

# RECLAMATION

*Managing Water in the West*

## **Development of Business Standards and Deployment of MXES 6.2 at the U.S. Bureau of Reclamation**

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**Before the Rocky Mt. Maximo Users' Group**

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U.S. Department of the Interior  
Bureau of Reclamation



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*Managing Water in the West*

- 100+ years old
- Constructs, operates and maintains major water and hydropower projects in 17 Western States
- Largest wholesaler of water in the Nation.
  - 348 reservoirs with a total storage capacity of 245 million acre-feet of water
- Nation's seventh largest power utility and second largest producer of hydroelectric power
  - 58 hydroelectric power plants, 14,800 MW of capacity, annual average generation of 42 billion kilowatthours
- Four National Critical Infrastructure facilities

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# Asset Management in Reclamation

- **Current Asset Management Plan (AMP) updated in March 2008**
- **Reflects mission of Reclamation**
  - *“manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American Public.”*

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*Managing Water in the West*

**Bureau of Reclamation  
Asset Management Plan**

Fiscal Year 2008



U.S. Department of the Interior  
Bureau of Reclamation

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# Reclamation's Four Strategic Business Objectives for Asset Management

<b>Delivery reliability (water and power)</b>	<b>Cost containment</b>
<b>Safety and security of assets</b>	<b>Support to the Western Interconnection (high-voltage electric grid)</b>

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# Reclamation's CARMA Project

- **Maximo is a critical asset/maintenance management tool for Reclamation**
  - presently used at 46 hydroelectric generation sites and 3 water sites.
- **Maximo has been in use since 1996, *separately deployed in 18 databases and applications.***
- **Capital Asset and Resource Management Application (Maximo 6 platform)**
  - Supports the business objectives in the Asset Management Plan
- **Three main drivers to go to Maximo 6**
  - MRO engineering support for Maximo Version 4.1 was anticipated to end on December 31, 2006
  - The Department of the Interior intends to consolidate all agency applications of Maximo into a “single platform”
  - Changes in Oracle licensing require a single database solution for Maximo

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# Reclamation's CARMA Project

- Four phases . . .
  - √ Phase I – Reclamation-wide assessment of Maximo usage and asset/maintenance management practices. Development of comprehensive standard business practices.
  - √ Phase IIA – Project mobilization, data collection, and technical environment initialization.
  - √ Phase IIB -- Standing up a prototype deployment of CARMA at an area office (two power plants and an irrigation system)
  - Phase III (in progress) – Full implementation of CARMA throughout Reclamation with a single, central Maximo 6 system in Denver connected to other legacy systems (T&A, purchasing, and data warehouse).

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# CARMA Implementation Strategy

- **Consolidate 18 independent installations of Maximo version 4.1 into a single Maximo 6 system in Denver.**
- **Prototype a full implementation of CARMA in one area office (Montana)**
  - Demonstrates successful configuration of Maximo 6 that will support the standard business practices.
- **Implement the rest of Reclamation using rolling implementations**
- **Employ contract support for the implementation to ensure completion in 2009.**

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# Asset Management Strategies Using Maximo 6

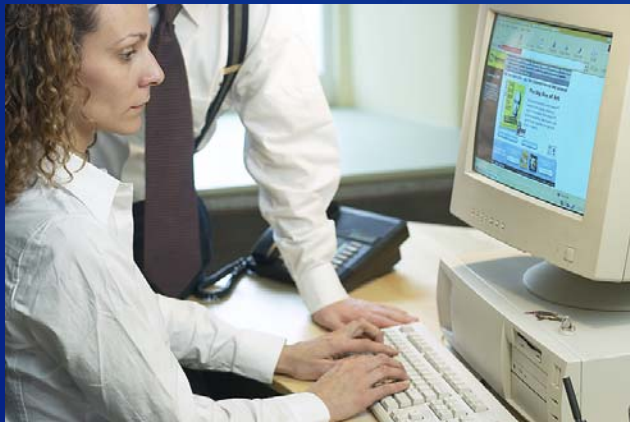
- Use a Computerized Asset and Maintenance Management System (i.e., Maximo 6)
  - consolidated into one database and one server
- Standardize Business Processes
- Optimize of Work Processes
- Accomplish High-Value Work
- Enable Decision-making Support
- Provide Materials and Inventory Support to Maintenance
- Define Metrics and Performance Indicators
- Use Training Support
- Enable Safety and Security



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# Use of a Computerized Asset and Maintenance Management System

- Reclamation sites will use CARMA for asset and maintenance management where it is cost effective to do so.
- Asset management includes work order management, work history, cost tracking, planning and scheduling of manpower and material resources, asset maintenance prioritization, condition monitoring, etc.



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# Standardization of Business Processes

- **Maintenance is a risk-control process!**
- As risk mitigation measures, resources are allocated to:
  - predictive
  - preventive
  - corrective
  - emergency maintenance
- Standard business processes directly support multiple features of asset risk management
  - allocation of budgetary and manpower resources
  - prioritization of maintenance and replacement/ refurbishment work
  - development of performance and process metrics to ascertain best practices and asset vulnerabilities.



