The Path Forward
2020 and Beyond…

Alan Johnston
2019 MIMOSA Open Meeting
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Presentation Outline

• It’s a Risky World: Identify, Model and Address Problems/Risks
• The Present – The Development of the OIIE and ISO 18101
• The Path Forward – Industry Digital Transformation in 2020 and Beyond
It’s a Risky World
Identifying, Modeling and Addressing Industrial Risks
What is Critical Infrastructure

- Critical infrastructure (or critical national infrastructure (CNI) in the UK) is a term used by governments to describe assets that are essential for the functioning of a society and economy – the infrastructure. – Wikipedia

- Government led efforts have addressed key aspects of Security (physical and cyber) and Resilience (usually focused on disaster and emergency preparedness).

- A key aspect of Critical Infrastructure is that it is Highly Interdependent.
Critical Infrastructure Sectors – From US PPD 21-2013

- Chemical
  - Commercial facilities
  - Communications
- Critical manufacturing
- Dams
- Defense industrial base
- Emergency services
- Energy

- Financial services (including insurance)
- Food and agriculture
- Government facilities
- Healthcare and public health
- Information technology
- Nuclear reactors, materials, and waste
- Transportation systems
- Water and wastewater systems
Critical Infrastructure Interdependencies

IEEE Journal- Dec 2001
Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies
Steven M. Rinaldi
James P. Peerenboom
Terrence K. Kelly
Critical Infrastructure Interdependencies-2

NIST Special Publication 1190
Community Resilience Planning Guide
For Buildings and Infrastructure Systems
Volume II
October 2015
Incorporating Prioritization in Critical Infrastructure Security and Resilience Programs

Homeland Security Affairs 13, Article 7
(https://www.hsaj.org/articles/1409)

October 2017
Duane Verner, Frederic Petit, and Kibaek Kim
Critical Infrastructure Interdependencies

NSW Critical Infrastructure Resilience Strategy
Partner, Prepare, Provide
NSW Department of Justice | Office of Emergency Management 2018
The Critical 5

- The Critical Five was established in 2012 to enhance information sharing and work on issues of mutual interest between Australia, Canada, New Zealand, the United Kingdom and the United States.
- One of the first efforts was to understand how each country addresses critical infrastructure as a basis for clearly articulating and communicating a common message on the value, meaning, and importance of critical infrastructure.
- “The Role of Critical Infrastructure in National Prosperity” published October 2015
Australia, Japan and United States Trilateral Partnership

- Announced July 31, 2018
  - Australia: Minister for Foreign Affairs-The Hon Julie Bishop MP
  - Japan: Japanese Bank for International Cooperation
  - United States: United States Overseas Private Investment Corporation (OPIC)

- Indo-Pacific region

- Cooperation on Investment to:
  1. Build infrastructure
  2. Address development challenges
  3. Increase connectivity
  4. Promote economic growth
Critical Infrastructure Risk Modelling and Management

Critical Infrastructure Management Process

- Risk Models
- Business Process Models
- Components Models
- Systems Models
- Industrial Process Models

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OSA-CBM Dual Use Technology Program
Office of Naval Research

MIMOSA Information Network (MIN)

June 21, 2000
MIN-Viewer
OSA-CBM Presentation
Alan T. Johnston
MIN Project Director

Model, Monitor and Manage Complex Physical Assets

MIMOSA OSA-CBM
ISO 13374
Plan to re-open in 2020
U.S. Army CECOM Collaborative Telemaintenance Project

Phase I Demonstration Briefing – July 31, 2002
Alan Johnston – MIMOSA
Kenneth Bever – MIMOSA
Bob Walter – Penn State ARL

U.S. Army Collaborative Telemaintenance Demonstration Revised 07/03/2002 – Phase I Demonstration

Demo Architecture Based on reusable MIN-Client™ & MIN-Server™ Components

Model, Monitor and Manage Complex Physical Assets

MIMOSA OSA-CBM
ISO 13374
Plan to re-open in 2020
OpenO&M Initiative – Formed 2004

