The OpenO&M™ Initiative and MIMOSA Collaborating To Develop Industry-Driven Solutions Architectures

Oil and Gas Industry Solutions Architecture - An applied standards activity leveraging ISO 15926, ISO 13374, ISO 18435, ISO 14224, MIMOSA, ISA 95, OPC UA and other key standards.

POSC Caesar Meeting
Kuala Lumpur, Malaysia
October 21, 2008

Alan T. Johnston
MIMOSA President
OpenO&M™ Initiative Chair
ISO TC184 Manufacturing Asset Management Integration Task Force Chair

Copyright 2008 MIMOSA
Presentation Outline

- A Critical Need For Interoperability
- Some of The Key Standards – No Single Standard
- The Need For Collaboration and Coordination
  - ✓ A Pragmatic Solutions Process
  - ✓ The Need For A Solutions Architecture Roadmap
Oil & Gas/PetroChem Industry Interoperability Requirements

ERM
Enterprise Risk Management System, Enterprise Resource Planning System & Enterprise KPI/Event Portals

ERP
Production Forecasting & Scheduling Systems

PORT
Operational Performance Modeling & Optimization Systems

MES
Production Forecasting & Scheduling Systems

OPM
Operational Risk Management Systems (EH&S, PSMS, AHMS, QMS)

ORM
Optimized Enterprise Asset Management Systems

EAM
Enterprise Asset Management Systems

EOM
Event-Oriented Message Bus

PDM
"As-Designed" & "As-Built" Product/Part Data (ISO 15926 & MIMOSA)

P2M
History Op. Data & Events (OPC UA-HDA)

DCS HMI
Control/SCADA, HMI, & Historians

HIST
Historians

ORM KPIs (MIMOSA & B2MML)

Forecasted Demand (B2MML)

Significant Actual & Early Warning ORM Events (MIMOSA)

CBM Advisories (MIMOSA)

Full-resolution Condition Data & Events (MIMOSA)

CBM/Calib. Work Completed (MIMOSA)

EOM KPIs

RFQs & POs (OAGIS, CIDX)

RFQ Cost/Delivery Schedule & PO Delivery Status (OAGIS, CIDX)

“As-Designed” & “As-Built” Product/Part Data (ISO 15926 & MIMOSA)

“As-Designed” & “As-Built” Plant/Process Engineering Data (ISO 15926 & MIMOSA)

“As-Designed” & “As-Built” Plant/Process Engineering Data (ISO 15926 & MIMOSA)

“As-Designed” & “As-Built” Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Copyright 2008 MIMOSA
What is MIMOSA?

- MIMOSA is an alliance of Operations & Maintenance (O&M)
  - Solution providers
  - End-users
  - Original Equipment Manufacturers (OEM)

- Advocating and developing industry-driven open standards and specifications to enable open standards-based O&M interoperability
  - Owner/operator (end-user) leadership
  - Vendor support

- Individually and in collaboration with other standards and industry organizations MIMOSA provides platform, supplier and product neutral IMPLEMENTATION ARCHITECTURE as a key enabler for interoperability

- MIMOSA has broad, long-standing ties to most international, national and DoD interoperability efforts related to Physical Asset Life-cycle Management.

- Formally organized in 1997 as a non-profit 501 (c) (6) trade association

- Completed MIMOSA standards and specifications are publicly published and available on a royalty free basis.
The MIMOSA Open Object Registry is a core O&M interoperability enabler for asset-intensive industries. It provides a full mesh network for maintaining interrelationships between people, processes, and systems in a Services Oriented Architecture. Unlike traditional Master Data Management (MDM), it is designed to support the highly dynamic requirements of physical asset management such as configuration management.
What Is The OpenO&M™ Initiative?

