# What is ISA108 About ?

- How is ISA-108 structured ?
- Why are iSA-108 Intelligent device management (IDM) standards needed ?
- Can existing automation systems Solve these problems ?
- Proposed Owner/Operator’s Critical Information Repository (CIR).
- Proposed Work Process standards.
- Integration with other “Risk Based” standards.
- What is new and useful about iSA-108 ?

# How is ISA108 Structured ?

ISA 108 describes how to apply Intelligent industrial Devices (IIDs) including the Design, Operation and Maintenance of control & Information systems that contain them.

- **Part 1** describes **concepts**, models, and terminology. This section was Issued as ISA108 and is close to submission as IEC 63082-1.
- **Part 2** is being drafted, and will contain normative content (**what to do**).
- **Part 3** will contain implementation guidelines (**how to do it**) including Work Processes, Procedures and Tasks and who should execute these.
- **Part 4** will contain implementation **examples** including vertical industry examples (like oil refining) or product type examples (such as control valves).

# Why is ISA 108 Standard Needed?



Intelligent Industrial Devices (IIDs) can bring significant benefits by reducing spares and predicting failures, however very little of this potential has been realized.

Major implementation problems include:

- Added complexity has meant that IIDs are often never fully implemented or adequately maintained.
- Vendors have failed to supply, support and update communication and configuration software, particularly for other's products.
- There are examples of industrial disasters costing $ billions that have involved IID Implementation failures.
- Unnecessary shutdowns costing $ millions have been caused by failure to use available IID Health and Diagnostic information.

# Why is ISA-108 Standard Needed?



As IIDs become more complex, management of associated data and design decisions is increasingly difficult.

- IIDs may require selecting and maintaining hundreds or even thousands of data values whose sheer volume is challenging
- The reasons for design choices is often lost between Engineering and Operations.
- Tag and Loop Data may be corrupted as it is passed between incompatible Engineering design systems, Construction systems, Operations and Maintenance systems.
- Plant maintenance often cannot determine whether “like-for-like” replacement of IIDs is possible.

# Why is ISA-108 Standard Needed?



Many companies have found that accuracy of IID configuration deteriorates with time, with configuration errors in 30% or more of their devices after a few years of operation.

- Configuration errors may include:
  - Simple Mistakes – special technician training and/or certification for IIDs is not recognized or prioritized (unlike welding for example).
  - Quick Fixes – Hand-*held programing devices facilitate "ad-hoc" modifications, but a "back shift" change may stay for years.*
  - Uncoordinated Changes – Field devices may be changed without updating higher level systems (e.g. DCS, SCADA, SAP, etc.)
  - Undocumented Changes – Hand-held programmers may be used to *change configurations without updating central "approved" records.*
  - Lack of Consistency – IID replacement or repair procedures are often not documented or enforced.

