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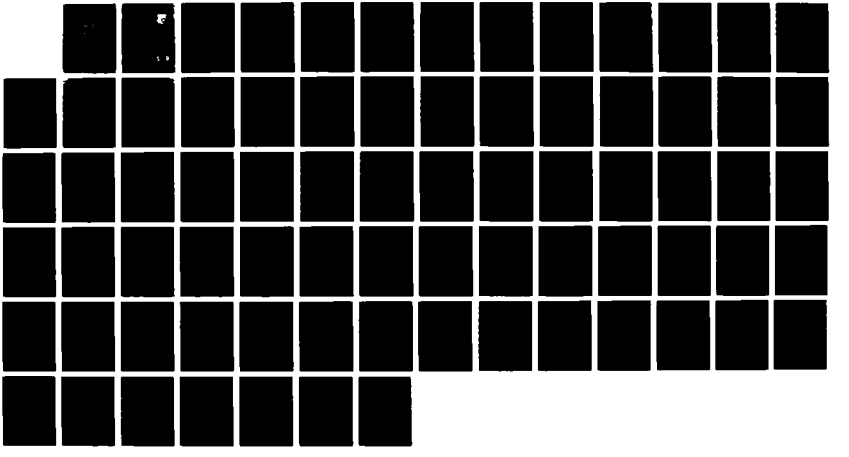

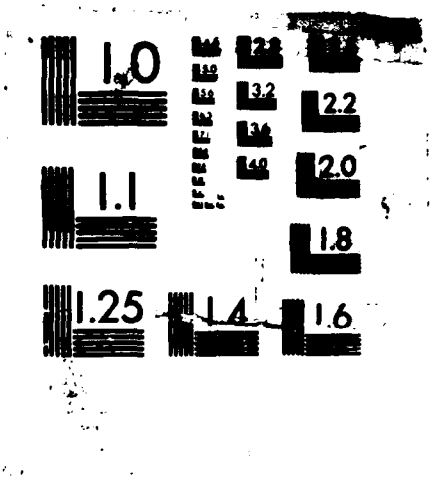

MICROCOPY RESOLUTION TEST CHART

AFWAL-TR-86-4006
Volume V
Part 27

INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume V - Common Data Model Subsystem
Part 27 - Distributed Request Supervisor Product Specification

General Electric Company
Production Resources Consulting
One River Road
Schenectady, New York 12345

Final Report for Period 22 September 1980 - 31 July 1985

November 1985

PREPARED FOR:

MATERIALS LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AFB, OH 45433-6533

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This report has been reviewed by the Office of Public Affairs (ASD/PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

David L. Judson

DAVID L. JUDSON, PROJECT MANAGER
AFWAL/MLTC
WRIGHT PATTERSON AFB OH 45433

5 Aug 1986
DATE

FOR THE COMMANDER:

Gerald C. Shumaker

GERALD C. SHUMAKER, BRANCH CHIEF
AFWAL/MLTC
WRIGHT PATTERSON AFB OH 45433

7 Aug 86
DATE

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This document is the product specification establishing the design implementation of the IISS Configuration Item Distributed Request Supervisor which controls the processing of distributed data requests by the aggregators and generated request processors.

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11. Title

Integrated Information Support System (IISS)
Vol V - Common Data Model Subsystem
Part 27 - Distributed Request Supervisor
Product Specification

PREFACE

This product specification covers the work performed under Air Force Contract F33615-80-C-5155 (ICAM Project 6201). This contract is sponsored by the Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. It was administered under the technical direction of Mr. Gerald C. Shumaker, ICAM Program Manager, Manufacturing Technology Division, through Project Manager, Mr. David Judson. The Prime Contractor was Production Resources Consulting of the General Electric Company, Schenectady, New York, under the direction of Mr. Alan Rubenstein. The General Electric Project Manager was Mr. Myron Hurlbut of Industrial Automation Systems Department, Albany, New York.

Certain work aimed at improving Test Bed Technology has been performed by other contracts with Project 6201 performing integrating functions. This work consisted of enhancements to Test Bed software and establishment and operation of Test Bed hardware and communications for developers and other users. Documentation relating to the Test Bed from all of these contractors and projects have been integrated under Project 6201 for publication and treatment as an integrated set of documents. The particular contributors to each document are noted on the Report Documentation Page (DD1473). A listing and description of the entire project documentation system and how they are related is contained in document FTR620100001, Project Overview.

The subcontractors and their contributing activities were as follows:

TASK 4.2

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Reviewer.
D. Appleton Company (DACOM)	Responsible for IDEF support, state-of-the-art literature search.
General Dynamics/ Ft. Worth	Responsible for factory view function and information models.

Subcontractors	Role
Illinois Institute of Technology	Responsible for factory view function research (IITRI) and information models of small and medium-size business.
North American Rockwell	Reviewer.
Northrop Corporation	Responsible for factory view function and information models.
Pritsker and Associates	Responsible for IDEF2 support.
SofTech	Responsible for IDEFO support.

TASKS 4.3 - 4.9 (TEST BED)

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Responsible for consultation on applications of the technology and on IBM computer technology.
Computer Technology Associates (CTA)	Assisted in the areas of communications systems, system design and integration methodology, and design of the Network Transaction Manager.
Control Data Corporation (CDC)	Responsible for the Common Data Model (CDM) implementation and part of the CDM design (shared with DACOM).
D. Appleton Company (DACOM)	Responsible for the overall CDM Subsystem design integration and test plan, as well as part of the design of the CDM (shared with CDC). DACOM also developed the Integration Methodology and did the schema mappings for the Application Subsystems.

Subcontractors	Role
Digital Equipment Corporation (DEC)	Consulting and support of the performance testing and on DEC software and computer systems operation.
McDonnell Douglas Automation Company (McAuto)	Responsible for the support and enhancements to the Network Transaction Manager Subsystem during 1984/1985 period.
On-Line Software International (OSI)	Responsible for programming the Communications Subsystem on the IBM and for consulting on the IBM.
Rath and Strong Systems Products (RSSP) (In 1985 became McCormack & Dodge)	Responsible for assistance in the implementation and use of the MRP II package (PIOS) that they supplied.
SofTech, Inc.	Responsible for the design and implementation of the Network Transaction Manager (NTM) in 1981/1984 period.
Software Performance Engineering (SPE)	Responsible for directing the work on performance evaluation and analysis.
Structural Dynamics Research Corporation (SDRC)	Responsible for the User Interface and Virtual Terminal Interface Subsystems.