- The OpenO&M Initiative is an applied standards activity with multiple participating standards organizations who are collaborating to enable open standards-based interoperability for Operations and Maintenance (O&M) related people, processes and systems.
  - ISA
  - MIMOSA
  - OAGIS
  - OPC Foundation
  - WBF B2MML
- OpenO&M is NOT a standard.
- The OpenO&M Initiative solutions process is developing industry-driven solutions architectures which are platform, supplier and product neutral in conjunction with multiple vertical industries.
  - Industry **Use-Case** Driven
  - **Owner/Operator** Leadership
  - Participation of key **Suppliers**
  - Participation of key **Standards Organizations**
The OpenO&M™ Solution: Open Standards & Collaboration
Get Everyone on the Same Page & Fill theWhitespace

Enterprise Business Systems
Enterprise Resource Planning (ERP)

Operations

Maintenance

OpenO&M™

Physical Asset Control
Real-time Systems
### Application Domain Integration Diagram

<table>
<thead>
<tr>
<th>Level R4</th>
<th>Enterprise / Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level R3</td>
<td>Area</td>
</tr>
<tr>
<td>Level R2</td>
<td>Work Center</td>
</tr>
<tr>
<td>Level R1</td>
<td>Work Unit</td>
</tr>
<tr>
<td>Level R0</td>
<td>Asset</td>
</tr>
</tbody>
</table>

#### A4.1 – Intra-enterprise activities: Business Planning, Orders & Production, and Maintenance
- A3.1 - Operations Planning & Scheduling
- A2.1 - Supervisory Control & Human-Machine Interface
- A1.1 - Control, I/O, Data Acquisition, Data Historian, Asset Utilization, & Displays
- A0.1 - Resource Identification and Location

#### A4.2 – Inter-enterprise activities: Supply Chain Planning, Logistics Strategy
- A3.2 - Capability Assessment & Order Fulfillment
- A2.2 - Asset Prognostics and Health, Quality, Safety, & Environmental Management
- A1.2 - Asset Condition Monitoring & Sample / Test / Diagnostic & Quality Monitoring
- A0.2 - Asset Identification and Location

#### Resources
- (Material / Personnel)

#### Assets
- (Equipment / Facilities / Serialized Components / Sensors / Transducers / Software / Documents)
Some Relevant ISO Related Activities

ISO TC 67
Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries

ISO TC 108
Mechanical vibration and shock

ISO TC 184
Industrial automation systems and integration

SC5
Condition monitoring and diagnostics of machines

SC4
Industrial Data

SC5
Architecture, communications and integration frameworks

ISO 14224
Petroleum, petrochemical and natural gas industries -- Collection and exchange of reliability and maintenance data for equipment

ISO 13374
MIMOSA OSA-CBM
WG6
Formats and methods for communicating, presenting and displaying relevant information and data

MIMOSA Technical Director is Convener and Liaison with TC184

ISO 15926- Data for Process Industries
10303-Product data representation and exchange
STEP/PLCS
OASIS

MIMOSA is an A-Liaison

DRAFT ISO 18435
MIMOSA OSA-EAI
WG7
Diagnostic and maintenance applications integration

MIMOSA is a D-Liaison

MIMOSA provides industry driven implementation specifications (schema & metadata) for Key ISO, IEC and ISA Standards to help enable practical interoperability in industry-driven solutions architectures.
OpenO&M™ Initiative Solutions Process
Manufacturing JWG Domain Mapping

Inter-Enterprise
Enterprise
Manufacturing Operations & Maintenance
Machine
Logical Basis For Collaboration
Major Classes of Data and Related Architecture

- MIMOSA Asset
  Instance Must Properly
  Inherit 15926 Make
  and Model Data and
  PLCS Reference Data

- Reference Data
  ISO 15926

- Instance Data
  MIMOSA OSA-EAI

- Ontology

- Event Data
  ISO 13374
  MIMOSA OSA-CBM

- Services Oriented Architecture

- Shared
  Collaborative SOA
  (Including OPC UA)

Copyright 2008 MIMOSA
The OpenO&M™ Initiative
Enabling Open Standards-Based Interoperability