# Why is ISA-108 Standard Needed?

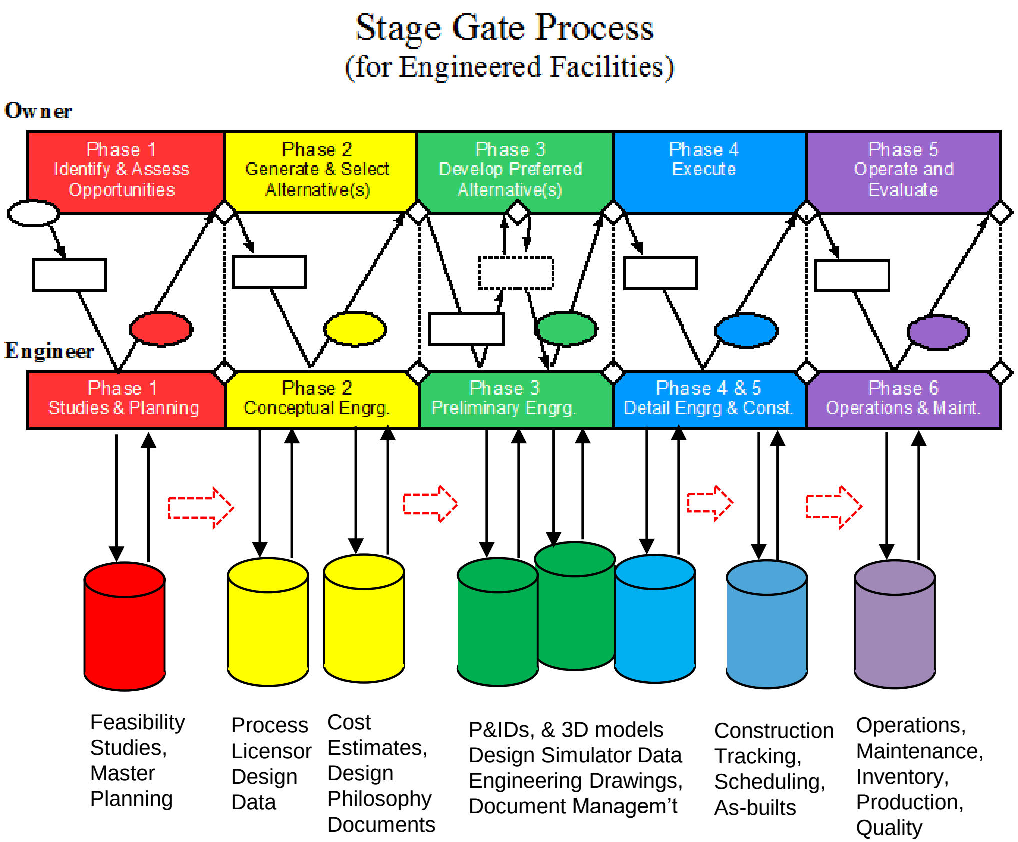


IIDs often require support from the supplier, or specialist services contractors, for example:

- Custody transfer meters that require regular certification or monitoring
- Sophisticated diagnostic devices like vibration analyzers that require specialists to interpret
- Boiler Stack Gas Analyzers (e.g. boiler optimizer services offered remotely)

However for cyber security reasons, site personnel are reluctant to allow remote access as there is little guidance on how to manage access to these devices.

