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INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume V - Common Data Model Subsystem
Part 40 - CDM Impact Analysis Unit Test Plan

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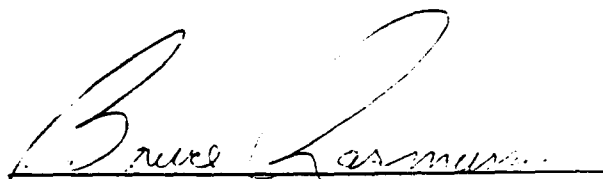
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FOREWORD

This technical report covers work performed under Air Force Contract F33600-87-C-0464, DAPro Project. This contract is sponsored by the Manufacturing Technology Directorate, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. It was administered under the technical direction of Mr. Bruce A. Rasmussen, Branch Chief, Integration Technology Division, Manufacturing Technology Directorate, through Mr. David L. Judson, Project Manager. The Prime Contractor was Integration Technology Services, Software Programs Division, of the Control Data Corporation, Dayton, Ohio, under the direction of Mr. W. A. Osborne. The DAPro Project Manager for Control Data Corporation was Mr. Jimmy P. Maxwell.

The DAPro project was created to continue the development, test, and demonstration of the Integrated Information Support System (IISS). The IISS technology work comprises enhancements to IISS software and the establishment and operation of IISS test bed hardware and communications for developers and users.

The following list names the Control Data Corporation subcontractors and their contributing activities:

<u>SUBCONTRACTOR</u>	<u>ROLE</u>
Control Data Corporation	Responsible for the overall Common Data Model design development and implementation, IISS integration and test, and technology transfer of IISS.
D. Appleton Company	Responsible for providing software information services for the Common Data Model and IDEF1X integration methodology.
ONTEK	Responsible for defining and testing a representative integrated system base in Artificial Intelligence techniques to establish fitness for use.
Simpact Corporation	Responsible for Communication development
Structural Dynamics Research Corporation	Responsible for User Interfaces, Virtual Terminal Interface, and Network Transaction Manager design, development, implementation, and support.

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Responsible for test bed operations
and support.

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Accession For	
NTIS Grant	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A-1	

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SECTION 1

GENERAL

1.1 Purpose

This unit test plan establishes the methodology and procedures used to adequately test the capabilities of the computer program identified as the CDM Impact Analysis known in this document as the CDM Impact. The CDM Impact is one configuration item of the Integrated Information Support System (IISS).

1.2 Project References

- [1] ICAM Documentation Standards, 23 December 1981, IDS150120000C.
- [2] D. Appleton Company, CDM Administrator's Manual, UM 620141000, 29 April 1985.
- [3] D. Appleton Company, CDM1, An IDEF1 Model of the Common Data Model, CCS620141000, 15 May 1985.
- [4] Control Data Corporation, Neutral Data Definition Language User's Guide, UM620341100, 31 May 1988.
- [5] C. J. Date, An Introduction to Database Systems, 1977, Addison-Wesley Publishing Company, Inc.
- [6] Control Data Corporation, NDDL Development Specification, DS620341100, 31 May 1988.
- [7] Control Data Corporation/D. Appleton Company, Conceptual Schema of CDM-1 for Cross References, 4 December 1985.
- [8] Control Data Corporation, CDM Impact Analysis User Manual, UM 620341420, 31 May 1988.
- [9] Control Data Corporation, CDM Impact Analysis Development Specification, DS 620341420, 31 May 1988.

1.3 Terms and Abbreviations

Application Process: (AP), a cohesive unit of software that can be initiated as a unit to perform some function or functions.

Common Data: all the data of the enterprise.

Common Data Model: (CDM), IISS subsystem that describes common data of an enterprise and includes conceptual, external and internal schemas and schema transformations.

Common Data Model Administrator: (CDMA), the person or group of persons responsible for creating and maintaining an enterprises's Common Data Model. The CDMA manages the common data rather than managing applications that access data.

