated exception reporting.

A.12.3.3 Shipment Financial

Additional audit procedures could result in shorter warehousing, more rapidly initiated tracing, early identification of "lost" shipments, and reduced per diem charges. However, these have not been considered here, since it must be assumed that few shipments will be involved. Audits for payment and financing may be used more routinely as a part of the shipment billing cycle which would facilitate credit control to some extent.

A.12.3.4 Utilization

On occasion, by flagging overdue shipment or improper sequence, it may be possible to spot stray equipment.

A.12.3.5 Control

An expanded audit procedure could be used to obtain periodic reports and as a source for useful decision making statistics.

A.12.3.6 Service

Aside from after the fact indication of trouble, it is unlikely that audit will be able to improve delivery or have a significant impact on delivery reliability. However, this,as well as the previously outlined benefits,should be reviewed in the light of specific audit procedures, once these have been better defined.

A.12.4 System Impact

As currently envisioned, audits would be performed as a system batch function. The files must be constructed to include timing and other pertinent information for audit and suitable software routines written to cross-check file content against other data for validity (the latter are one-time costs).

A.12.4.1 Business and Utility

While some minor benefit in this area may be expected, an after the fact audit capability will generally not be obvious to most users. Accordingly, a significant impact on the business posture is not expected.

A.12.4.2 Operational

In this case, some of the operational effort which may arise from incorporating periodic audits may actually be offset by virtue of improvements resulting from the purging of dead files and from cleaning up other inconsistent records.

A.12.4.3 Managerial

With respect to system management, one should anticipate improvements in certain areas rather than any need for increased effort. Accordingly, the inclusion of this function benefits the system operator and warrants consideration as a way to reduce system operating problems.

A.12.4.4 Technological

Since the audit procedures are envisioned as off-line functions operating on shipment files during quiet periods, the technological impact of their inclusion will be minor. Moreover, by reducing file requirements and hence on-line storage, system benefits, such as reduced equipment complement, should result. Funding of audit is a simple matter, since the required software need not be operational until long after the facility is on-line and producing substantial revenue.

TABLE A-12. SHIPMENT FILE AUDIT

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact [X]						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200			34	17
Reduced Paperwork: Preparation Time	10					
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5					
Reduced Paperwork: Documents	8		2	16		
Reduced Paperwork: Copies	3		2	6		
Accuracy	4		3	12		
ADMINISTRATIVE		195			19	10
Improved Staff Productivity	10					
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6					
Peak Handling Capabilities	7		1	7		
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			9	7
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3		3	9		
UTILIZATION		110			20	18
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		2	16		
Less Need for Additional Facilities	4		1	4		
Delay Avoidance at Ports	10					
CONTROL		120			36	30
Reduced Progress Checking	10					
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		2	12		
SERVICE		115				
Speedier Delivery	10					
Greater Delivery Reliability	8					
Market Impact (Based on Above)	5					

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			15	9
Broadens Participation	10					
Generates Revenue	7		1	10		
Advertising Value	6		−1	− 7		
Facilitates use by Cooperating Systems	9		2	12		
OPERATIONAL		435			−15	−3
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8		−2	−16		
Per Message Processing	7		1	7		
Requires Special File Maintenance	7		−2	−14		
Increases Frequency of Audit	6					
Increases Print Load	2		−1	− 2		
Requires Security Procedures	10		−1	−10		
Increases Complexity of On-Line Environment	9					
Creates Additional Communication Traffic						
User-Center	3					
Inter Center	5					
Creates Maintenance Difficulties	5		+2	+10		
Complicates Facilities Management	5		+2	+10		
MANAGERIAL		225			75	33
Requires Special Standards Attention	3		−1	− 3		
Decreases Need for Human Intervention	5		+5	+25		
Requires Specialized Skills	4					
Complicates Billing	6		+2	+12		
Complicates Interfaces	9		+1	+ 9		
Increases Audit Trail Capability	8		−1	− 8		
Complicates Man/Machine Interface	10		+4	+40		
TECHNOLOGICAL		240			−12	−5
Complicates System Design	10		−3	−30		
New Developments	10					
Hardware Impact: Main Frame	3					
Front End & Switching	2					
Terminals	3					
On-Line Storage	2		+3	+6		
Software: Operating System	4					
Files	3		+2	+6		
On-Line Applications	2		+2	+4		
Off-Line Applications	1		−2	−2		
Financial – Development Costs	5		−1	−5		
– Financing (Incremental Costs)	3		+3	+9		

A.13   SHIPMENT HISTORY FILE (TABLE A-13)

A.13.1   Description

This function would require that a log be kept of all update transactions to shipment files in addition to a record of the original entry. This is particularly important if contention occurs with respect to shipment parameters (e.g., weight, volume, valuation, damage, assessment, theft, etc.) to which more than one party to the shipment have legitimate access for purposes of changing information. This function also is required for effective security. Journaling of data entry and access will be an effective technique for tracking access to files. Depending on the frequency of referral, some part of the history file may be kept on-line as a part of the actual shipment record.

A.13.2   General Benefit

The benefit accruing from this feature is the integrity of the data in the files. Also important is the confidence in the system which results from being able to reference accesses and their impact. A brief list of advantages might include:

Ease in adjudication of conflicts

Enhanced security

Enhanced recovery

Assurance of data integrity

Aids in system management arising from analysis of required data manipulation.

A.13.3   Utility

A.13.3.1 Direct CARDIS Benefits

Direct CARDIS benefits should be evident in the areas of filing (changes are automatically accommodated) and in accuracy which results from effective cross-checking.

A.13.3.2 Administrative

Although minor, some advantages will be evident in that complete information would be readily available to reconstruct situations which have occurred with respect to shipments.

A.13.3.3 Shipment Financial

In the main, advantages to accounting will occur by virtue of rapid resolution of billing problems.

A.13.3.4 Utilization

There are no foreseeable benefits in this category.

A.13.3.5 Control

Since all information is captured, one should anticipate better information for the decision making process.

A.13.3.6 Service

The record history function should allow much more rapid conflict resolution and tracing of sources of error. This should result in a corresponding effect on the speed and reliability of service and should also have a beneficial effect on the market by viture of conflict resolution.

A.13.4 System Impact

A.13.4.1 Business and Utility

There is no question that provision of a history file will prove attractive to potential clients of the system.

A.13.4.2   Operational

The Phase I estimates allowed for an approximate increase in the on-line data base of 50 percent to accommodate this feature. This will result in increased storage costs (these are fairly low on a per shipment basis) as well as in some increased difficulty in file organization. Computer time utilized per shipment should not be increased appreciably. One should also realize that it may not be necessary to keep the file on-line depending on how often reference must be made to it and the response time demanded for resolution.

A.13.4.3   Managerial

Some additional effort will be required on the part of managing the system. However, this will not be a major impediment.

A.13.4.4   Technological

Most technological considerations aside from on-line storage and file structure, should not stand in the way of effective implementation of this function. The techniques are certainly well known, so that the risk of an appropriate solution is not substantial.

TABLE A-13. SHIPMENT HISTORY FILE

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact	X					
Per Shipment Estimated Cost Saving	$0.50					
DIRECT CARDIS BENEFITS		200			42	21
Reduced Paperwork: Preparation Time	10					
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5		4	20		
Reduced Paperwork: Documents	8					
Reduced Paperwork: Copies	3		2	6		
Accuracy	4		4	16		
ADMINISTRATIVE		195			39	20
Improved Staff Productivity	10					
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6		2	12		
Peak Handling Capabilities	7					
Reduced Demands on Data Recipients	5		3	15		
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125			57	46
Faster Payment	6		2	12		
Reduced Demurrage	10		3	30		
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3		5	15		
UTILIZATION		110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8					
Less Need for Additional Facilities	4					
Delay Avoidance at Ports	10					
CONTROL		120			30	25
Reduced Progress Checking	10					
Accurate Timely Statistics	8					
Decisions based on Better Info.	6		5	30		
SERVICE		115			56	49
Speedier Delivery	10		2	20		
Greater Delivery Reliability	8		2	16		
Market Impact (Based on Above)	5		4	20		

TABLE A-13. SHIPMENT HISTORY FILE (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			105	66
Broadens Participation	10		3	30		
Generates Revenue	7					
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		5	45		
OPERATIONAL		435			184	−42
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8		−5	−40		
Per Message Processing	7		−4	−28		
Requires Special File Maintenance	7		−5	−35		
Increases Frequency of Audit	6					
Increases Print Load	2					
Requires Security Procedures	10		−2	−20		
Increases Complexity of On-Line Environment	9		−4	−36		
Creates Additional Communication Traffic						
User-Center	3					
Inter Center	5					
Creates Maintenance Difficulties	5		−3	−15		
Complicates Facilities Management	5		−2	−10		
MANAGERIAL		225			−76	−34
Requires Special Standards Attention	3		−2	− 6		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4					
Complicates Billing	6		−3	−18		
Complicates Interfaces	9					
Increases Audit Trail Capability	8		−4	−32		
Complicates Man/Machine Interface	10		−2	−20		
TECHNOLOGICAL		240			−94	−39
Complicates System Design	10		−2	−20		
New Developments	10		−2	−20		
Hardware Impact: Main Frame	3					
Front End & Switching	2					
Terminals	3					
On-Line Storage	2		−5	−10		
Software: Operating System	4		−1	− 4		
Files	3		−4	−12		
On-Line Applications	2		−3	− 6		
Off-Line Applications	1		−4	− 4		
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3		−1	− 3		

A.14   REPETITIVE SHIPMENT PROCESSING (TABLE A-14)

A.14.1   Description

There is a sufficient amount of reordering to warrant the consideration of using CARDIS files as the basis for building new files. By the user establishing a new shipment number and referencing an old one for data, the system could create the new file without the necessity for re-entry of an entire shipment record. Alternately, a special repetitive file could be established as is currently done for repetitive waybills. On the same basis, with properly controlled access to the system by the consignee, an existing shipment record could be used as a reference to generate an order to the shipper via the system. This function seems a logical one for ultimate inclusion since the paper-work savings would indeed be significant.

A.14.2   General Benefit

In those shipments which are repeats, the possibility of completely eliminating data entry is an attractive one. With a basic system in operation, it would seem that the means for accomplishing this will be at hand. CARDIS would also provide a much more intimate link to user operations by assisting in the ordering process to some extent.

A.14.3   Utility

A.14.3.1   Direct CARDIS Benefits

For those shipments where file generation is possible, one could postulate $\frac{1}{2}$ hour of entry or approximately \$5.00. If 10 percent of shipments are repeats, then \$.50 per shipment saving would result to the user on average. This estimate would be extremely modest for many facilities, so that much more significant savings might ensue.

A.14.3.2   Administrative

It should be possible to anticipate significant benefits in this category by virtue of eliminating the data entry function in many instances.

A.14.3.3   Shipment Financial

No benefits are foreseen in this area.

A.14.3.4   Utilization

Again, no benefits in this area are foreseen.

A.14.3.5   Control

Some effect on statistics and decision making may arise as an indirect benefit of more rapid file creation.

A.14.3.6   Service

If properly used, there may be some impact on service arising from more rapid initiation of paperwork.

A.14.4   <u>System Impact</u>

A.14.4.1   Business and Utility

This feature will be highly visible to potential system users with beneficial results on participation and advertising.

A.14.4.2   Operational

Few operational problems are foreseen at this point.

A.14.4.3   Managerial

Similarly, there seem to be few areas in which substantial additional effort will be required.