A Collaborative, Consensus-based Solutions Process

- Industry Requirements-driven
- Owner/Operator Leadership
- Participation of Key Standards Organizations
- Vendor Supported

Key Objectives

- To enable a shift from a product and project-centric systems integration model to an industry-centric, open standards-based interoperability model.
- To enable critical global infrastructure to be modeled, monitored and managed in a cohesive and practical fashion.
- Supporting emerging operational and enterprise risk management requirements for reliability, safety and quality (requires increasing levels of interoperability)
OpenO&M™ Industry-driven Solutions Process

- Capture key O&M use cases from industry - Owner/Operators & Suppliers
- Validate and prioritize use cases - Owner/Operator leadership teams
- Compare industry use cases to generalized use cases for cross-industry synergies - Tech Team
- Update generalized use cases as needed – Tech Team
- Map use cases to scenarios and sequence diagrams – Tech Team
  - Maintain generalized scenarios and sequence diagrams as required
  - Maintain industry specific scenarios and sequence diagrams as required
- Map use case to standards-based solutions architecture – Tech Team
  - Maintain generalized solutions architecture as required
  - Maintain industry-specific solutions architecture and ROADMAP as required

The industry solutions architectures will include industry requirements, conceptual and implementation standards elements to properly enable interoperability.

Copyright 2008 MIMOSA
Process Industry
Adoption of Cross Industry Standards

Unique Individual & Organization
Value Added Approaches
(People, Processes and Technologies)

OpenO&M™
(MIMOSA, OPC, ISA, WBF/B2MML, OAGi)
+ Open Life-cycle Engineering
(FIATECH, POSC Caesar, ISO TC184)
= Open DOM

Copyright 2008 MIMOSA
Owner/Operator Meeting Participants

- BP
- Chevron
- ExxonMobil
- Suncor
- Petro Canada
provide input, oversight & prioritization of use-cases & scenarios

use-cases address high-value added activities

scenarios combine use cases to depict system interactions

**oil & gas leadership team**
(proposed early 2008)

Mike Brooks - Chevron, MESA
Mike Knight - bp
Greg Pattinson - bp
Bruce Taylor - Suncor, NPRA
Fayez Kharbat - Saudi Aramco, MESA

June 17, 2008
to be state for asset excellence

open operations & maintenance enterprise information bus specification

control systems, operational data historians & hmi's
OPC XML & MIMOSA OSA-EAI

operational forecasting, planning & scheduling systems
ISA-95, OPC XML & MIMOSA OSA-EAI

order/mission mgt., material mgt., personnel & financial systems (ERP), CMMS
ISA-95

MIMOSA OSA-EAI
periodic & online condition monitoring systems

MIMOSA OSA-EAI
diagnostic / prognostic asset health system

MIMOSA OSA-EAI
enterprise asset management (EAM) systems (asset registry) & maintenance work management.

MIMOSA OSA-EAI
asset capability forecasting & asset optimization DSS

physical asset resource management systems

June 17, 2008
Owner/Operator Leadership With Vendor Support
Selected Supporting Organizations - Process Industries
modern approaches:

information technology evolution: data to applications, to services-based work process

Mike Brooks
Chevron, Global Refining
bp data model map
plant lifecycle

engineering  procurement  construction  operation  capability

- Material Specifications
- Piping Specs, Material Master Catalog
- Tool Catalog
- Crude Assays
- MSDS

- Vendor Catalogs
- Bill of Material
- As-Installed Equipment Data
- Operations Procedures
- Equipment & Alarm Configuration
- Operating Envelopes

- Vendor & Engineering Contracts
- Service Contracts
- Contracted Service Contracts
- Operator Unit Knowledge
- Maintenance Procedures
- Job plans
- As maintained eqpt. data
- As operated reliability data

- Design Requirements
- Purchase Requests
- Construction Schedule
- Operator Unit Knowledge
- Trade skills register
- Root Cause Analysis Data

