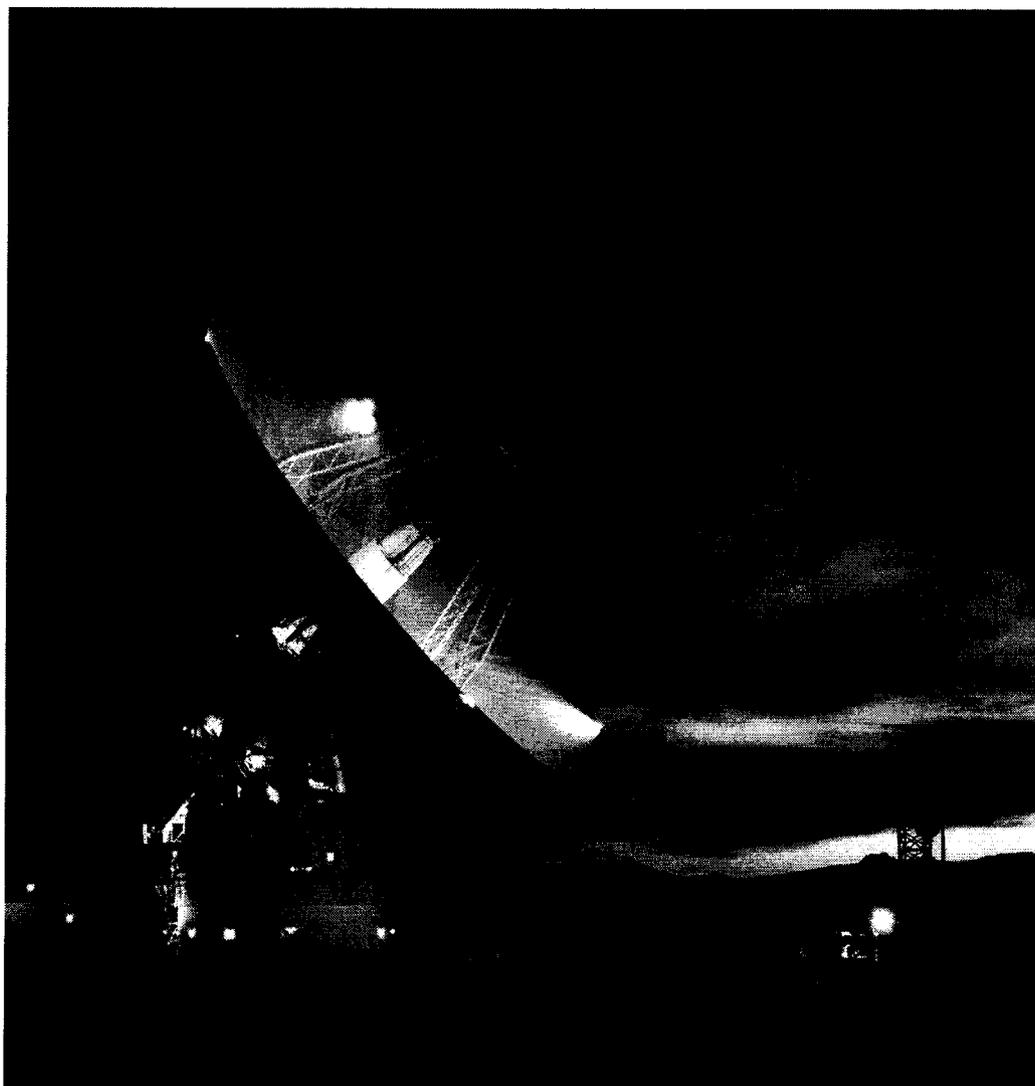




Jet Propulsion Laboratory
California Institute of Technology

Integrating Configuration Management Tools and Processes into Legacy Systems



T. Cooper ¹; J. Lin ²;
M. Chatillon ³, Robert
W. Sible, Jr. ¹

¹Jet Propulsion Laboratory (JPL)/
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²Chase Computing International, Corp.,
Alhambra, California USA;

³Raytheon Australia, Canberra Deep
Space Communication Complex,
Canberra Australia;

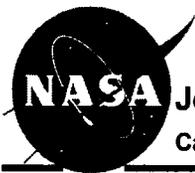


The Background and the Challenge:

- The Deep Space Network was established in 1963
- In 1997, two separate organizations, the Deep Space Network (DSN) and the Multimission Ground Systems Office (MGSO) were merged into the Deep Space Mission Systems (DSMS), each bringing a unique set of processes and databases
- Manual paper processes with data entry into several related and redundant databases became difficult to maintain and provide consistent reporting
- CM was tasked with merging the CM processes and making information available ‘on-line’
- The first step was to understand all the relationships of the CM processes and to system engineer an integrated process



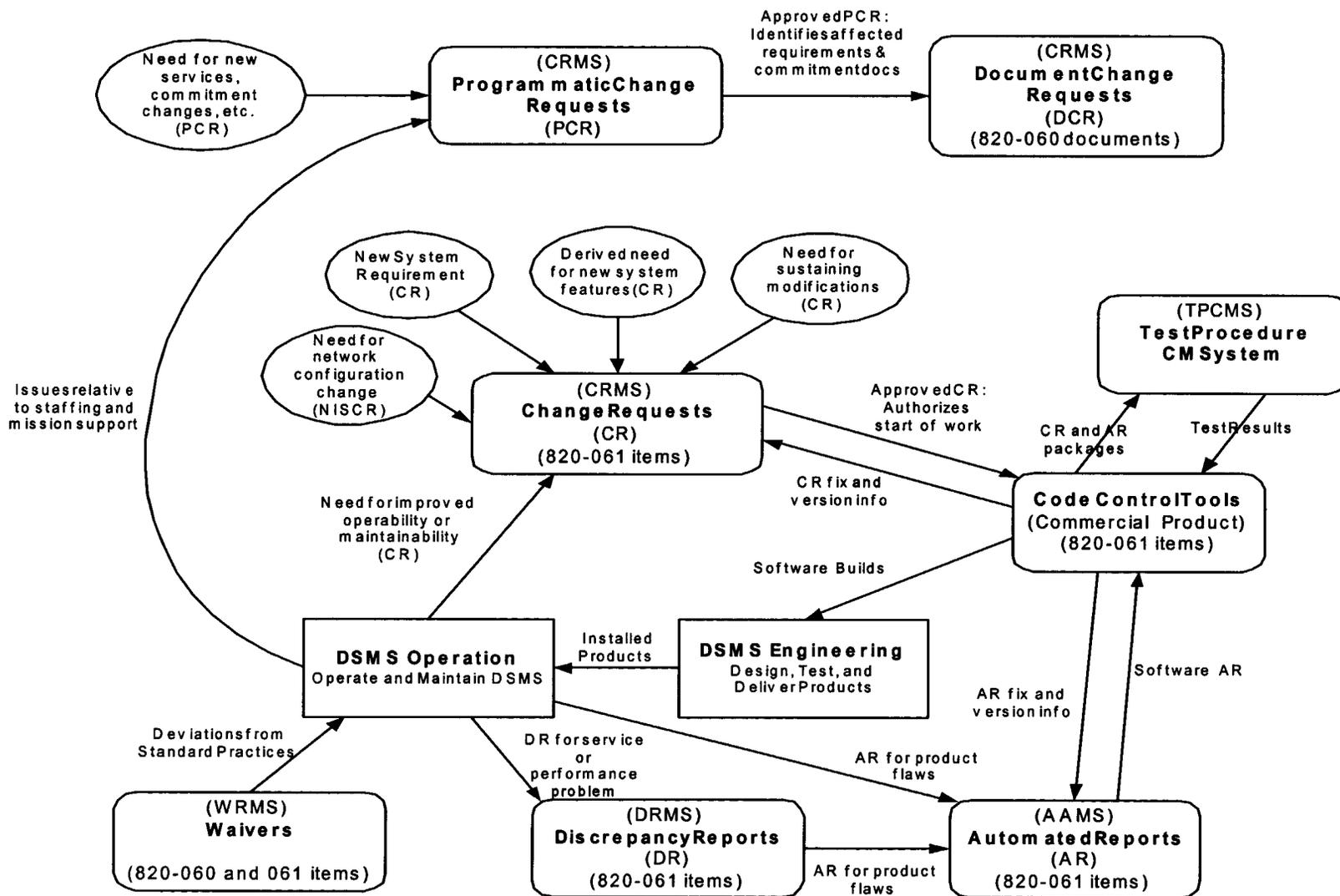
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- The establishment of a database to record and control these products, 820-061, is a central component to the CM Tools
- This database provides key information on the personnel responsible for the products as well as the hierarchical relationships.
 - One challenge is that ‘responsible personnel’ reside in three different countries, under four different organizations
 - Another challenge is that historical knowledge both on products and personnel need to be maintained