Other prime contractors under other projects who have contributed to Test Bed Technology, their contributing activities and responsible projects are as follows:

Contractors	ICAM Project	Contributing Activities
Boeing Military Aircraft Company (BMAC)	1701, 2201, 2202	Enhancements for IBM node use. Technology Transfer to Integrated Sheet Metal Center (ISMC).

Contractors	ICAM Project	Contributing Activities
Control Data Corporation (CDC)	1502, 1701	IISS enhancements to Common Data Model Processor (CDMP).
D. Appleton Company (DACOM)	1502	IISS enhancements to Integration Methodology.
General Electric	1502	Operation of the Test Bed and communications equipment.
Hughes Aircraft Company (HAC)	1701	Test Bed enhancements.
Structural Dynamics Research Corporation (SDRC)	1502, 1701, 1703	IISS enhancements to User Interface/Virtual Terminal Interface (UI/VTI).
Systran	1502	Test Bed enhancements. Operation of Test Bed.

TABLE OF CONTENTS

SECTION 1

SCOPE

1.1 Identification

This specification establishes the design of Function DRS, "Distributed Request Supervisor", one of the major functions of the Configuration Item, to be built and formally accepted by the ICAM Program Office. This CI constitutes one of the subsystems of the Common Data Model Processor (CDMP).

1.2 Functional Summary

The overall objectives of this CPCI are to:

1) Determine the appropriate sequence of inter database Join, Union and Not In Set operations required to produce the result for a multi-database transaction; and

2) Coordinate and control the interactions among a user's application process (AP), the generated Request Processor (RP) and the Aggregator(s) for both single and multi-database transactions.

Keywords: ICAM (Integrated Computer Aided Manufacturing)

SECTION 2

DOCUMENTS

2.1 Reference Documents

1. ICAM Documentation Standards: IDS15012000A, 28 December 1981.

2. D. Appleton Co, CDM Administrators Manual: UM620141000, March 1984.

3. D. Appleton Co., CDM1-IDEF1 Model of the Common Data Model; CCS620141000, 15 May 1985.

4. D. Appleton Co., Computer Program Development Specification (DS) for Integrated Support System (IISS) Configuration Item: NDML Precompiler; DS620141200, October 1984.

5. D. Appleton Co., Embedded NDML Programmer's Reference Manual: PRM620141200, March 1985.

6. Softech, Inc., NTM Programmer's Guide: UM620140001, July 1984

7. Control Data Corporation, Computer Program Development Specification (DS) for ICAM Integrated Support System (IISS) Configuration Item: NDDL Command Processor: DS620141100, June 1985.

2.2 Terms and Abbreviations

Attribute Use Class: (AUC)

Conceptual Schema: (CS)

Common Data Model Processor: (CDMP)

Common Data Model: (CDM) Describes common data application process formats, form definitions, etc, of the IISS and includes conceptual schema, external, internal schemas, and schema transformation operators.

Data Field: (DF) An element of data in the external schema. It is by this name that an NDML programmer reference

data.

Database Management System: (DBMS)

Distributed Request Supervisor: (DRS) This IISS CDM subsystem configuration item controls the execution of distributed NDML queries and non distributed updates.

Domain: A logical definition of legal attribute class values.

Domain Constraint: Predicate that applies to a single domain.

External Schema: (ES)

Forms: Structured views which may be imposed on windows or other forms. A form is composed of fields where each field is a form, item, or window.

Forms Processor: (FP) A set of callable execution time routines available to an application program for form processing.

Internal Schema: (IS)

Integrated Information Support System: (IISS) A test computing environment used to investigate, demonstrate and test the concepts of information management and information integration in the context of Aerospace Manufacturing. The IISS addresses the problems of integration of data resident on heterogeneous databases supported by heterogeneous computers interconnected via a local Area Network.

Mapping: The correspondence of independent objects in two schemas: ES to CS or CS to IS.

Network Transaction Manager: (NTM) Performs the coordination, communication and housekeeping functions required to integrate the application processes and system services resident on the various hosts into a cohesive system.

Neutral Data Manipulation Language: (NDML) A language developed by the IISS project to provide uniform access to common data, regardless of database manager or distribution criteria. It provides distributed retrieved and single node updates.

ORACLE: Relational DBMS based on the SQL (Structured Query Language, a product of ORACLE Corp, Menlo Park, CA). The CDM is an ORACLE database.

Parcel: A sequential file containing sections source code of the input application program.

Request Processor: (RP) A COBOL program that will satisfy a retrieval or update NDML subtransaction against a particular Database Management System.

User Interface: (UI) Controls the user's terminal and interfaces with the rest of the system.

Virtual Terminal Interface: (VTI) Performs the interfacing between different terminals and the UI. This is done by defining a specific set of terminal features and protocols which must be supported by UI software which constitutes the Virtual Terminal Definition. Specific terminals are then mapped against the Virtual Terminal software by specific software modules written for each type of real terminal supported.

SECTION 3

REQUIREMENTS

3.1 Structural Description

A graphic portrayal of this CPCI is included in Section 3.10. This chart shows the hierarchical relationship of each module making up this CPCI.

The DRS has been coded as a single, large COBOL subprogram.

It is internally composed of three subfunctions and defined in the DS Reference 8. These subfunctions are:

1. Initiate/Resume Subtransaction Processing
2. Schedule Stages
3. Initiate CS/ES Transform Processing

3.2 Functional Flow

This CPCI implements the logic defined in the Development Specification for this CPCI. Details of inputs/outputs and relationships between modules are to be found in Section 3.10.

This CPCI has been designated to operate in an interactive mode. It must operate in the system environment established for IISS; that is, use of the Network Transaction Manager.