Common Data Model Processor: (CDMP), a component of the Common Data Model subsystem which is the distributed database manager of the IISS.

Conceptual Schema: (CS), the standard definition used for all data in the CDM. It is based on IDEF1 information modelling.

External Schema: (ES), an application's view of the CDM's conceptual schema.

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

Internal Schema: (IS), the definition of the internal model, the storage structure definition, which specifies how the physical data are stored and how they can be accessed. It is represented in terms of the physical database components, including record types and inter-record relationships.

Neutral Data Definition Language: (NDDL), a language used to manipulate and populate information in the Common Data Model (CDM) or IISS System Database.

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 retrieval, and non-guaranteed distributed update.

Presentation Schema: (PS), the totality of the form fields in an application which are targets of data derivative from the common data.

SECTION 2

DEVELOPMENT ACTIVITY

During system development, the computer program was tested progressively. Functionality was incrementally tested and as bugs were discovered by this testing, the software was corrected.

This testing was conducted by the individual program developer in a manual mode. Any errors were noted by the developer and corrections to the program were then made after a testing session.

SECTION 3

SYSTEM DESCRIPTION

3.1 System Description

The CDM Impact Analysis will report software modules which use external schemas affected by CDM changes. The generated reports are to be used to keep application programs consistent with the CDM. The report will contain: the name of the software module affected, the type of NDDL command causing the change and the ES changed by the command (view name and data items). Since some NDDL commands indirectly affect external schemas, the report includes the sequence of the objects affected, from the objects directly affected by the NDDL command to the external schema used by a software module. This will provide the CDM administrator with enough information to either modify application programs to work with the new CDM model or revise the NDDL changes themselves.

Figure 3-1 describes the structure of the CDM Impact interfaces.

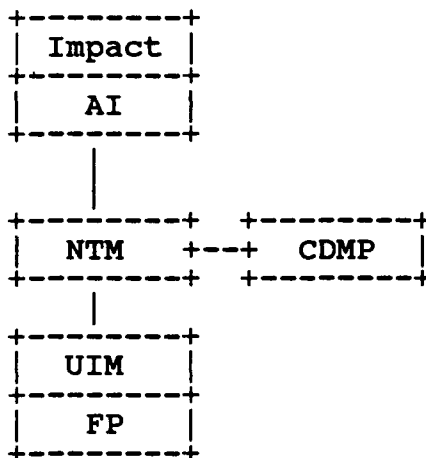


Figure 3-1 CDM Impact Interfaces

3.2 Testing Schedule

The execution of the CDM Impact is dependent upon the following systems: NTM, UI, and CDMP. The Impact should not be tested until these systems have been tested.

3.3 First Location Testing

These tests of the Impact require the following:

Equipment: Air Force VAX, terminals supported by the virtual terminal as listed in the IISS Terminal Operator's Guide.

Support Software: The Integrated Information Support System, and the Oracle database management system.

Personnel: One integrator familiar with the IISS.

Training: The CDM Impact User Manual has been provided with the current release.

Deliverables: The CDM Impact subsystem of the IISS UI/VTI.

Test Materials: This test is interactive and can be manually performed as outlined in this test plan. It also could be run as a script file if so desired.

Security considerations: None.

3.4 Subsequent Location Testing

The requirements as listed above need to be met; however, in subsequent testing it is advantageous to create a script file of the outlined tests and run this, saving the output of the test for future comparisons.

SECTION 4

SPECIFICATIONS AND EVALUATIONS

4.1 Test Specification

The following requirements are demonstrated by the outlined tests:

1. All tests are run from the UIMS.
2. Impacts to Schemas are tested by:

Schema/Mapping Items	Test Activity													
	A	B	C	D	E	G	H	J	K	M	N	P		
ES									*	*				
CS	*	*	*	*	*	*	*							
IS											*			
CS/ES								*						
CS/IS												*	*	
Complex Mapping														