- Calculations, Project 3D's
- Purchase Orders
- Invoices
- As-built 3D's
- HAZOP minutes
- Shift roster
- Daily plans
- Stock progression
- Price sets
- Work requests
- TAR plans
- PM program
- Inspection schedule
- Maintenance roster
- Equip. Calibration
- Equip. Capability Forecast

- PISTEP PIDX
- ISA85
- OPC
- MIMOSA
- ISO14224

ISO 15926

© Chevron 2007
# bp data model map

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Procurement</th>
<th>Construction</th>
<th>Operation</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials model</td>
<td>Piping Specs, Material Master Catalog</td>
<td>Tool Catalog</td>
<td>Crude Assays, MSDS</td>
<td>Spare Parts Lists, Stores Inventory, Reliability Data</td>
</tr>
<tr>
<td>Equipment model</td>
<td>Vendor Catalogs</td>
<td>Bill of Material</td>
<td>As-installed Equipment Data</td>
<td>Operations Procedures, Equipment &amp; Alarm Configuration, Operating Envelopes</td>
</tr>
<tr>
<td>Personnel model</td>
<td>Vendor &amp; Engineering Contracts</td>
<td>Service Contracts</td>
<td>Contracted Services Contracts</td>
<td>Maintenance Procedures, Job plans, As maintained eqpt. data, As operated reliability data</td>
</tr>
<tr>
<td>Plant model</td>
<td>Design Requirements</td>
<td>Purchase Requests</td>
<td>Construction Schedule</td>
<td>Operator Unit knowledge</td>
</tr>
<tr>
<td>Actuals model</td>
<td>Calculations, Project R&amp;ID's</td>
<td>Purchase Orders, Invoices</td>
<td>As-built R&amp;ID's, HAZOP minutes</td>
<td>Trade skills register, Root Cause Analysis Data</td>
</tr>
</tbody>
</table>

**openO&M standards**  
(based on MIMOSA, OPC, ISA95, etc.)
Process Industry
(Oil & Gas / Petrochemical / Chemical)

Selected O&M Use Cases
Use Case #1 – Handover EPC to O/O

- “Handover” of As-Designed Information from Engineering, Procurement, and Construction (EPC) Contractor(s) to Owner/Operator: A core problem for Owner/Operators (O/O), vendors and systems implementers is the lack of good mechanisms for managing the needed information exchanges between EPC activities and the O&M related systems, applications and technologies.

- Information to Be Exchanged: Information is needed to properly "bootstrap" O&M systems with as-designed functional segment data, including P&ID diagram information related to process/equipment data sheets. Need to have access to "tag" databases which identify where sensors have been installed for control and monitoring, related to the process equipment they are monitoring, and the meta-data about them (tag ID, update frequency, engineering unit, etc.).

- Scenarios Activated: # 4 and # 7
  - Pull As-Designed Plant/Process Engineering Network/Segment/Tag Data Out of EIS to REG
  - Pull Registry Data Out of REG to ERM, ERP, PORT, ORM, EAM, HMI, HIST, OPM, MES, CMS
Use Case #3 – Field Changes

- **Field Engineering – Changes Sent To Plant or Facilities Engineering:** In a perfect world, fully leveraging best practices, all engineering changes would flow through the enterprise design engineering and approval systems on a “waterfall” basis, even if the actual design work is done locally or through an independent contractor. All such engineering changes would be fully reconciled and rationalized before the work was actually done and the integrity of the Engineering Reference Databases would be ensured as a specialization of use case 2. Unfortunately, there are many situations where this does not occur (and may be impractical). This frequently results when a centralized plant or facilities engineering organization is overwhelmed by emergent situations and the plant or facilities manager must take responsibility for the situation without the ideal level of centralized support. Lack of proper synchronization of this work can result in anomalies with respect to the system of record for the engineering information, since in this case, the most up-to-date As-Designed information is flowing from the field to the enterprise, rather than the other way around.