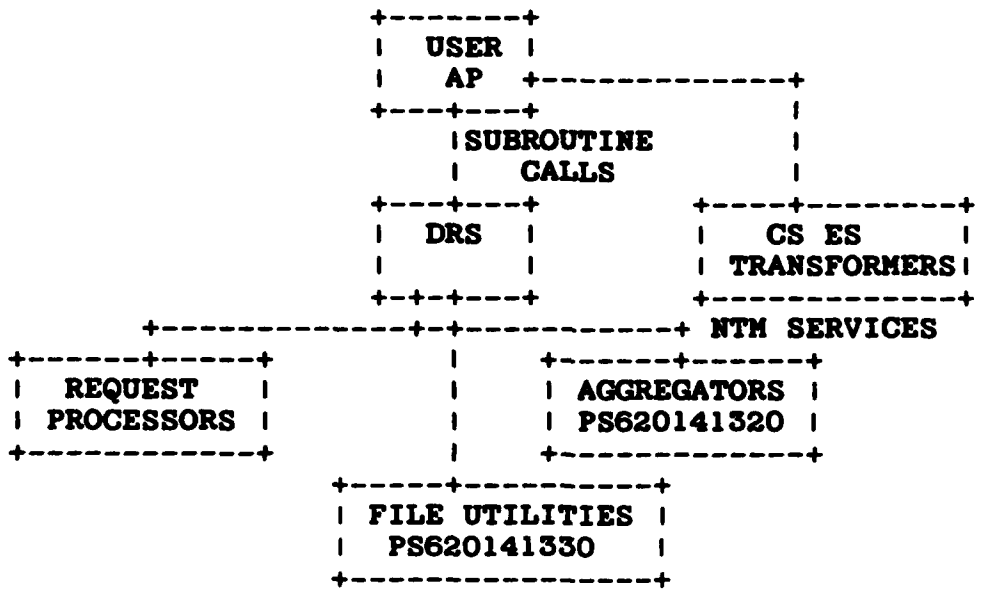
The following exceptions to the Development Specification are noted.

1. The DS calls for the CS/ES transform step to be controlled by the DRS as a separate process, using file input-output and NTM interprocess communication. In interests of efficiency, the CS/ES transform is controlled by code generated into the user AP directly. This saves one file of external query results and allows th interaction with the CS/ES transform to be direct, without use of NTM services.
2. The DS called for the DRS to be a separate process. In the interests of efficiency, it has been implemented as a subprogram called from the user's AP.

3. The contents of Transmission Cost Table are compiled into the DRS. The DRS specifies that this be found in a file.

3.3 Interfaces

The following diagram depicts the interface of DRS and the other CPCI's.



3.3.1 Input/Outputs

The following table depicts the inputs and outputs of this CPCI. A detailed description for each item can be found in the DS for this CPCI.

FUNCTION: DRS

INPUT	OUTPUT
Subtransaction Number	
DRS Action	Conceptual Schema Result File
Pool of Input Tables from the Users Application Process	Results Count
	Module Status

3.4 Program Interrupts

The DRS makes use of NTM services to start and control multiple request processors at the same time. It also controls multiple instances of aggregators at the same time. It must wait until each process has completed before it can begin its next sequence of activities.

3.5 Timing and Sequencing Description

The DRS can control many request processors at the same time, asynchronously. In other words, it will start all subtransactions of a query and wait for them all to complete. When complete, it handles aggregation of these results. The aggregation may also execute asynchronously in parallel. The DRS will wait for all processes to complete. It has no time limits.

3.6 Special Control Features

Not applicable to this CPCI.

3.7 Storage Allocation

3.7.1 Database Definition

No databases are used by this CPCI.

3.7.1.1 File Description

No permanent files have been defined for this CPCI. It may use temporary scratch files for such things as generated program source code or temporary query results. The cost information table has not been implemented as a file.

3.7.1.2 Table Description

All tables used by this CPCI have been defined by the Development Specification for this CPCI.

3.7.1.3 Item Description

Not applicable to this CPCI.

3.8 Object Code Creation

The object code for this CPCI will be created by the system

integration test team by using defined IISS Software Configuration Management procedures. This CPCI will use the COBOL language compiler.

3.9 Adaptation Data

This CPCI has been coded using ANSI COBOL. The intent was to provide a transportable system. Any system environment supporting this language, a virtual memory management scheme, the COMM and NTM subsystems of IISS and the ORACLE Database Management System should be able to support this CPCI. Every possible attempt has been made to localize and identify any machine or environment dependent modules through the original design of the IISS and application of Configuration Management Procedures.

3.10 Detail Design Description

The following sections have been computer generated for this CPCI.

3.10.1 Main Program List

The following is a list of all "Main Programs" which are modules that are not called by any other module being documented here. These modules are either program entry points or, if they are hooked into another set of programs via subroutine calls, they are the points the external programs can call and therefore enter through. To differentiate between the two types of entry points, look at the individual Module Documentation (section 3.10.8) and look at Module Type for each of the Main Program modules listed. Note whether the routine is a Program, Subroutine, or Function. If it is a Program, it is truly a main program entry point. If not, then it is merely called by other programs not being documented here.

DISTRIBUTED REQUEST SUPERVISOR Main Program List

Module Name	Purpose
INTFTN	CONVERT INTEGER VALUE TO CHARACTER STRING
TOTOPN	CONTROL OPENING OF TOTAL DB FILES
TRMNDML	TERMINATE USE OF NDML AND NTM

3.10.2 Module List

The following is a list of all the modules being documented here along with their purpose. Each module has a unique name, no matter what language it was written in.

DISTRIBUTED REQUEST SUPERVISOR Module List

Module Name	Purpose
CDFUNC	DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
INTFTN	CONVERT INTEGER VALUE TO CHARACTER STRING
TOTOPN	CONTROL OPENING OF TOTAL DB FILES
TRMNDML	TERMINATE USE OF NDML AND NTM

3.10.3 External Routines List

The following is a list of all routines or functions not documented here that are called by modules that are documented here. The first caller, in alphabetical order, is listed as well. The specification in which any module is documented may be found in the Module Documentation Index (Document Number CM 620100001). See section 3.10.6 for a list of the modules that call each of these external routines.

