

# Week 1 – Instrument SIG workshop

---

## Company Expectations

- ABB – Supplier
- Aibel – EPC
- Aker Solutions – EPC
- Bechtel – EPC
  - Currently has 11 resources involved with 15926 implementation
  - Primary expectation is to achieve a consensus modeling methodology
  - Support Emerson on Instrumentation modeling
  - Support JORD efforts
  - Bechtel is a customer of 15926 and is implementing it for production use
- Bentley – Software vendor
  - Invested a lot in R&D of 15926
  - Need to achieve agreement of consistent approach on reference data use and implementation for full interoperability
  - Have been collaborating on implementation side, now need to collaborate on the usage side of reference data
  - Instrumentation scope – help domain experts come up to speed on 15926
  - Move from academic to industrial stage
- CCC – EPC
  - Two resources dedicated to 15926
- DNV – Consultant
  - Understanding of data is critical to data exchange and interoperability
  - Need agreement on how to represent information in order to prevent ambiguity
  - Agreed-up on modeling followed by agreed-upon processes

- JORD project is key, as today reference data is being developed only on projects and handed over to PCA with no follow up
- Dow – Owner/Operator
- Emerson – Supplier
  - Answer modeling questions
  - Complete modeling work
  - Implement data exchange for Rosemount
  - Reference data quality management
  - Improve ease of use issues, make 15926 more understandable, especially to new participants
  - Consensus on modeling methodology
- Fluor – EPC
  - One resource currently working on 15926
  - Primary goal is to facilitate creating 15926 interfaces to commercial software, with the software vendor's active participation and/or EPC contractors
- GlencolS – Consultant
  - Long-time involvement with several different companies
  - Now involved as an independent contractor
  - Find most cost-effective way to meet reference data expectations
  - JORD project, working with FIATECH and PCA and others
  - Focusing on business use and needs of reference data
- Hatch – EPC
  - Has been primarily involved in creating iRINGTools software
  - Now need to develop modeling and reference data expertise
  - Review and understand what is in the reference data
  - Clients are beginning to require 15926 for handover

- IBS – Consultant
- PCA – Standards organization
  - JORD is crucial
  - Need to develop understandable guidelines for creating and contributing reference data
  - Inject more energy into SIGs
    - SIGs have domain experts, whose input is critical to moving forward
- Rosatom – EPC and Owner/Operator
  - Consistent modeling methodology
  - Processes for data handover
  - Engineering requirements for instrumentation reference data
  - Creation of a common catalog system
- Sharecat – Service provider
- Tecgraf – Research institution
  - 15926 seen as potential cost reduction solution
  - Achieve consensus on modeling methodology for Geometry and other
  - Pilot project focused initially on Instrumentation scope
- TechInvestLab.ru – Consultant
  - Data modeling methodology which can be taught to others to build a community of modelers
  - Interested in JORD project, connecting international standards with national and industry reference data libraries
  - Tools that support use of federated reference data
  - Interested in activity modeling as well as project modeling
  - Use and development of modeling tools
- VNIIAES – Consultant
- Woodside – Owner/Operator

- Worley Parsons – EPC
- 

## General Modeling Topics from PCA's Discussion Forum

<https://www.posccaesar.org/discussion/10>

### Class Structure and Hierarchy in RDL

The current RDL class structure has many confusing combinations due to following reasons

- a) There are multiple classes for the same object with different names.
- b) The hierarchical structure is not consistent across the classes created for the similar devices.

Originally posted by Grampurohit

### Modeling Validation

The modelling exercise carried out by Emerson needs to be validated. System of validation needs to be formulated within the community, which will authenticate the model for correct application of ISO 15926 methodologies.

Originally posted by Grampurohit

### Value Maps

With the increasing number of templates and classes the value map is growing enormously. There are following questions on value maps.