# Can Existing Engineering Automation Tools Solve the "Data Management" Problem ?



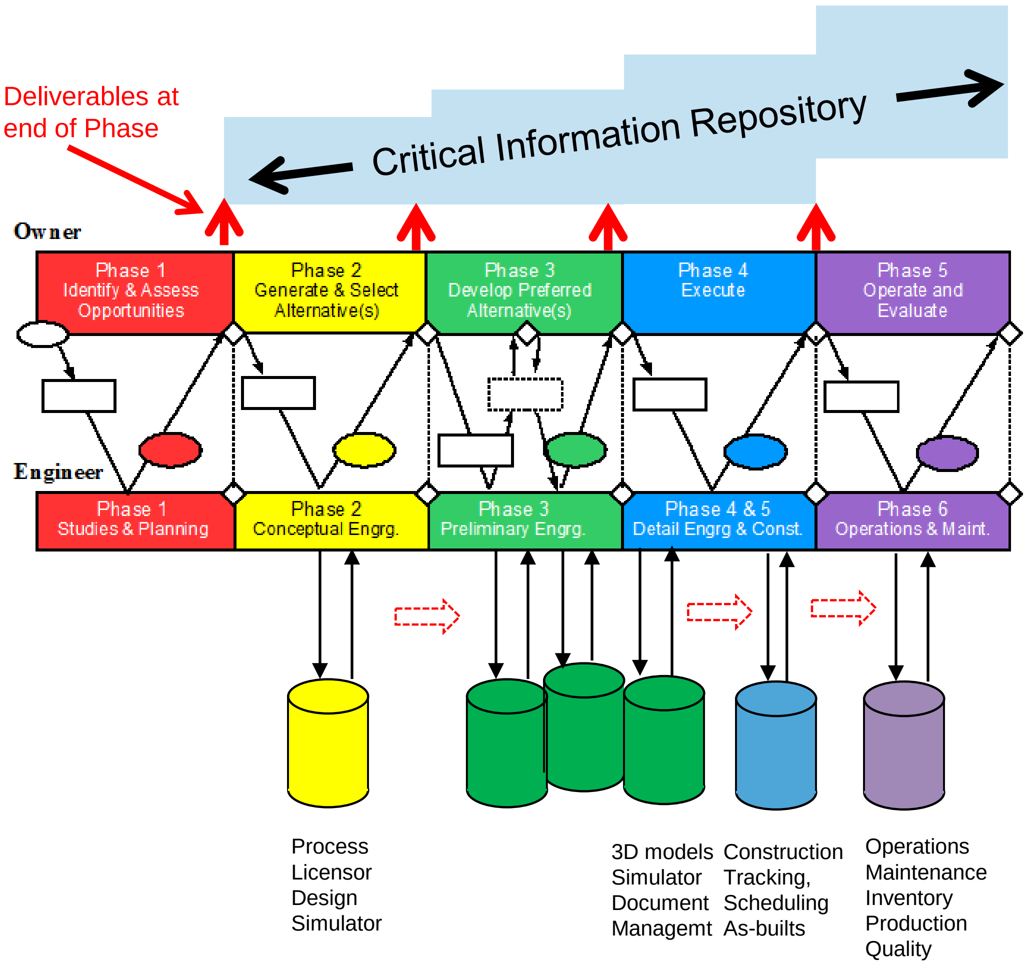

Data is developed in "silos" and is often not effectively transferred between Engineering, Construction & Operating Phases

# Can Existing Engineering Automation Tools Solve this Problem ?

The large volume of project data requires use of automation tools (e.g. CADD, Databases, Modeling, etc.). Large projects MUST use them, so ISA 108 requirements MUST integrate with these tools as well as "traditional" engineering procedures.

- However, the existing automation tools used in each Phase and by each Discipline are usually different and incompatible.
- *Existing automation tools provide no "single source" of approved* design information.
- Thus, existing automation tools actually make IDM data transfer between Phases and Organizations even more difficult, time consuming & expensive.

# "Critical Information Repository"
# Is an Example IID Data Management Solution




CIR is controlled by facility Owner/Operator.

CIR uses Standard data format

Work processes insure validity of CIR changes.

Data is developed in "silos" and is often not effectively transferred between Engineering, Construction and Operating Phases

# Example CIR IID Data Management Solution

This Critical Information Repository (CIR) will be the responsibility of the Owner/Operator and will span all Enterprise Phases.

CIR will hold at least the key information on all "High Risk" or "High Impact" Intelligent Devices (including SIS/SIL & CyberSecurity).

The CIR data will be uploaded at the end of each enterprise Phase (contractual requirement from all subcontractors).

Loading IID data to the CIR, and changes to approved CIR data requires formal work processes, including technical & management approvals (Engineering Change Control).

Consistent Engineering Data formats (e.g. STEP) and Multi-vendor field communication protocols (e.g. FDI) are required.

# Example CIR IID Data Management Solution

An audit of CIR data is required at end of each enterprise phase, and after major maintenance turnarounds and upgrades.

The CIR will provide a full historical record for each “Service Tag, including:

- Original approved design basis, specifications, configuration data /information, etc.
- *Design changes with reasons and approvals (including “As-builts”)*
- Maintenance events including failures and in-kind replacements
- Modifications by maintenance and site engineering, including approved designs and approvals.
- Current approved configuration (for comparison with active field configuration).

# Other IID CIR Implementation Alternatives

There are many ways that a CIR could be implemented ranging from simple to sophisticated, depending on the scale and complexity of the facility or enterprise.

- A small liquid storage and loading site with a few dozen tags might use a spreadsheet or even a paper system (file cabinet).
- *A centralized "internal cloud" database might be implemented to* support multiple large facilities such as refineries or pipelines.
- *A "block chain" or a "mediated" system might enforce Engineering Management of Change as part of an "Asset Management System.*
- Whatever technology is chosen, it must be implemented as part of a coordinated Intelligent Device Management (IDM) program.

# What do ISA 108 Work Processes look like ?

They are similar to existing engineering and maintenance Work Processes and may vary in detail and format as determined by each Enterprise.