A.14.4.4   Technological

The applications modules to accomplish this function are relatively straight-forward. With properly implemented security procedures no major difficulties are anticipated, although there will, of course, be a requirement for some additional development effort.

TABLE A-14. REPETITIVE SHIPMENT PROCESSING

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact X						
Per Shipment Estimated Cost Saving $0.50						
DIRECT CARDIS BENEFITS		200			70	35
Reduced Paperwork: Preparation Time	10		5	50		
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5					
Reduced Paperwork: Documents	8					
Reduced Paperwork: Copies	3					
Accuracy	4		5	20		
ADMINISTRATIVE		195			130	67
Improved Staff Productivity	10		5	50		
Lower Skill Levels (Rec. & Train)	7		3	21		
Flexibility re Changes	6		2	12		
Peak Handling Capabilities	7		5	35		
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4		3	12		
SHIPMENT FINANCIAL		125				
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
UTILIZATION		110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8					
Less Need for Additional Facilities	4					
Delay Avoidance at Ports	10					
CONTROL		120			28	23
Reduced Progress Checking	10					
Accurate Timely Statistics	8		2	16		
Decisions based on Better Info.	6		2	12		
SERVICE		115			46	40
Speedier Delivery	10		2	20		
Greater Delivery Reliability	8		2	16		
Market Impact (Based on Above)	5		2	10		

TABLE A-14. REPETITIVE SHIPMENT PROCESSING (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			61	38
Broadens Participation	10		3	30		
Generates Revenue	7		1	7		
Advertising Value	6		4	24		
Facilitates use by Cooperating Systems	9					
OPERATIONAL		435			-114	-26
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8					
Per Message Processing	7					
Requires Special File Maintenance	7		-4	-28		
Increases Frequency of Audit	6		-3	-18		
Increases Print Load	2					
Requires Security Procedures	10		-4	-40		
Increases Complexity of On-Line Environment	9		-3	-27		
Creates Additional Communication Traffic						
User-Center	3		3	9		
Inter Center	5					
Creates Maintenance Difficulties	5					
Complicates Facilities Management	5		-2	-10		
MANAGERIAL		225			-51	-23
Requires Special Standards Attention	3		-2	-6		
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4					
Complicates Billing	6		-2	-12		
Complicates Interfaces	9		-1	-9		
Increases Audit Trail Capability	8		-3	-24		
Complicates Man/Machine Interface	10					
TECHNOLOGICAL		240			-41	-17
Complicates System Design	10		-2	-20		
New Developments	10					
Hardware Impact: Main Frame	3					
Front End & Switching	2					
Terminals	3					
On-Line Storage	2					
Software: Operating System	4					
Files	3		-4	-12		
On-Line Applications	2		-2	-4		
Off-Line Applications	1					
Financial – Development Costs	5		-1	-5		
– Financing (Incremental Costs)	3					

A.15   TITLE TRANSFER (TABLE A-15)

A.15.1   Description

This sensitive function would utilize CARDIS for purposes of title transfer. This could be accomplished by an authorized change in a sensitive file location. There is a divergence of opinion as to whether or not CARDIS will ultimately serve this function. In light of discussions to date, the most probable scenario is one in which de facto title transfer does take place within CARDIS while de jure transfer follows by paperwork flowing around the prime shipment data handling cycle. It has been pointed out that "call back" procedures with teletypewriters are now in use for similar purposes and that these are considered, if anything, more secure than the current method of acceptance of negotiable bills and other documents as verification of title. Accordingly, the probability of this function being incorporated into CARDIS seems possible.

A.15.2   General Benefit

There is no doubt that with this capability, CARDIS will prove useful in alleviating the delays associated with proper paperwork clearance. Accordingly, the fall-out in benefits will be similar to those achieved through the provision of both message switching and document preparation functions.

A.15.3   Utility

A.15.3.1   Direct CARDIS Benefits

While it is difficult to establish a direct dollar value for saved paperwork, some paperwork advantages could accrue if pressing requirements for documents in support of title transfer are mitigated. For example, last minute preparation, rushed transfer and other aspects of critical document handling would show some improvement.

A.15.3.2   Administrative

One could expect much better productivity and improved managerial efficiency as a result of the ability to transfer title via CARDIS.

A.15.3.3   Shipment Financial

Through impact on the speed of the shipping cycle, there should be significant advantages financially.

A.15.3.4   Utilization

Through delay avoidance, utilization should benefit.

A.15.3.5   Control

There is some question as to whether any significant impact on control may be foreseen although the diminution of shipment time should have a beneficial effect.

A.15.3.6   Service

Service associated areas should show a significant improvement as a result of the ability to circumvent present laborious methods of title transfer.

A.15.4   System Impact

A.15.4.1   Business and Utility

With properly safeguarded methods of title transfer, most aspects of this area will show benefits.

A.15.4.2   Operational

The operational problems associated with CARDIS will be compounded because of the added necessity to protect against fraud. It must be remembered, however, that present procedures are far from foolproof so that the security provided for many of the other functions would probably suffice for title transfer as well.

A.15.4.3   Managerial

In this area some additional complication would ensue, especially with respect to standards and the need for human intervention to doublecheck and verifty the validity of claims to title.

A.15.4.4   Technological

       Aside from those features attendant on security being properly implemented, no other development difficulties are foreseen. This application does reinforce the need for comprehensive security measures.

TABLE A-15. TITLE TRANSFER

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact X						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200			60	30
Reduced Paperwork: Preparation Time	10		1	10		
Reduced Paperwork: Transfer Time	10		3	30		
Reduced Paperwork: Filing	5		1	5		
Reduced Paperwork: Documents	8		1	8		
Reduced Paperwork: Copies	3		1	3		
Accuracy	4		1	4		
ADMINISTRATIVE		195				
Improved Staff Productivity	10					
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6					
Peak Handling Capabilities	7					
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4					
SHIPMENT FINANCIAL		125				
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
UTILIZATION		110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8					
Less Need for Additional Facilities	4					
Delay Avoidance at Ports	10					
CONTROL		120				
Reduced Progress Checking	10					
Accurate Timely Statistics	8					
Decisions based on Better Info.	6					
SERVICE		115				
Speedier Delivery	10					
Greater Delivery Reliability	8					
Market Impact (Based on Above)	5					

TABLE A-15. TITLE TRANSFER (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			91	57
Broadens Participation	10		3	30		
Generates Revenue	7		1	7		
Advertising Value	6		3	18		
Facilitates use by Cooperating Systems	9		4	36		
OPERATIONAL		435			−277	−64
Transaction Rates	10					
Real Time Transactions	10		−3	−30		
Increases File Seeks	8		−3	−24		
Per Message Processing	7		−2	−14		
Requires Special File Maintenance	7		−4	−28		
Increases Frequency of Audit	6		−5	−30		
Increases Print Load	2					
Requires Security Procedures	10		−5	−50		
Increases Complexity of On-Line Environment	9		−5	−45		
Creates Additional Communication Traffic						
User-Center	3		−2	− 6		
Inter Center	5		−2	−10		
Creates Maintenance Difficulties	5		−3	−15		
Complicates Facilities Management	5		−5	−25		
MANAGERIAL		225			−181	−80
Requires Special Standards Attention	3		−5	−15		
Decreases Need for Human Intervention	5		−4	−20		
Requires Specialized Skills	4		−4	−16		
Complicates Billing	6					
Complicates Interfaces	9		−5	−45		
Increases Audit Trail Capability	8		−5	−40		
Complicates Man/Machine Interface	10		−4	−40		
TECHNOLOGICAL		240			−153	−64
Complicates System Design	10		−4	−40		
New Developments	10					
Hardware Impact: Main Frame	3		−2	− 6		
Front End & Switching	2		−2	− 4		
Terminals	3		−5	−15		
On-Line Storage	2		−2	− 4		
Software: Operating System	4		−5	−20		
Files	3		−5	−15		
On-Line Applications	2		−5	−10		
Off-Line Applications	1		−5	− 5		
Financial − Development Costs	5		−5	−25		
− Financing (Incremental Costs)	3		−3	− 9		

A.16   CODE MAINTENANCE (TABLE A-16)

A.16.1   Description

This function would seem to be clearly within the CARDIS scope of activities no matter which system or group of systems were eventually implemented. A CARDIS body would assume responsibility for maintaining commodity codes. Duns number or other party identifier, location codes, port codes, shipment numbering convention and any other agreed upon codes that would relate to CARDIS. In many instances the actual establishment of the codes themselves are the responsibility of other government agencies or of international bodies and transportation industry groups. However, the coordination of the codes and making them available through CARDIS would still be an important function as would the actual generation and updating of codes unique to the CARDIS environment.

An interesting aspect of this process would be the maintenance of code files on-line as a service to CARDIS users. These could then be accessed by inquiry where assistance is required in developing shipment data for transmission or use.

A.16.2   General Benefit

CARDIS files of current codes would provide an easily accessed reference for users and thereby assure accuracy of shipment designation for commonly coded parameters. The availability of the reference may be used to assist in file editing both during entry and when the file is accessed for application usage.

From a management standpoint, codes along with other aspects of CARDIS standards are a logical function of any CARDIS steering organization. Having these codes on-line and available for access would greatly facilitate their use and result in benefits to the various CARDIS compatible facilities tying into the network.

Use of codes can result in the reduction of CARDIS data storage requirements by as much as 50 percent. Although the actual costs of on-line data storage on a per shipment basis is small, the mass storage units will prove to be an appreciable part of the equipment investment for any CARDIS center.

Corresponding decreases in the cost of transmission will result from full code utilization. Again, one might envisage reducing communication costs by up to a factor of two. Perhaps even more important is the character thruput requirement for participating CARDIS compatible facilities. These will diminish as will the amount of processor time necessary to perform certain applications keyed to file content search. The results will be much simpler machine configurations to perform a given range and volume of CARDIS functional activities.

A.16.3   Utility

A.16.3.1   Direct CARDIS Benefits

Although it is difficult to place a dollar estimate on the savings which could be realized, effective use of codes should significantly assist most areas in the paper-work category of benefits.

A.16.3.2   Administrative

Similarly, one should anticipate significant administrative benefits arising from the use of well maintained shipping and other codes.

A.16.3.3   Shipment Financial

Aside from better accuracy arising out of coded parties to the shipment, no significant benefits are foreseen in this category.

A.16.3.4   Utilization

No impact is foreseen in this category.

A.16.3.5   Control

Some minor benefit in this area may arise from ease in manipulation of data.

A.16.3.6   Service

No benefits are foreseen in this category.

A.16.4   System Impact

It is likely that each CARDIS compatible facility will be required to keep a
repertory of code files for use by subscribers. A central code maintenance facility will
be required to keep master records resulting from new negotiations, producing additions
and deletions to code lists. Facilities for updating individual CARDIS compatible facilities
would then be required to round out the operating environment.

To aid in the economic viability of such a central facility, the system will
have had to attain some degree of generality in usage. Code updates could be available
in hard copy or in machine readable format, thus providing the maximum economic base
during the phase-in of CARDIS.

In any case, a fairly careful design effort is necessary to assure that code
maintenance is facilitated. This requires organizational as well as system design.

A.16.4.1   Business and Utility

With CARDIS having the capability of maintaining codes for industry use,
all aspects of this category will show an appreciable benefit.

A.16.4.2   Operational

Few serious operational difficulties arise from the use and maintenance
of codes of the sort envisioned here. However, particular note should be taken of the
file maintenance and associated system software maintenance difficulties which would
result from this function.

