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Applied Research Laboratory
The Pennsylvania State University

Including OSA-CBM and OSA-EAI in Integrated System Health Management (ISHM)

PRESENTED TO:

Machinery Information Management Open Standards Alliance (MIMOSA)

28 August 2006

PRESENTED BY:

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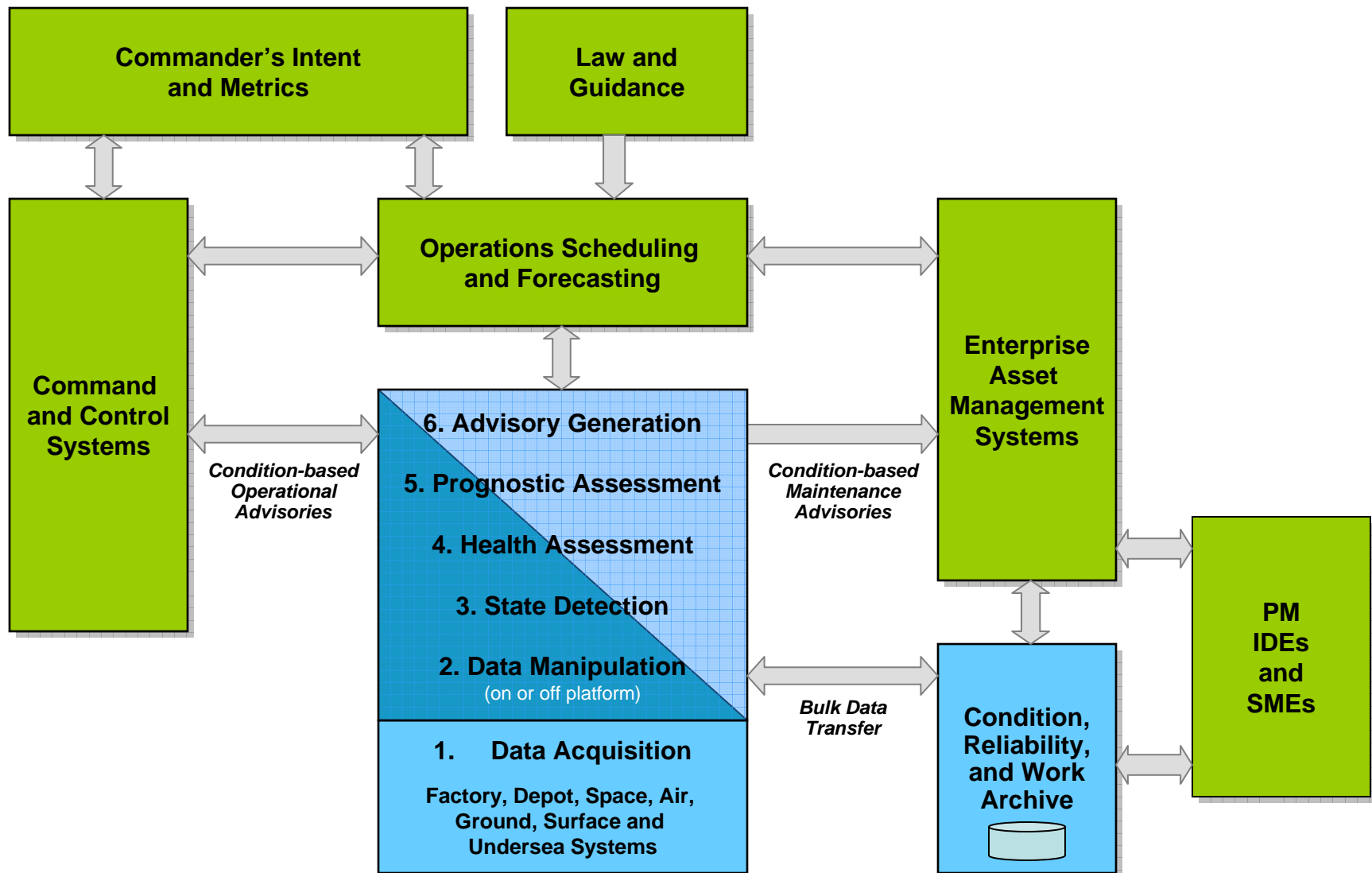
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- Many DOD acquisition programs now require embedded diagnostics and/or CBM