Work processes are divided into “Pools” by Phase and Stakeholder

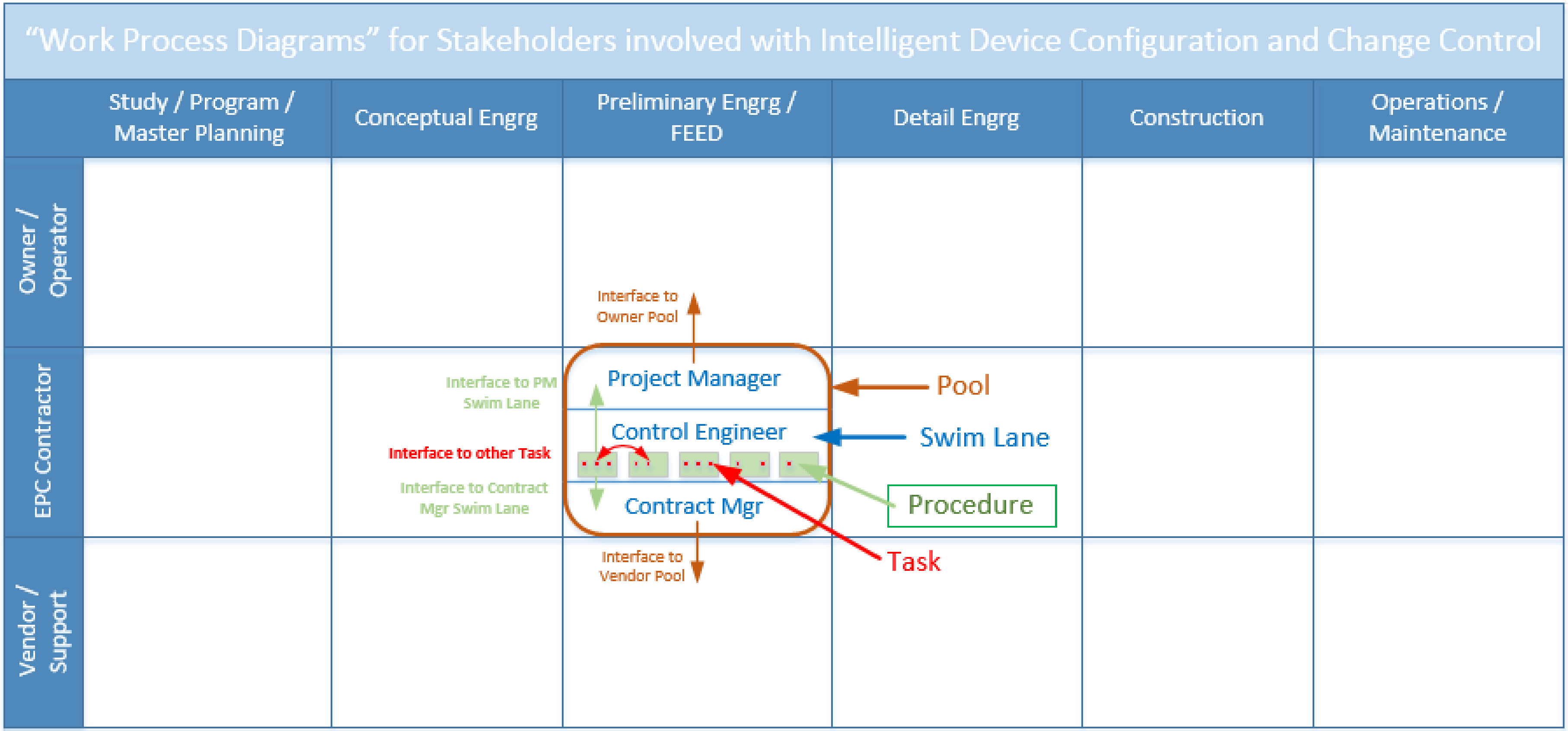
Pools are Divided into “Swim-lanes” by Role within the Stakeholder organization.

Swim-lanes are divided into Procedures that produce Deliverables (like Drawings, Work Permits, etc.)

Procedures are composed of Tasks that are assigned to one person and can be completed without management supervision.  In some cases, certified qualifications are required for the person who performs a Task.