Enterprise Business Systems
Enterprise Resource Planning (ERP)

Operations

OpenO&M™

Maintenance

Physical Asset Control
Real-time Systems

Level R4
Level R3
Level R2
Level R1
Level R0
Owner/Operators Objective
Shared Industry Foundation Architecture

OpenO&M Information Service Bus Model (ISBM)

Data Model:
- External Model Map
- MetaData
- NameServices

Persistence:
- Intelligent Caching
- Data Store
- Data Warehouse

Event Detection Subsystem: real-time detect, correlate, publish/subscribe, forwarding, etc.

Messaging Subsystem: routing (content, rules, etc.), queuing, transformation, synch/asynch, etc.
The Present
Industrialization of the Internet Industry, ISO and IEC Level Cooperation

Many business models are already broken. Others are breaking. Major changes are inevitable.

- Network Models are inherently adaptive and fault tolerant.
  - The OIIE and ISO 18101 provide a pragmatic path forward.
Relevant ISO Technical Committees & Activities

**Industry Specific** Practices and Content (ISD versus ISDD)
- **ISO TC 67** Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries
- **ISO 14224** Petroleum, petrochemical and natural gas industries — Collection and exchange of reliability and maintenance data for equipment

**Cross-Industry** Digitalization and Interoperability
- **ISO TC 184** Automation systems and integration
  - **WG 6** ISO 18101-Asset intensive industry interoperability
- **ISO TC 108** Mechanical vibration, shock and condition monitoring
- **ISO 13374** Condition monitoring and diagnostics of machines — Data processing, communication and presentation

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

**Relevant Cooperation also exist between ISO and IEC**
- IEC TC 165 and JIEC/ISO WG 21
- ISO 18435-O&M Integration
- ISO 15926-Process Data
- ISO 8000-Data Quality

**SC 4** Industrial Data
- ISO 15926-Process Data
- ISO 8000-Data Quality

**SC 5** Interoperability, integration, and architectures for enterprise systems and automation applications
- ISO 18435-O&M Integration

**Industry Specific Practices and Content (ISD versus ISDD)**
Secondary Business Process

Derived from ISO TC 184
Manufacturing Asset Management Integration Task Force Final Report
Inter-Enterprise OIIIE Digital Ecosystem

EPC
Engineering, Procurement and Construction Systems

IT Networks

OEM Manufacturers
Enterprise Business Systems

IT Networks

Manufactured Asset Data (Make/Model Information, Serial #)

Operations & Maintenance Data (Monitoring, Diagnostics, Prognostics)

Owner/Operators
Enterprise Business Systems

Automation and Control Systems

Functional and Technical Requirements
Model and Instance Information
PFM R&D, Tags, Docs & Requirements
Business Requirements
Intra-Enterprise OIlE Digital Ecosystem

Enterprise Business Systems

- OIlE Administration
- Planning
- Engineering Design
- Construction Management
- Operations Management
- Operations Risk Management
- Maintenance Management

IEC 62264 Messaging Service Model / OpenO&M ISBM

Connectivity Legend

- IIoT Connections
- (Constrained)
- Trusted IT/OT connections
- ISBM Web Services
- (Constrained)

Inter-Enterprise Connections

Automation Control Bus

- Automation and Control
- HSE and Operation Monitoring
- Prognostic & Health Management

IIoT Device

Device

Sensor/Transducer

Shared Information and Semantic Context

Enterprise Reference Data Libraries
IIoT Device Metadata

Industry Reference Data Libraries
IIoT Device Metadata
(ISO 15926, OTD, CDD...)

Standard, Cloud Friendly Enterprise Solutions Architecture For Digital Business Ecosystems
ISO 18435 Application Domains as Depicted in ISO TS 18101-1 Normative Annex
“This document was prepared by Technical Committee ISO/TC 184, Automation systems and integration.

