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Year 2000 Summary for the ECS/SDPS Project

Technical Paper

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Abstract

This technical paper documents the results of the SDPS Year 2000 compliance testing for the ECS/SDPS Project. It addresses issues related to Y2K compliance and ECS/SDPS requirements, design, and test activities intended to support this goal. It includes test cases results, describes the manner in which the tests were conducted, and describes the controlled environment in which the tests were performed and discrepancies that were discovered.

Keywords: Y2K, Year 2000, requirements, Level 4, CSS Time Service, DCE Time

Service, test, system

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Abbreviations and Acronyms

1. Introduction

1.1 Purpose

The purpose of Year 2000 testing was to verify Year 2000 compliance of the ECS/SDPS system at the subsystem and end to end level. Executing functional test cases was the approach to demonstrating compliance. Some of the test cases were developed from existing System Verification (SV) and Acceptance Test (AT) test cases and some new test cases were developed. Specific Y2K test dates used for ECS/SDPS Y2K testing included:

January 1, 2000 One-Year Look-Ahead Date into Next Century.

February 28, 2000 (Leap Year Test 60th day of the year)

February 29, 2000 Uncommon Leap Year

December 31, 2000 (366th Day of Uncommon Leap Year)

Y2K testing occurred with Drop 5A. Technical Direction Number 28, Year 2000 Requirements, and updates to the ECS Statement of Work in accordance with Contract Modification 82, which directed ECS/SDPS to develop and document this testing.

1.2 Organization

This paper is organized as follows:

Section 2.0 discuses the Y2K assessment and resolution. Section 3.0 discusses the planning execution and results of Y2K VATC Testing.

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2. Y2K Assessment

2.1 COTS Assessment

ECS/SDPS has implemented an aggressive COTS monitoring program to ensure that all of the COTS is Y2K compliant. The current status of COTS Y2K hardware and software is contained in the ECS SDPS COTS report. The COTS verification program made use of several verification methods. Initially each vendor was asked to sign a Raytheon Y2K certification letter. In cases where vendors did not sign the provided letter, vendor letters or information from vendor web sites were reviewed and credited if acceptable. In a few cases of shareware/freeware no information was available about the Y2K compliance from the developers. In this case, the software was brought under ECS/SDPS configuration control and run as part of the test environment. ECS/SDPS is currently researching commercial replacements for these products. It is now standard practice to include Y2K compliance requirements in all future COTS purchases.

Current Y2K COTS upgrades in progress are :

Table 2-1. Y2K COTS Upgrades

Product Name	Baseline Version	New Version	Need Date	Status
Netscape Enterprise Server	2.o2a	3.6.1	Sept.-99	PSR to be completed in Oct.-99
IMSL	2.5 Fortran Libraries 2.0 C Libraries	Fortran: 3.0 C: 4.0	Oct.-99	Instrument team has not upgraded to 64 bit library, action is on Science Office to work with instrument team.
Solaris Compilers	4.0	4.2	Oct..-99	IDG cell testing is completed. PSR to be issued in Oct.-99

2.1.1 SDPS Custom Code Assessment

The SDPS software baseline consists of custom code developed in C, C++, Fortran and Java. Additionally, the baseline consists of a large number of scripts developed for the purpose of configuration control, setup and monitoring.

The custom C/C++ code was assessed using the DISCOVER TOOL. The analysis of the results from using the DISCOVER tool was performed by proServices, Inc. and is included in their report “Raytheon EOS- Y2K Refined Assessment Analysis Reporting”, dated November 24, 1998. In summary, the ECS/SDPS software was reported as having relatively few of the “classic” Y2K problems associated with older systems. Areas of sensitivity in the ECS/SDPS code consisted of local implementation of year 2000 “windowing” code for handling 2-digit year

values, conversion of date values through locale-based strings and the use of many date structures and classes. It was reported that the ECS/SDPS software has a relatively low cyclomatic complexity and is relatively easy to understand. As such, it is probably not necessary that remediation be performed by the original development team for each subsystem.

The assessment of the Fortran, Java and script baseline code was completed by Raytheon's State College Operations. The State College operation worked closely with the Landover Development group to resolve questions concerning the custom code implementation and resolution of potential Y2K issues. Very few Y2K problems were uncovered during this assessment.

It is now common practice to have Y2K checkpoints throughout the development cycle to include code walkthrough, NCR and CCB reviews.

2.1.2 Resolution/Integration Activities

Results of both the proServices and the State College assessments were reviewed with Landover Development engineering and a priority resolution plan was developed. State College operations implemented the Y2K fixes. Each of the recommended fixes were reviewed by ECS/SDPS subsystem leads before being allowed to be merged into the 5AY2K release in ClearCase.

The Y2K modifications to the 5A baseline code were merged and integrated by the ECS/SDPS Development organization. Integration testing consisted of using sample Y2K dates in GUI input, PDPS processing, granule insert, inventory search, acquires and subscription triggering. This testing did not include the changing of the system clocks to simulate a Y2K environment. Detailed discussion can be found in the Build Plan for Version 2.0 Drop 5A iteration dated February 10, 1999.