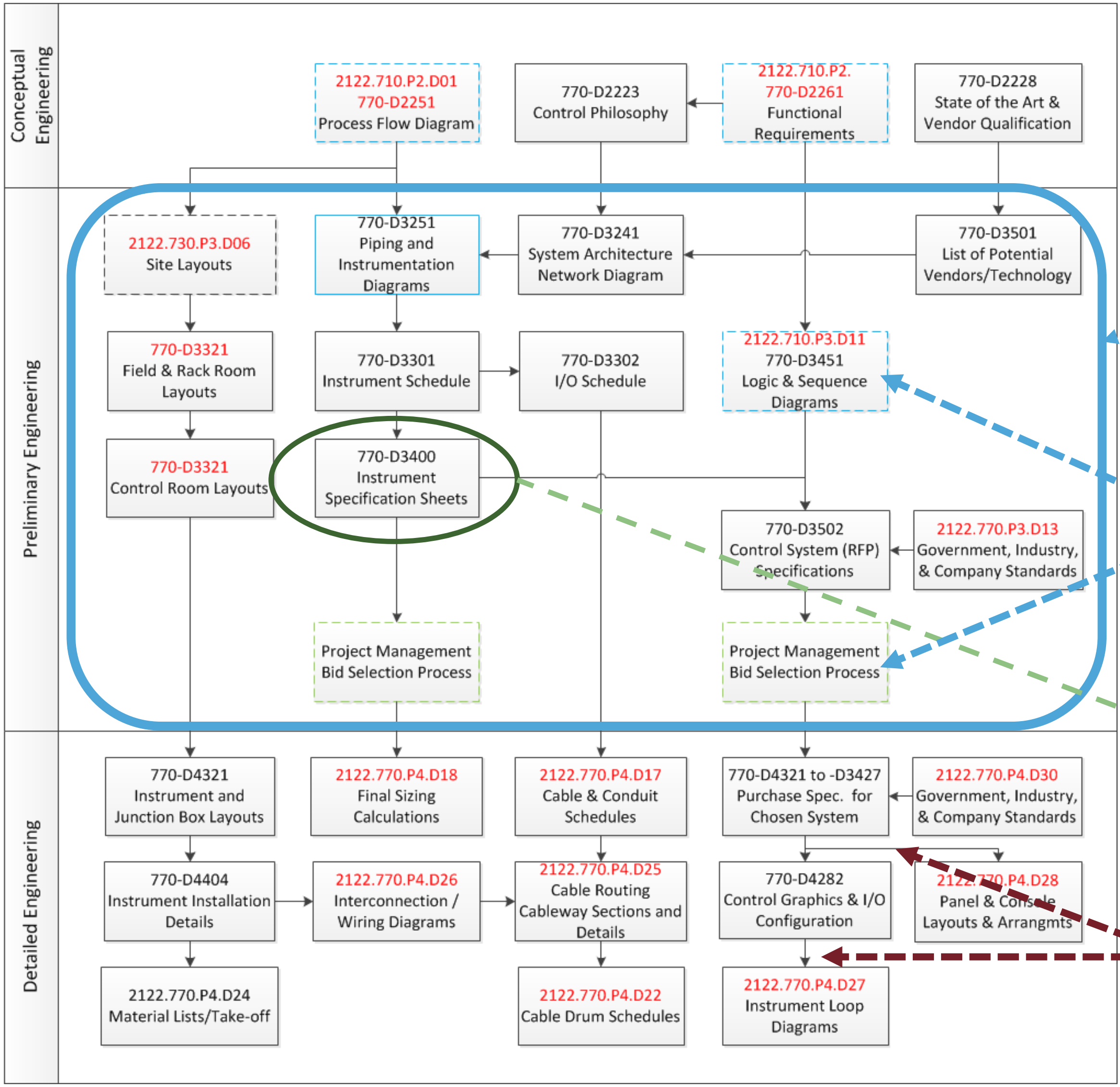
Interfaces are defined between Pools, Swim-lanes, Procedures and Tasks

Various Forms, Checklists, Standard Designs and Documents, etc., may be used by Pools, Swim-lanes, Procedures and Tasks.




- Each "cell" above represents a Work Process "Pool" for one Enterprise Phase (e.g. Preliminary Engrg/FEED) and one "Stakeholder" (such as an Owner/Operator, EPC or a Vendor).
- Each Pool may have several "Swimlanes" for Roles associated with that Stakeholder during that Phase (e.g. Control Engineer, Engineering Mgr, Contract Mgr., etc.)
- Each Swimlane (Role) includes multiple Procedures and each Procedure is approved by a single "Role Manager".
- Procedures are typically associated with "Deliverables" although there may be more than one Deliverable per Procedure or more than one Procedure per Deliverable. Deliverables are formally approved and "issued".
- Each Procedure includes one or more Tasks (which are accomplished by an individual without supervision).
- A Task must be assigned to an individual that is responsible for it's completion, even though the assistance of others may be required (e.g. a Task may be assigned to a Supervisor).
- Tasks or Procedures may have "interfaces" to other Tasks, Procedures or Swimlanes
- Interfaces between Tasks are informal, between Swim Lanes are Proceduralized, and between Pools are formal.