Integrating Configuration Management Tools and Processes into Legacy Systems



DSMS Change Management Tool Interaction





Tool Descriptions

- **Discrepancy Reporting Management System (DRMS)**
 - The DRMS is used to report any condition that negatively impacts the quantity or quality of committed data or service to a scheduled DSN customer. The system collects, processes, communicates and manages data discrepancies, equipment resets, physical equipment status, and provides an internal Station Log capability.
 - A DR can automatically generate an AR
- **Automated Anomaly Management System (AAMS)**
 - The Automated Anomaly Management System (AAMS) is used to report defects against DSMS software and hardware products. The system collects, processes, communicates and manages anomaly reports.
 - ARs against software are sent to the Harvest system upon origination and go through the software development process phases with information being sent to AAMS



Tool Descriptions

- **Change Request Management System (CRMS)**
 - The CRMS supports several different types of changes requests that have different review, approval, and implementation cycles. Generically a CR requests new capabilities, enhancements, or configuration changes. A Program Change Request (PCR) requests changes to customer commitments or high level services the DSMS offers to Flight Projects or customers outside of JPL. A Program Change request can automatically generate a Document Change request (DCR).
 - CRs against software are sent to the Harvest system upon approval and go through the software development process phases version and test information being sent to CRMS. Each CR has the version information and the test status.
- **Document Change Request (DCR)**
 - The DCR is used to record changes needed to the high level requirements or policy documents that govern the DSMS products



Tool Descriptions

- Code Control
 - All Fusion Harvest is utilized to manage changes to software
 - Code modules are checked out, changed, checked back in identifying “packages” (ARs, CRs, etc.) an interface has been created to exchange data between Harvest and AAMS and between Harvest and CRMS
- Test Procedure Configuration Management
 - A web-based application to document test procedures and to produce multi-dimensional test status reports by version, build, and subsystem
- Waiver Request Management System (WRMS)
 - The WRMS is used to document non-compliance to a specific DSMS policy or standard practice



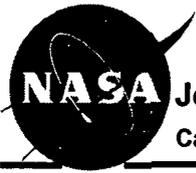
Workflow

- The tools utilize a workflow mechanism based on **phases** and **actions**
 - A phase represents the current state of a change or anomaly and the action is what the designated person assigned the role (i.e. Operations Engineer, Cognizant Development Engineer) in must do to move to the next phase.
 - An AR could be in the ‘corrective action’ **phase** where it is awaiting **action** from the Development Engineer to record what was done to fix the anomaly and what version it will be implemented
 - A DR could be in the ‘open dr’ **phase** where it is awaiting **action** from the maintenance and installation personnel to record the investigation details of the discrepancy
 - This provides the means to enforce a consistent process

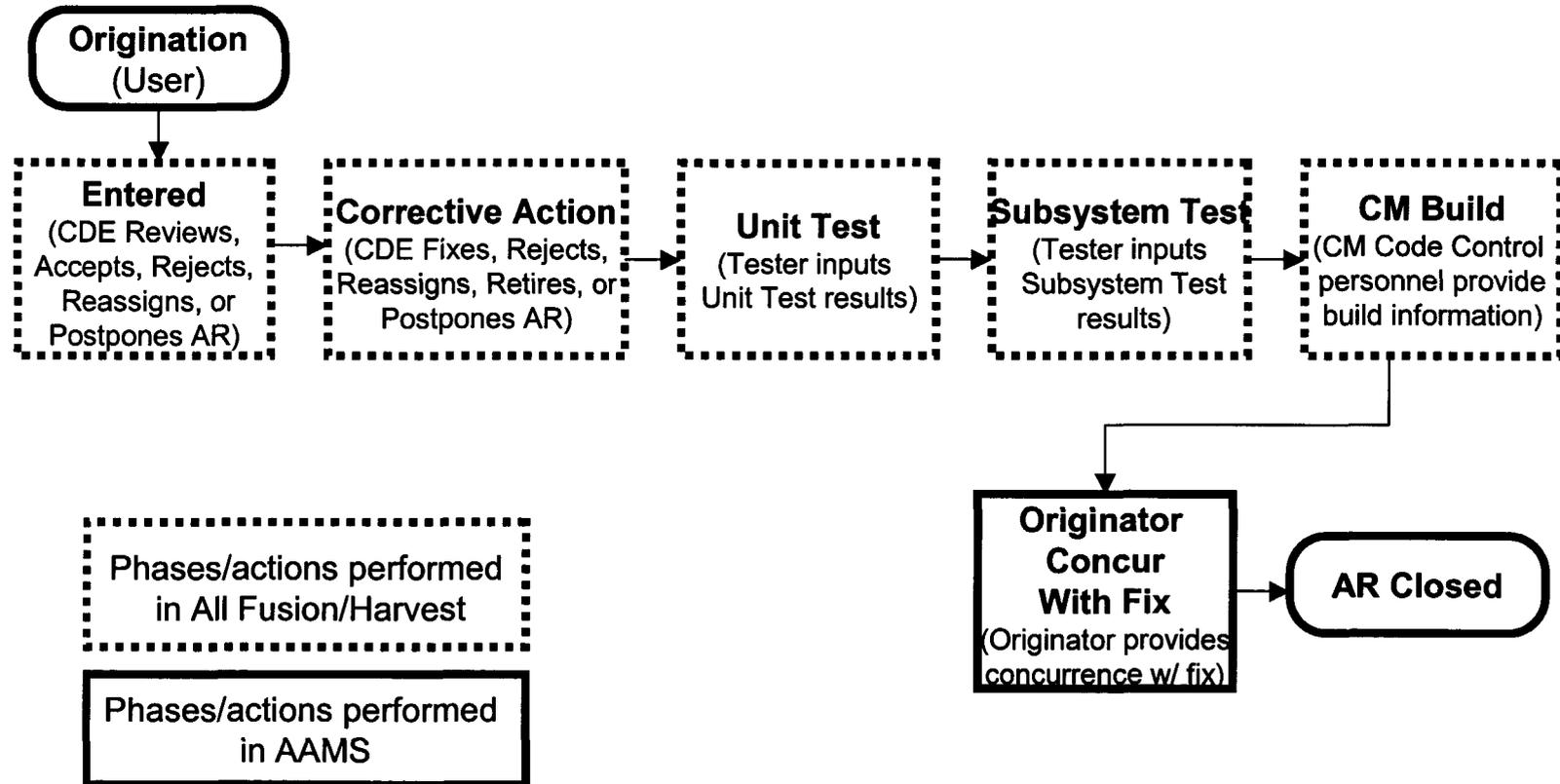


Process Rules

- The tools contain logic to enforce the process, for example
 - The AR will not be open for the Tester to record the test result until the CDE has provided the corrective action
 - The CR can not be dispositioned by the change control board until the designated engineer(s) has provided an impact
- The tools contain logic to provide data validation
 - You cannot remove all the assemblies from an approved Change Request
 - You cannot record a DR against a hardware product listing the cause as software