- **Information to Be Exchanged:** The information is very similar to that which is contained in Use Case 2, but it now needs to flow from the field to the Engineering Reference Database so that the systems can be kept in synch. Need to propagate changes to functional segment data, including P&ID diagram information related to process/equipment data sheets with guaranteed delivery despite network hiccups.

- **Scenarios Activated:** #8 and #9
Use Case #5 – Asset Updates

- **Automatic O&M Configuration (Remove/Replace) Updates:** One of the largest headaches for any complex facility or plant is keeping accurate track of the uniquely identified physical assets which are currently installed in a given functional location. Use Cases 1 and 2 deal with “top-down” Design Engineering-driven activities and Use Case 3 deals with the situation where this is a “bottom-up” process, but routine remove/replace operations are workflow-driven rather than design-driven.

- While all organizations make an attempt to properly keep track of this information for classes of assets with critical functions, experience has shown that substantial process and information gaps routinely exist. After a few years of operations, there is often a substantial difference between the assets that are shown to be installed in the system of record and those that actually are installed. This situation is normally verified and at-least partially corrected when a “walk down” takes place in conjunction with the implementation of some new related system (such as an EAM system). This is an expensive, labor intensive process and it does not solve the fundamental problem, which results in its recurrence. Lack of proper management of this seemingly straight-forward element of configuration change can have profound consequences for reliability, EH&S, quality, yield.

- **Information to Be Exchanged:** When a fieldbus device is replaced and a CMS system is able to sense that a new device has been removed/installed, it should immediately update the registry (REG) system of this configuration change, which should then be propagated to all other O&M systems. When data is keyed into an EAM system that an asset removal and/or installation has taken place, it should immediately update the registry (REG) system of this configuration change, which should then be propagated to all other O&M systems with guaranteed delivery despite any potential network connectivity and/or latency problems.

- **Scenarios Activated:** #6, #26, #28
Use Case #7 – CBM Triggering

- **Open Automatic or Semi-Automatic CBM Triggering:** The benefits of interoperability start to pay significant dividends when the *near-real time decision support systems* (such as ORM) begin to properly interact with the *transaction processing oriented business systems* (such as EAM) based on *data/information feeds from true real-time systems involved in monitoring and control*. While it is fairly easy to show a hierarchy of data/information/knowledge on a PowerPoint slide, the nature of the use cases needs to be fully contemplated when the transforms are taking place as part of the systems interaction scenarios. This involves several categories of systems spanning 3 basic layers (real-time, near real-time and transaction processing) in the interoperability stack and they are normally provided by several communities of solutions providers, with multiple vendors in each community. Providing sustainable interoperability for all of these systems of systems is a critical focal-point for open standards based interoperability.

- This use case does NOT assume interaction with operations planning and scheduling oriented systems. It is limited to the current practice where specialized maintenance, reliability, quality and safety systems are able to diagnose or prognoses a need for a maintenance action. When an ORM system (PSMS< AHMS, QMS, EMS) determines that a maintenance action is required; it must be able to generate a CBM-driven request for action/work advisories using an open interface to an EAM system. The ORM should be smart enough to check beforehand to see if similar maintenance work entries are outstanding on an asset so as not to "flood" an EAM system with the exact same CBM request for action/work. In addition, the ORM system needs to be able to check the status of the work submitted.

- **Information to Be Exchanged:** All information required to generate a CBM request for action/work.

- **Scenarios Activated:** #12, #13, #14, #25, #26, #27, and #28
Use Case #9 – Incident Accountability

**Incident Management:** With the increasing emphasis on risk management topics including Operational Risks and Health, Safety and Environmental risks, better incident management methods must be established. While traditional incident management systems relied on somewhat arbitrary (and frequently manual) methods to declare, capture, escalate and respond to various categories of incidents, a more systemic approach enables a substantially improved approach to risk management. Post mortem analysis shows that in many cases, a catastrophic event is proceeded by a series of improperly captured and escalated incidents. When the catastrophe occurs, management often responds by indicating they were unaware of the situation in spite of prior related incidents. In response, regulatory agencies such as OSHA are communicating their intent to hold management increasingly accountable (including criminal prosecution) for future catastrophes with ignorance to not be an excuse. In order to enable management to be properly aware of these incidents (in addition to the other risk indicators flowing in association with use case 8), industry must make sure that critical information is captured and escalated along the lines of accountability. An automated approach offers the greatest assurance of such a flow by eliminating unnecessary gaps in the process. This will also properly support the forthcoming requirements to capture, track and report “near-miss” incidents.