# Example Control System Procedures & Deliverables




Control Systems Swim Lane for Preliminary Engineering

Interfaces to other Swimlanes (Process Engrg & Project Management)

Control Systems Preliminary Engineering Procedure

Deliverables will be connected with Procedures and Work Processes.

# Each Deliverable may have:

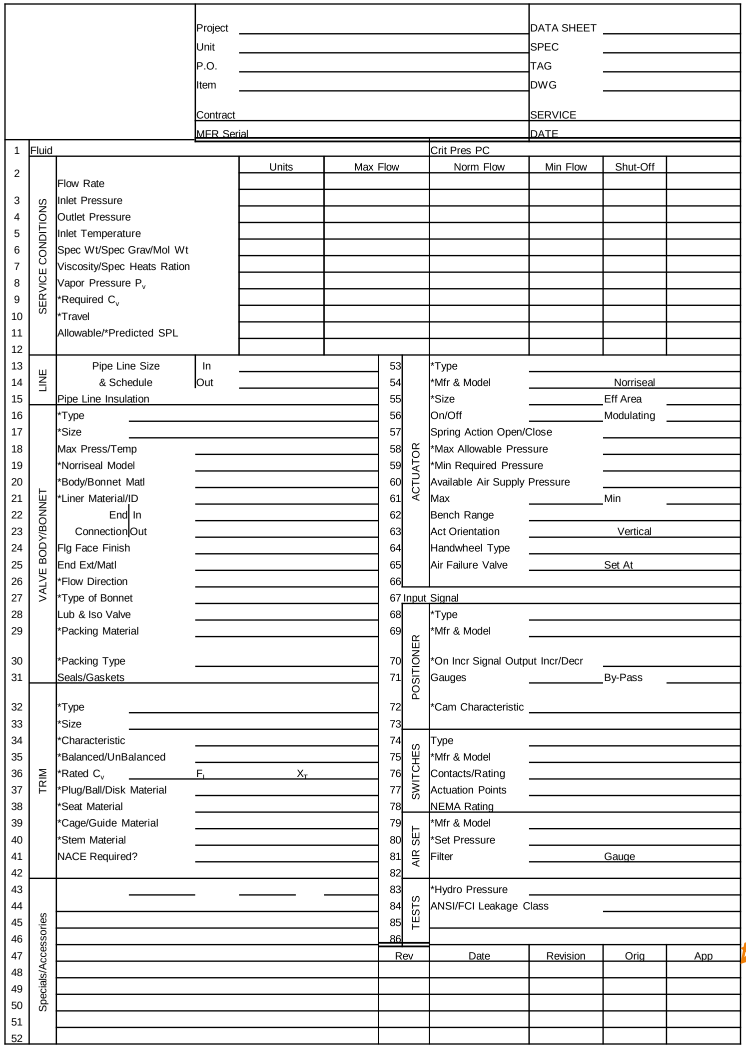
Each Deliverable may have associated Work Processes, Procedures and Tasks, and these may in turn have:

- Forms (e.g. ISA-12 Specification Sheets)
- Work Flow Diagrams
- Example Drawings, “Go-by” Documents, Reference Designs, etc.
- Metrics including KPIs

ISA 108 will use standard Engineering forms such as ISA Instrument Specification Sheets or API Pump Sheets as a base, but will add additional data.

Deliverables may be eliminated and the associated Procedures, Forms, etc. will also be deleted.