Schema/Mapping Items	Test Activity												
	Q	R	S	T	V	W	X	Y	Z	1	4	6	
ES										*			
CS													
IS	*				*			*			*	*	
CS/ES													
CS/IS		*	*	*		*	*	*					
Complex Mapping													

Schema Object	Test Activity													
	A	B	C	D	E	G	H	J	K	M	N	P		
DATA BASE														
RECORD TYPE														
DATA FIELD											*			
RECORD SET														
ENTITY CLASS			*			*								
ATTRIBUTE CLASS	*				*									
ATTRIBUTE USE CL			*											
RELATION CLASS				*			*							
KEY CLASS			*											
DATA ITEM								*						
USER VIEW								*	*					
HORIZONTAL_PART												*		
ECRTUD														
PROJECT DATA FIELD											*			
AUC ST MAPPING											*			
RC BASED REC SET											*			
PROJECT DATA ITEM								*						
VIEW EC XREF								*						
DOMAIN CLASS	*													
USER DEF DATA TYPE	*													

Schema Object	Test Activity													
	Q	R	S	T	V	W	X	Y	Z	1	4	6		
DATA BASE														
RECORD TYPE	*							*				*		
DATA FIELD					*									
RECORD SET														
ENTITY CLASS														
ATTRIBUTE CLASS														
ATTRIBUTE USE CL														
RELATION CLASS														
KEY CLASS														
DATA ITEM												*		
USER VIEW														
HORIZONTAL_PART			*				*							
ECRTUD		*						*						
PROJECT DATA FIELD						*								
AUC ST MAPPING						*								
RC BASED REC SET						*								
PROJECT DATA ITEM						*								
VIEW EC_XREF														
DOMAIN CLASS														
USER_DEF_DATA_TYPE														

3. The input NDDL commands are:

NDDL Commands	Test Activity													
	A	B	C	D	E	G	H	J	K	M	N	P		
Alter Attribute	*													
Alter Domain		*												
Alter Domain		*												
Alter Entity			*											
Alter Entity			*											
Alter Relation				*										
Alter Relation				*										
Drop Attribute					*									
Drop Database														
Drop Entity						*								
Drop Relation							*							
Drop Set														
Drop View								*						
Rename View									*					
Alter Database														
Alter Field										*				
Alter Map											*			
Alter Map											*			
Alter PSB														
Alter Partition												*		
Alter Partition												*		

NDDL Commands	Test Activity												
	Q	R	S	T	V	W	X	Y	Z	1	4	6	
Alter Record	*												
Alter Union		*											
Alter Union		*											
Create Partition			*										
Create Union				*									
Drop Algorithm					*								
Drop Field						*							
Drop Map							*						
Drop Map							*						
Drop Partition								*					
Drop Record									*				
Drop Union										*			
Rename Data Item											*		
Rename Host												*	
Rename Database													
Rename Field												*	
Rename Set													
Rename Record												*	

- A - The NDDL command file ALTATT.DAT
- B - The NDDL command file ALTDOM1.DAT
- C - The NDDL command file ALTENT.DAT
- D - The NDDL command file ALTREL.DAT
- E - The NDDL command file DRPATT.DAT
- G - The NDDL command file DRPENT.DAT
- H - The NDDL command file DRPREL.DAT
- J - The NDDL command file DRPVIW.DAT
- K - The NDDL command file RENVIV.DAT
- M - The NDDL command file ALTFLD.DAT
- N - The NDDL command file ALTMAP.DAT
- P - The NDDL command file ALTPAR.DAT
- Q - The NDDL command file ALTREC.DAT
- R - The NDDL command file ALTUNI.DAT
- S - The NDDL command file CRTPAR.DAT
- T - The NDDL command file CRTUNI.DAT
- V - The NDDL command file DRPFLL.DAT
- W - The NDDL command file DRPMAP.DAT
- X - The NDDL command file DRPPAR.DAT
- Y - The NDDL command file DRPREC.DAT
- Z - The NDDL command file DRPUNI.DAT
- 1 - The NDDL command file RENDI.DAT
- 4 - The NDDL command file RENFLD.DAT
- 6 - The NDDL command file RENREC.DAT

4. Each test includes two reports. One shows the software module using an ES which is affected by a command and the command causing the impact. A second report lists the schema objects affected by a command and the commands causing the impact.