- Some programs are ambitiously reaching toward prognostics

- Each is developing a unique data architecture

- Vendors want to protect proprietary solutions

The Challenges

- Implement a common architecture framework for ISHM that:

  – Has a foundation in open standards

  – Approaches the goal of plug and play

  – Allows vendors to protect proprietary solutions

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Leveraging Asset Health Information throughout the Enterprise

Commander's Intent and Metrics

Law and Guidance

Operations Scheduling and Forecasting

Command and Control Systems

Enterprise Asset Management Systems

6. Advisory Generation

5. Prognostic Assessment

4. Health Assessment

3. State Detection

2. Data Manipulation
(on or off platform)

1. Data Acquisition

Factory, Depot, Space, Air, Ground, Surface and Undersea Systems

Condition-based Operational Advisories

Condition-based Maintenance Advisories

Bulk Data Transfer

Condition, Reliability, and Work Archive

PM IDEs and SMEs

Condition Monitoring - Build on Open Standards

(1) **ISO-13374**

Condition Monitoring and Diagnostics of Machines
- Part 1 released
- Part 2 in final draft, expect release in August 2006
- Just a framework

(2) **MIMOSA OSA-CBM**

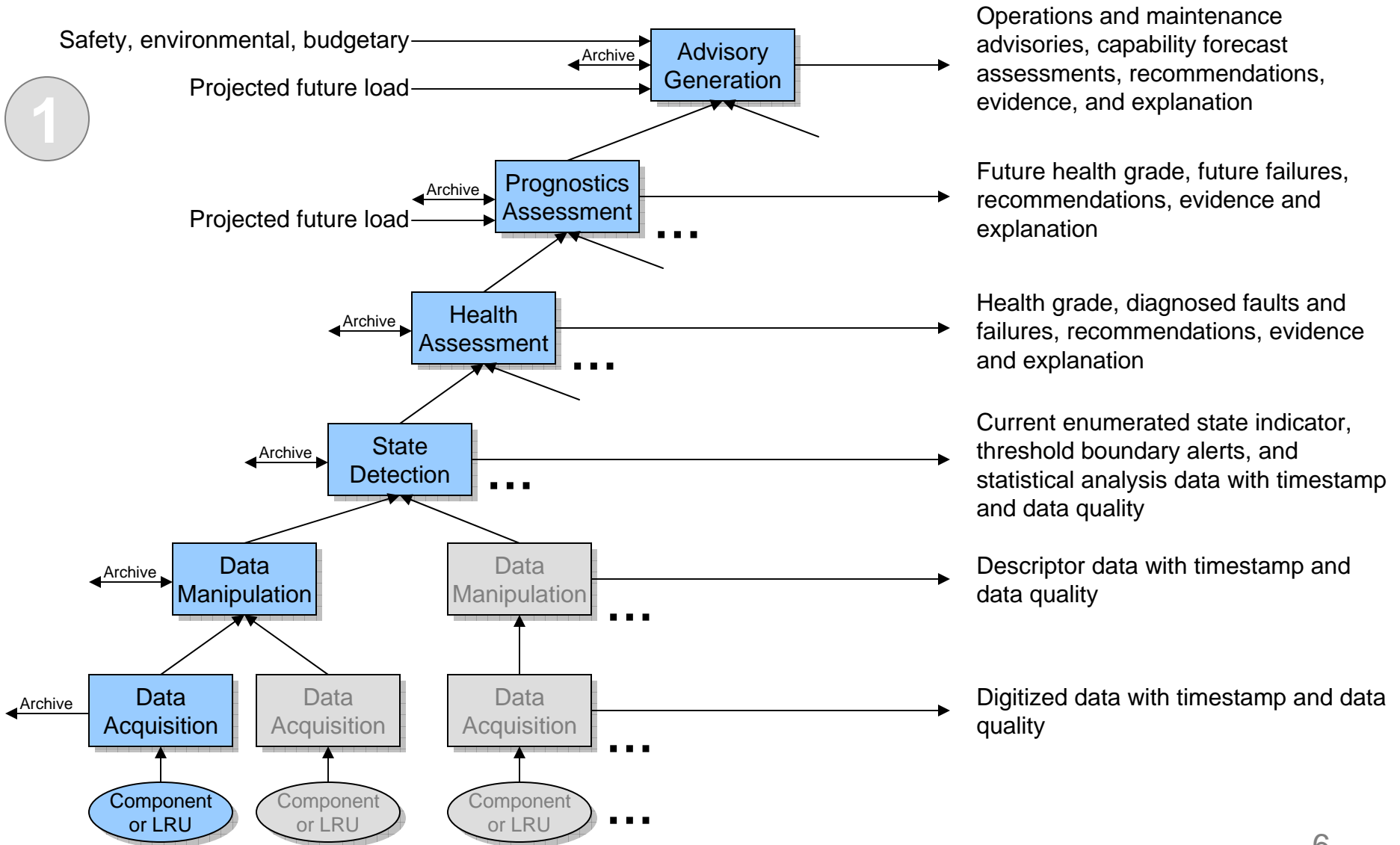Open System Architecture for Condition-Based Maintenance
- Implements ISO-13374
- Harmonized with OSA-EAI
- Substantial enhancements in v3.1, 2006
- Will likely be added to the DISR in late 2006 or early 2007