# Using an IID May add Hundreds of Data Elements to the Instrument Specification


Project
Unit
P.O.
Item
Contract
MFR Serial
DATA SHEET
SPEC
TAG
DWG
SERVICE
DATE

1 Fluid | Crit Pres PC
2 | Units | Max Flow | Norm Flow | Min Flow | Shut-Off
SERVICE CONDITIONS
3 Flow Rate
4 Inlet Pressure
5 Outlet Pressure
6 Inlet Temperature
7 Spec Wt/Spec Grav/Mol Wt
8 Viscosity/Spec Heats Ration
9 Vapor Pressure $P_v$
10 *Required $C_v$
11 *Travel
12 Allowable/*Predicted SPL

LINE
13 Pipe Line Size In
14 & Schedule Out
15 Pipe Line Insulation

VALVE BODY/BONNET
16 *Type
17 *Size
18 Max Press/Temp
19 *Norriseal Model
20 *Body/Bonnet Matl
21 *Liner Material/ID
22 End In
23 Connection Out
24 Flg Face Finish
25 End Ext/Matl
26 *Flow Direction
27 *Type of Bonnet
28 Lub & Iso Valve
29 *Packing Material
30 *Packing Type
31 Seals/Gaskets

TRIM
32 *Type
33 *Size
34 *Characteristic
35 *Balanced/UnBalanced
36 *Rated $C_v$ $F_L$ $X_T$
37 *Plug/Ball/Disk Material
38 *Seat Material
39 *Cage/Guide Material
40 *Stem Material
41 NACE Required?
42

Specials/Accessories
43
44
45
46
47
48
49
50
51
52

ACTUATOR
53 *Type
54 *Mfr & Model Norriseal
55 *Size Eff Area
56 On/Off Modulating
57 Spring Action Open/Close
58 *Max Allowable Pressure
59 *Min Required Pressure
60 Available Air Supply Pressure
61 Max Min
62 Bench Range
63 Act Orientation Vertical
64 Handwheel Type
65 Air Failure Valve Set At
66
67 Input Signal

POSITIONER
68 *Type
69 *Mfr & Model
70 *On Incr Signal Output Incr/Decr
71 Gauges By-Pass
72 *Cam Characteristic
73

SWITCHES
74 Type
75 *Mfr & Model
76 Contacts/Rating
77 Actuation Points
78 NEMA Rating

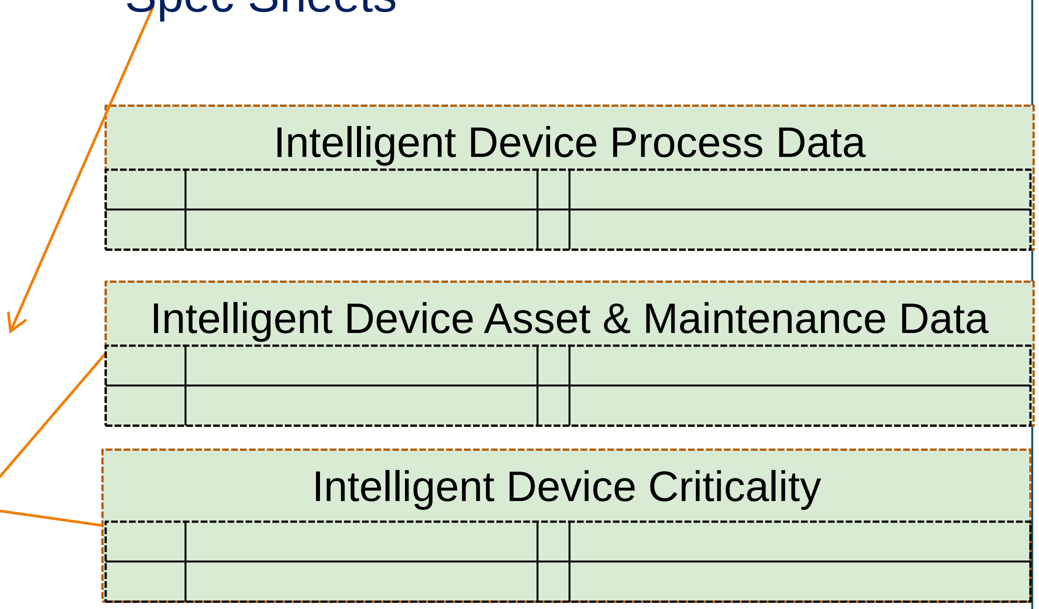
AIR SET
79 *Mfr & Model
80 *Set Pressure
81 Filter Gauge
82