**Information to Be Exchanged:** Enterprise Risk Management Systems must be guaranteed delivery of actual and near miss incidents as they are declared and captured at the lowest practical level in the data/information “food chain”. They can then escalate and manage the incidents bases upon previously defined rules.

**Scenarios Activated:** #19, #20, #25, #26, #27, and #28
Oil & Gas/PetroChem Industry OpenO&M Interoperability Top-Priority Scenarios As Determined By Top-Priority Use Cases

Open Standards Which Define Data Content for Information Exchange:
- OAGIS, CIDX
- ISO 15926 & MIMOSA
- B2MML
- B2MML & PRODML
- MIMOSA & B2MML
- MIMOSA
- OPC
- Fieldbus (Foundation, Profibus, etc.)

NOTE: Arrows with Do Not Connect Directly to Another System Publish Information Which Can Be Subscribed to By Multiple Systems
Oil & Gas/PetroChem Industry OpenO&M Interoperability Top-Priority Scenarios


PORT

Production Forecasting & Scheduling Systems

MES

Operational Performance Modeling & Optimization Systems

OPM

ORM Operational Risk Management Systems (EH&S, PSMS, AHMS, QMS)

Operational Performance KPIs (B2MML & PRODML)

Significant Actual & Early Warning ORM Events (MIMOSA)

Forecasted Demand (B2MML & PRODML)

Emitted ORM Events (MIMOSA)

CBM Advisories (MIMOSA)

CBM/Calib. Schedule (MIMOSA)

CBM/Calib. Work Completed (MIMOSA)

Asset Removals & Installations (MIMOSA)

Maintenance Work Status, & Work History (MIMOSA)

EOM Event-Oriented Message Bus

EAM Enterprise Asset Management Systems

CBM Advisories (MIMOSA)

Planned Asset Unavailability Schedule (MIMOSA)

EOM KPIs (MIMOSA)

CBM/Calib. Work History (MIMOSA)

Asset Removals & Installations (MIMOSA)

Maintenance Work Status, & Work History (MIMOSA)

EOM Event-Oriented Message Bus

REG PDM 2

Plant/Process "As-Installed" & "As-Maintained" Master Data (MIMOSA & B2MML)

Plant/Process Engineering Advisory 2

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

Plant/Process Engineering Change Advisories

Plant/Process Engineering As-Designed & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)
<table>
<thead>
<tr>
<th>Scenarios</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two of the Top-Priority Scenarios Sequence Diagrams in detail.....
Oil & Gas/PetroChem Industry OpenO&M Interoperability Top-Priority Scenarios

Suppliers
- RFQs & POs (OAGIS, CI DX)
  - RFQ Cost/Delivery Schedule & PO Delivery Status (OAGIS, CI DX)
  - "As-Designed" & "As-Built" Product/Part Data (ISO 15926 & MIMOSA)
  - Product/Part Change Advisories
- OEM Product Data Mgmt. Systems
  - "As-Designed" & "As-Built" Product/Part Data (ISO 15926 & MIMOSA)
  - Product/Part Engineering Change Advisories
- Historical Data & Events (OPC UA-HDA)
  - Detailed Prod. Schedules (B2MML)
- Plant/Process Engineering As-Designed & As-Built Segment/Tag Information, Configuration Management Historians
  - "As-Designed" & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)
  - Usage Readings (MIMOSA)
  - Current Op. Data & Events (OPC UA DA/A&E)