Automated Anomaly Management System High-level Phase/Action Workflow

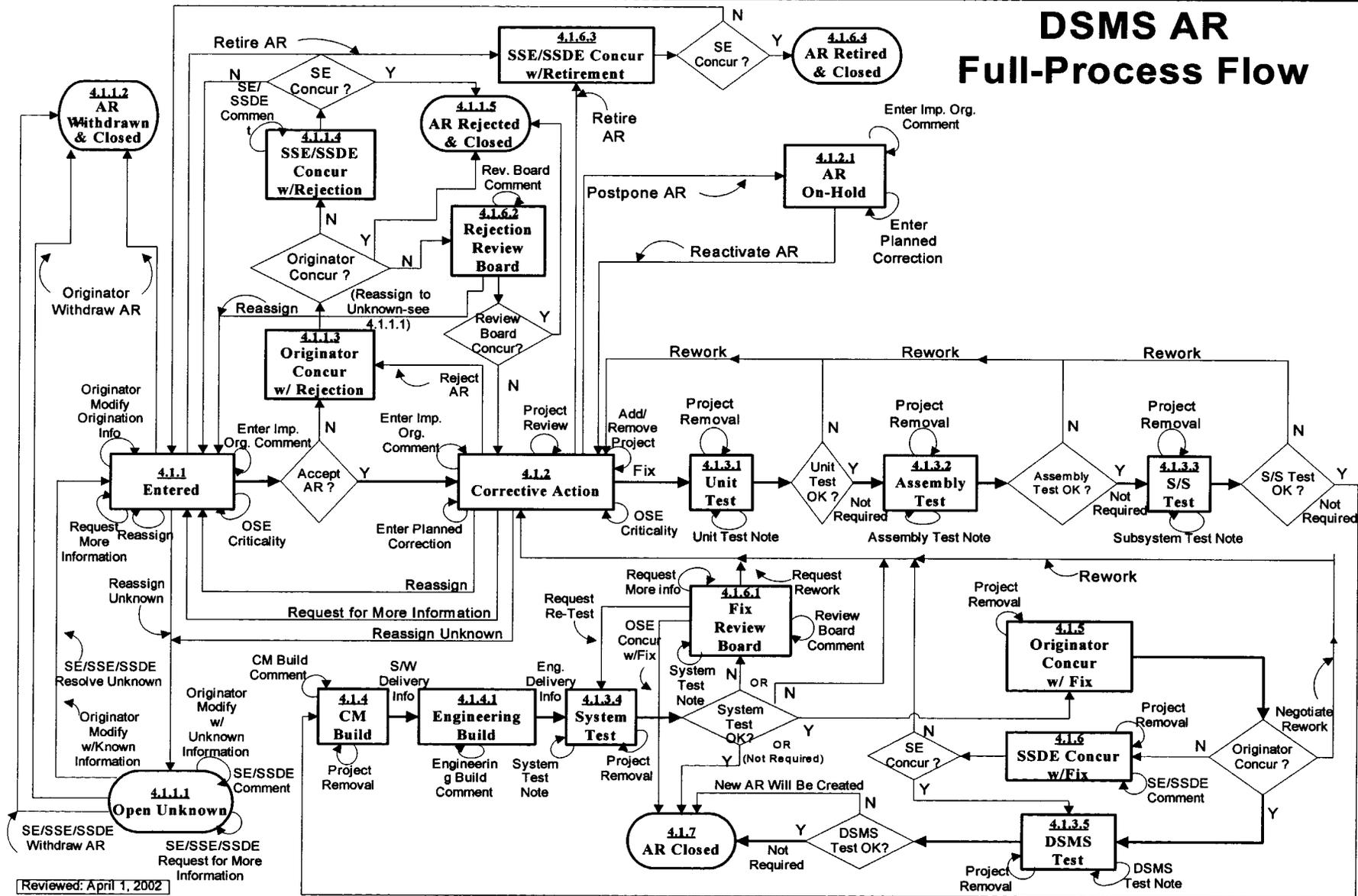


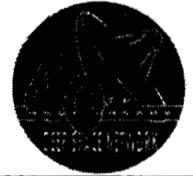


Integrating Configuration Management Tools and Processes into Legacy Systems



DSMS AR Full-Process Flow





Introducing Change

- No one wanted to change “we’ve done it this way for 25 years”
 - Yes, but now there is ISO and CMMI and ITAR and IT Security and full cost accounting
- The first product we introduced was the Anomaly Reporting tool, beginning in 1998.
 - A requirement gathering team was formed from both the DSN and TMOD areas, that included operations, development and management personnel
 - The requirements and design were documented in July, 1998
 - Reviews and walkthroughs were held throughout the development
 - Data was migrated from the two databases established by the DSN and by TMOD
 - Training sessions for DSMS personnel and user’s outside DSMS were conducted over a four week period
 - The system went operational in April, 1999



Introducing Change (cont.)

- The next product we introduced was the Discrepancy Reporting tool
 - The same process was followed for the DRs. Requirements definition began in early 2000 and the system went operational in June 2001
- The same process was followed for the Change Request Management System (CRMS) which handles changes to documentation, network infrastructure, and program office commitments and services and the subsequent tools.
 - Because we had a proven track record, the size of the requirements gathering team was reduced, the oversight of the development was less intensive, and design and development time was shortened
 - Because all the tools have the same look and feel, and utilize common features, such as ‘TO DO Lists’, proxy capabilities, and similar query functions
 - Training took less time
 - Resistance to using the new tools was reduced



Reporting/Query Capability

- Because the product database is hierarchical, data can be reported on an assembly, major assembly, subsystem or higher level
- Because the tools are based on the product database, reporting is consistent
- Because there is a high degree of data validation, there is a high degree of data integrity
- Queries can be saved and edited
- Reporting is very flexible
 - Nearly all data fields can be queried
 - Data can be grouped and sorted by different fields
- Process metrics can be gathered to find which phase in a process may be a bottleneck
- Data can be gathered for specific time periods



Metric/Reporting Uses

- The tools have allowed the development and operations personnel to maintain an overview of how their product performs in the field. Some examples:
 - developers of automation software designed to aid the link operators conduct a track of a spacecraft, monitor all problems reported against their software and take appropriate steps to improve their product
 - an engineering team responsible for transmitters has recently broadened the components of the transmitter systems to provide better data on which parts of their system are causing the most problems
 - a cross-functional support team for tracking data closely monitors specific outages in an effort to improve data capture and reliability
 - management can make use of metrics to identify trends in product performance or overall system reliability
 - CM and management can use metrics to see where a process is breaking down