A.16.4.3   Managerial

Obtaining agreement on codes and upgrading them is a time consuming
and difficult process. However, once this has been accomplished, the continuing effort
on the part of management should not be overly difficult.

A.16.4.4   Technological

Certain aspects of code maintenance in connection with maintaining shipment
files will require fairly careful design and implementation. The interaction of changes

in code files with already existing records is one example of a difficulty which may arise. Others include the process by which the system assimilates and disseminates code information to subscribers.

TABLE A-16. CODE MAINTENANCE

BENEFITS		W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE							
Central to CARDIS Concept	X						
Significant System Impact							
Minor System Perf. Impact							
Per Shipment Estimated Cost Saving							
DIRECT CARDIS BENEFITS			200			96	48
Reduced Paperwork: Preparation Time		10		3	30		
Reduced Paperwork: Transfer Time		10		1	10		
Reduced Paperwork: Filing		5		4	20		
Reduced Paperwork: Documents		8		2	16		
Reduced Paperwork: Copies		3					
Accuracy		4		5	20		
ADMINISTRATIVE			195			125	64
Improved Staff Productivity		10		3	30		
Lower Skill Levels (Rec. & Train)		7		5	35		
Flexibility re Changes		6		5	30		
Peak Handling Capabilities		7		2	14		
Reduced Demands on Data Recipients		5					
Managerial Efficiency		4		4	16		
SHIPMENT FINANCIAL			125			9	7
Faster Payment		6					
Reduced Demurrage		10					
Reduced Financing: "In Pipeline"		2					
"Buffer Stock"		4					
Improved Credit Control		3		3	9		
UTILIZATION			110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)		8					
Less Need for Additional Facilities		4					
Delay Avoidance at Ports		10					
CONTROL			120			28	23
Reduced Progress Checking		10					
Accurate Timely Statistics		8		2	16		
Decisions based on Better Info.		6		2	12		
SERVICE			115				
Speedier Delivery		10					
Greater Delivery Reliability		8					
Market Impact (Based on Above)		5					

SYSTEM IMPACT	W_i	Max. Value $5\sum W_1$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
<u>BUSINESS AND UTILITY</u>		160			143	89
Broadens Participation	10		4	40		
Generates Revenue	7		4	28		
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		5	45		
<u>OPERATIONAL</u>		435			−97	−22
Transaction Rates	10		2	20		
Real Time Transactions	10					
Increases File Seeks	8		−1	− 8		
Per Message Processing	7					
Requires Special File Maintenance	7		−5	−35		
Increases Frequency of Audit	6					
Increases Print Load	2		−2	− 4		
Requires Security Procedures	10					
Increases Complexity of On-Line Environment	9		−3	−27		
Creates Additional Communication Traffic						
User-Center	3		−1	− 3		
Inter Center	5		−2	−10		
Creates Maintenance Difficulties	5		−5	−25		
Complicates Facilities Management	5		−1	− 5		
<u>MANAGERIAL</u>		225			−62	−28
Requires Special Standards Attention	3		−3	− 9		
Decreases Need for Human Intervention	5		−4	−20		
Requires Specialized Skills	4		+2	+ 8		
Complicates Billing	6		−1	− 6		
Complicates Interfaces	9		−3	−27		
Increases Audit Trail Capability	8		−1	− 8		
Complicates Man/Machine Interface	10					
<u>TECHNOLOGICAL</u>		240			−185	−77
Complicates System Design	10		−5	−50		
New Developments	10		−5	−50		
Hardware Impact: Main Frame	3		−2	− 6		
Front End & Switching	2		−1	− 2		
Terminals	3					
On-Line Storage	2		−3	− 6		
Software: Operating System	4		−1	− 4		
Files	3		−5	−15		
On-Line Applications	2		−5	−10		
Off-Line Applications	1		−5	− 5		
Financial − Development Costs	5		−5	−25		
− Financing (Incremental Costs)	3		−4	−12		

A.17   FILE CROSS-REFERENCE (TABLE A-17)

A.17.1   Description

       Incorporation of this function permits the shipment record to reflect the current status and location, even when the shipment is consolidated into a container load. This function supports tracing and carrier manifest generation. Probably the easiest way to implement such a system is to keep a container file that has all reference numbers of shipments in the container. If the shipment file is then appended with the container number, all checks on current shipment status would automatically be cross-referenced to the container. The same or a similar hierarchical approach could be used with respect to containers as part of vessels, barges, or aircraft. Alternately, each entry pertaining to container status update could be used to automatically update every file for shipments within the container or other shipping unit.

A.17.2   General Benefit

       Consolidation and/or breakout is common throughout the shipping industry. With that in mind, it would be almost impossible to perform tracing effectively without some sort of system of cross-reference to the shipping unit. Also, it then becomes possible to interface the system with existing or planned systems for container tracing without any additional data entry requirements.

A.17.3   Utility

A.17.3.1   Direct CARDIS Benefits

       Based on the fact that cross-reference will automatically tie together many information transfer elements, one should anticipate significant savings to the paperwork process associated with the shipment. The cross-reference function will be an added aid to manifest preparation and should reflect benefits as a result. Information filing will also be facilitated by virtue of better access.

A.17.3.2   Administrative

       By appropriate cross-indexing, it should be significantly easier to locate required data.

A.17.3.3   Shipment Financial

Keying shipments to units of carriage and vice-versa should facilitate movement and location with some savings in demurrage and shipment financing as a result.

A.17.3.4   Utilization

By virtue of improved movement some savings in this category may be anticipated.

A.17.3.5   Control

The benefits for control criteria due to file cross-reference are fairly obvious.

A.17.3.6   Service

Through tracing and facilitation of other functions which affect service, a significant improvement should result.

A.17.4   System Impact

A.17.4.1   Business and Utility

Because the capability will exist to support many other desirable functions, this capability will almost certainly have a significant impact on participation and on use by cooperating systems.

A.17.4.2   Operational

Despite some increase in complexity, the impact of including file cross-reference will not be major.

A.17.4.3   Managerial

Despite technological implications, the impact on system management does not seem to be great.

A.17.4.4 Technological

This function will complicate the system design and have a fairly significant impact on the operating system and files. However, the techniques for accomplishing cross-reference are fairly well known, so that one should be able to draw on a body of existing procedures and software. Where larger facilities are contemplated with high throughput, this feature may require substantial modification to operating system and filing structures.

TABLE A-17. CROSS-REFERENCE FILE

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact X						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
<u>DIRECT CARDIS BENEFITS</u>		200			120	60
Reduced Paperwork: Preparation Time	10		4	40		
Reduced Paperwork: Transfer Time	10		1	10		
Reduced Paperwork: Filing	5		5	25		
Reduced Paperwork: Documents	8		3	24		
Reduced Paperwork: Copies	3		3	9		
Accuracy	4		3	12		
<u>ADMINISTRATIVE</u>		195			107	55
Improved Staff Productivity	10		3	30		
Lower Skill Levels (Rec. & Train)	7		4	28		
Flexibility re Changes	6		3	18		
Peak Handling Capabilities	7		2	14		
Reduced Demands on Data Recipients	5		1	5		
Managerial Efficiency	4		3	12		
<u>SHIPMENT FINANCIAL</u>		125			42	34
Faster Payment	6					
Reduced Demurrage	10		3	30		
Reduced Financing: "In Pipeline"	2		2	4		
"Buffer Stock"	4		2	8		
Improved Credit Control	3					
<u>UTILIZATION</u>		110			42	38
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		3	24		
Less Need for Additional Facilities	4		2	8		
Delay Avoidance at Ports	10		1	10		
<u>CONTROL</u>		120			88	73
Reduced Progress Checking	10		4	40		
Accurate Timely Statistics	8		3	24		
Decisions based on Better Info.	6		4	24		
<u>SERVICE</u>		115			67	58
Speedier Delivery	10		2	20		
Greater Delivery Reliability	8		4	32		
Market Impact (Based on Above)	5		3	15		

TABLE A-17. CROSS-REFERENCE FILE (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			94	59
Broadens Participation	10		4	40		
Generates Revenue	7					
Advertising Value	6		3	18		
Facilitates use by Cooperating Systems	9		4	36		
OPERATIONAL		435			−116	−27
Transaction Rates	10		+2	+20		
Real Time Transactions	10					
Increases File Seeks	8		−1	− 8		
Per Message Processing	7		−1	− 7		
Requires Special File Maintenance	7		−5	−35		
Increases Frequency of Audit	6		−1	− 6		
Increases Print Load	2		−1	2		
Requires Security Procedures	10		−3	−30		
Increases Complexity of On-Line Environment	9		−4	−36		
Creates Additional Communication Traffic						
User-Center	3		+1	+ 3		
Inter Center	5					
Creates Maintenance Difficulties	5		−1	− 5		
Complicates Facilities Management	5		−2	−10		
MANAGERIAL		225			− 69	−31
Requires Special Standards Attention	3		−1	− 3		
Decreases Need for Human Intervention	5		+2	+10		
Requires Specialized Skills	4		+1	+ 4		
Complicates Billing	6		−3	−18		
Complicates Interfaces	9					
Increases Audit Trail Capability	8		−4	−32		
Complicates Man/Machine Interface	10		−3	−30		
TECHNOLOGICAL		240			−156	−65
Complicates System Design	10		−5	−50		
New Developments	10		−3	−30		
Hardware Impact: Main Frame	3		−2	− 6		
Front End & Switching	2					
Terminals	3					
On-Line Storage	2		−3	− 6		
Software: Operating System	4		−3	−12		
Files	3		−5	−15		
On-Line Applications	2		−5	−10		
Off-Line Applications	1		−3	− 3		
Financial − Development Costs	5		−3	−15		
− Financing (Incremental Costs)	3		−3	− 9		

A.18   USER STATISTICS (TABLE A-18)

A.18.1   Description

The CARDIS system can offer users the ability to develop statistics which could prove of immense benefit to their operations. Trends, personnel projections, revenue projections, market analyses and the like will be much easier to generate once the data has been captured electronically. This function will probably begin with a few simple offerings and then expand in response to user requests. Where the interface is with a more sophisticated system, statistical packages may reside with the user deriving relevant raw data from the system.

A.18.2   General Benefit

The capability to provide users with management data and statistics should significantly enhance the attractiveness of CARDIS to potential users. By allowing better control of operations, appropriately designed statistical packages can be a significant factor in the profitability of participating firms.

A.18.3   Utility

A.18.3.1   Direct CARDIS Benefits

No direct benefits are foreseen from inclusion of this function.

A.18.3.2   Administrative

This benefit category should derive advantages from a properly designed set of user statistical packages, particularly with respect to staff analysis and management aids.

A.18.3.3   Shipment Financial

Only minor benefits arising from faster payments in some cases are foreseen.

A.18.3.4   Utilization

By tracking use of facilities, planning for procurement will be greatly en-
hanced.   Patterns of utilization when properly reported will also result in better usage
of existing capital equipment.

A.18.3.5   Control

Control of operations will depend to a large extent on the adequacy of statis-
tics.   Decision making should derive direct benefits from this function.

A.18.3.6   Service

Statistical packages should serve to improve user efficiency and methods sig-
nificantly.

A.18.4   System Impact

A.18.4.1   Business and Utility

The provision of useful statistical packages will significantly add to the de-
sirability of CARDIS participation and provide advertising benefits.

A.18.4.2   Operational

The size and content of user data bases must be determined with some
knowledge of the nature of the CARDIS statistical programs.   Depending on the frequency of
reporting and methods of access,there will be a significant impact on system loading as well.