5. The CDM impact runs under IISS and uses its security procedures. The NDDL commands may be input by file or by terminal. The output may be sent to a file or terminal.

6. The CDM impact accepts NDDL commands as input (see number 3 above) and outputs the reports (see number 4 above).

The steps outlined in section 5.3 show the correspondence between the test and the functional requirements as listed in this section. These functional requirements match those as specified in the CDM Impact Analysis Development Specification.

4.2 Testing Methods and Constraints

The tests as outlined in section 5.3 must be followed. The required input is stated for each test. This testing tests the normal mode of operation of these functions and does not completely exercise all the error combinations that a user of the CDM Impact might create by faulty entry of form field information. These tests have been done, however, through the normal testing done by the developer of these functions. It is suggested that on further running of this test, scripting of the test be done and the output from running the script be saved for future testing. No additional constraints are placed on this unit test besides those listed in section 3.3 of this unit test plan.

4.3 Test Progression

The progression of testing of the CDM Impact is fully outlined in section 5.3 of this unit test plan. This progression should be followed exactly to insure the successful testing of this IISS configuration item.

4.4 Test Evaluation

The test results are evaluated by comparing the information returned on the various output screens to that specified as successful for the given test. As outlined in section 5.3, each test of Impact functionality provides an input screen with the required data entry specified and the resulting output for a successful test. To speed up testing of future releases, scripting may be used.

SECTION 5

TEST PROCEDURES

5.1 Test Description

A general description of this unit test is provided in section 5.3.

5.2 Test Control

As outlined, this unit test is a manual test which may be done by anyone. The required input data are documented for each function being tested and the resulting successful output is also documented. The order of the testing is also completely documented. The test control information is completely described in section 5.3. Accurate observation of the resulting successful output must be made to ensure the unit test was done properly.

5.3 Test Procedures

Below is an example of how the CDM Impact may be invoked in the VAX/VMS environment. To run the unit test plan as outlined: one must be logged on to an IISS account. The NTM must be up and running and the UI group logical names IISSFLIB, IISSULIB and IISSMLIB must be set properly. IISSFLIB points to the directory containing form definitions (.FD files) of the VIMS. IISSULIB is set to the directory containing the form definition for the impact forms. IISSMLIB points to the directory containing error messages (.MSG files). The function key definitions are documented in Appendix A for a VT100.

The steps listed in section 5.3.1 to 5.3.4 must be run for each of the test cases listed below. Each case is identified by its root file name. The first test case ALTATT, is used as an example. The appropriate file extensions are:

- .DAT - NDDL commands input/test file, supplied by CDC.
- .SAV - The CDM Impact's report output, supplied by CDC.
- .OUT - The CDM Impact's report output. Generated by running the test and to be compared with the .SAV file.

The test cases are (listed by file name and the NDDL command being tested:

- ALTATT - Alter Attribute/Domain
- ALTDOM1 - Alter Domain/Drop Data Type and
Alter Domain/Alter Data Type
- ALTENT - Alter Entity/Drop Key Class and
Alter Entity/Drop Attribute
- ALTREL - Alter Relation cardinality and
Alter Relation/Drop Migrates

```

DRPATT - Drop Attribute
DRPENT - Drop Entity
DRPREL - Drop Relation
DRPVIW - Drop View
RENVIV - Rename View
ALTFLD - Alter Field
ALTMAP - Alter Map/attribute use class and Alter Map/relation class
ALTPAR - Alter Partition/add and Alter Partition/drop
ALTREC - Alter Record
ALTUNI - Alter Union/add andAlter Union/drop
CRTPAR - Create Partition
CRTUNI - Create Union
DRPFLL - Drop Field
DRPMAP - Drop Map/attribute use class and Drop Map/relation class
DRPPAR - Drop Partition
DRPREC - Drop Record
DRPUNI - Drop Union
RENDI - Rename Data Item
RENFLD - Rename Field
RENREC - Rename Record

```

5.3.1 Access to IISS

Assuming the NTM is up and running, an IISS user may start the test as follows:

```
$ CREATE ALTATT.OUT
$ RUN VT100
```

Following entry of the system command "RUN VT100" which activates the User Interface, the form in Figure 5-1 is displayed.