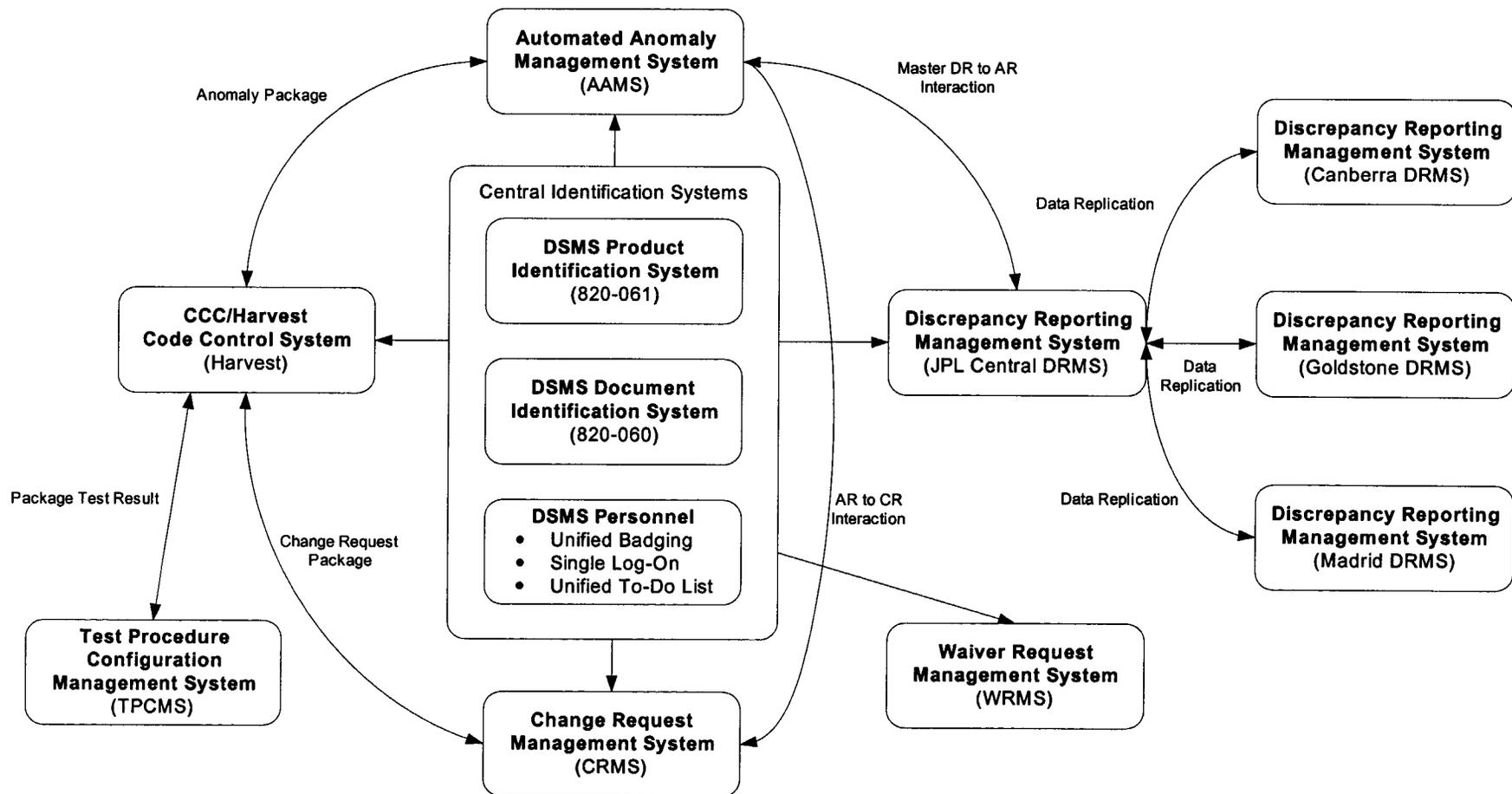


Looking Ahead

- Database and web technology is constantly moving. The first tool segment introduced in 1998, even though it has been upgraded to SQL 2000, will need to be reimplemented. Our most recent development segment of the product database (820-061) was our first implementation on Microsoft's .net architecture. We are planning to move to a true object oriented approach to obtain a unified framework
 - CM record serves as the base class
 - All AR, CR, DR, and others inherit from the base class to eliminate duplicate work for common capabilities while maintaining their own unique features and data collection
 - All CM records are based on:
 - A central product identification hierarchy (820-061)
 - A central document identification system (820-060)
 - A unified personnel database



DSMS CM Systems and Interfaces





Unified Workflow Framework

- A common state-transition based workflow engine at the core level
- Lifecycle is composed of phases and actions to illustrate one unique business process
- Actual lifecycle used could be determined by the combination of product, CM record type
- Supports very fine granularity on updating privilege based on the combination of product, CM record type, lifecycle, phase, action
- Keep track of all updating details



Benefits

- A single unified log-in supporting all systems
- A unified to-do list across systems for users
- Unified metrics across systems for managers
- A unified querying capability across systems
- Enforce business rules and increase productivities
- Enable process orchestration across systems through XML web services
- A unified graphical user interface greatly simplifies user training



Unified To Do List

DSMS CM My To Do List Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://cmsas.jpl.nasa.gov/todo.aspx> Go Links Norton AntiVirus

My To Do List

Name: JAMES LIN (108747)

AAMS

Enter Implementing Organization Fixed Information

AR No.	Anomaly Title	Waiting Since	Action
109264	Query Selection Criteria Truncated on Saved Queries	12/10/2003	Update
109265	Add sequence count to query output	12/10/2003	Update

DRMS

Close DR

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G103112	SW	CAS	26	AMC	216	Update
C102584	HW	SGP	45	ADC	216	Update