A.18.4.3   Managerial

This area will show the effect of providing for useful user statistics.

A.18.4.4   Technological

Most system design parameters will show an impact from the develop-
ment of user statistics.

TABLE A-18. USER STATISTICS

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
<u>IMPORTANCE</u>						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
<u>DIRECT CARDIS BENEFITS</u>		200				
Reduced Paperwork: Preparation Time	10					
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5					
Reduced Paperwork: Documents	8					
Reduced Paperwork: Copies	3					
Accuracy	4					
<u>ADMINISTRATIVE</u>		195			92	47
Improved Staff Productivity	10		4	40		
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6		3	18		
Peak Handling Capabilities	7		2	14		
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4		5	20		
<u>SHIPMENT FINANCIAL</u>		125			12	10
Faster Payment	6		2	12		
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
<u>UTILIZATION</u>		110			36	33
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8		3	24		
Less Need for Additional Facilities	4		3	12		
Delay Avoidance at Ports	10					
<u>CONTROL</u>		120			70	58
Reduced Progress Checking	10					
Accurate Timely Statistics	8		5	40		
Decisions based on Better Info.	6		5	30		
<u>SERVICE</u>		115			69	60
Speedier Delivery	10		3	30		
Greater Delivery Reliability	8		3	24		
Market Impact (Based on Above)	5		3	15		

TABLE A-18. USER STATISTICS (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160			110	69
Broadens Participation	10		5	50		
Generates Revenue	7		3	21		
Advertising Value	6		5	30		
Facilitates use by Cooperating Systems	9		1	9		
OPERATIONAL		435			−174	−40
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8		−2	−16		
Per Message Processing	7		−1	− 7		
Requires Special File Maintenance	7		−4	−28		
Increases Frequency of Audit	6		−1	− 6		
Increases Print Load	2		−5	−10		
Requires Security Procedures	10		−5	−50		
Increases Complexity of On-Line Environment	9		−2	−18		
Creates Additional Communication Traffic						
User-Center	3		−3	− 9		
Inter Center	5		−2	−10		
Creates Maintenance Difficulties	5		−2	−10		
Complicates Facilities Management	5		−2	−10		
MANAGERIAL		225			−108	−48
Requires Special Standards Attention	3		−2	− 6		
Decreases Need for Human Intervention	5		−2	−10		
Requires Specialized Skills	4		−3	−12		
Complicates Billing	6		−3	−18		
Complicates Interfaces	9		−2	−18		
Increases Audit Trail Capability	8		−3	−24		
Complicates Man/Machine Interface	10		−2	−20		
TECHNOLOGICAL		240			− 79	−33
Complicates System Design	10		−3	−30		
New Developments	10					
Hardware Impact: Main Frame	3		−1	− 3		
Front End & Switching	2		−1	− 2		
Terminals	3		−2	− 6		
On-Line Storage	2		−2	− 4		
Software: Operating System	4		−1	− 4		
Files	3		−3	− 9		
On-Line Applications	2		−3	− 6		
Off-Line Applications	1		−5	− 5		
Financial − Development Costs	5		−2	−10		
− Financing (Incremental Costs)	3					

A.19   GOVERNMENT REQUIRED STATISTICS (TABLE A-19)

A.19.1   Description

This function would serve to provide the government with required import and export statistics. Both Census and Customs have been making considerable headway in providing for automated interface with large users. In fact, the cooperativeness on their part is laudatory and will assure that active cooperation with CARDIS compatible facilities in this regard may be anticipated - even to the extent of eliminating currently required forms by resorting to direct data interface.

A.19.2   General Benefit

Recent reports to the CARDIS Coordinating Committee by both Census and Customs have provided some indication of the savings which can be realized by provision within CARDIS for generation and direct transfer of data such as Export Declarations, etc., to the government. One could postulate as many as three or four document copies saved in any given shipment if proper attention is paid to government statistical reporting.

A.19.3   Utility

A.19.3.1   Direct CARDIS Benefits

The cost savings associated with the direct provision of government statistics is a bit difficult to compute, expecially once a functioning CARDIS system is already in place and providing documents automatically. Between postage and generation, it is not difficult to project a realized saving of approximately $1.00 per shipment just from this feature alone.

In this case, one can certainly project an appreciable impact on direct paperwork factors if the government interface is properly handled. Reporting accuracy would also be significantly enhanced which consequently provides a great impetus for government participation in developing reporting procedures which are not overly burdensome to the CARDIS system operator.

A.19.3.2   Administrative

These benefits will be less profound although some improvement in shipment management may be anticipated as a result of simplified procedures for reporting of government statistics. One interesting sidelight in this area is the direct interest by trading companies in the results of census generated trade statistics. Provision of accurate statistics, while immediately benefiting the Bureau of Census, really ultimately benefits the shippers themselves who place demands on Census for the data.

A.19.3.3   Shipment Financial

At the moment, statistical data reporting does not impeed cargo movement so that one could not anticipate any significant savings with respect to financing costs.

A.19.3.4   Utilization

Equipment utilization will have no direct benefit although more accurate trading statistics can certainly aid in planning capital equipment acquisition.

A.19.3.5   Control

Automating reporting procedures may have the function of providing some degree of cross checking of shipment data parameters. Some examples of this were demonstrated during briefing by Census personnel.

A.19.3.6   Service

Only minor impact on service is expected by virtue of including this function.

A.19.4   System Impact

A.19.4.1   Business and Utility

Automated filing of required government data should prove to be of significance in attracting users to a CARDIS center. Some revenue should result from incorporation of this capability and one could reasonably expect a degree of advertising benefit as well.

A.19.4.2   Operational

Most operational implications arising from this function should be minimal since most of the reports to be generated could be developed from off-line routines. However, the packages used to develop this data and the data itself must be carefully protected to assure only authorized access. Recent precautions on the part of Census taken with similar data highlight the privacy requirements associated with this function.

A.19.4.3   Managerial

The security requirements arising from this function will have a significant impact on some aspects of system management. With the provision of such services in multi-user facilities, careful procedural checks will have to be instituted. However, these will also be required for other applications packages which access sensitive data so that the incremental impact may turn out to be insignificant in a well run CARDIS facility.

A.19.4.4   Technological

The actual mechanism for generation of required government data will not prove overly burdensome to generate. Since the basic data will be contained in the shipment record, on-line and off-line applications are all that are necessary to develop reports. The interface provisions will require some attention. However, it is worthy of note that current procedures being worked out by Census are much more difficult than would be the case if a CARDIS compatible facility acted as an intermediary between the participating element and government.

APPENDIX B - CARDIS TEST FUNCTIONAL ANALYSIS

B.1 GENERAL

The shipping community that utilizes the CARDIS network will increasingly use data communications and data processing to facilitate data interchange between interested parties. The provision of electronic data processing facilities for various elements of the industry will afford the potential for automating a number of functions associated with processing shipment data. These will aid in the transfer of information, automate the actual preparation of documents still required, and afford a wide range of services to the industry.

The CARDIS experimental program will provide the framework for the development, implementation, and evaluation of applications. Many of the functions (aside from those strictly associated with data transfer) are optional in that they do not impact on the ability of CARDIS to speed data transfer. However, provision for the inclusion of these functions may be necessary in that the services offered will encourage the user participation so necessary to providing an economic base for systems support.

The facilities to be developed in the CARDIS environment to serve basic data interchange needs will exhibit wide variations in their specific characteristics. To a large extent, the facilities will be defined by the specific functions or services they provide to the user community.

During the Phase I effort, CSC, TDCC, and NCITD developed a series of functions suggested for incorporation into CARDIS. In many cases, the provisions of these functions will impact directly on the operation of the system itself in that communications, record keeping, documentation preparation, etc. will be shaped by the services CARDIS can provide. Other functions which have been proposed are more in the nature of services which can aid the shipping community in their operations, but which are not absolutely essential in defining the CARDIS environment. While one

would ordinarily relegate these to the "nice to have" category, these services may, in fact, provide the necessary impetus for many users to avail themselves of CARDIS services. As such, they must be considered both with respect to the benefits which could evolve from their development and their potential impact on system implementation.

The treatment in this appendix first defines a set of benefit and impact criteria to be used in evaluating each CARDIS function. Each criteria is described and weighted with respect to benefits (including direct cost savings where this can be estimated) and system impact. Then, a subjective profile is obtained and the analysis presented in a matrix which summarizes the attributes of each function.

At this juncture it is perhaps necessary to describe the intent of the analysis. It is hoped, by developing a rational effectiveness measure for potential CARDIS functions, that two objectives will be served. First, a rational rank ordering of functions will aid in defining the form which CARDIS will ultimately take. The most essential functions will probably form a system "kernel" for each participating CARDIS facility with additional functions added by individual facilities serving a circumscribed community of users.

Secondly, with a better understanding of the impact of these functions on shipping, it will be possible to select a group of functions for the experimental system implementation. At this point it seems safe to say that these should be chosen with a view toward maximum impact on current paperwork operations to achieve a clear understanding of just how the process could be improved by adding a selected set of CARDIS functions.

One should include a word concerning development of CARDIS characteristics. The functions developed define the system. The characteristics define system-user and system-system interrelationships and quality of performance. Once the "kernel" functions are established, a good start at performance guidelines is possible. As each function is added, it must be critically examined for its impact on CARDIS performance guidelines to see if a new level of service is required or if the existing levels suffice to cover the new function. An attempt is made during the functional analysis to estimate the guidelines impact for each function.

B.2 EVALUATION CRITERIA

The evaluation criteria have their bases in previous work performed by SITPRO, an evaluation of factors which directly impact on the flow of paperwork in the shipping cycle (listed as direct CARDIS benefits since this is, after all, the main reason for CARDIS) and in a listing of criteria which impact on system financial, operational, managerial and developmental efforts. Table B-1 lists the criteria used for evaluation. Each of the categories is described below along with an assessment of future potential for quantitative evaluation.

B.2.1 Importance Category

This category lists criteria with respect to impact of each function on the CARDIS concept. While it is true that one could first analyze a specific function and then place it in one of the three importance criteria based on hindsight, no set of evaluation criteria can effectively ascertain the conceptual as opposed to the beneficial impact of specific functions on CARDIS operation. Accordingly, this evaluation is determined subjectively and is used to indicate the care with which the function under analysis must be assessed before decisions are made with respect to its incorporation within CARDIS.

Three criteria within the Importance Category are presented in Table B-1. Functions which are central to the CARDIS concept are assumed to have a significant impact on the way business is done under CARDIS or otherwise grossly affect the operation or implementation. A prime example of a "central" function might be that of electronic data transfer -- without which CARDIS would not exist.

The Significant System Impact criteria is used to identify functions which, while not changing the basic CARDIS structure, greatly affect utility and performance or, conversely, have a major impact (perhaps quantitatively) on system implementation.