Customers
- RFQ Cost/Delivery Schedule & PO Delivery Status (OAGIS, CI DX)
  - "As-Installed" & "As-Maintained" Product/Part Data (ISO 15926 & MIMOSA)
- EOM Event-Oriented Message Bus
  - Planned Asset Unavailability Schedule (MIMOSA & B2MML)
  - Maintenance Work Status, & Work History (MIMOSA)
  - "As-Installed" & "As-Maintained" Master Data (MIMOSA)
- REG Plant/Process "As-Installed" & "As-Maintained" Segment/Asset/Tag Registry & Configuration Management Historians
  - "As-Installed" & "As-Maintained" Plant/Process Engineering Data (ISO 15926 & MIMOSA)

ERPM
  - Production Orders (OAGIS, CI DX, B2MML)
  - Production Performance (B2MML)
  - MES KPIs (B2MML)

PORT
- Production Forecasting & Scheduling Systems
  - Forecasted Demand (B2MML & PRODML)
  - Asset Performance Prediction (B2MML & PRODML)

MES
- Operational Performance Modeling & Optimization Systems
  - Detailed Prod. Performance (B2MML)
  - Planned Asset Unavailability Schedule (MIMOSA & B2MML)

OPM
- Operational Risk Management Systems (EH&S, PSMS, AHMS, QMS)
  - Significant Actual & Early Warning ORM Events (MIMOSA)

EAM
- Enterprise Asset Management Systems
  - Full-resolution Condition Data & Events (MIMOSA)

EIS
- DCS HMI Control/SCADA, HMI, & Historians
  - Current Op. Data & Events (OPC UA DA/A&E)

HIST
- Operational Information Management Systems
  - Historic Op. Data & Events (OPC UA-HDA)
  - Asset Removals & Installations (MIMOSA)

OPM
- O&M Event Monitoring
  - O&M Event Monitoring
- Portable I&C Device Monitoring (Off-& On-line)
- Online Surveillance Monitors
- Online Protection Monitors
- Online Transient Monitors
- Laboratory Information Management Systems (LIMS)

DEV
- Measurement, Events, Inspections, Calibrations, Conditions, Usage, and Sensed O&M Actions

CMS
- "As-Designed" & "As-Built" Plant/Process Engineering Data (ISO 15926 & MIMOSA)
- Plant/Process Engineering Change Advisories

Copyright 2008 MIMOSA
Scenario 21 – OPM KPIs Out of OPM to ERM, PORT, MES

Consumer (ERM PORT MES) → EOM Subscriber On-Ramp → EOM Subscriber Off-Ramp → EOM Bus → EOM Publisher Off-Ramp → EOM Publisher On-Ramp → Provider (OPM)

RequestOPMKPIData(OPMKPI Filter)
Return Status & Request ID

RequestOPMKPIData(OPMKPI Filter)
Return Status & Channel ID

RequestOPMKPIData(Channel ID, OPMKPI Filter)
Return Status

ResponseOPMKPIData(Channel ID, OPMKPI Data)
Return Status

ResponseOPMKPIData(Request ID, OPMKPI Data)
Return Status
# Military Adoption of Industry Best Practices for Platform Sustainment

<table>
<thead>
<tr>
<th>Army Best Practices &amp; Standards</th>
<th>CROSS Industry Best Practices &amp; Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>AILA &amp; CLOE</td>
<td>MIMOSA OSA-EAI, OSA-CBM</td>
</tr>
<tr>
<td>3008B</td>
<td>GEIA 927</td>
</tr>
<tr>
<td></td>
<td>ISO 13374</td>
</tr>
<tr>
<td></td>
<td>OAGi</td>
</tr>
</tbody>
</table>

*Industry Specific Best Practices & Standards (Joint Military - Aerospace & Defense)*
- PLCS, S1000D, GEIA STD 0007
Open Standards Based Interoperability for AMC Platform Life-Cycle Management

Presenter:
Alan T. Johnston
MIMOSA President
Chair ISO TC 184 MFG Asset Management Integration Task Force