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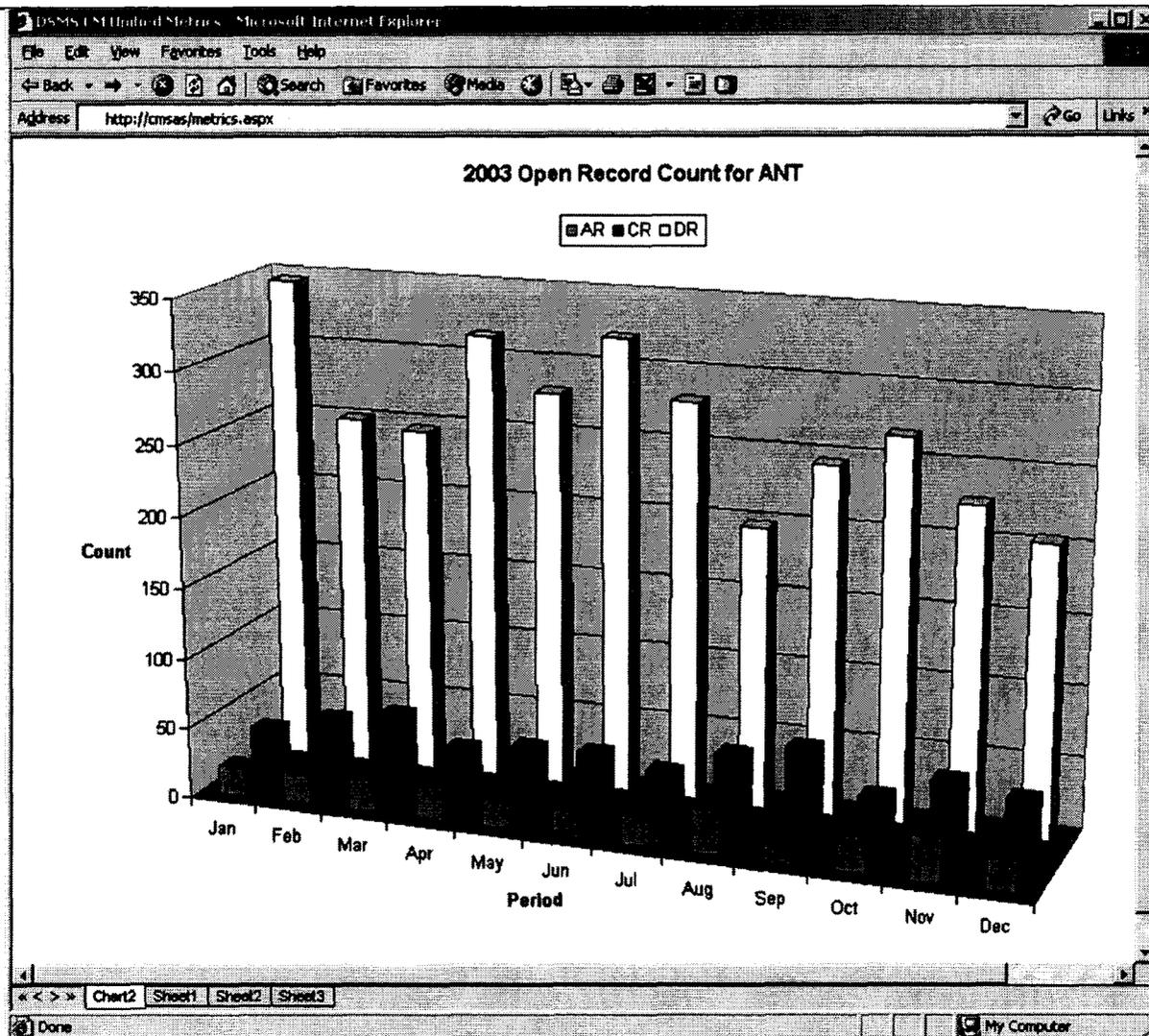
[AAMS](#) | [DRMS](#) | [CRMS](#) | [WRMS](#) | [820-061](#) | [820-060](#)



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Unified Metrics

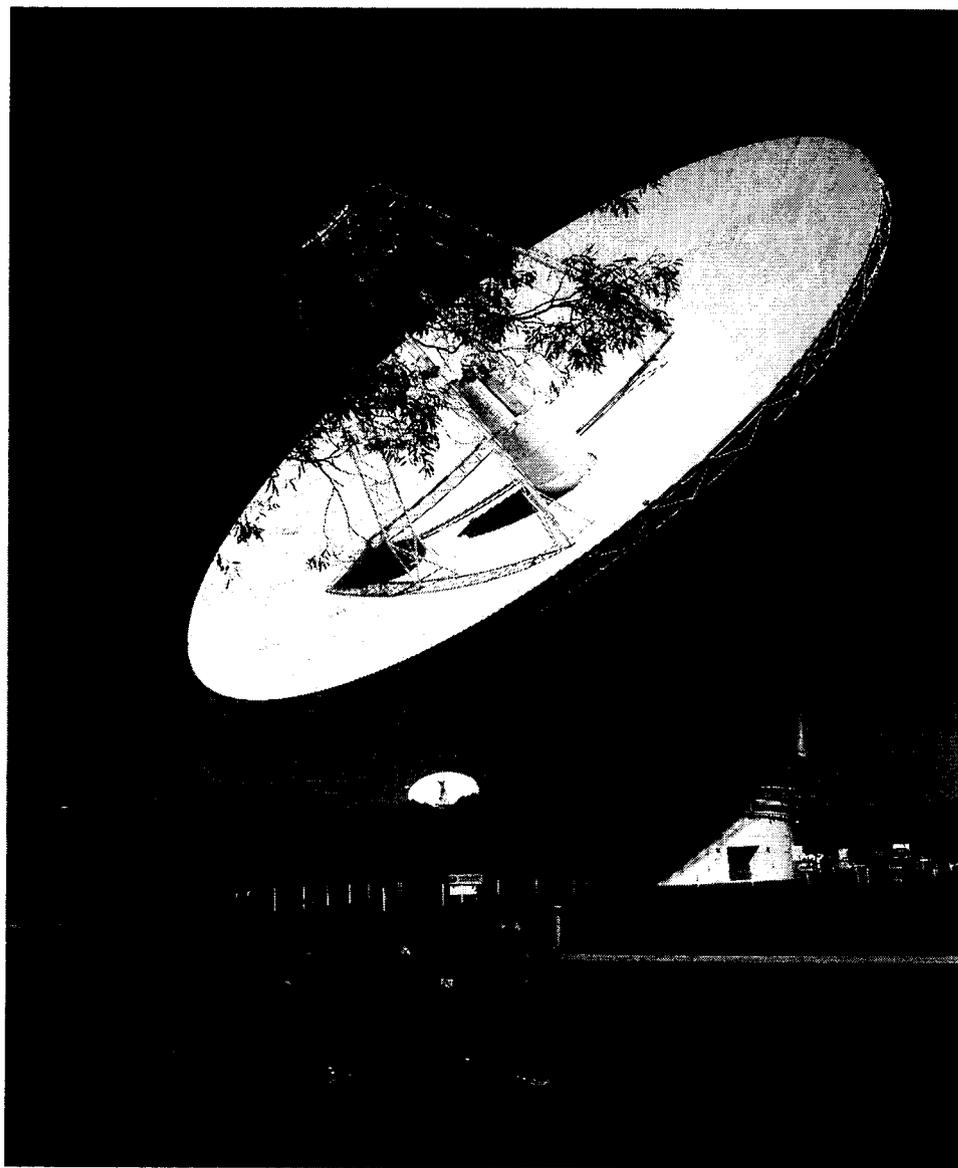




- DSS43 the 70M dish at Canberra, DSS46 in the background.
- Thank you for your attendance.
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ACKNOWLEDGMENT: This work was carried out at and performed for the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