DISTRIBUTED REQUEST SUPERVISOR External Routines List

Module Name	First User
DELFIL	CDS01
ERRPRO	CDFUNC
ISEND	CDS01
NSEND	CDS01
OPENX	TOTOPN
RCV	CDS01
SIGABT	CDS01
SIGERR	CDS01
TRMNAT	TRMNDML
WHTHST	CDS01

3.10.4 Include File List

The following is a list of all include files called in by modules being documented here. Each include file has a unique name regardless of the language being used. The purpose of each include file is listed as well. A more complete description of each include file is given in section 3.10.9. The purpose listed is the one that is in the source code of the include file.

A purpose of "***** PURPOSE NOT FOUND BY STRIPPER *****" indicates that a purpose statement was not written into the include file itself. The most common reason for this is that the include file comes from system libraries that were not developed by the project, such as 'C' libraries that are provided with the 'C' compiler.

See section 3.10.6 for a set of lists which show all the modules which call in each of these include files.

DISTRIBUTED REQUEST SUPERVISOR Include File List

File Name	Purpose
AGGMSG	AGGREGATOR INPUT MESSAGE
APL	JOIN QUERY ATTRIBUTE PAIR LIST
CHKCDM	IISS CDMP CHECK STATUS CODES
CITABLE	COST INFORMATION TABLE
CSAL	CONCEPTUAL SCHEMA ACTION LIST
DMPCSAL	DISPLAYS THE CONTENTS OF THE CS ACTION LIST
DUMPAPL	DISPLAYS THE CONTENTS OF THE ATTRIBUTE PAIR LIST
DUMPCIT	**** PURPOSE NOT FOUND BY STRIPPER ****
DUMPJQG	DISPLAY THE CONTENTS OF THE JQG TABLE
DUMPRFT	DISPLAY THE CONTENST OF THE RFT TABLE
DUMPRIT	DISPLAY THE CONTENTS OF THE RIT TABLE
ERRCDM	IISS ERROR STATUS CODES FOR CDMP MODULES
ERRPRO	PROCESS ERROR INCLUDE FILE
FSMSG	MESSAGE FOR THE FILE SEND UTILITY
JQGTBL	JOIN QUERY GRAPH TELLS HOW TO CONNECT SUBTRANSACTIONS
LNKEDGE	DETERMINE DUPLICATE EDGES IN THE JQG
QITABLE	REQUEST INFORMATION TABLE
RFTABLE	THE RESULT FIELD TABLE
RITABLE	RIT- RELATION INFORMATION TABLE
SRVRET	AS THE RETURN GIVEN A TABLE-FULL ERROR
STDRESP	WS DEFINITION FOR STANDARD STATUS VARIABLE
SUBPROC	SUBTRANSACTION PROCESSES ID TABLE
TCTABLE	TRANSMISSION COST TABLE

3.10.5 Where Include File Used List

The following lists each include file from 3.10.4 and all the modules documented in this specification which include them. The purpose of each module is listed as well.

DISTRIBUTED REQUEST SUPERVISOR Where-include-file-used List

Include File	Module Name	Module Purpose
AGGMSG		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
APL		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
CHKCDM		
	CDFUNC	DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
	TOTOPN	CONTROL OPENING OF TOTAL DB FILES
	TRMNDML	TERMINATE USE OF NDML AND NTM
CITABLE		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
CSAL		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
DMPCSAL		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR

DISTRIBUTED REQUEST SUPERVISOR Where-include-file-used List

Include File	Module Name	Module Purpose
DUMPAPL		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
DUMPCIT		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
DUMPJQG		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
DUMPRFT		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
DUMPRIT		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
ERRCDM		
	CDFUNC	DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
	TOTOPN	CONTROL OPENING OF TOTAL DB FILES
	TRMNDML	TERMINATE USE OF NDML AND NTM

DISTRIBUTED REQUEST SUPERVISOR Where-include-file-used List

Include File	Module Name	Module Purpose
ERRPRO		
	CDFUNC	DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
	TOTOPN	CONTROL OPENING OF TOTAL DB FILES
	TRMNDML	TERMINATE USE OF NDML AND NTM
FSMSG		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
JQGTBL		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
LNKEDGE		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
QITABLE		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
RFTABLE		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR

DISTRIBUTED REQUEST SUPERVISOR Where-include-file-used List

Include File	Module Name	Module Purpose
RITABLE	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
SRVRET	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
STDRESP	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
SUBPROC	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
TCTABLE	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR

3.10.6 Where External Routine Used List

The following lists each external function or routine listed in 3.10.3 and all the documented modules which call it. The purpose of each module is listed as well.

DISTRIBUTED REQUEST SUPERVISOR Where-external-routine-used List

System Module	Module Name	Module Purpose
DELFIL		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
ERRPRO		
	CDFUNC	DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
	TOTOPN	CONTROL OPENING OF TOTAL DB FILES
	TRMNDML	TERMINATE USE OF NDML AND NTM
ISEND		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
NSEND		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
OPENX		
	TOTOPN	CONTROL OPENING OF TOTAL DB FILES
RCV		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
SIGABT		
	CDSO1	THE DISTRIBUTED REQUEST SUPERVISOR
SIGERR		

DISTRIBUTED REQUEST SUPERVISOR Where-external-routine-used List

System Module	Module Name	Module Purpose
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR
TRMNAT		
	TRMNDML	TERMINATE USE OF NDML AND NTM
WHTHST		
	CDS01	THE DISTRIBUTED REQUEST SUPERVISOR

3.10.7 Main Program Parts List

The following lists each Main Program listed in 3.10.1 and all the modules which are called either by that module itself or by any of the documented modules which it calls. It is possible for a non-main module to be listed more that once if it is called by multiple modules. The called modules, in this case known as program parts, are marked as to whether they are documented here. If so, the phrase "well-defined module" appears by the module name, if not it is an "external "routine". The Purpose of the Main Program module is listed as well.