Those functions which do not impact greatly on the system concept or performance are left for the last category. In general, these functions could be evaluated on a cost-benefit basis by individual operators wishing to provide services either to

TABLE B-1. CARDIS FUNCTION ANALYSIS

FUNCTION: _____ (FUNCTION BEING EVALUATED)

Benefits   System Impact

IMPORTANCE		**BUSINESS AND UTILITY**	
Central to CARDIS Concept		Broadens Participation	
Significant System Impact		Generates Revenue	
Minor System Perf. Impact		Advertising Value	
		Facilitates use by Cooperating Systems	
Per Shipment Estimated Cost Saving			
DIRECT CARDIS BENEFITS		**OPERATIONAL**	
Reduced Paperwork : Preparation Time		Transaction Rates	
Reduced Paperwork : Transfer Time		Real Time Transactions	
Reduced Paperwork : Filing		Increases File Seeks	
Reduced Paperwork : Documents		Per Message Processing	
Reduced Paperwork : Copies		Requires Special File Maintenance	
Accuracy		Increases Frequency of Audit	
		Increases Print Load	
ADMINISTRATIVE		Requires Security Procedures	
Improved Staff Productivity		Increases Complexity of On-Line	
Lower Skill Levels (Recr. & Train)		Environment	
Flexibility re Changes		Creates Additional Communication Traffic	
Peak Handling Capabilities		User-Center	
Reduced Demands on Data Recipients		Inter Center	
Managerial Efficiency		Creates Maintenance Difficulties	
		Complicates Facilities Management	
SHIPMENT FINANCIAL		**MANAGERIAL**	
Faster Payment		Requires Special Standards	
Reduced Demurrage		Decreases Need for Human Intervention	
Reduced Financing: "In Pipeline"		Requires Specialized Skills	
"Buffer Stock"		Complicates Billing	
Improved Credit Control		Complicates Interfaces	
		Increases Audit Trail **Capability**	
UTILIZATION		Complicates Man/Machine Interface	
Capital Eq. (Ships, Loading Facilities,			
Vehicles, etc.)		**TECHNOLOGICAL**	
Less Need for Additional Facilities		Complicates System Design	
Delay Avoidance at Ports		New Developments	
CONTROL		Hardware Impact : Main Frame	
Reduced Progress Checking		: Front End & Switching	
Accurate Timely Statistics		: Terminals	
Decisions based on Better Info.		: On-Line Storage	
		Software : Operating System	
SERVICE		: Files	
Speedier Delivery		: On-Line Applications	
Greater Delivery Reliability		: Off-Line Applications	
Market Impact (Based on Above)		Financial - Development Costs	
		- Financing (Incremental Costs)	

themselves or to a prospective client community. Provided these services and functions are implemented within CARDIS specification constraints, the choice is pretty much up to the operator as to whether a profitable implementation is possible. In many cases, provision of the function would greatly encourage participation in the system. This marketability impact can have significance for the prospective operator and should be considered along with cost-benefit.

B.2.2 Direct CARDIS Benefits Category

This category of system benefits is delineated to evaluate each prospective CARDIS function with respect to its impact on those paperwork preparation and transfer tasks which are the main objectives of the CARDIS program. While it is true that many other benefits might accrue, it is the expense of the paperwork itself that provided the main impetus for CARDIS development and which will probably provide the most measurable impact as a result of introduction of functions within the CARDIS system.

Per Shipment Estimated Cost Saving

Where it is possible to estimate savings which would accrue from introduction of a specific function, a calculation is made based on estimates of time saved by personnel involved in paperwork preparation and utilization, savings in filing and communications costs, and any other costs directly attributable to managing or otherwise tracking shipments. Where the existence of prior functions must be assumed as a prerequisite to the function under analysis, marginal costs associated with introducing that function into an already operational system are shown. No attempt has been made at this point to estimate per shipment cost savings accruing from the beneficial impact of CARDIS on management and other shipment operational costs not directly impacting on the paperwork process.

Reduced Paperwork Processes Criteria

In addition to the estimated dollar savings, each work process associated with shipment paperwork handling is evaluated with respect to estimated benefits from the introduction of the function being investigated.

Paperwork parameters evaluated include:

Preparation Time: The time required for preparation of all documents involved in the shipment. The benefit is usually directly related to the degree of machine preparation used in paperwork.

Transfer Time: The time associated with mailing, transmitting or otherwise transferring paperwork from originator to addressee.

Filling: An improvement related to eliminating the necessity for keeping copies of shipment records by the various parties to the shipment. The assumption is that the availability of on-line shipping data will reduce the necessity for keeping paperwork for reference.

Documents: A benefit related to the elimination of documents, again arising from the availability of information in electronic form for transfer and storage.

Copies: Related to the reduction of the number of copies of documents produced by virtue of data accessibility via the system.

Accuracy Criteria

This criteria ranks each function with respect to the potential if has for improving the accuracy of shipment data either stored within the system or, for that matter, produced in document or other form as output.

B.2.3 <u>Administrative Benefits Category</u>

This benefit category was suggested by a recent SITPRO report and relates to benefits resulting from paperwork and other simplification which affect the overall performance of organizations responsible for the shipping process. Although one should anticipate cost benefits to ensue from CARDIS function implementation, quantifying these benefits is a formidable task in view of the tenuous relationships between factors and direct cost savings.

Improved Staff Productivity Criteria

This criteria will be affected in direct relation to the facilitation afforded by the system in the performance of documentation and other functions normally performed manually. Other considerations in arriving at a relative weight include the degree to which information is made more readily available and the extent to which automation serves to eliminate errors of omission in the course of processing shipments.

Lower Skill Levels (Recruiting and Training) Criteria

Increasingly in recent years, it has become more difficult to attract competent personnel to handle some of the more complex functions associated with the shipping process. To handle some of the other functions requiring experienced personnel, automation is increasingly important as recruiting becomes more difficult. The introduction of automation by reducing the reliance on highly skilled personnel provides an advantage to individual activity points involved in the shipment cycle.

Flexibility to Accommodate Changes Criteria

Data codes and procedures are continually in a state of flux. With appropriate modules available, changes are more easily accommodated in that reference files are dated and procedural changes incorporated more rapidly

into the logic associated with shipment data flow. Transitions to new operational modes are facilitated and the margin for error reduced by appropriate introduction of automation.

Peak Handling Capabilities Criteria

Providing excess capacity is a much simpler matter through the provision of more capable hardware than it is when personnel must be overloaded or temporary staff added, especially in view of training problems associated with inexperienced personnel performing complex manual functions. Automation properly implemented can reallocate capacity, e.g., by deferring low priority tasks, to provide much greater peak handling capabilities. Also, since service personnel skill levels can be reduced, the labor pool available for peaks is considerably increased.

Eliminate Redundant Data Capture Criteria

A significant amount of time can be saved when data pertaining to a shipment is input only once at the earliest possible time. Thus, redundant input of the same data and all of the inherent errors caused by manual intervention are avoided.

Managerial Efficiency Criteria

With many of the routine procedural decisions accomplished within the system, management personnel are available for those instances where real problems exist. The provision of summary reports tailored to management's individual needs can also greatly reduce the management work load.

B.2.4 Shipment Financial Category

These criteria are associated with the benefits accruing from financing of the shipment itself. Although beyond the scope of the present effort, it would prove of interest to develop actual cost savings to be anticipated as a result of reduced delays in the shipping process. Such an analysis would require a much better understanding of the delay impact of CARDIS than currently exists and must therefore be deferred

until the appropriate background data and relationships have been developed. Accordingly, the criteria are rated by scale factors in this treatment. Where the criteria has promise of being quantifiable in the future, it is discussed in the following.

Faster Payment Criteria

This criteria will be almost directly related to both the speed with which the shipment moves from shipper to consignee and the speed with which the paperwork is handled between shippers, consignees and appropriate credit agencies. With a more careful analysis, it should be possible to quantify the time savings expected and then translate these into real savings based on interest rates.

Reduced Demurrage Criteria

A reduction in demurrage charges resulting from paperwork delays is often quoted as a prime example of benefits to be anticipated from an automated shipping environment. Here again, if sufficient investigative effort is expended, it could be possible to estimate demurrage savings. At this juncture, with the available data, it is only possible to relatively evaluate the impact of each function subjectively.

Reduced Financing (in Pipeline and Stock) Criteria

Faster shipments should result both in reductions of inventories and in a reduced requirement for financing goods in transit. To some extent, functions which increase shipment reliability can also impact on the reliance on inventories as opposed to orders. However, with this criteria it must be remembered that the more significant delays in many instances are those associated with the manufacturing process rather than the time during the actual shipping cycle. Nevertheless, CARDIS can have a significant monetary impact when high value shipments are considered so that suitable analysis in the future could serve to acquaint potential users with real savings in this area.

Improved Credit Control Criteria

With much of the burdensome paperwork relegated to the system, credit management will become a much simpler task. It would seem that this criteria will be almost impossible to quantify so that the rationale employed here is probably the best one can do in evaluating functions for this impact. (Of course, review by parties to the shipping cycle will serve to improve the confidence in rankings used.)

B.2.5 Utilization Category

The criteria in this category relate to the efficiency with which major capital items are fully utilized. Advantages in fuller utilization of any equipment used in the shipping process are fairly self-evident. Quantitative estimates in this case would have to be based on a fairly good sample of historical utilization with emphasis on under-utilization directly resulting from snags in the paperwork process or lack of avail-ability of information when needed. The most evident example of this, often quoted in the past, are the delays experienced at many ports due to delayed manifest preparation. These delays will affect other major capital equipment costs.

Capital Equipment Utilization (Ships, Loading Facilities, Vehicles) Criteria

The extent to which each function reduces intransit delays will impact on utilization. The ability to forecast equipment requirements will also affect operational efficiency. For instance, container or railroad equip-ment utilization can be increased by redistribution of empties based on equipment forecasts.

Less Need for Additional Facilities Criteria

By facilitating movement through better control and timely information, it should be possible to reduce the investment in loading facilities and ware-housing. Thus, even though a warehouse is fully occupied, cargo throughput itself could be increased by proper introduction of automation. The most significant example of this benefit is that associated with the LACES system

where major reductions in warehousing time (and, concomitantly, in required warehousing facilities) have been achieved. Savings can even extend to the communication facilities needed for checking on shipments - noticeable reductions in telephone costs have been experienced as a direct result of automation.

Delay Avoidance at Ports Criteria

Availability of required paperwork (manifests in particular) can avoid the delays which have been experienced in the past.

B.2.6 Control Category

This category includes factors related to availability of accurate information pertaining to the shipment. Better control can have a significant impact on other facets of shipment processing as well. In fact, many of the evaluation factors are rather strongly interrelated in this respect.

Reduced Progress Checking Criteria

The degree to which inclusion of a function obviates the necessity for personnel to make inquiries about the shipment. Included are all functions which serve to speed the shipment itself and those which make shipment status data readily available through proper filing and other system features.

Accurate Timely Statistics Criteria

Automation within the shipping process will provide a significant management tool as a result of the capability to discern current trends. At every node in the shipping cycle, resource allocation and planning should be greatly enhanced as the ability to provide appropriate statistics is increased CARDIS functions which serve to automate statistical functions contribute indirectly, in addition to alleviating the burden of the manual procedures now used for data entry to Statistical Data Processing facilities.

Decisions Based on Better Information Criteria

Through proper use of CARDIS facilities, information available to management should be more accurate. The qualitative ranking factor indicates the degree to which each function is deemed to aid in the provision of better information concerning the shipment (almost all functions should have at least some impact on this area).

B.2.7 Service Category

The result of improved shipment flow is, of course, better service to clients. These criteria will give some indication of the degree of impact on delivery. The impact of this set of criteria on each function will probably remain a subjectively determined rating since estimation of a quantitative impact is so complex as to almost defy analysis.

Speedier Delivery Criteria

Those functions which impact on goods movement are rated for significance of contribution to shipment speed.

Greater Delivery Reliability Criteria

Those functions which improve tracking and accountability for shipments will invariably impact on delivery reliability.

Market Impact Criteria

Many potential CARDIS functions may contribute to a firm's marketing potential. This will have a direct bearing as a result of speed and reliability which afford their own advertisement, and, in some cases, where the function itself can be used as a feature in marketing.