(3) **MIMOSA OSA-EAI**

Open System Architecture for Enterprise Application Integration
- Primary domains are registry, condition, reliability and maintenance functions
- Developed around foundational data structures (Common Conceptual Object Model)
- Includes:
  - Database schemas and scripts
  - XML message schemas (Tech-XML)
  - Bulk data exchange (Tech-Compound Document Exchange (CDE))
- Added to DISR 06.01 in March 2006 as a mandated standard

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Safety, environmental, budgetary ──────────────→ Archive ← Advisory Generation

Projected future load ────────────────────→

Operations and maintenance advisories, capability forecast assessments, recommendations, evidence, and explanation

Archive ← Prognostics Assessment · · ·

Projected future load ────────────→

Future health grade, future failures, recommendations, evidence and explanation

Archive ← Health Assessment · · ·

Health grade, diagnosed faults and failures, recommendations, evidence and explanation

Archive ← State Detection · · ·

Current enumerated state indicator, threshold boundary alerts, and statistical analysis data with timestamp and data quality

Archive ← Data Manipulation

Data Manipulation · · ·

Descriptor data with timestamp and data quality

Archive ← Data Acquisition

Data Acquisition

Data Acquisition · · ·

Digitized data with timestamp and data quality

Component or LRU

Component or LRU

Component or LRU · · ·

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MIMOSA OSA-CBM does the following:

- Specifically defines the functions for all six levels
  - Data
  - Configuration
  - Explanation

- Defines communications interfaces
  - Synchronous
  - Asynchronous
  - Service
  - Subscription

- Does <u>not</u> define processing, functions and algorithms within the 6 levels. Vendors do that and they can remain proprietary.

Advisory Generation (AG)

Prognostics Assessment (PA)

Health Assessment (HA)

State Detection (SD)

Data Manipulation (DM)

Data Acquisition (DA)