DISTRIBUTED REQUEST SUPERVISOR Main Program Parts List

Main Pgm Name	Module Name	Module Type
TOTOPN	Purpose-->	CONTROL OPENING OF TOTAL DB FILES
	ERRPRO	External routine
	OPENX	External routine

DISTRIBUTED REQUEST SUPERVISOR Main Program Parts List

Main Pgm Name	Module Name		Module Type
TRMNDML		Purpose--›	TERMINATE USE OF NDML AND NTM
	CDFUNC		Well-defined module
	CDS01		Well-defined module
	DELFIL		External routine
	ERRPRO		External routine
	ISEND		External routine
	NSEND		External routine
	RCV		External routine
	SIGABT		External routine
	SIGERR		External routine
	TRMNAT		External routine
	WHTHST		External routine

3.10.8 Module Documentation

The following documentation describes information which is specific to each individual module being documented in this specification as listed in section 3.10.2. It provides a compact way of getting information that would be otherwise buried within each module's source code.

The specific items in this module documentation have the following meanings:

NAME:	Name of program Module.
PURPOSE:	Purpose of Module as detailed in the source code.
LANGUAGE:	Programming language source code is written in. The choices are: VAX-11 FORTRAN C (I/S-1 Workbench 'C') VAX-11 COBOL
MODULE TYPE:	Whether a Program, Subroutine, or Function.
SOURCE FILE:	Name of Source File from file specification.
SOURCE FILE TYPE:	Source File Extension from file specification.
HOST:	Whether this is a host-dependent routine (VAX or IBM) or blank if host-independent.
SUBSYSTEM:	IISS sub-system this file resides in.
SUBDIRECTORY:	Sub-directory of that subsystem in which this file resides.
DOCUMENTATION GROUP:	Name of documentation group of which this source file is a member.
DESCRIPTION:	A description of the module as otained

from the source code.

ARGUMENTS: The arguments with which this routine is called if it is a Subroutine or a Function.

INCLUDE FILES: A list of all the files that are included into this module as well as their purposes.

ROUTINES CALLED: Subroutines or Functions, either documented or external, called by this module, if any.

CALLED DIRECTLY BY: The documented routines which call this module, if any.

USED IN MAIN PROGRAM(S): The documented Main Programs which contain this module in their parts list according to the list in section 3.10.7.

The Module Documentation is arranged alphabetically according to Module Name.

DISTRIBUTED REQUEST SUPERVISOR Module Documentation

NAME: CDFUNC
PURPOSE: DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: CDFUNC
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41310

DESCRIPTION:

- PERFORM A TABLE LOOK UP BASED ON THE GIVEN HOST NAME AND THE FUNCTION DESIRED.
RETURN THE PROPER AP NAME.

-

ARGUMENTS:

FUNCT-IN = DSPLY [X(10)]
HOST-IN = DSPLY [XXX]
TARGET-AP = DSPLY [X(10)]
RET-STATUS = DSPLY [X(5)]

INCLUDE FILES:

ERRCDM - IISS ERROR STATUS CODES FOR CDMP MODULES
CHKCDM - IISS CDMP CHECK STATUS CODES
ERRPRO - PROCESS ERROR INCLUDE FILE

ROUTINES CALLED:

ERRPRO

CALLED DIRECTLY BY:

CDS01 - THE DISTRIBUTED REQUEST SUPERVISOR

USED IN MAIN PROGRAM(S):

TRMNDML - TERMINATE USE OF NDML AND NTM

DISTRIBUTED REQUEST SUPERVISOR Module Documentation

NAME: CDS01
PURPOSE: THE DISTRIBUTED REQUEST SUPERVISOR
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: CDS01
SOURCE FILE TYPE: .COB
HOST: VAX
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41310

DESCRIPTION:

- THE DRS IS THE RUN TIME MONITOR OF ALL RUN TIME PROGRAMS NECESSARY TO FULFILL A NDML REQUEST.

ARGUMENTS:

SS-NO-SUBTRANS = DSPLY [999]
DRS-ACTION = DSPLY [X]
SS-POOL = RECRD
CS-ACTION-LIST = RECRD
JQG = RECRD
JQG-ATTRIBUTE-PAIR-LIST = RECRD
USER-RFT = RECRD
CS-RESULTS-FILE = DSPLY [X(30)]
CS-RESULTS-COUNT = DSPLY [9(6)]
RET-STATUS = DSPLY [X(5)]

INCLUDE FILES:

TCTABLE	- TRANSMISSION COST TABLE
CITABLE	- COST INFORMATION TABLE
RITABLE	- RIT- RELATION INFORMATION TABLE
QITABLE	- REQUEST INFORMATION TABLE
SUBPROC	- SUBTRANSACTION PROCESSES ID TABLE
RFTABLE	- THE RESULT FIELD TABLE
STDRESP	- WS DEFINITION FOR STANDARD STATUS VARIABLE
ERRCDM	- IISS ERROR STATUS CODES FOR CDMP MODULES

CHKCDM	- IISS CDMP CHECK STATUS CODES
SRVRET	- AS THE RETURN GIVEN A TABLE-FULL ERROR
FSMSG	- MESSAGE FOR THE FILE SEND UTILITY
AGGMSG	- AGGREGATOR INPUT MESSAGE
CSAL	- CONCEPTUAL SCHEMA ACTION LIST
JQGTBL	- JOIN QUERY GRAPH TELLS HOW TO CONNECT SUBTRANSACTIONS
APL	- JOIN QUERY ATTRIBUTE PAIR LIST
ERRPRO	- PROCESS ERROR INCLUDE FILE
LNKEDGE	- DETERMINE DUPLICATE EDGES IN THE JQG
DUMPCIT	- **** PURPOSE NOT FOUND BY STRIPPER ****
DUMPRIT	- DISPLAY THE CONTENTS OF THE RIT TABLE
DUMPAPL	- DISPLAYS THE CONTENTS OF THE ATTRIBUTE PAIR LIST
DUMPRFT	- DISPLAY THE CONTENST OF THE RFT TABLE
DUMPJQG	- DISPLAY THE CONTENTS OF THE JQG TABLE
DMPCSAL	- DISPLAYS THE CONTENTS OF THE CS ACTION LIST

ROUTINES CALLED:

ERRPRO	
SIGERR	
NSEND	
ISEND	
RCV	
CDFUNC	- DETERMINE AP NAME GIVEN THE FUNCTION AND HOST
DELFIL	
WHTHST	
SIGABT	

CALLED DIRECTLY BY:

TRMNDML	- TERMINATE USE OF NDML AND NTM

USED IN MAIN PROGRAM(S):