- a) Is it essential to construct value map when there is a choice of multiple options as Role type? Is there any alternative way of handling the requirement of value maps?
- b) Also it is not possible to construct value map for every object. Example: items like Material of construction, Process Compounds, Pressure rating can have very large number of combinations as values. How to handle situations dealing with such type of parameters?
- c) Will the value map be available to all the parties involved in data exchange? Example: If Emerson exchanges data with a new company who has established mapping between their database objects and ISO Roles. How will the new company become aware of the values to be chosen for data exchanges using value maps? What if they want to exchange a value not covered in the map?
- d) We have created Value Maps for Material Of Construction, which includes value maps for O'Ring, Enclosure, Flanges and so on. The list has become very long. Now when the user needs to select a particular Material of Construction, whether he will be presented entire list of Material Of Construction each time, he needs to select it?

Originally posted by Grampurohit

## Equipment Centric Model

The current Emerson approach of modelling is Instrumentation centric. However, with the maturing of modelling efforts we feel that the model should be Equipment centric.

The [diagram](#) shows Process Equipment at the centre and the associated equipment (like Instrumentation, DCS, Piping and Electrical Equipment) and operational parameters (Process Data) associated with it. Design of the associated equipment depends on the functioning and operational parameters of the process equipment. In addition to these, there are

- a) Common factors like ambient conditions which impact the design of the associated equipment.
- b) Information of the associated equipment impacting each other. E.g Size of piping will decide the size of flowmeters and control valves associated with particular equipment.
- c) The parameters like Control loop setpoints, Alarm limits, Loop name are perceived as instrument settings. Essentially these are the properties of process and not of a particular instrument though they are implemented using instruments. These properties should be attached to the process and transferred to all the associated supporting equipment. What is the right way of establishing relationship between such properties and the supporting equipment?

The modelling efforts done by various participants involved in modelling of different equipment can be centralised with the equipment centric focus. The common factors will be modelled only once and they can be shared by all. This will also help in building a complete model

Originally posted by Grampurohit

## Specialization of Templates versus Class specialization

We need to come to a position on Template specialization versus Class specialization.

Originally posted by Robin Benjamins

## Query on ClassifiedAssemblyOfIndividual

We have been using ClassifiedAssemblyOfIndividual template with following roles. The query is about the third role i.e. assemblyType. An example of Transmitter and Enclosure assembly relationship is also mentioned.

Role 1: part: ISO 15926-4 POSSIBLE INDIVIDUAL: ENCLOSURE Role 2: whole: ISO 15926-4 ARRANGED INDIVIDUAL: TRANSMITTER Role 3: assemblyType: CLASS OF ASSEMBLY OF INDIVIDUAL: TRANSMITTER has ENCLOSURE

Having mentioned part and whole, it is already known that "TRANSMITTER has ENCLOSURE". The template would carry more meaning if the 'type of assembly' is mentioned against "assemblyType" such as rivetted, press-fitted, screw-tightened and so on.

We would be simply creating a class named "TRANSMITTER has ENCLOSURE" in the sandbox, unnecessarily.

Alternately the third role can be deleted altogether.

Originally posted by Grampurohit

## **Instrumentation Modeling Topics from PCA's Discussion Forum**

<https://www.posccaesar.org/discussion/11>

### **Virtual / Soft Relationships**

Emerson has made an attempt to prepare a vendor neutral bubble diagram for [.Process Control System](#)

The relationship between Cabinet, Controller and Input Output Circuit Boards can be established easily as Assembly or Connection.

However, relationship between a Process Control System, Control Algorithm, Function Blocks (Not Reflected in the diagram) and the parameters is complex (mostly virtual).

Need to develop necessary templates to suit this requirement.

Originally posted by Grampurohit

### **Role 2 of ClassificationOfIndividual**

In ClassificationOfIndividual template, Role 2 is Possible Individual.

However, Possible Individual being a very generic term, it has to be made more specific, while specializing, pointing to the exact class.

For Example, when we say TRANSMITTER Output Signal, the possible options are 4~20 mA, 1~5 VDC etc.

Ideally Role2 should be a (Super) Class that binds 4~20mA, 1~5 VDC etc. together. Placing ISO 15926-4 POSSIBLE INDIVIDUAL as Role2 makes it too generic, indicating any Possible Individual can be a TRANSMITTER Output Signal.

Originally posted by Grampurohit

### **Direction / Orientation / Position Template**

We need to model the Direction / Orientation / Location of certain devices or parts of devices or Process Fluid. For Example,

FLUID STREAM Direction (Top to bottom / Bottom to Top) ACTUATOR Orientation HAND WHEEL Position (Top / Side)

Is it appropriate to use ClassificationProperty template in such cases?