<u>Status</u>:
- Is now managed by the MIMOSA standards body

- MIMOSA publicly released v3.1 on August 1, 2006

MIMOSA OSA-EAI Overview

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Machinery Information Management Open Systems Alliance (MIMOSA)
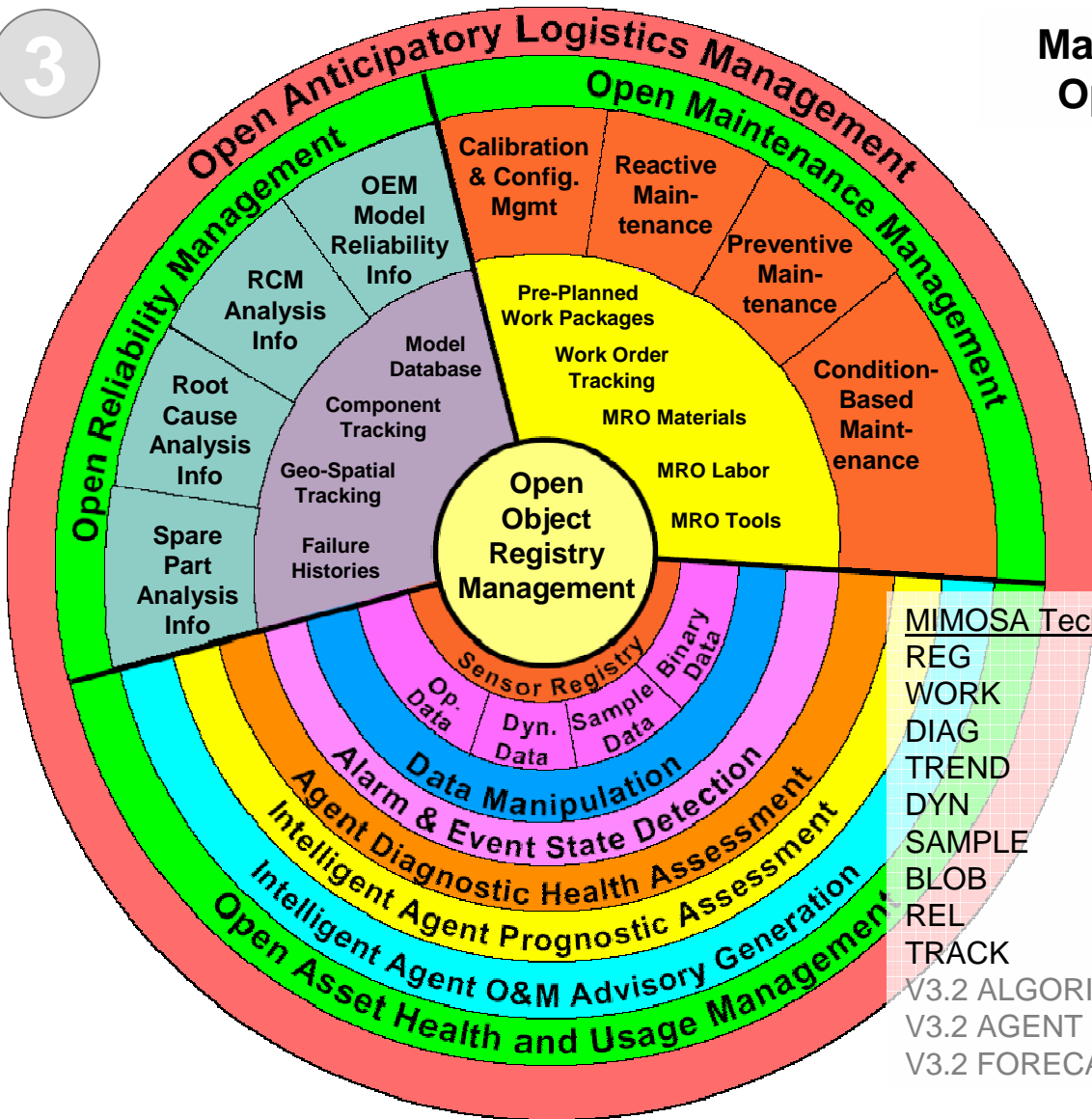
OSA-EAI database schemas and XML message schemas are all derived from the common conceptual object model (CCOM).
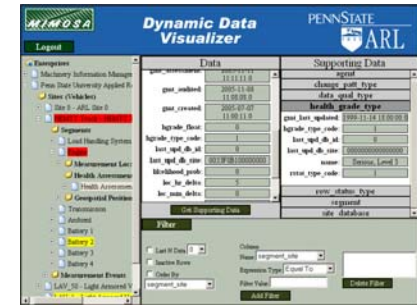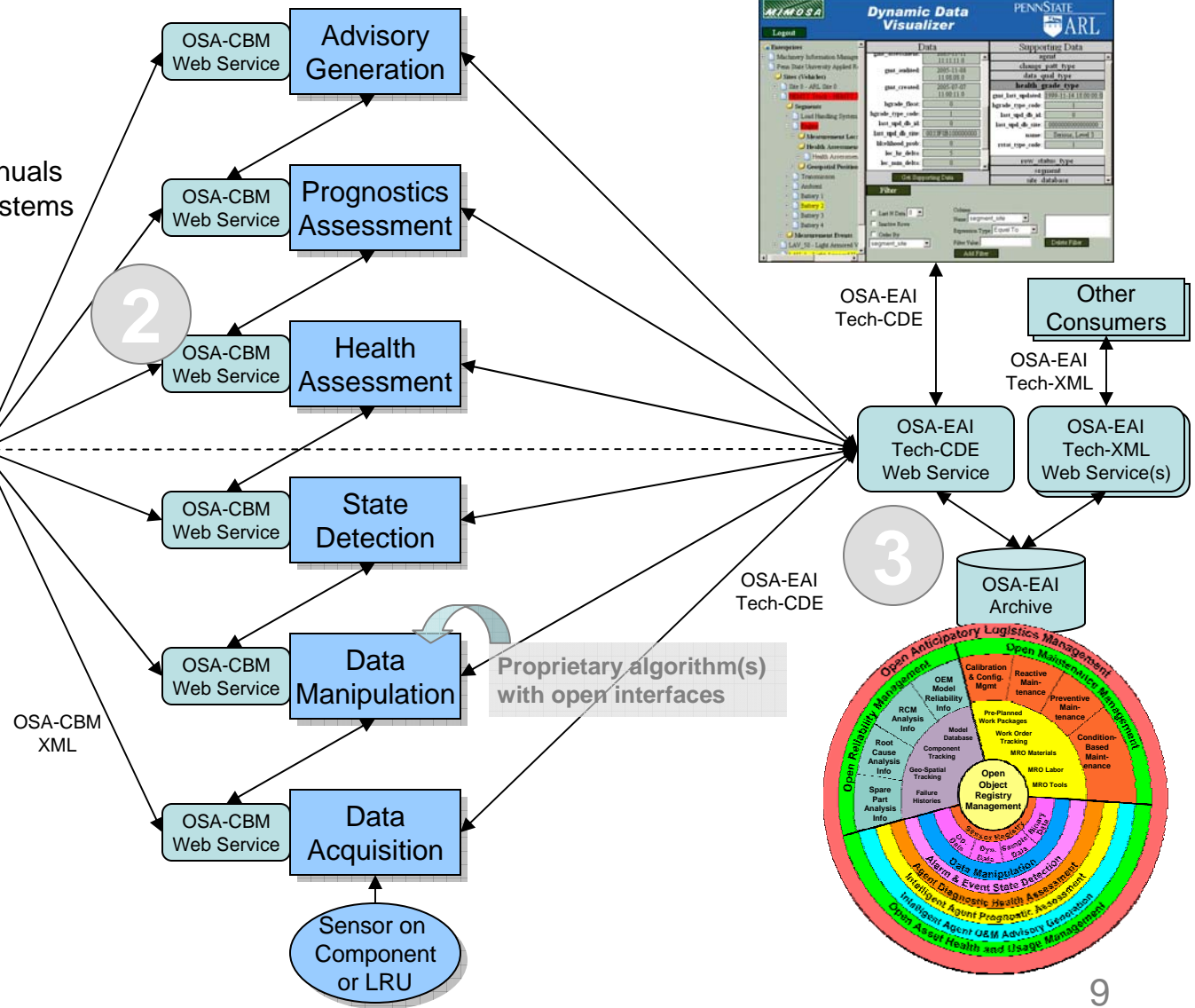
MIMOSA Technology Types