3. ECS/SDPS Y2K System Verification and Test

3.1 Y2K Test Environment

One of the original assumptions in the test approach for Y2K testing was that the ECS/SDPS Communications Subsystem (CSS) Time services would allow the setting of the system time in several of the modes during Y2K testing. The current as built status of the CSS module did not provide this full capability across the entire system. This necessitated the investigation of an alternative way in which to simulate the Year 2000 environment. System Engineering investigated several methods and COTS products that potentially solved the problem. It was decided to control the date and time from the operating system level.

To anticipate any unexpected issues with the operating system as it moved forward and backwards from the year 2000, a small test cell was established to do initial OS tests. The results of these tests confirmed that there was low risk in moving the system time to create a Y2K test environment.

Prior to starting Y2K testing a complete backup of the system was completed prior to the first time shift. It was understood that no backups would be conducted while the clocks were set to a time other than current.

To actually set the times ahead was a very involved process and required the development of a step by step procedure to configure the system with respect to the system time on all of the machines and also to configure the Distributed Computing Environment (DCE) software.

Y2K testing was conducted in all three modes of the VATC. Software and hardware configuration for the VATC can be obtained from the following link: http://pete.hitc.com/baseline/index.html.

3.2 Test Requirement/Procedure Development

Test Requirement and mapping of Y2K test cases evolved from a variety of sources to include the NASA Year 2000 Agency Test and Certification Guidelines and Requirements. From this and other documents a set of Y2K test requirements were developed and mapped to system verification and acceptance test cases. These requirements were generated and approved through the normal ECS/SDPS Systems Engineering Architect Office and ESDIS review procedure. The requirements and mappings are contained in the MR1C.doc ticket. The original set of recommended Y2K test procedures documented in prior Y2K plans was reevaluated against the current custom code baseline and the approved requirements and was modified to the current set of tests. Additionally, as more of the tests were reviewed and approved, duplications were eliminated without the loss of Y2K test coverage. The current test procedures used for Y2K testing are located at http://dmserver.gsfc.nasa.gov/relb_it/relbit.htm

3.3 Test Execution Results

Y2K testing was conducted from March 18 to April 30 1999 for the ECS/SDPS SDPS system. The execution of these tests was a very complex evolution. There were many observations, dependencies and contributing factors that effected the execution of the tests.

3.3.1 Setting of System time/Control of the DCE environment

The establishment of the Y2K environment for each time period required a complex set of procedures to coordinate the setting of the system time on approximately 30 machines from multiple vendors, rebooting of the machines and ensuring that the DCE environment was up, running and stable. Early on in the test program there were several false starts due to unexpected issues that arose.

3.3.2 Functionality Issues

During some tests it was discovered that assumed non-Y2K functionality for a certain test was not operating as expected. In most cases this required a software fix to be implemented before Y2K testing could proceed.

3.3.3 Time Sensitive Execution of Tests

One of the main test points for the Y2K testing was to ensure execution of the ECS/SDPS software as the time rolled over midnight. In some cases this involved executing test steps within minutes of the rollover. Some problems encountered could and did prevent the test from being executed on this tight schedule.

3.3.4 Test Dependencies Among Tests

In an effort to minimize the number of time changes, it was decided to develop test threads that could run together. This also satisfied the prerequisites for several tests, as most tests required functions to happen to support individual test cases. On the average six tests would run during a given time change. The dependencies did cause some problems due to problems with tests that were prerequisites for other tests. Good communication among the test group and a quick learning curve helped make this impact manageable. Data search and order tests were evaluated to see if they could run in any time frame (i.e. 1999 or 2000). It was determined that these tests were independent from the system time and were scheduled when testing resources were available to accommodate the tests. The priority was given to the tests that required time shifts.

3.3.5 Test Durations

The typical time shift based Y2K test day consumed approximately 8 hrs. This time was broken down as follows:

Test Environment configuration (Setting of clocks, Configuring DCE)	1.5 hours
Test Preparation(bringing servers up, Staging data)	1.0 hour
Test Execution	5.5 hours

3.3.6 Test Data

Test data was identified prior to the start of Y2K testing. In the final review of the test procedures, modifications to the required data needed to ensure coverage of the Y2K test requirements was identified. This data was researched and provided as required for the appropriate tests.

3.4 Y2K VATC Testing Results

Y2K VATC testing did not uncover any major Y2K issues. This is consistent with the Y2K assessment performed on the program earlier. Testing did uncover some Y2K issues but none at this time seem to be uncorrectable. The following table outlines the NCRs/issues that have been generated with respect to Y2K testing. Two of following NCRs/tests are waived to be run for verification as a result of ESDIS direction (no time shift tests will be executed).