B.2.8 Business and Utility Category

This category lists impact criteria that provides a positive impact on the development and use of CARDIS. Relative impact is indicated by a polarized ranking, (-), signifying that more effort or difficulty is encountered in attempting to include the

function within CARDIS. Conversely, a (+) indication signifies that the function actually improves CARDIS operation or diminishes demands on the system by virtue of its inclusion.

With this first category of impact criteria, there is really no way other than to subjectively estimate a measure of impact. Accordingly, while future analysis may serve to obtain a better understanding for purposes of ranking, it is very difficult to accurately evaluate these functions.

Broadens Participation Criteria

By encouraging the use of CARDIS, the major aims of the program are served. It is of prime interest, in the development of the system to assure the broadest possible utilization. In fact, many of the proposed functions basic to CARDIS will have little value unless the user community encompasses most parties to the shipping process. Thus, although many of the functions may not be significant insofar as their impact on CARDIS operation, they do serve to broaden interest and thereby system participation and must be considered as prime candidates for inclusion into the system.

Generates Revenue Criteria

Minimizing negative cash flow will be important during the implementation phase of CARDIS. Those functions which have promise of immediate and/or substantial revenue production can serve to place CARDIS on a fiscally sound basis earlier rather than later. At some point in the future, a more detailed analysis sh 'd probably be undertaken to estimate revenues for many proposed functic . This would greatly aid potential system operators in their planning with respect to offering CARDIS services to a selected marketplace.

Advertising Value Criteria

Many functions will enhance utilization and confidence in the system by virtue of advertising based on their inclusion. Here again, one has to consider that a

major ingredient in the success of CARDIS will be a number of fiscally sound reliable systems in operation. Accordingly, functions which can aid in selling CARDIS to clients must take on an importance beyond their utility in terms of paperwork and shipment services.

Facilitate Use by Cooperating Systems Criteria

Again, the utility of CARDIS to clients will rest on the ability to interchange data with as many different systems as possible. Functions which enrich the community of correspondents will serve to offer clients a much broader range of services and hence make their participation that much more attractive. Above all, a broad interface with similar systems will greatly facilitate information flow and enable penetration into more aspects of the shipment cycle. For example, a TRAIN II interface provides significant tracing capability which would otherwise be extremely cumbersome to achieve.

B.2.9 Operational Impact Category

Each function is evaluated with respect to this set of criteria to assess the impact on CARDIS system operation. The criteria selected for evaluation purposes are those which help to define the system in terms of technical stress parameters as well as in procedural terms affecting the manning and logistics of system operation. While functions are analyzed individually, it should be remembered that implementation of a group of functions can often result in a much more efficient use of system resources. This topic will be treated in a later phase of the Task II effort when functional prerequisites are defined. If a good understanding is obtained as to which functions are necessary to serve as building blocks for subsequent addition of system capability, only marginal increase in implementation and operational difficulties will be encountered. A good example of this may be found in the numerous functions which rely on implementation of a sound "store and forward" message switching capability.

Transaction Rates Criteria

System hardware and software capability will be directly affected by required transaction rates. Therefore, each function must be assessed with respect to the impact on this factor. Phase I efforts did arrive at approximate transaction rates for the entire CARDIS environment based on essential CARDIS functions. With the use of a multiple system approach to implementation, the throughput at most facilities should not prove unduly difficult. However, some point prior to development planning will have to include transaction rates anticipated for the specific facility to assure required grade of service to the user.

Real-Time Transactions Criteria

Functions requiring real-time response will impact more in identifying system stress than those which do not. For purposes of this analysis, real-time is construed to be an operator interactive type of operation Each function is ranked with respect to its real-time impact.

Increases File Seeks Criteria

Heavy use of on-line files will be characteristic of many functions, whether performed on-line or off-line. For example, where searches are conducted based on content, simple requests can often severely impact on performance. The factor will indicate the arrangement of on-line files, the number of access channels increasing in direct proportion to peak disc seeks.

Per Message Processing Criteria

This criteria will relate directly to the main frame capability installed by each CARDIS user. As the per message processing load increases, throughput is diminished for a given class of processor. Examples of functions which will greatly impact on this factor are security and those requiring validity checking, which requires considerable per message processing.

Requires Special File Maintenance Criteria

Where functions require that files be updated on a continuous basis, a considerable background load must be anticipated. Also, the actual operation of the center may become more complex depending on required techniques for both file and software maintenance.

Increases Frequency of Audit Criteria

Periodic auditing of files will be necessary for a number of reasons. Auditing in quiet hours, although creating heavy demands on the system, can often be easily accommodated without additional capability. Where the frequency of audit may extend to peak hours of operation, the additional burden could have significant impact on the system hardware and software configuration. Audits associated with security precautions may fall into this category.

Increases Print Load Criteria

Although not overly important, this will give some indication as to whether CARDIS centers are becoming just another paper mill rather than a means for reducing printed documents.

Requires Security Procedures Criteria

Security requirements will have major impact both on the system operation (personnel, physical safeguarding, etc.) and on the architecture of software and hardware. Functions which imply a greater degree of security in their performance should be more heavily weighted.

Increases Complexity of the On-Line Environment Criteria

This criteria is designed to indicate that a function requires more complex service by both the system and its operators. For example, where messages associated with a particular function introduce complicated logical structures into the programming framework, operation and maintenance will be more costly.

Creates Additional Communication Traffic Criteria

Although primarily related to transaction rates, many functions can have
the effect of creating their own traffic. An update of a shipment record
might impact several data files. An increased utilization of the
communications environment will impact on equipment and personnel
associated with CARDIS center operation.

Creates Maintenance Difficulties Criteria

This criteria relates to the frequency with which changes to the system must
be implemented. While intelligent software design can eliminate much of
this, a continuous need for introduction of parameters or change in logic
will almost certainly complicate system operation.

Facilities Management Criteria

Configuration, physical security and many other system performance
characteristics will affect facilities management. To the extent that
a function increases demands on the system, this must be included in con-
sidering operational costs.

B.2.10 Managerial Impact Category

These criteria relate to the ongoing structure of the government, industry and
regulatory bodies who will be associated with the CARDIS environment as well as
those involved in direct management of the facilities themselves. These criteria
will not generally lend themselves to quantification so that the subjective procedures
used in this analysis will probably prevail.

It should be noted that the success of CARDIS will hinge on an effective manage-
ment team in both direct and indirect support of the system. Thus, to a large extent,
continuous work on the part of appropriate agencies and industry representatives will
be necessarily independent of any specific function. Accordingly, it is not unusual to
find that a function will have a great impact on such ancillary work.

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Requires Special Standards Criteria

This criteria is designed to indicate that a proposed function will require standards for CARDIS operation which would otherwise be unnecessary. International standards often mean long lead times and tough negotiations, so each case should be carefully examined for impact in that forum before its introduction into the system. Where the standards relate to internal CARDIS operation, the impact will be much less severe.

Increases Need for Human Intervention Criteria

Both operationally and for maintenance, human intervention should be minimized to best realize potential CARDIS benefits.

Requires Specialized Skills Criteria

Based on the previous discussion under Administrative Benefits, the desirability of avoiding requirements for highly skilled personnel are obvious. Of course, in this instance, skill levels may be quite different so that the impact has to be separately assessed.

Billing Criteria

Billing for CARDIS services will imply a good deal of subsidiary record keeping and system control. Where special billings are required, for example, in accessing service-oriented files such as those associated with traffic and bookings, management of the system (and associated auditing) becomes more difficult and must be considered in developing the system cost profile.

Impact on Interfaces Criteria

Additional and/or special interfaces, e.g., with cooperating systems, raise significant problems in assuring system integrity during the course of operation. Careful checks and barriers must be erected each time a new interface

is considered. The negotiations and other managerial interrelationships must be considered along with the increased technological capability.

Increases Audit Trail Capability Criteria

In addition to the frequency of audit, overly sophisticated auditing will require a level of managerial intervention and expertise which could provide an impediment to successful system operation. While this can be alleviated, to some extent, by provision of interpretive software, even the software itself must be continuously subjected to careful scrutiny if the effectiveness is to be assured.

Complicates Man-Machine Interface Criteria

Where functions require complex interaction because of data entry, inquiry or manipulation, system management and operation takes on a more difficult aspect. Each function should be assessed with respect to its impact in this important area.

B.2.11 Technological Impact Category

This category of criteria groups those issues which will have an effect on actual CARDIS facility (and system) development. As the stress on each of these factors is increased, the system development cycle can be expected to require more effort and time.

CARDIS System Design Criteria

With each additional system element or interaction, the necessary steps in debugging and verification increase geometrically. The extent to which a function complicates the system is a good measure of the difficulty to be anticipated in development.

New Developments Criteria

This criteria will require a continuous review as new technology being developed which could increase the efficiency of CARDIS and decrease the

operating costs. Many of the security features which will be necessary may adversely affect this factor.

Hardware Impact Criteria

More hardware will result in a more expensive system. Where increased revenues can be anticipated, this should not become an overriding factor. A further breakdown is provided to identify the subsystem levels affected by each of the functions analyzed.

Software Impact Criteria

This criteria will probably have the most severe impact on the development of CARDIS. Functions which impact on operating system software can result in significant expenditures if an operating system software environment does not already exist which can provide the new application requirements. The contributing factors to the software environment will require careful evaluation for each system enhancement. This analysis will determine the impact on CARDIS.

Financial Impact Criteria

This criteria is intended to display two aspects of financing--initial or overall development costs for the function and the extent to which funding can be accomplished incrementally. If there is a method which accommodates a "pay-as-you-go" approach, then the cost need not be an overly severe factor. Examples might be functions served by "add-on" modules which can be implemented after the basic system is operational. Where a severe strain is applied to the system structure which must be accommodated as a prerequisite for operation, this can provide significant barriers to implementation and must be carefully assessed against anticipated functional benefits.

B.3 WEIGHTED EVALUATION CRITERIA

To construct an impact/benefit profile for each function, a technique was developed whereby each criteria is assigned a weight of from 1 to 10. This weight is designed to indicate the relative importance of each criteria with respect to its impact on each category being analyzed and is entered in the column headed W_i in Table B-2.

At this juncture, no attempt should be made to establish a single cost-benefit ratio. Rather, it would seem more beneficial to display a profile of each function.

The technique is then:

A weight, W_i, ranging from 1 to 10, is assigned to each criteria within a category. These weights are developed to indicate relative importance of the individual criteria in influencing the category (e.g., Administrative, Financial, etc.) and will remain fixed for all evaluations.

For each function analyzed, value I_i, which varies between ± 5 is used to indicate the approximate extent to which the individual criteria is affected by incorporation of the function.

The relative impact of each function on each category of factors is determined as:

Maximum possible impact magnitude $= 5 \sum W_i$

Actual impact achieved $= \sum W_i I_i$

Relative impact (%) $= \dfrac{\sum W_i I_i}{5 \sum W_i}$

This relative impact, along with any quantitative cost-benefit which can be determined, will then be displayed as part of the profile describing functional impact. By displaying the resulting profile for each function, a relatively rapid assessment may be made for inclusion in the CARDIS framework. The analysis criteria for individual CARDIS functions is contained in T ble B-3 and inserted in Appendix C.