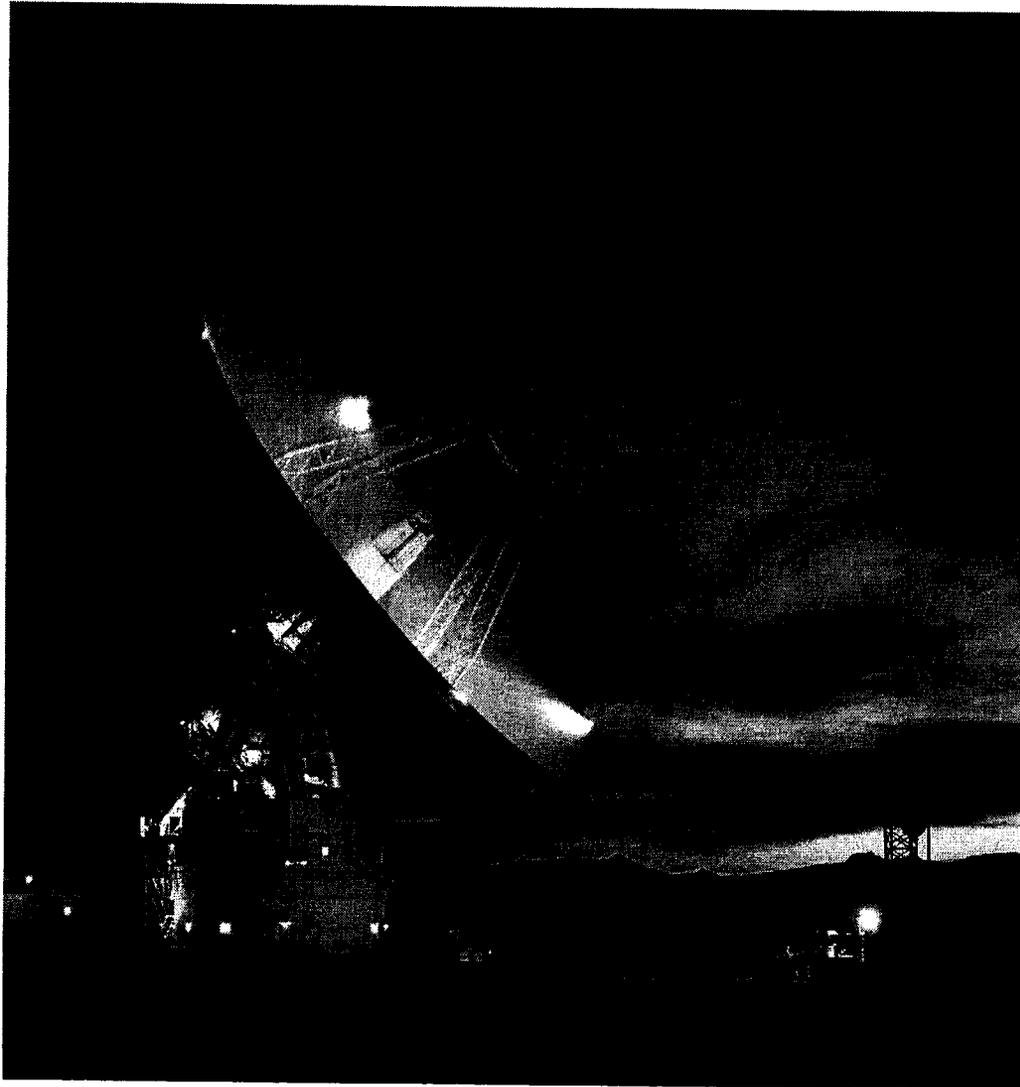
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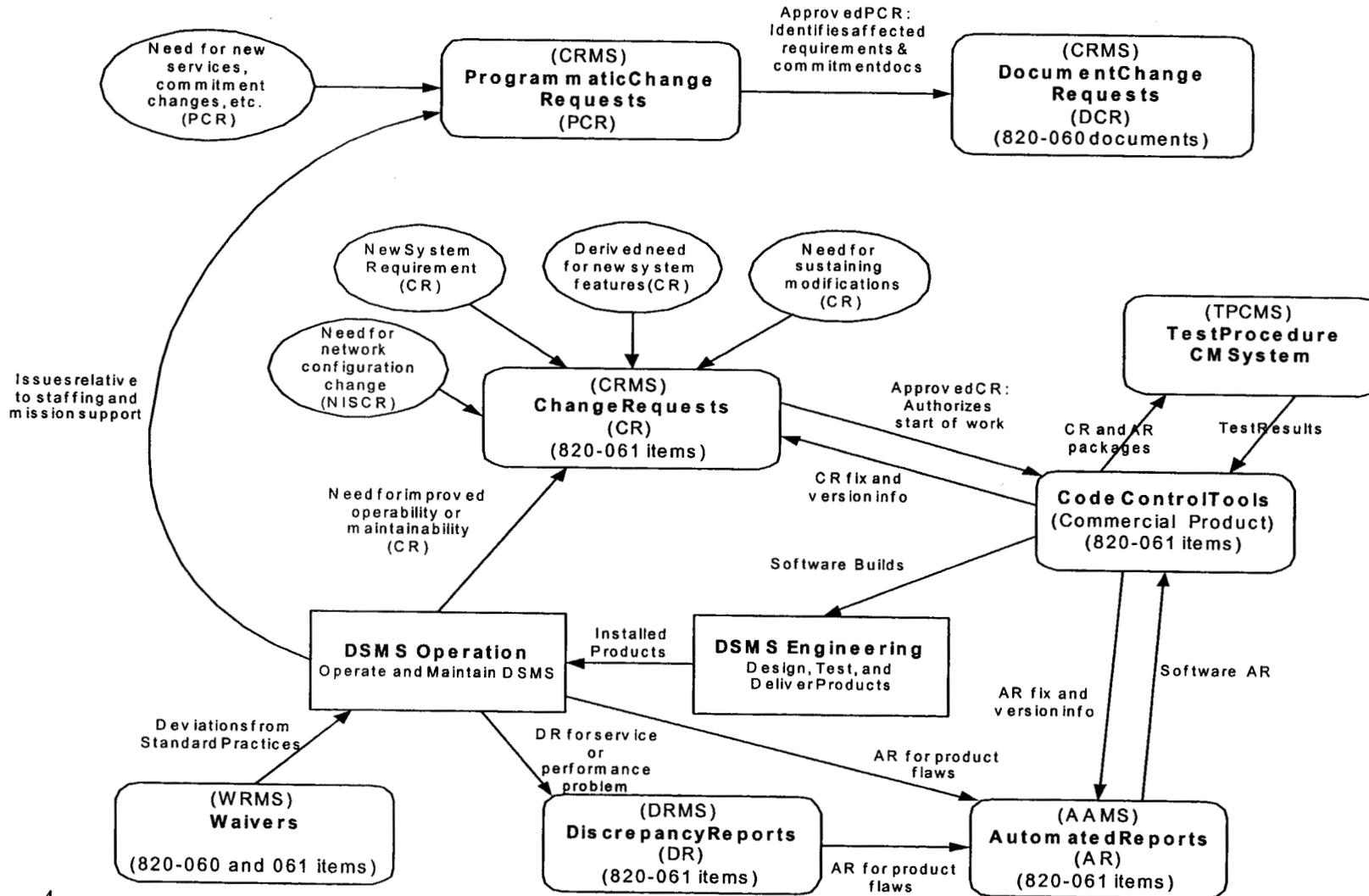
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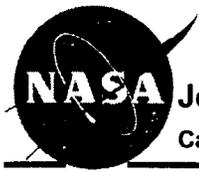
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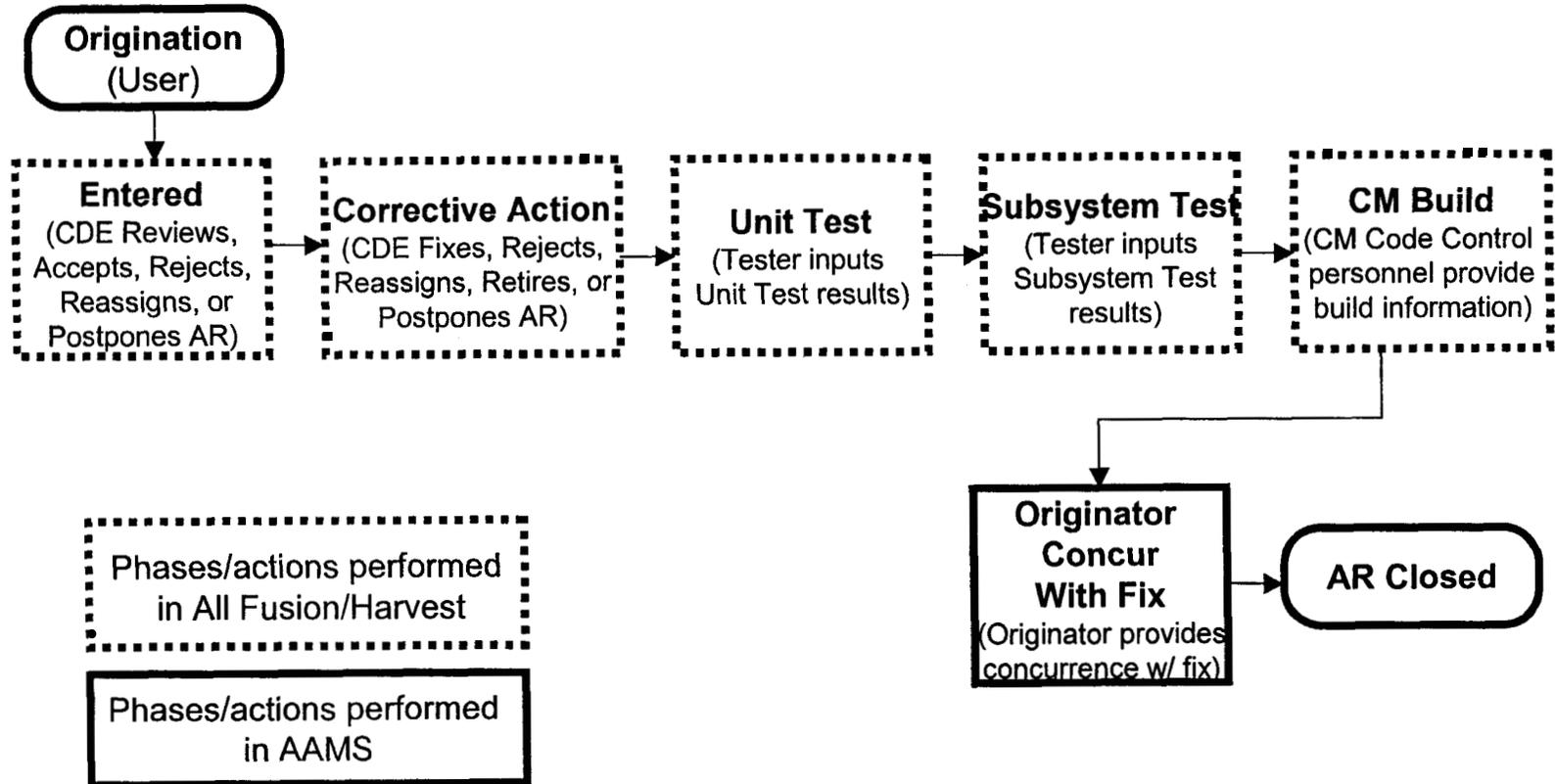