TRMNDML	- TERMINATE USE OF NDML AND NTM

DISTRIBUTED REQUEST SUPERVISOR Module Documentation

NAME: INTFTN
PURPOSE: CONVERT INTEGER VALUE TO CHARACTER STRING
LANGUAGE: VAX-11 FORTRAN
MODULE TYPE: SUBROUTINE
SOURCE FILE: INTFTN
SOURCE FILE TYPE: .FOR
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41310

DESCRIPTION:

ARGUMENTS:

NUMBER = I*4
CHAROT = CHAR

DISTRIBUTED REQUEST SUPERVISOR Module Documentation

NAME: TOTOPN
PURPOSE: CONTROL OPENING OF TOTAL DB FILES
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: TOTOPN
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41310

DESCRIPTION:

- BY USING A GLOBAL REALM CONTAINING ALL FILES CURRENTLY OPENED BY TOTAL OF THIS PROCESS AND A LOCAL REALM OF FILES A PARTICULAR RP NEEDS, ONLY THE NEW FILES NEED BE OPENED AND RECORDED IN THE GLOBAL REALM TABLE. A SINGLE "OPENX" CALL MAY BE ISSUED, AND EACH FILE SUCCESSFULLY OPENED STORED IN THE GLOBAL REALM. IF ANY FILE IS FOUND IN ERROR, A MESSAGE IS LOGGED.

ARGUMENTS:

LOCAL-REALM = RECRD
GLOBAL-REALM = RECRD
TOTAL-STATUS = DSPLY [X(4)]

INCLUDE FILES:

ERRCDM - IISS ERROR STATUS CODES FOR CDMP MODULES
CHKCDM - IISS CDMP CHECK STATUS CODES
ERRPRO - PROCESS ERROR INCLUDE FILE

ROUTINES CALLED:

OPENX
ERRPRO

DISTRIBUTED REQUEST SUPERVISOR Module Documentation

NAME: TRMNDML
PURPOSE: TERMINATE USE OF NDML AND NTM
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: TRMNDML
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41310

DESCRIPTION:

- THIS MODULE WILL BE USED TO SIGNAL END OF ANY NDML COMMAND PROCESSING. IT WILL SEND A SPECIAL CALL TO THE DRS, SO THAT IT CAN NOTIFY EACH ACTIVE RP TO DO A CLOSE AND TERMINATE ITS PROCESSING. WHEN THE DRS RETURNS AFTER EACH RP IS DONE, NTM SERVICE TRMNAT WILL BE CALLED TO STOP THE RUN. NOTE, THE USER WILL NOT NEED TO USE TRMNAT.

ARGUMENTS:

TERMINATION-STATUS = DSPLY [X]

INCLUDE FILES:

CHKCDM - IISS CDMP CHECK STATUS CODES
ERRCDM - IISS ERROR STATUS CODES FOR CDMP MODULES
ERRPRO - PROCESS ERROR INCLUDE FILE

ROUTINES CALLED:

CDS01 - THE DISTRIBUTED REQUEST SUPERVISOR
TRMNAT
ERRPRO

3.10.9 Include File Descriptions

The following list contains a purpose and description of each include file listed in 3.10.4 as specified in the source code. The language it is written in is also given.

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: AGGMSG
PURPOSE: AGGREGATOR INPUT MESSAGE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS THE FORMAT OF THE INPUT MESSAGE FOR THE
CDMP AGGREGATORS

DESCRIPTION :-

AGGREGATOR INPUT MESSAGE FORMAT

NIS = NOT IN SET

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: APL
PURPOSE: JOIN QUERY ATTRIBUTE PAIR LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS INFORMATION ABOUT THE JOIN
ATTRIBUTES FOR NDML SUBTRANSACTIONS

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: CHKCDM
PURPOSE: IISS CDMP CHECK STATUS CODES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS ALL STATUS CODES FOR THE
CDMP MODULES

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: CITABLE
PURPOSE: COST INFORMATION TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THIS TABLE IS USED BY THE DRS TO
TRACK COSTS OF POSSIBLE SUBTRANSACTIONS

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: CS
PURPOSE: DISPLAY CONTENTS OF THE COST INFORMATION TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: CSAL
PURPOSE: CONCEPTUAL SCHEMA ACTION LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

TABLE TO HOLD CONCEPTUAL DATA ABOUT THE REQUEST

***** THE CONCEPTUAL SCHEMA ACTION LIST

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: DMPCSAL
PURPOSE: DISPLAYS THE CONTENTS OF THE CS ACTION LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: DUMPAPL
PURPOSE: DISPLAYS THE CONTENTS OF THE ATTRIBUTE PAIR LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: DUMPJQG
PURPOSE: DISPLAY THE CONTENTS OF THE JQG TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: DUMPRFT
PURPOSE: DISPLAY THE CONTENST OF THE RFT TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: DUMPRIT
PURPOSE: DISPLAY THE CONTENTS OF THE RIT TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: ERRCDM
PURPOSE: IISS ERROR STATUS CODES FOR CDMP MODULES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

```
------------
   CONTAINS ALL ERROR CODES USED BY CDMP      *
   MODULES FOR ERROR HANDLING                 *
```

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: ERRPRO
PURPOSE: PROCESS ERROR INCLUDE FILE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: FSMSG
PURPOSE: MESSAGE FOR THE FILE SEND UTILITY
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

MESSAGE FORMAT FOR THE FILE SEND INPUT

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: JQGTBL
PURPOSE: JOIN QUERY GRAPH TELLS HOW TO CONNECT SUBTRANSACTIONS
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: LNKEDGE
PURPOSE: DETERMINE DUPLICATE EDGES IN THE JQG
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

DURING JQG COLLAPSING, DUPLICATE JQG ENTRIES MAY RESULT WITH
DIFFERENT APL'S. THIS WILL BE EXECUTED AT THE END OF SENDS
FOR A STAGE AND WILL FIND THE DUPLICATE EDGES AND HOOK THE
APL'S TOGETHER BEFORE THE CIT IS REBUILT AT THE BEGINNING
OF THE NEXT STAGE.