TABLE B-2. IMPACT/BENEFIT PROFILE

BENEFITS	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
IMPORTANCE						
Central to CARDIS Concept						
Significant System Impact						
Minor System Perf. Impact						
Per Shipment Estimated Cost Saving						
DIRECT CARDIS BENEFITS		200				
Reduced Paperwork: Preparation Time	10					
Reduced Paperwork: Transfer Time	10					
Reduced Paperwork: Filing	5					
Reduced Paperwork: Documents	8					
Reduced Paperwork: Copies	3					
Accuracy	4					
ADMINISTRATIVE		195				
Improved Staff Productivity	10					
Lower Skill Levels (Rec. & Train)	7					
Flexibility re Changes	6					
Peak Handling Capabilities	7					
Reduced Demands on Data Recipients	5					
Managerial Efficiency	4					
SHIPMENT FINANCIAL		125				
Faster Payment	6					
Reduced Demurrage	10					
Reduced Financing: "In Pipeline"	2					
"Buffer Stock"	4					
Improved Credit Control	3					
UTILIZATION		110				
Capital Eq. (Ships, Loading Facilities, Vehicles, etc.)	8					
Less Need for Additional Facilities	4					
Delay Avoidance at Ports	10					
CONTROL		120				
Reduced Progress Checking	10					
Accurate Timely Statistics	8					
Decisions based on Better Info.	6					
SERVICE		115				
Speedier Delivery	10					
Greater Delivery Reliability	8					
Market Impact (Based on Above)	5					

TABLE B-2. IMPACT/BENEFIT PROFILE (CONT'D)

SYSTEM IMPACT	W_i	Max. Value $5\sum W_i$	I_i	$W_i I_i$	$\sum W_i I_i$	$\dfrac{W_i I_i}{5\sum W_i}$
BUSINESS AND UTILITY		160				
Broadens Participation	10					
Generates Revenue	7					
Advertising Value	6					
Facilitates use by Cooperating Systems	9					
OPERATIONAL		435				
Transaction Rates	10					
Real Time Transactions	10					
Increases File Seeks	8					
Per Message Processing	7					
Requires Special File Maintenance	7					
Increases Frequency of Audit	6					
Increases Print Load	2					
Requires Security Procedures	10					
Increases Complexity of On-Line Environment	9					
Creates Additional Communication Traffic						
User-Center	3					
Inter Center	5					
Creates Maintenance Difficulties	5					
Complicates Facilities Management	5					
MANAGERIAL		225				
Requires Special Standards Attention	3					
Decreases Need for Human Intervention	5					
Requires Specialized Skills	4					
Complicates Billing	6					
Complicates Interfaces	9					
Increases Audit Trail Capability	8					
Complicates Man/Machine Interface	10					
TECHNOLOGICAL		240				
Complicates System Design	10					
New Developments	10					
Hardware Impact: Main Frame	3					
Front End & Switching	2					
Terminals	3					
On-Line Storage	2					
Software: Operating System	4					
Files	3					
On-Line Applications	2					
Off-Line Applications	1					
Financial – Development Costs	5					
– Financing (Incremental Costs)	3					

TABLE B-3. OUTLINE FOR INDIVIDUAL FUNCTIONAL ANALYSIS

1. **DESCRIPTION**

   A definition of the function to be performed along with a description of its use with CARDIS.

2. **GENERAL BENEFIT**

   Description of the value of the function to expend shipment or otherwise enhance system performance. Identification of improved administration, utilization of equipment and customer relations.

3. **UTILITY EVALUATION**

   Where possible, the actual impact on the cost of paperwork is assessed by:

   a. Determining costs based on current manual operation where the function already exists.

   b. Determining the cost of manually performing the function under the assumption of a comprehensive CARDIS system minus the specific function under analysis.

   c. Determining the cost of performing the function under the assumption of a comprehensive CARDIS operations including the function.

   Additionally, an assessment is made in qualitative terms by discussing other parameters concerning the functional utility to the shipment, e.g., time, reduced warehousing.

4. **SYSTEM IMPACT OR IMPLEMENTATION IMPLICATIONS**

   When adding a function to CARDIS, how does it impact operational, development, equipment complement, etc.

5. **EVALUATION CRITERIA APPLIED TO FUNCTIONS**

   Appendix C contains a list of selected CARDIS functions which have been evaluated using the preceding function analysis technique described in Paragraph B.3.

B.4 CARDIS TEST FUNCTIONS

There are two classifications for CARDIS functions which must be performed. Namely, those CARDIS operational functions which are employed in the transmission of data between CARDIS compatible facilities and those transportation system functions which must be accomplished by the transportation-oriented industries in their day to day operations.

The CARDIS operational functions which are central to the CARDIS concept, by nature of their definition will be included in the experimental CARDIS test. Representative functions included in this category are the Electronic Data Transfer, Foreign and Domestic Interface, and the User Interface function, to name but a few.

Selected CARDIS transportation functions will be included in the initial CARDIS test as identified by CSC, NCITD, and TDCC, while other functions that have been evaluated by the CARDIS participants might be excluded for various reasons. For instance, the problem of creating and maintaining a viable tariff file would require a very large staff and tax the available CARDIS resources beyond practical limits. It is understood that tariffs are very important and some day may be included. On the other hand, functions such as market forecasting and voyage pro forma systems do not have a direct bearing on transportation and therefore are not being considered as candidate functions for the initial experimental CARDIS test phase.

The CARDIS functions which have been selected as candidate test functions are based on current key industry requirements and, therefore, are not meant to be an exhaustive list of all transportation needs. Some of these functions may not appear to provide a significant saving, but they might be a prerequisite which must be included so that subsequent functions can be developed. When evaluating any proposed test CARDIS function, the entire CARDIS network must be considered in relationship to the impact of any proposed modification.

Therefore, this evaluation method and form of presentation was developed to allow the analysis of selected and additional functions as future research may dictate. The initial set of 18 test CARDIS candidate functions is included in this report.

B.5 BENEFIT/IMPACT PROFILE OF FUNCTIONS

The results of the detailed analysis of each function shown in Appendix C are summarized in Table B-4. The relative benefits and impact for each function appear as line items while each CARDIS function is shown as column headings across the top of Table B-4. The individual assessment of each function was concerned with the relative significance of each function to the several benefit/impact categories. These judgments were applied without any attempt to evaluate one function against another; therefore, attempts to determine the relative worth of one functions to another using Table B-4 will not yield useful results.

As noted in Appendix C, the benefit categories generally relate to benefits that will accrue to the users of CARDIS. System impact categories relate to the effect of each function on the CARDIS system itself. Consequently, the relative assessments of CARDIS benefits all appear as positive numbers, while most system impact assessments appear as negative numbers in Appendix C and Table B-4. One general exception to this rule is in the business and utility category portion of system impact where all assessments appear as positive numbers. This is because the addition of functions to CARDIS generally increase the economic viability of CARDIS, even though there may be added difficulties of implementing any specific function.

B.6 TECHNIQUES FOR RANKING CARDIS FUNCTIONS

Having completed an evaluation (admittedly subjective) of the relative benefit/ impact of a number of potential CARDIS functions, it remains to compare the functions by some technique to develop some order of priority to guide the future development and test of CARDIS. There are many different techniques by which functions may be ranked. The six selected for this analysis cannot be assumed as comprehensive; but simply an attempt to present the data from several different viewpoints with the thought that somewhat consistent results might increase our confidence in the numerous subjective judgments involved. Before presenting the rankings that result from the different techniques used, a brief description of the method of ranking is included in Paragraph B.7.

TABLE B-4. CARDIS RELATIVE BENEFIT/IMPACTS BY FUNCTION

BENEFITS	Electronic Data (Message) Transfer	Foreign & Domestic Interface	User Interface	CARDIS System Statistics	Data Entry/Update	Inquiry	Shipment Documentation	Shipment Tracing	Equipment Tracking	Booking	Manifest Preparation	Shipment File Audit	Shipment History File	Repetitive Shipment Processing	File Transfer	Code Maintenance	File Cross-Reference	User Statistics
Importance	1	1	1	1	2	3	2	2	3	3	3	3	3	3	3	1	3	3
Per Shipment Estimated Cost Saving	$35.	$150	N/A	N/A	$30.	$115	$11.	N/A	N/A	N/A	N/A	N/A	$0.50	$115	N/A	N/A	–	–
Direct CARDIS Benefits	85		71	82	62	82	73	70	36	84		17	21	35	30	48	60	–
Administrative	72		55	89	61	86	80	60	72	80		10	20	67	N/A	64	55	47
Shipment Financial	95		53	75	58	75	53	53	–	86		7	46	–	N/A	7	34	10
Utilization	100		40	60	31	56	18	40	82	84		18	0	80	N/A	–	38	33
Control	40		68	100	87	8	88	57	62	70		30	25	60	N/A	23	73	58
Service	80		20	71	65	50	100	100	87	100		–	49	80	N/A	–	58	60
SYSTEM IMPACT																		
Business and Utility	76		93	69	77	43	84	66	91	81		9	66	38	57	89	59	69
Operational	-14		-43	-63	-79	-69	-49	-48	-62	-31		-3	-42	-26	-64	-22	-27	-40
Managerial	-50		-40	-60	-45	-17	-36	-42	-41	-23		33	-34	-23	-80	-28	-31	-48
Technological	-56		-49	-50	-81	-48	-51	-41	-65	-36		-5	-37	-17	-64	-77	-65	-33

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B.7 RANKING CARDIS FUNCTIONS

Tanking by Direct CARDIS Benefit Without Respect to Importance Category

Without regard to the importance category, all functions are ranked in accordance with the numeric values that appear in the Direct CARDIS Benefits line item of Table B-5. Direct CARDIS benefits are those tangible benefits expected to accrue to the users of CARDIS--especially in the area of estimated shipment and paperwork cost savings as described in Appendix C. Tanking functions by direct benefit while ignoring the importance category might indicate where the rankins should be re-examined to make sure that each function is assigned a logical priority for development and test.

Ranking by Overall CARDIS Benefit, Without Weighting

For each function, the benefit categories are totalled and the functions ranked accordingly, without any attempt to assign any value to the various benefit categories. In the tables contained in Appendix C, the criteria associated with each benefit/impact category were assigned relative weights which indicate the percentage relationship of each criteria to the category. No attempt was made to establish any relationship between the various benefit/impact categories of CARDIS, a factor important to the proper ranking of CARDIS functions. Accordingly, relative subjective weights have been assigned to each benefit/impact category as shown in Table B-6.

Ranking by Weighted Overall CARDIS Benefit

The weights shown in Table B-6 were then applied to the values shown in Table B-4 for each benefit and impact category for each CARDIS function to allow the several weighted rankings that follow. Weighted values for each benefit category are determined for each function. Functions are then ranked in accordance with the total value of the weighted benefits derived for each function.

TABLE B-5. MATRIX OF CARDIS RANKINGS

	Direct CARDIS Benefits w/o Respect To Importance	Overall CARDIS Benefits No Weighting	Overall CARDIS Benefit With Benefit Categories Weighted	Overall CARDIS Impact With Impact Categories Weighted	Overall Weighted CARDIS Impact (Less Business and Utility)	Weighted Benefit/ Impact Ratio
SYSTEM FUNCTIONS						
Electronic Data Transfer	1	3	3	8	8	5
Foreign and Domestic Interface	2	4	4	9	9	6
User Interface	7	12	9	5	10	7
CARDIS System Statistics	17	18	18	1	1	3
Code Files	11	15	13	12	14	16
SECONDARY CARDIS FUNCTIONS						
Data Entry-Update	5	2	2	15	15	11
Inquiry	9	7	8	17	18	17
Shipment Tracing	6	5	5	10	11	8
Equipment Tracking	8	6	7	11	7	9
TRANSPORTATION APPLICATIONS						
Booking	12	9	11	13	16	14
Shipment Documentation	4	8	6	16	13	15
Manifest Preparation	3	1	1	3	4	2
Shipment File Audit	16	16	16	2	2	1
Shipment History File	15	14	14	7	6	12
Repetitive Shipment Process	13	10	12	4	3	4
Title Transfer	14	17	17	18	17	18
File Cross Reference	10	11	10	14	12	13
User Statistics	18	13	15	6	5	10

Ranking by Weighted System Impact

Functions are ranked in this instance by their relative impact on CARDIS. As shown in Table B-4, system impact can have either a positive or negative value, since, in most cases, the addition of a function can improve the economic viability of CARDIS despite the fact that the development and operation of that function may develop some negative impact. In this column, each function is ranked according to the net positive/negative value of all impact categories.