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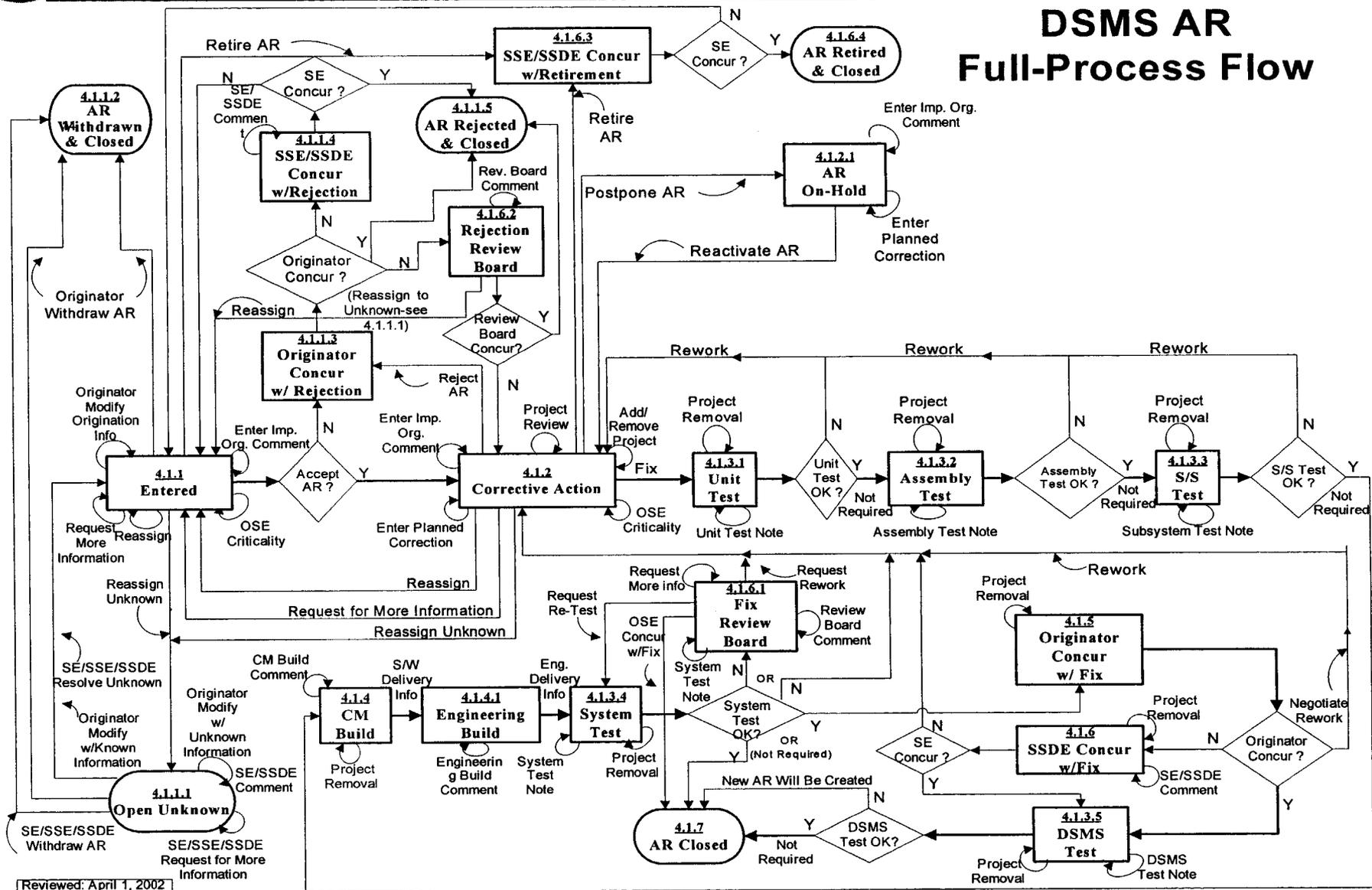