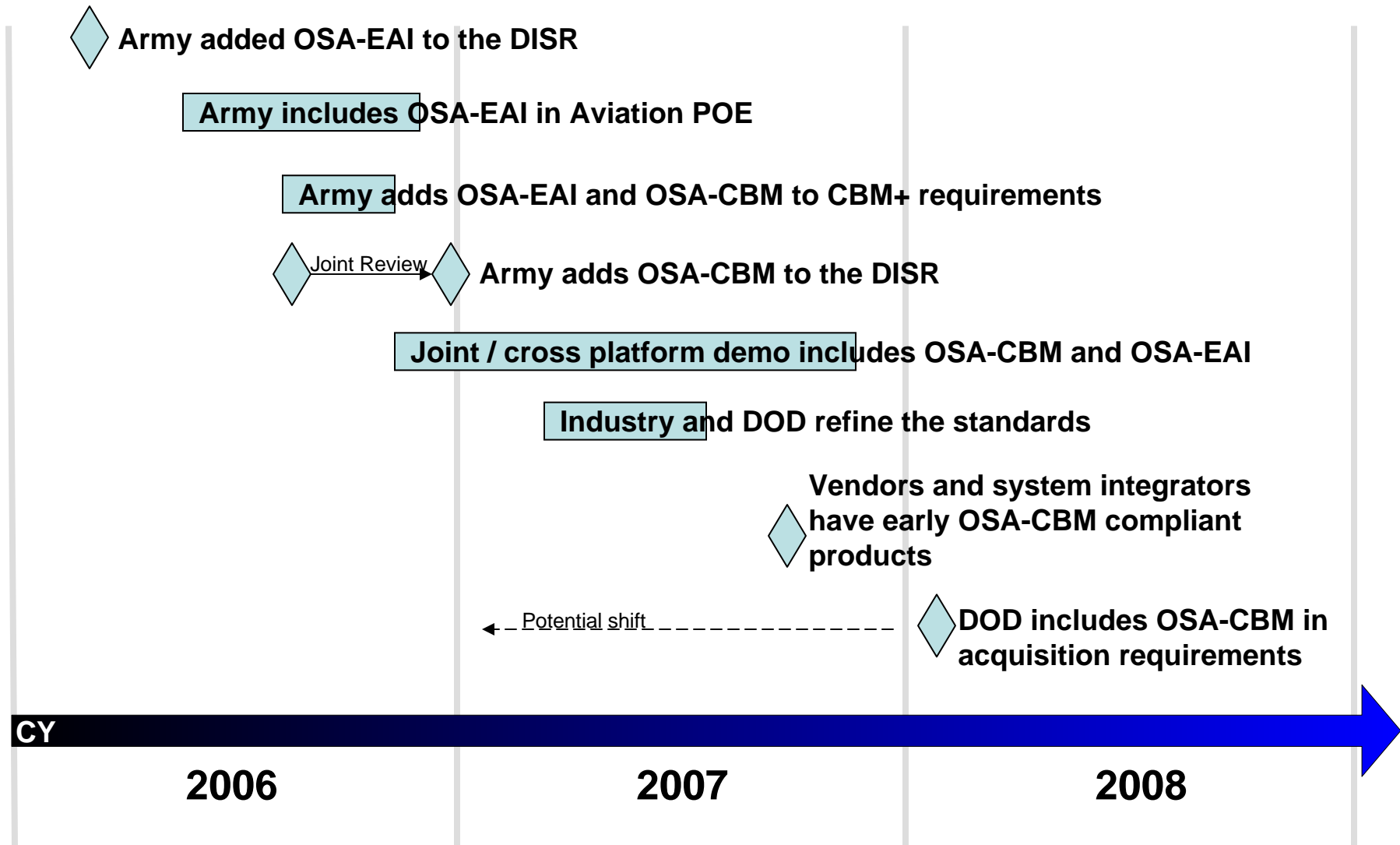|	
REG	Physical Asset Register Management
WORK	O&M Agent Work Management
DIAG	Diagnostics/Prognostics/Health Assessment
TREND	Operational Scalar Data & Alarms
DYN	Dynamic Vibration/Sound Data & Alarms
SAMPLE	Oil/Fluid/Gas/Solid Test Data & Alarms
BLOB	Binary Data/Thermography Data & Alarms
REL	RCM/FMECA/Model Reliability Information
TRACK	Physical Asset GeoSpatial Tracking Info.
V3.2 ALGORITHM	Algorithm Management Information
V3.2 AGENT	Intelligent Agent Management Information
V3.2 FORECAST	Capability Forecasting & Projections

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Other examples:
Portable Maintenance Aids
Mobile Field Service Tools
Interactive Electronic Technical Manuals
Electronic Maintenance Support Systems

OSA-CBM Web Service — Advisory Generation

OSA-CBM Web Service — Prognostics Assessment

OSA-CBM Web Service — Health Assessment

OSA-CBM Web Service — State Detection

OSA-CBM Web Service — Data Manipulation

OSA-CBM Web Service — Data Acquisition

Sensor on Component or LRU

OSA-CBM XML

Proprietary algorithm(s) with open interfaces

OSA-EAI Tech-CDE

OSA-EAI Tech-CDE Web Service

OSA-EAI Tech-XML Web Service(s)

OSA-EAI Tech-CDE

OSA-EAI Tech-XML

Other Consumers

OSA-EAI Archive

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- Plan now for the DOD to require
  OSA-CBM and OSA-EAI in the near future

- Evaluate the standards (www.mimosa.org),
  - Identify weaknesses
  - Participate in improving them

- Execute a Joint demonstration leveraging the standards

- Evaluate what products/systems should be compliant
  and when