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# CARMA Standard Business Practices

- *Introduction and Strategy*
  - Introduction and Strategy Statements
- *Organization*
  - Organization
  - Authorities
  - Interfaces
- *Programs*
  - Corrective Maintenance Program
  - Preventive Maintenance Program
  - Predictive Maintenance Program
  - Asset Modification and Improvement Program



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# CARMA Standard Business Practices

- *Planning and Scheduling*
  - Maintenance Planning
  - Maintenance Scheduling
- *Purchasing and Inventory Control*
  - Material Support for Maintenance
  - Material and Service Requisition and Procurement
- *Outage Management*
  - Outage Planning and Scheduling
  - Outage Performance and Tracking
  - Outage Restoration and Reporting
  - Forced Outage Maintenance Plans



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# CARMA Standard Business Practices

- ***MAXIMO Administration***
  - MAXIMO System Administration (Phase IIA)
  - Location and Equipment Naming Conventions
  - Maintenance Reporting and Metrics
  - Management of Failure Codes and Classifications
  - Workflow of Work Order Processes
- ***Quality Assurance***
  - Maintenance Quality Control
  - Calibration of Measuring and Test Equipment
  - Tool and Equipment Control



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# CARMA Standard Business Practices

- *Contracted Maintenance Management*
  - Contractor Administration
  - Contractor On-Site Requirements
- *Maintenance Training*
  - Mandatory Training
  - Technical Training
  - MAXIMO Training Requirement Matrix
- *Fleet (Motorized Equipment)*
  - Fleet
- *Glossary of Terms*



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# Optimization of Work Processes

- Efficiency
  - application of resources to achieve a particular outcome at the least cost.
- Efficiency is enhanced when CARMA is used to schedule
  - human, material and equipment for accomplishment of a particular job.
- Planning
  - a focused effort to ensure all resources are identified and available to accomplish work.
- Scheduling
  - the allocation and timing of resources to optimize their application to the highest priority work.
- Reclamation is becoming a “planned and scheduled” resource management organization.



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# Accomplishing High-Value Work

- High-value work directly supports the maintenance of mission-critical assets
- Enabling Reclamation to achieve its four principal goals:

<b>Delivery reliability (water and power)</b>	<b>Cost containment</b>
<b>Safety and security of assets</b>	<b>Support to the Western Interconnection (high-voltage electric grid)</b>

- CARMA is employed as a tool to assist in the tracking and scheduling of work so that the highest-value work is readily identified and can be scheduled on a priority basis.

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# Decision-making Support

Reclamation can plan budgetary and other resources to accomplish work in the future through the use of CARMA's features:

- work order management
- manpower tracking
- material and asset costs tracking
- asset condition monitoring
- other metrics.



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# Materials and Inventory Support to Maintenance

- Through the use of CARMA, inventory of critical parts/spares is optimized through:
  - standardization of part numbers and part descriptions
  - identifying available quantities
  - frequent communication among maintenance, inventory and purchasing professionals.
- Collaboration between maintenance planning and warehouse management and staff, and materials support to maintenance,
  - ensures critical parts/spares are available when they are required to support the accomplishment of work in accordance with applicable schedules.



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# Metrics and Performance Indicators

- Standardization of business practices
- Critical data
- Uniform configuration of CARMA **will facilitate the local and Reclamation-wide development and reporting of important metrics and other performance indicators.**

In turn, this will facilitate the identification of:

- potential best practices
- maintenance intervals for common equipment
- resource requirements for particular work
- material support
- preventive maintenance accomplishment
- other measures that can enhance Reclamation's asset management performance over time.

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# Training Support

- Reclamation's asset and maintenance management requirements are complex, and the configuration and use of CARMA reflects such complexity. Reclamation will invest in the appropriate, long-term training and support for use of Maximo 6.
- Standardization of business practices, data, inventory and configuration requires Reclamation to develop and continually deliver standardized, appropriate training for management and staff.



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# Safety and Security

- Reclamation is responsible for four National Critical Infrastructures – Hoover Dam, Grand Coulee Dam, Shasta Dam and Glen Canyon Dam.



- CARMA will assist Reclamation in achieving safety and security objectives through work planning and scheduling and maintenance of security-related assets.

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# Maximo 6 Prototype

- Rebuild or development of location and asset hierarchies, failure codes and asset templates
- Building PMs and Job Plans
- Build inventory item masters and set up storerooms
- Training on business practices, Maximo 6 application navigation and capabilities
- Data migration
- On-site, “go-live” support
- Conduct demos to other sites and meet on “lessons learned”



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## “Phase III”



- Deploy refined application and database model to the remainder of Reclamation
- 18 major sites with associated satellite offices
- Institute permanent business and technical support in Denver office
- Educate senior and mid-level managers on use, capabilities and support requirements for CARMA (e.g., planners/schedulers)
- Gather Power Train data for analysis

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# Example - Power Train Condition Monitoring

- HydroAMP – Originally, a consortium among Bureau of Reclamation, HydroQuebec, U.S. Army Corps of Engineers and Bonneville Power Administration to develop a framework to improve the evaluation of hydroelectric equipment and prioritization of hydropower investments.
  - Developing common Equipment Condition Assessment
  - Guides for all major powerhouse equipment
  - Developing Asset Management Tools that use equipment condition, risk and other factors to support and improve decision-making.

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# Power Train Condition Monitoring

- Establishes metrics and condition points in Maximo for:
  - Transformers
  - Turbine Runners
  - Generators (Stator and Rotor)
  - Circuit Breakers
  - Batteries
  - Arrestors
  - Governors
  - Compressors
  - Gates/Valves



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# Power Train Condition Monitoring – Example: Transformers



- **Condition Indicators**
  - Transformer Oil
  - Transformer Power Factor
  - Transformer O&M
  - Transformer Age
- **Capability to run a Maximo report across Reclamation that identifies the unit and component that is rated as in “poor” condition**

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