Originally posted by Grampurohit

### **Inlet / Outlet Pressure of In Line instrument**

A Flow meter (Vortex, Mag or Mass) is an In-Line instrument. Inlet / Outlet Pressure (Min/Max/Oper) of the Fluid Compound needs to be specified while designing a Flowmeter. Same applies to a Control Valve Body.

Although the said Pressure can be modelled as a Direct Property of the Fluid Compound, the words 'Inlet' and 'Outlet' are specific to the In-Line Instrument or Valve.

In that case, Inlet /Outlet Pressure Min/Max/Oper becomes a Indirect property of In-Line Instrument and Valve.

How do we handle this without duplication of model?

Originally posted by Grampurohit

### **'If - then - else' situation in Modeling**

Thermowell has 'Thermowell Process Connection'. EPC specifies Thermowell Process Connection Type as – Threaded or Flanged.

If it is 'Threaded', the EPC needs to specify only Size and Rating.

However, if it is 'Flanged', the EPC needs to specify Type, MoC, Size and Rating.

How to handle this "If-Then-Else" situation in Modelling?

Originally posted by Grampurohit

### **Modeling Instrument Certificates**

Modelling of Certification is a major issue, as certificates applicable to a device / instrument are large in variety. A vendor needs to know which certificate(s) are applicable to each individual Tag. It is more like a "Select the checkbox against the certificate you want, in the list"

This is not blanket information. How do we take care of this in modelling?

Originally posted by Grampurohit

## Classifying Transmitters

Primarily the transmitters are classified based on the parameters like Level, Pressure, Flow and Temperature at the top. The transmitters measuring each type are further specialised based on their working principle like:

a)Flow: Vortex Flowmeter, Magnetic Flowmeter, Coriolis Flowmeter

b)Pressure: DP Transmitter, Gauge Pressure Transmitter

DP transmitters are pressure transmitters in principle but they are used to measure Flow and Level with minor modifications in the construction. (Flow measurement requires Square root extraction facility or Level measurement requires Zero elevation / Suppression as add on feature).

i) What is the correct way of showing the relationship between Level Transmitter Class and DP Transmitter or Flow Transmitter Class and DP Transmitter?

ii)Remote Seal transmitter is a specialisation of Pressure / DP Transmitters. Where should remote seal transmitters appear in the hierarchy of bubble diagram?

iii)Multi variable transmitters are instruments which can measure more than one variable at a time. How should these be classified?

Originally posted by Grampurohit

## Presentations

Presenter overview can be found at <https://www.posccaesar.org/wiki/SigInstWorkShops>, and all slides from presentations are available at <https://www.posccaesar.org/svn/pub/SIG/Instrumentation/WS/>

## JORD (Joint Operational reference Data) Project (Ian)

- “Joint” refers to PCA and FIATECH
- Ref. Ian’s presentation
- The Compliance guideline document is being revised
- Manoj raised a question about whether the following examples fall within the JORD scope:
  - “Punning” – for example defining Part 4 classes to represent Part 2 entities
  - Mapping from a Part 7 role type to a Part 8 implementation type, such as rdf:List



## Standardization Process (Magne)

- PCA standardization process, not just 15926
- Ref. Magne's presentation
- Discussion of how many aspects to include in a class, i.e. "when to stop"
  - An aspect is, for example, size, material, bend angle, certification, wall thickness, etc. etc.

## EqHub Modeling Overview

Note: add entity types to figure for:

- Functional – FunctionalPhysicalObject
- Specification – FunctionalPhysicalObject?
- Catalog/Product – FunctionalPhysicalObject?
- Individual – ActualIndividual? MaterializedPhysicalObject?

Need Part 2 class diagram showing relationships between these four.

Start with a set of statements that you want to make

Domain experts define what data is needed for interoperability

Modeler determines how to do it

Keith: dozen base templates cover 95%

In 15926 an instance is a record in a database, not a member of a class.

Rahul: would like to get corrected entity types for 10 classes and properties.

## Emerson Modeling Overview

Q: Does 15926 and iRING take care of Change Management? Does it have a built-in Revision Control?