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: QITABLE
PURPOSE: REQUEST INFORMATION TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THIS TABLE WILL TRACK ALL ACTIVE REQUEST PROCESSORS FOR THE DRS.

QITABLE.INC

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: RFTABLE
PURPOSE: THE RESULT FIELD TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS CONCEPTUAL SCHEMA INFORMATION ABOUT
THE RESULTS OF AN NDML REQUEST

THE RESULT FIELD TABLE

WHEN CHANGING THE STRUCTURE OF THIS TABLE
BE SURE TO CHANGE THE LAYOUT IN THE
LINKAGE SECTION OF THE DRS (CDS01)
WHICH WAS COPIED FROM THIS.

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: RITABLE
PURPOSE: RIT- RELATION INFORMATION TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

USED BY THE DRS TO KNOW ABOUT EACH RELATION IN A TRANSACTION

THIS TABLE MUST HAVE THE SAME NUMBER OF OCCURS AS THE SUBPROC.INC SINCE THEY ARE PARALLEL TABLES.

DISTRIBUTED REQUEST SUPERVISOR Include File Description

```
FILE NAME: SRVRET
PURPOSE:   AS THE RETURN GIVEN A TABLE-FULL ERROR
LANGUAGE:  VAX-11 COBOL

DESCRIPTION:
------------
   MODIFIED 11/2/83 TO INCLUDE RET-CODE-5                          *
   MODIFIED 1/9/84 TO INCREASE ALL ERROR CODES TO PIC X(5)         *
     AND TO ELIMINATE ALPHA'S                                      *
   MODIFIED 1/26/84 TO ADD RET-CODE FOR GETUSR-NOT-SUCC            *
   SRV-SUCCESSFUL ADDED FOR GENERIC RETURN                         *
   MODIFIED 2/7/84 TO ADD ERROR CODES FOR ENTRY-NOT-FOUND          *
   MODIFIED 2/8/84 TO ADD WHTHST-NOT-SUCCESSFUL                    *
   MODIFIED 2/20/84 TO ADD TSTMOD NEW CODES.                       *
      MODIFIED 20 AUG 84 INITALIZE ALL LOCAL VARAIBLES TO
               SPACES OR 0.
   MODIFIED 5/21/85 TO ADD RCL AND FILGEN RETURN CODES
```

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: STDRESP
PURPOSE: WS DEFINITION FOR STANDARD STATUS VARIABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THE STANDARD 'PROCESS COMPLETE' MESSAGE

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: SUBPROC
PURPOSE: SUBTRANSACTION PROCESSES ID TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THIS TABLE MUST HAVE THE SAME NUMBER OF OCCURS AS THE RITABLE.INC SINCE THEY ARE PARALLEL TABLES.

DISTRIBUTED REQUEST SUPERVISOR Include File Description

FILE NAME: TCTABLE
PURPOSE: TRANSMISSION COST TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

HOLDS RELATIVE COST OF TRANSMISSION/PROCESSING
FILE TRANSFERS/JOINS ON THE NETWORK AND IS USED AS
A BASIS OF STAGER/SCHEDULER OPTIMIZATION ALGORITHMS

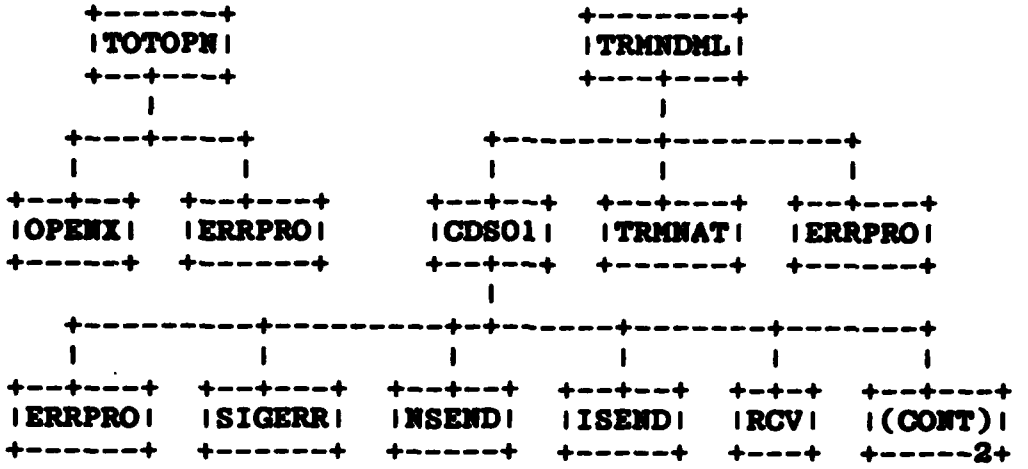
THESE ARE THE EXPERIMENTAL VALUES FOR THE TCT:

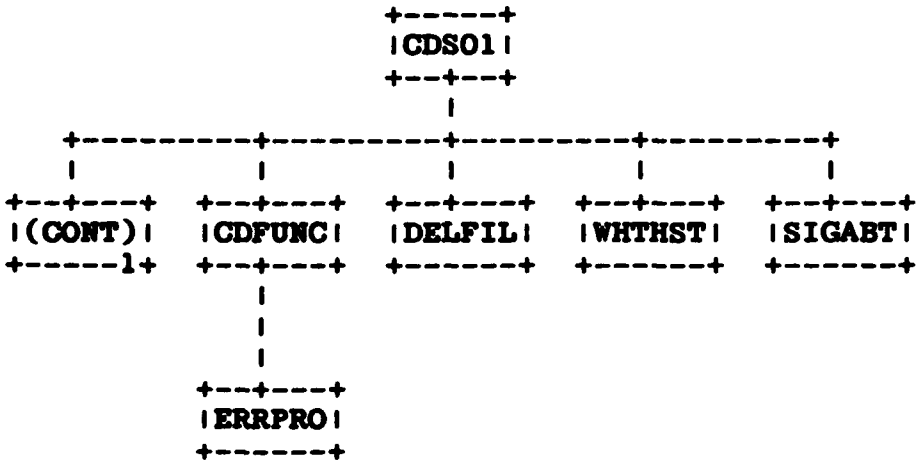
3.10.10 Hierarchy Chart

The following hierarchy charts show the relationships between all of the modules mentioned in the above documentation. A module may call a subroutine several times within its code, but the call will only be shown once as a single relationship on this hierarchy chart. All modules shown at the top of the first page are considered Main Programs as described in section 3.10.1 above.