Table 3-1. Y2K NCRs (1 of 2)

NCRs	#	State	Status
Can't Bring Up DDIST GUI for Y2K Testing	21517	C	GUI problem only, database was storing the data correctly. Ready for reverification
Y2K: Autosys event processor died at 12/31/99 - 01/01/2000 crossover	21471	A	This event only happened twice and it's appearance was not consistent each time. At this point it is not though of as a Y2K problem
Zmail not Y2K compliant	21472	A	This COTS will be replaced by Netscape Communicator and the test will be withdrawn.Will be closed upon the upgrade to Netscape Communicator. Currently being tested in the VATC
Y2K: L7 MOC Script Calls 123000 and 123100 Day 366	21952	T	Leap year problem not specific to Y2K. ECS will be not rerun this test based upon ESDIS direction(no more time shift testing)
SGI operating system resets the system date back one day, when the system is rebooted			This problem is not considered a Y2K problem as it happens every year. The fix to this problem is identified in SGI patch 3566 (2/99). This patch will be added to the ECS/SDPS baseline. Scheduled for June 1999

Table 3-1. Y2K NCRs (2 of 2)

NCRs	#	State	Status
Y2K: System time change Tests(TS0815.3)		W	This is canceled and drop from y2k test per ESDIS direction.Test ran for 12/31/99 date. Due to the Sybase problem, test points 02/28/00, 2/29/00 and 12/30/00 were not be run. However , no additional issues will be detected at other time shift. Sybase connection issues; NCR being written.
Y2K: Pre-2000 Y2K Data Proc.- DPREP (TS0493)		T	The test is schedule to be run in Oct. 99. NCR: ECSed22624 Sev: 2 Impact:This is an anomalous situation where a production request for data processing incorrectly orders the data based on data start and stop time.

3.5 Functional Component Mapping Verification

There are currently 227 Functional Components (FC) mappings related to Y2K requirements. A quick look of the current status as of 7/20/99 is as follows:

Total Number of FC mappings	227
Total Number Verified	137
Total Not Verified	5
Total Number not run	58
Total will be verified	27

The status of the 32 FC mappings not verified are:

27 FCs mappings are ready for revalidation

5 FC mappings were not verified due to functionality issues

Discussion with ESDIS have achieved that no significant Y2K risk remains which requires the entire time shift test process to be reinitiated. It is believed that the initial time shift tests have uncovered the same failure, which would be seen upon subsequent date shift.

The 32 FCs mappings contained in the last two tests do not pose significant Y2K risk. Closure of the formal Y2K testing can be completed upon scheduling of the re-verification activity listed in Table 3.4, and the resources to support it, upon closure of the functional issues that prevent further Y2K testing from continuing.

3.6 Summary

ECS/SDPS is Y2K compliant with the exceptions noted. The liens identified are assessed to pose no significant risk to the disruption of critical system operations. ECS/SDPS will continue to close on the resolution of the outstanding issues as well as ensure that Y2K analysis continues to ensure no future Y2K issues will affect the ECS/SDPS baseline system.

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Abbreviations and Acronyms

ASF	University of Alaska Synthetic Aperture Radar (SAR) Facility
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AT	Acceptance Test
CCB	Configuration Control Board
CERES	Clouds and Earth's Radiant Energy
CI	Configuration Item
CLS	Client System
CM	Configuration Management
COTR	Contract Officer Technical Representative
COTS	Commercial Off-the-Shelf
CSMS	Communications and Systems Management Segment
CSS	Communications subsystem
DAACs	Distributed Active Archive Centers
DCN	Document Change Notice
DMS	Data Management System
DSS	Data Storage System
EBNet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDC	Earth Resources Observation Systems (EROS) Data Center
EDF	ECS Development Facility
EDHS	ECS Data Handling System
EDOS	EOS Data and Operations System
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System (EOS) Data and Information System (DIS)
EROS	Earth Resources Observation Systems
ESDIS	Earth Science Data and Information System

ESN	EOSDIS Science Network
FDDI	Fiber-optic Distributed Data Interface
FOS	Flight Operations Segment
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
HDF	Hierarchical Data Format
HP	Hewlett Packard
HTML	Hypertext Markup Language
HW	Hardware
ICD	Interface Control Document
ING	Ingest
IOS	Inter-operability System
IV&V	Independent Verification and Validation
JPL	Jet Propulsion Laboratory
LAN	Local Area Network
LaRC	Langley Research Center
M&O	Maintenance and Operations
MISR	Multi-Imaging SpectroRadiometer
MODIS	Moderate-Resolution Imaging SpectroRadiometer
MOPITT	Measurements Of Pollution In The Troposphere
MSS	Management Subsystem
NA	Network Administrator
NASA	National Aeronautics and Space Administration
NCR	Non-conformance Report
NSIDC	University of Colorado, National Snow and Ice Data Center
PDPS	Planning and Data Processing System
PGE	Product Generation Executable
QO	Quality Office
RAID	Redundant Array of Independent Disks

RTM	Requirements and Tracebility Management
SA	System Administrator
SI&T	System Integration and Test
SDPS	Science Data Processing Segment
SMC	System Monitoring and Coordination Center
SOW	Statement of Work
SV	System Verification
SVAT	System Verification and Acceptance Test Organization
SW	Software
UTC	Universal Time Code
VATC	Verification and Test Center
Y2K	Year 2000

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