- Question should refer to iRINGTools, iRING is branding for "full conformance to ISO 15926"
- 15926 supports full lifecycle/temporal data
- 15926 is generic

RDL issues: create an RDS Support ticket at <http://rdssupport.posccaesar.org/wiki>

Interoperability?

Recommend reading Part 2 Section 4

## Bentley

- Class Editor has extensions to build Part 4 schemas and map to Part 7 templates
  - Can't add reference data back to RDS/WIP because required services don't exist yet
- Open Plant ISO 15926 Instance Plug-in is used to move data according to mapping
- Templates are now visible to users (previously templates were hidden from users in favor of native object oriented view). However template problems will not keep products from working.
- The Bentley Class Editor was provided to FIATECH members several years ago. This is no longer necessary because there are now other editors available to work with 15926 reference data.
- Bentley's preferred approach is to base application schemas directly on 15926 rather than mapping.
- OAV – Object, Attribute, Value. Predates triple-store concept.
- OpenPlant schema is based on 15926 and is used to integrate Bentley products
- Class Editor Demo
  - Federated search is supported
  - Tool tip for RDL classes shows Definition
  - Advanced options:
    - Filter by entity types
    - Specify what metadata to search (e.g. label, definition...)
    - Approval status
    - Limit to members of a specified class of class
  - Can build new schemas or update existing ones
  - Pick templates from those available in the federated reference data and map EC Schema values to template roles
  - Template inheritance is shown
  - Focusing on improving ease of use for engineers – reducing number of clicks required
  - Example: mapping for Axsys, an older product that is not based on 15926.
  - Bentley is replacing their older app-to-app product integrations for internal products with 15926-based mappings

- Specialized templates
  - Bentley wants to use base templates where possible
  - Templates that are possessor-specialized will show with class
- Navigation through relationship templates
- Expectations/immediate needs
  - See action items
- Magne: Templates are NOT everything. It is hard to interoperate if different templates are used.

## Bechtel

Ref presentations

- Individual vs class
- Definition – normative
- Description – informative

## Thursday

### Methodology Discussion (Magne)

- Mapping – representing a data set using signatures and reference data
- EPISTLE Principles
  - Attributes should be entities (classes)
  - Manoj will find and send out EPISTLE principles doc
- Why specialize, classify
- Everything that applies to a class applies to its subclasses
  - This is different from the OO concept of inheritance because inheritance can be overridden
  - There are more rules/constraints for the subclass than for the superclass
- Individuals do not have subclasses or superclasses because they are not classes
- You can never specialise an individual
- What things are! The underlying nature of the object.

- Relationships is between individuals (level 0), Class of relationships between classes (level 1) etc.
- A car is a specialization of [vehicle](#). So any car is also a vehicle, but not every vehicle is a car. Therefore, a type needs to satisfy more constraints to be a car than to be a vehicle.
- class of class – a grouping mechanism
- Explicit and implicit information in sources

## Template Specialization

### Pro:

- Increased precision
- Ease of use for mapper
- Improved validation
- Move decisions earlier, instead of being made at project, multiple times

### Con:

- Excessive RDL expansion
- May become redundant if class specialization covers

ClassOfRelationshipWithSignature is for generic relationships. It *may* be untyped, so it works for “catch-all” relationships.

## Friday

### iRINGTools

- Demo of RESTful services
  - Graph can be returned in XML, DTO, RDF
- Note that specialized and their parent templates share the same role IDs, and role IDs are globally unique, not shared with identically named roles in other templates. Need to look into altering queries to remove template IDs so that specialized and parent templates can interoperate (!)

### EqHub (continued)

- Example
  - Actuator service

- Sharecat allows these values
  - Modulating
  - On/Off
  - Stepping
- Create specialized actuator classes
  - MODULATING ACTUATOR
  - ON-OFF ACTUATOR
  - STEPPING ACTUATOR
- Create CofC ACTUATOR SERVICE CLASS
  - Members are each subclass
  - Use this for role type to specify the type
    - Role filler will be any member of this class
- Create classes for string values
- 4-20 mA can be a protocol to which instruments are designed to operate, or it can be a current range