USER ID: _____

PASSWORD: _____

ROLE: _____

Msg: 0

application

Figure 5-1 IISS Logon Screen

- (1) USER ID is the identification name of the user, and is 1 to 10 alpha-numeric characters. USER ID is CDM.
- (2) PASSWORD must be the password associated with the USER ID, and is 1 to 10 alpha-numeric characters. PASSWORD is CDM.
- (3) ROLE is any of the identifiers which are associated with the USER ID, and is 1 to 10 alpha-numeric characters. It is checked against functions and applications which are selected by the user. ROLE is CDM. When this form is correctly completed and the ENTER key is pressed, the screen in Figure 5-2 is displayed.

5.3.2 Choosing The CDM Impact Function

Specific applications are accessed through the form displayed in Figure 5-2. When the form appears, the cursor is located in the item FUNCTION. The items in the form are summarized below:

I I S S T E S T B E D V E R S I O N 2.3			
DATE: __/__/__	TIME__:__:__	USER ID:_____	ROLE:_____
FUNCTION:_____		DEVICE TYPE:_____	DEVICE NAME:_____
Msg: 0		application	

Figure 5-2 IISS Function Screen

- (1) DATE contains the current date. This may not be changed by the user.

- (2) TIME contains the current time. This may not be changed by the user.
- (3) USER ID is the user's identification that was entered in the previous form. This may not be changed by the user.
- (4) ROLE is the currently active role and was entered in the previous form. This may be changed at any time.
- (5) FUNCTION is the function the user desires to activate. In the function field type CDMIMPACT and press the <ENTER> key. The screen in Figure 5-3 is displayed.

5.3.3 Running the CDM Impact

The following figure is the input screen for the CDM Impact. A description of each field is given below.

```
-----+-----
              INTEGRATED INFORMATION SUPPORT SYSTEM
              CDM IMPACT ANALYSIS
              -----
Device Type: _____ Device Name: _____
NDDL Commands File: _____
NDDL Commands:
_____  
_____  
_____  
_____
MSG: _____ application
-----+-----
```

Figure 5.3 CDM Impact Input Screen

- (1) Device Type is the type of device the output is directed to. Enter "SDPRINTERZ".
- (2) Device Name is the name of the device or file the output is directed to. Enter the output file name "ALTATT.OUT".
- (3) NDDL Commands File is the name of the input file containing the NDDL commands. Enter "ALTATT.DAT".

When the CDM Impact is finished the IISS function screen is redisplayed, press the <QUIT> key.

5.3.4 Comparing the Results

To compare the results use the VAXVMS utility DIFFERENCES. On the VMS command line type:

```
$ DIFF ALTATT.SAV ALTATT.OUT
```

The only differences should be in the lines containing dates. It is possible additions or deletions have been made to the CDM between the times the two reports were made. Check with the CDM Administrator to determine what changes have been made to the CDM.

APPENDIX A
VT100 KEYPAD LAYOUTS

Mode	Help	Message Queue	Quit
			Enter

Figure A-1 IISS Form Processor Function Keys (application mode)

APPENDIX B

TEST CASE FILE LISTINGS

The following is a list of the file contents which are used to test the CDM Impact as outlined in Section 5.