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Reviewed: April 1, 2002



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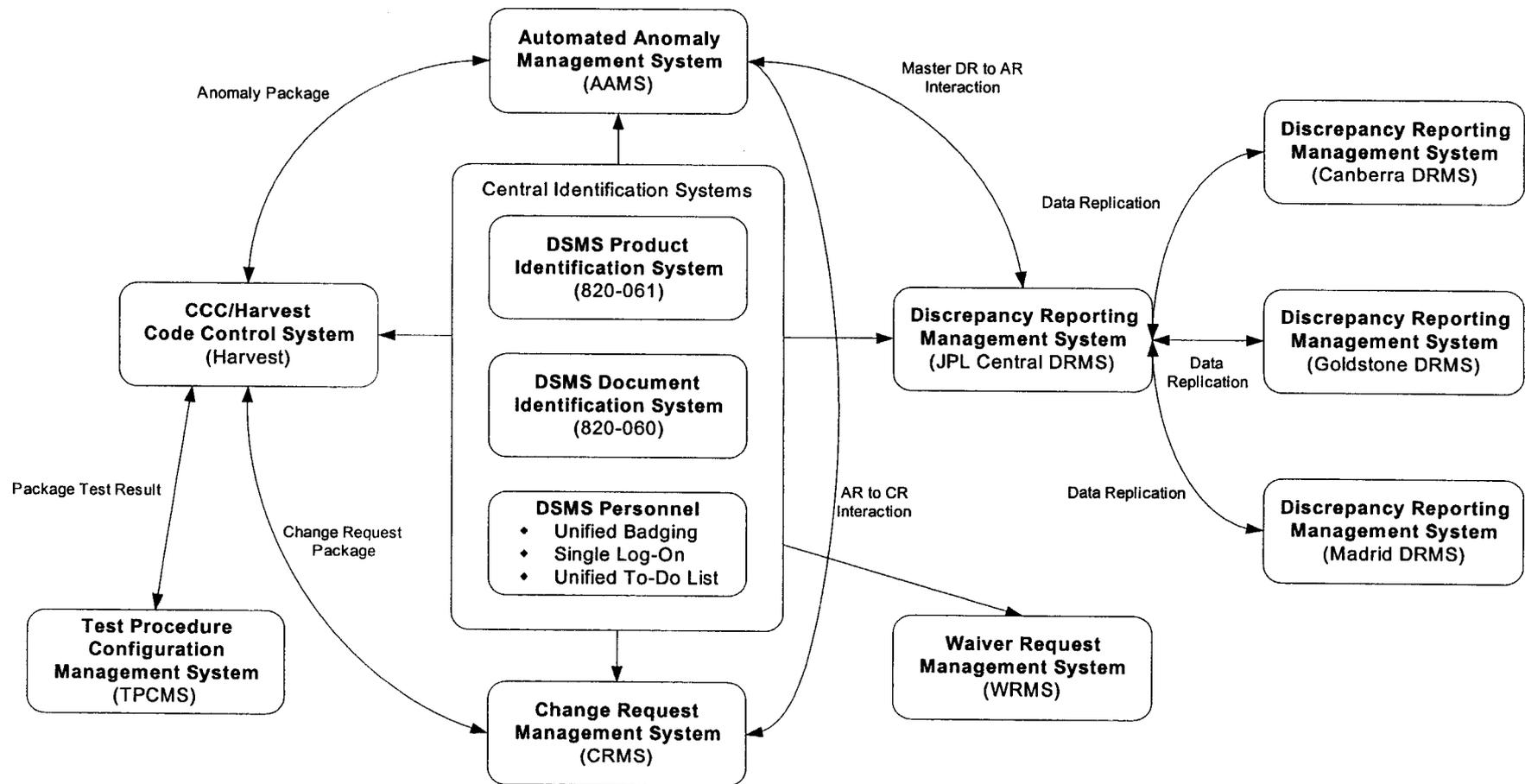


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DSMS CM Systems and Interfaces





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Unified To Do List

DSMS CM My To Do List - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://cmsas.jpl.nasa.gov/todo.aspx> Go Links Norton AntiVirus

My To Do List

Name: JAMES LIN (108747)

AAMS

Enter Implementing Organization Fixed Information

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DRMS

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CRMS SWCR

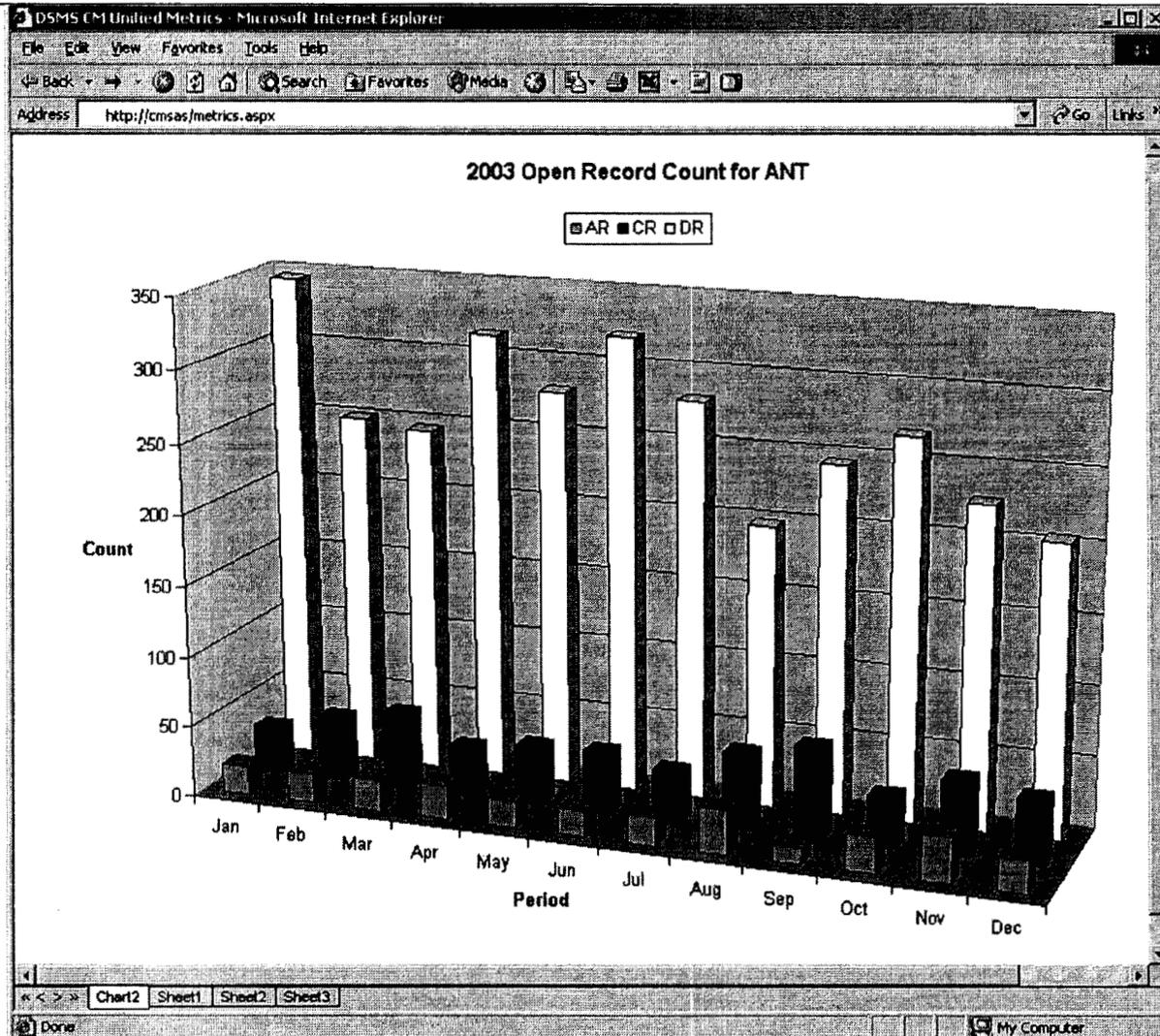
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[AAMS](#) | [DRMS](#) | [CRMS](#) | [WRMS](#) | [820-061](#) | [820-060](#)



Unified Metrics





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ACKNOWLEDGMENT: This work was carried out at and performed for the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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