Ranking by Weighted System Impact Without Reference to the Business and Utility Category

To illustrate the relative difficulty of implementing the various functions without regard to any potential business benefits that may accrue, functions are ranked as in the previous column, except that the business and utility factor is deleted.

Ranking Based on Ratio of Benefit to Impact

Comparing total weighted benefits with total weighted impact can be used to provide further insight to the problem of ranking CARDIS functions. Caution should be exercised in using this approach since both benefits and impact are determined on a marginal basis. There is some question as to whether a useful benefit to cost ratio can be estimated using this approach. The method used here is to simply estimate the relative value of weighted benefit to weighted impact of each function, without any attempt to assign any actual economic value to the ratios obtained.

The six defined rankings of CARDIS functions are presented in Table B-5.

TABLE B-6. RELATIVE SUBJECT WEIGHT

BENEFIT	RELATIVE WEIGHT
Direct CARDIS Benefits	.40
Administrative	.10
Shipment Financial	.15
Utilization	.15
Control	.10
Service	.10
TOTAL	1.00

IMPACT	RELATIVE WEIGHT
Business and Utility	.30
Operational	.20
Managerial	.10
Technological	.40
TOTAL	1.00

B.8 IDENTIFICATION OF PRIMARY CARDIS FUNCTIONS

Thus far in the CARDIS program, transportation-related functions, document preparation/transmission functions, and system-related functions have been treated as one undifferentiated group. However, in selecting a group of functions for the further development and test of CARDIS, it is important to isolate those functions that provide the central framework or foundation of CARDIS. Using a "top-down" approach to system development, these technical system-related functions may be separately treated in outlining the specifications of a system capable of performing the transportation task.

Using the "top-down" approach to system development in reviewing Tables B-4 and B-5 will indicate, for the most part, that systems-related functions have been evaluated as being "central" to CARDIS (indicated by a "1" in the importance category of Table B-4) regardless of the various value judgments or rankings that have been applied to these several "central" functions in Table B-5. For example, the user interface function is considered "central" to CARDIS even though this function falls in the mid-range of all the functions ranked in Table B-5. At this point, it may be appropriate to review each of these CARDIS system functions in more detail.

User Interface

Some form of user interface is prerequisite to CARDIS. Without some method of getting data into or out of the system, CARDIS cannot exist. The user interface will include, among other features, techniques for data validation and edit; code conversion; message formatting, queuing and addressing; Unique Consignment Reference Number (UCRN) generation; inbound message routing, and a data privacy module.

Domestic and International Interface

The viability of CARDIS, to a substantial degree, will depend upon how well it can be implemented without disrupting the numerous technical/ commercial relationships that already exist between the users and providers

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of electronic data transmission services. Given the domestic business environment, a practical approach might be to foster the development of a series of data network interfaces that would allow transmission of CARDIS data over and between various commercial data networks without difficulty. From a technical standpoint, this is not a problem. From a business standpoint, there may be some initial reluctance to the idea until the potential for CARDIS-related business is understood.

Internationally, the interface problem is more complex due to the added complications of different data codes, message formats, and language preferences. On the international diplomatic level, considerable effort has been devoted to the creation of a unified (or harmonized) system of data codes and message formats to facilitate the transmission of trade and transportation data across national boundaries. Although this work continues, completion still lies some years in the future. In this environment, it seems that a generalized CARDIS data exchange system can best be realized by providing an interface to translate the different data codes, message formats, and languages used in the various systems.

Electronic Data Transfer

Electronic data transfer is the basic reason for the existence of a data transmission network or value added network. The ability to route a message from thesender to the address specified is inherent in the network. So, although this function is indispensable to the proper functioning of CARDIS, the ability already exists.

Code File

The proper functioning of CARDIS relies on the use of various codes to describe commodities, carriers, geographic places, and other information essential to trade and transportation. It would not be realistic to expect a statis system of codes in our changing world; therefore, arrangements must

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be made to allow periodic updating of the various codes used in CARDIS.
The function is essential to the operation of CARDIS, since without such a
capability, information transmitted would be unintelligible to the recipient.
The task could best be handled by making available to the users of CARDIS
a computerized file of currently effective codes.

CARDIS System Statistics

The proper management of CARDIS will require some ability to determine
what is happening, some ability to audit system operations, and an ability
to use the data to manage the system effectively. It would appear that little
would be needed in this area, except that developed by the operator of each
data network; although there may be some need to audit access to code
maintenance files, international interfaces, and other specialized areas.

B.8.1. Secondary CARDIS Functions

Between the system-related functions and the transportation- or user-related
functions of CARDIS are several functions that do not conveniently fit into either
category. These include:

Data Entry/Update and Inquiry

Used in connection with CARDIS, these functions presuppose an ability to
directly access data files controlled by another CARDIS user. Also implied
is at least a certain amount of on-line, interactive data manipulation. Under
certain specialized and limited circumstances, this kind of activity will
probably occur; however, the two functions are not essential to the effective
functioning of CARDIS.

Shipment Tracing and Equipment Tracking

Along with the expansion of intermodal movement of trade, there is also a
greater need for the intermodal handling of information--especially for that
limited amount of information needed to trace the location of any particular
shipment and/or the related transporting equipment.

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Currently, each mode addresses this situation uniquely. Some tracking
and tracing systems are more effective than others. One common charac-
teristics seems to be that the commercial relationship between the shipper
and the originating carrier is maintained.

CARDIS could offer an improved and more effective method of tracking and
tracing for the transportation community if such a capability is desired.
Properly designed, the service could be performed without disturbing the
present commercial relationships between carrier and shipper. Essential
data privacy could be protected by limiting the data elements contained in
the tracking and tracing functional module. As with data entry, update and
inquiry, the functions of tracking and tracing involve a considerable amount
of data interchange; but are not essential to the effective functioning of
CARDIS.
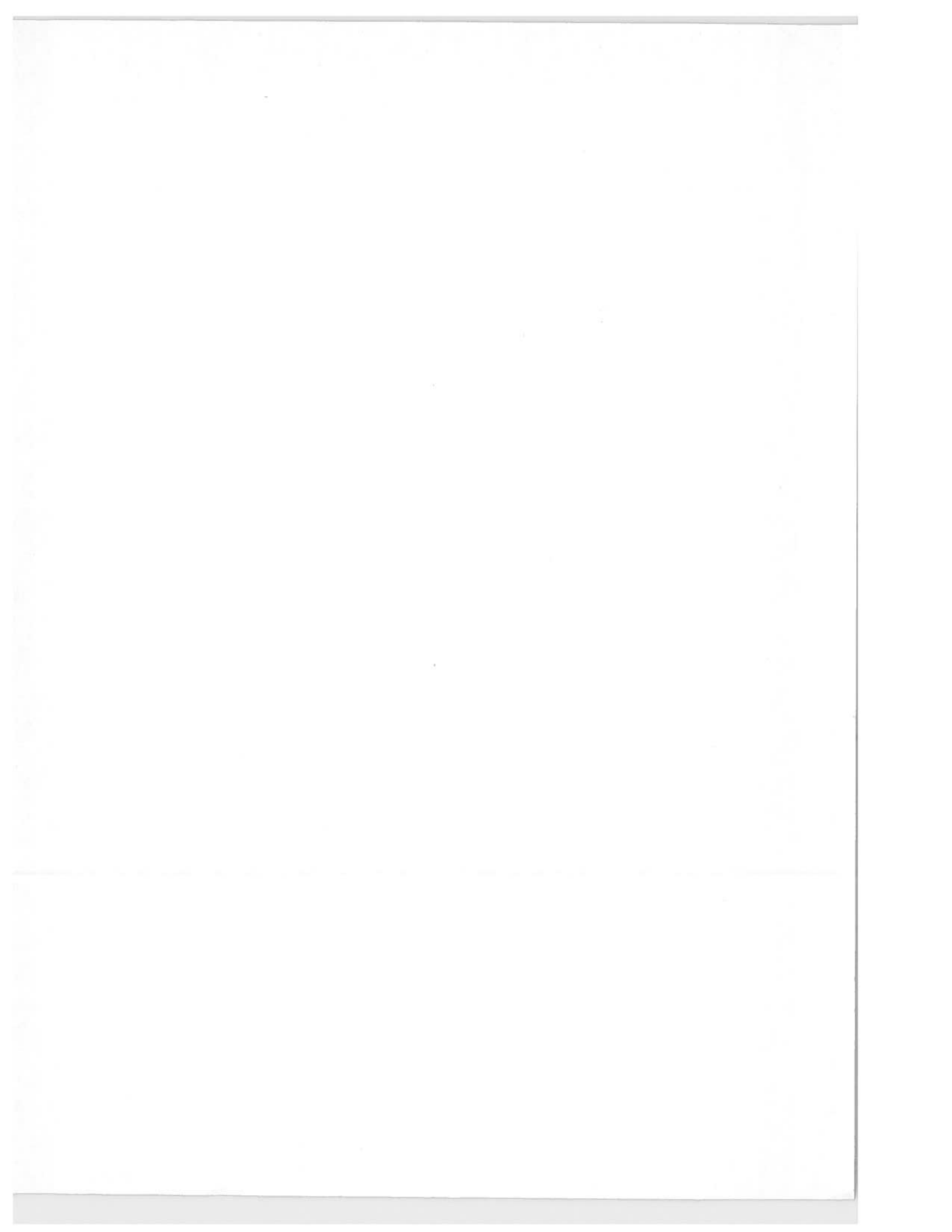
B.8.2 CARDIS User Functions

There are two general techniques for connecting the users of CARDIS to the
system. One method is for a user that operates an in-house computer facility com-
patible with CARDIS. In this case, the user may directly interface with a data net-
work that offers CARDIS services. The other general approach is for users that
choose not to operate in-house but, instead, choose to link with CARDIS via a remote
terminal to a commercial timeshared data processing service that offers a CARDIS
compatible interface.

Regardless of the method used to interface with the system, CARDIS is designed
to handle a variety of data codes and message formats that have been adopted by the
trading community. The uses to which this information can be put is limited only by
practical economics and the imagination of the user. Several useful user functions
have been recognized and appear in the user function portion of Table B-4. Where
the function requires a certain amount of data interchange (such as booking), message
format conventions have been established. However, there are numerous uses of

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CARDIS data; and the user is able to process their data in any way which will benefit operations, management, or executive personnel and thus enable them to function more effectively.

B.9 SUMMARY

The primary objective of this appendix was to separate selected candidate system functions into three groups, namely, System Functions, Secondary CARDIS Functions, and Transportation Applications as illustrated in Table B-5. The test CARDIS configuration can now begin to take form using the CARDIS system functions as the nucleus and selecting the additional CARDIS functions or applications that industry participants select to develop.