ALTATT.DAT;1

```
alter attribute AC_NO domain CHARACTER_NAME;
exit;
```

ALTDOM1.DAT;6

```
alter domain CHARACTER NAME
  drop data type line1
  alter data type line2;
exit;
```

ALTENT.DAT;4

```
alter entity KEY_CLASS
  drop key class KEY_CLASS_KEY KEY_CLASS_KEY_2;
alter entity ENTITY_CLASS
  drop attribute EC_NO MODEL_NO;
exit;
```

ALTFLD.DAT;1

```
alter field EC_NO of record ENTITY_CLASS of database CDM
  data type inumber;
exit;
```

ALTMAP.DAT;3

```
ALTER MAP ENTITY_CLASS.EC_NO FOR PREFERENCE 1
  DROP FIELD DB_NAME.REC_NAME.DF_NAME;
```

```
ALTER MAP ENTITY_CLASS CONTAINS ATTRIBUTE_USE_CL
  DROP SET DB_NAME.SET_NAME;
```

EXIT;

ALTPAR.DAT;1

```
alter partition 1 of entity ENTITY_CLASS
  drop record CDM.ENTITY_CLASS CDM.ATTRIBUTE_CLASS
  add record cdm.entity_class cdm.attribute_class;
```

exit;

ALTREC.DAT;1

```
alter record ENTITY_CLASS of database CDM
  add fields ec_no model_no
  drop fields EC_NO MODEL_NO;
```

exit;

ALTREL.DAT;5

```
alter relation class ATTRIBUTE_CLASS IS_ASSIGNED_TO
OWNED_ATTRIBUTE
  drop migrates ATTRIBUTE_CLASS_KEY;
```

```
alter relation class 1 ENTITY_CLASS OWNS OWNED_ATTRIBUTE;
```

```
alter relation class ENTITY_CLASS CONTAINS 0:1 ATTRIBUTE_USE_CL;
```

```
alter relation class ENTITY_CLASS HAS KEY_CLASS;
```

exit;

ALTUNI.DAT;1

```
alter union of record CDM.ENTITY_CLASS
  drop entity ENTITY_CLASS ATTRIBUTE_CLASS
  add entity entity_class when df5 = 'K' and df6 = 'P'
    attribute_class when df5 = 'K' and df6 = 'R';
```

exit;

CRTPAR.DAT;1

```
create partition 1 of entity ENTITY_CLASS
  to record CDM.ENTITY_CLASS CDM.ENTITY_CLASS;
```

exit;

CRTUNI.DAT;1

create union of record CDM.ENTITY_CLASS
to entity ENTITY_CLASS when df1 = 'A';

exit;

DRPAT.T.DAT;1

drop attribute AC_NO EC_NO;

exit;

DRPENT.DAT;1

drop entity ENTITY_CLASS ATTRIBUTE_CLASS;

exit;

DRPFLD.DAT;2

drop fields EC_NO MODEL_NO of record ENTITY_CLASS of database
CDM;

exit;

DRPMAP.DAT;1

drop map ENTITY_CLASS.EC_NO FOR PREFERENCE 1
;
DROP MAP ENTITY_CLASS CONTAINS ATTRIBUTE_USE_CL;

exit;

DRPPAR.DAT;1

drop partition 1 of entity ENTITY_CLASS;

exit;;

DRPREC.DAT;1

drop record ENTITY_CLASS of database CDM;

exit;

DRPREL.DAT;1

drop relation ENTITY_CLASS CONTAINS ATTRIBUTE_USE_CL
ATTRIBUTE_CLASS IS_ASSIGNED_TO OWNED_ATTRIBUTE;

exit;

DRPUNI.DAT;1

drop union of record CDM.ENTITY_CLASS;

exit;

DRPVIW.DAT;1

drop view ENTITY_CLASS ATTRIBUTE_CLASS;

exit;

RENDI.DAT;1

rename dataitem ENTITY_CLASS.EC_NO to ec_no;

exit;

RENFLD.DAT;1

rename field CDM.ENTITY_CLASS.EC_NO to ec_no;

exit;

RENREC.DAT;1

rename record CDM.ENTITY_CLASS to entity_class;

exit;

RENVIW.DAT;1

rename view ENTITY_CLASS to entity_class;

exit;