This document provides an overview and outlines the fundamental principles of the ISO 18101 series. Future parts of the ISO 18101 series will be developed including sets of industry developed use cases, once the use cases have been documented using the Open Industrial Interoperability Ecosystem (OIIE) use case architecture and validated using the OIIE Oil and Gas Interoperability (OGI) Pilot, with the results captured in Technical Reports. These use cases will incrementally define industry prioritized elements of the secondary business process, which is the scope of the ISO 18101 series.”
Build on Success from OIIE OGI Pilot Phase 3.1

1. P&ID Creation and Export of Condenser Unit P&ID to Proteus XML Format
   - (Worley)

2. Transform to CCOM XML Format
   - (UniSA)

3. Greenfield RFI/RFI Response
   - RFI based on functional requirements (UniSA)
   - RFI Response, Models (Yokogawa)

4. Capital Project Asset Installation
   - (UniSA)

5. (Simulated) Handover of As-Built Data to PdMA
   - (UniSA)

6. CBM—Collection of Measurement data and output of Advisory
   - (PdMA)

7. Remove and Replace Maintenance Activity
   - (UniSA)

8. Brownfield Information Remediation
   - RFI based on limited asset data (UniSA)
   - RFI Response, Model/Asset data (Yokogawa)

OIIE Use Case 1 (As-Designed)

OIIE Use Case 12

OIIE Use Case 15

OIIE Use Case 1

OIIE Use Cases 14, 7, 5 (CBM Acquisition, Triggering, and Resulting Maintenance)

OIIE Use Case 12

12 December, 2019
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Path Forward

Pragmatic Industrial Digital Transformation

Cooperation in network-based industry business models

• Stimulate and connect sources of innovation
• Supplier-neutral Industrial Digital Ecosystems enable Industrial Digital Transformation
Industrial Digital Transformation - 2020
A Pragmatic Solution: Standards-based Interoperability

Custom Integration
- Owner/operator responsible for sustainment
- High Development and Sustainment Costs
- Inflexible and Fragile
- High Risk/Vulnerable
- No practical basis for industry transformation

Open Standards-based Interoperability
- Defined by supplier-neutral standards
- Suppliers build and maintain standard adaptors with commercial support model
- Higher quality with lower costs and risks
- Practical Basis for industry transformation

Open Industrial Interoperability Ecosystem (OIIE)
ISO TS 18101

Industry Standard Digital Ecosystem
- Supplier neutral – open source and COTS
- Standard **shared set** of standards
- Standard APIs and services definitions
- Standard information payloads
- Standard reference data - ISDDs
- Standard ecosystem administration
- Standard piloting testbed
  - Standard use case architecture
  - Standard use cases, scenarios & events
  - Standard adaptors

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Starting NOW

- Includes sponsorship by National Energy Resources Australia
  - Mission is to improve efficiencies in Australian Energy Sector
  - Australia does not have globally dominant IT suppliers and wants to be free to innovate
  - They are positioning the OIIE as the innovation template for their SMEs
  - 4 University based research centres are included along with Woodside and Origin
  - Australia Roadshow in early 2020 – Adelaide, Brisbane, Perth

Scope

- Add basic Inter-bus and Inter-enterprise features to OIIE OGI Pilot
  - Associated with OpenO&M ISBM 1.2 Specification Update (OpenO&M and NIST)
  - Driven by Use Cases (starting with RFI/RFI Response)
  - Test validate joint work on IIOT/CBM with NIST

- OIIE Entry Point for ILAP (with Team Norway)
- OIIE Entry Point for SPIR
- Preparation for next steps with NIST, NERA, CII, THTH and IOGP
The Open Industrial Interoperability Ecosystem (OIIE) and ISO 18101

The Industry and ISO Standard Solution

Cloud-based Analytics

Supplier-neutral Industrial Digital Ecosystem