Presented by:
MIMOSA Center of Excellence
Software Engineering Directorate
Aviation and Missile Research, Development and Engineering Center
SALE Services Oriented Architecture
Hypothetical To Be Systems Architecture
Leveraging SAP NetWeaver, PLM+, CLOE and Industry Standards

Army Enterprise Data Hub

SAP NetWeaver XI
MIMOSA
Other Open STDs
Mil STDs

Army Logistics Information Hub
CLOE Enterprise Services Bus

CLOE National Level Server(s)
CLOE Information Broker
MIMOSA-CLOE

Distributed Information Manager

Battalion LAN
Battalion Server

MCD
Browser

Platforms

External Applications

Army Knowledge Online (AKO) based single sign-on

Combat/Mission Management Applications

Other F/T Applications

FIT EAM
Opportunity For Global Collaboration and Coordination

- CIEAM - Asia Pacific / Australia Region
- MIMOSA/OpenO&M
- FIATECH
- POSC Caesar

MIMOSA has gained significant experience in helping lead major standards collaboration and harmonization efforts. We expect the process to continue with our joint activities for critical infrastructure management in Oil and Gas and Military sectors.
MIMOSA and OpenO&M™ Initiative
Selected Key Interoperability Activities

- MIMOSA Summer Meetings – August 25-27, 2008
  - BP Houston, Texas
  - Oil and Gas SIG Meetings – August 25-26
- POSC Caesar MIMOSA Workshop – DNV - September 15-19 – Oslo, Norway
- MESA Oil and Gas Meetings – September 23 - Florida
- NPRA 2008 Q&A and Technology Forum - October 5-8 - Champions Gate, FL
- ARC Life-Cycle Asset Management Forum – October 13-15 – Houston Texas
- ISA Expo 2008
  - October 14-16 - Reliant Center – Houston, TX
  - OpenO&M Interoperability Demonstration, Workshop and Presentations
- POSC Caesar Meetings – PETRONAS – October 21,22 – Malaysia
- ISO TC184 SC4 Meetings – November 2-5 - Pusan, Korea
- ISO TC184 Plenary - October 29-31 - Pusan Korea
- 2008 International Maintenance Conference–December 1-5 –Bonita Springs, FL
  - Joint Meeting with ISA-95
  - Joint Meeting with ISO TC184 SC5 WG7
  - OpenO&M Interoperability Demonstration and Workshop

- OpenO&M Oil and Gas SIG Meeting
  - Chevron Houston, Texas
  - February 17-29, 2009 - Tentative
Conclusions

- Multiple industry groups associated with Critical Infrastructure must take a more disciplined approach to Physical Asset Life-cycle Management, including a focus on Risk Management.
  - Oil and Gas / Integrated Energy / Petrochemical
  - Aerospace and Defense
  - Transportation
  - Public Utilities
  - Communications
- The OpenO&M™ Initiative enables owner/operators, key standards organizations and key suppliers to work together.
  - In a globally coordinated, **industry-driven solutions process**
  - Addressing critical business interoperability requirements with **Open Standards-based Interoperability**
  - OpenO&M functions as an **applied standards activity**.
- An open standards-based **solutions architecture roadmap** for the oil and gas industry is under development with the support of key suppliers and standards organizations.
  - The solutions architecture will include requirements, conceptual and implementation elements
  - Specializations for **upstream** and **downstream** are being developed
  - This effort will enable end-users and suppliers have a common point of reference for near-term, mid-term and long-term solutions focused projects.
  - The solutions process and the resulting roadmaps will function as a conflict resolution tool to help owner/operators and suppliers gain and sustain a common understanding
  - The roadmaps will help owner/operators know what they can specify during the procurement phase of real projects, while moving forward along industry-driven paths,
  - By working across multiple vertical industries, software suppliers gain the needed synergies to build interoperable commercial off the shelf products
- **Get involved and help lead/support the effort within the Oil and Gas industry.**