There is an internal paging scheme as marked by the numbers in the upper right corner of each page. An index after the last page of the chart shows where a routine and its calls are first defined. If a routine has no page reference, it either makes no calls or is an external routine. A continuation box on the end of a tree limb shows where that the tree continues on the page numbered mentioned. A number in a box with a routine name points to the page where the routine is further defined within the hierarchy tree. If there is no number in a box, the routine either makes no calls or is an external routine.

1


TOTOPN
TRMNDML
OPENX
ERRPRO
CDS01
TRMNAT
ERRPRO
ERRPRO
SIGERR
NSEND
ISEND
RCV
(CONT)
2


CDS01
(CONT)
CDFUNC
DELFIL
WHTHST
SIGABT
ERRPRO

CDFUNC.....2
CDS01.....1
DELFIL
ERRPRO
ISEND
NSEND
OPENX
RCV
SIGABT
SIGERR
TOTOPN.....1
TRMNAT
TRMNDML....1
WHTHST

3.11 Program Listings Comments

This information is contained in the Module Descriptions in section 3.10.

SECTION 4

QUALITY ASSURANCE PROVISIONS

4.1 Introduction and Definitions

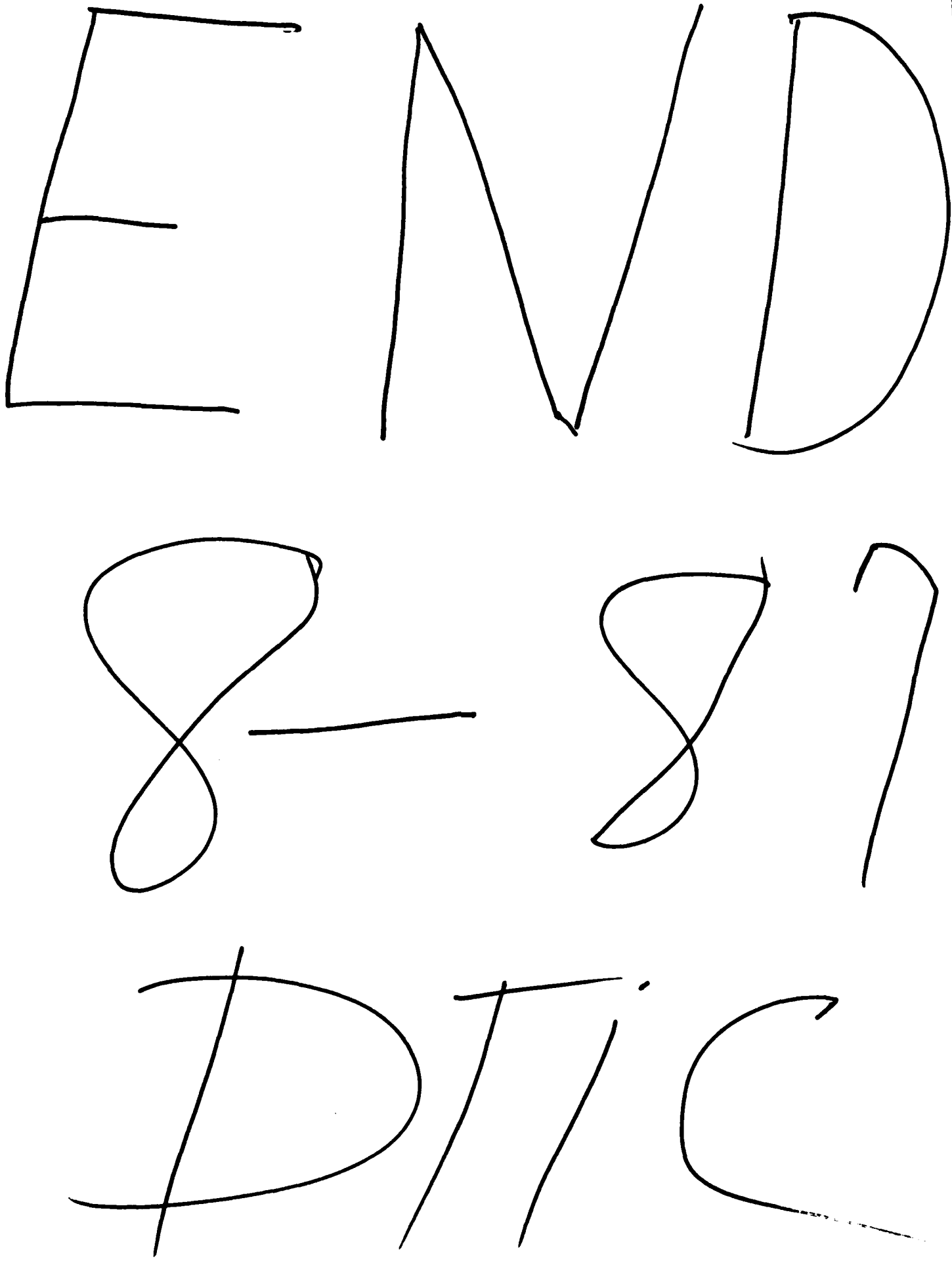
"Testing" is a systematic process that may be preplanned and explicitly stated. Test techniques and procedures may be defined in advance, and a sequence of test steps may be specified. "Debugging" is the process of isolation and correction of the cause of an error.

"Antibugging" is defined as the philosophy of writing programs in such a way as to make bugs less likely to occur and when they do occur, to make them more noticeable to the programmer and the user. In other words, as much error checking as is practical and possible in each routine should be performed.

4.2 Computer Programming Test and Evaluation

The quality assurance provisions for test consists of the normal testing techniques that are accomplished during the construction process. They consist of design and code walk-throughs, unit testing, and integration testing. These tests are performed by the design team. Structured design, design walk-through and the incorporation of "antibugging" facilitate this testing by exposing and addressing problem areas before they become coded "bugs."

*U.S.Government Printing Office: 1987 — 748-061/60920


END
8-87
DTIC