TESTS
83 *Hydro Pressure
84 ANSI/FCI Leakage Class
85
86

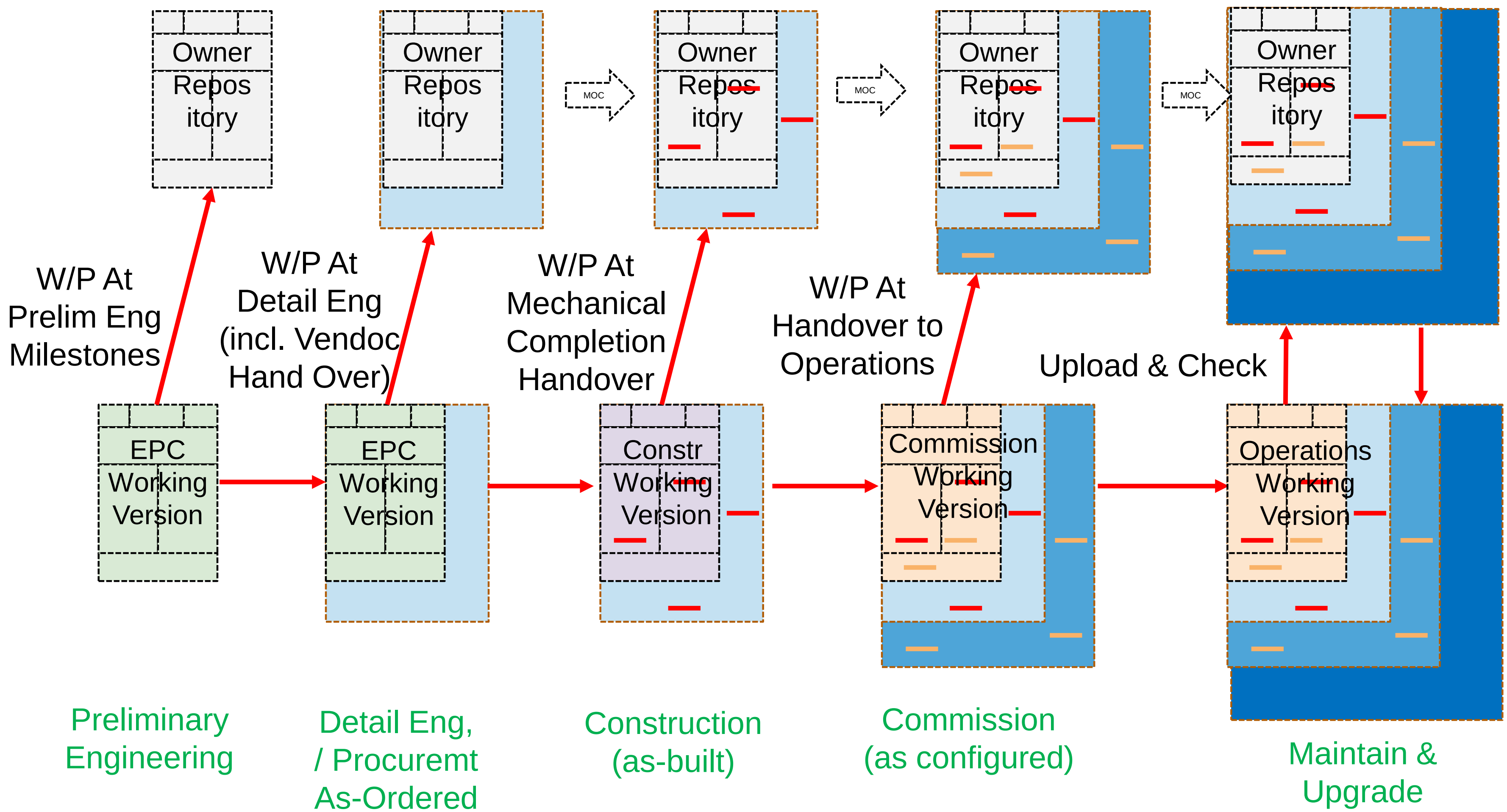
Rev | Date | Revision | Orig | App

As with other Spec Sheet data, fields may be filled in by different Roles (e.g. Process Engr. or Controls Engr.), and during different Phases.

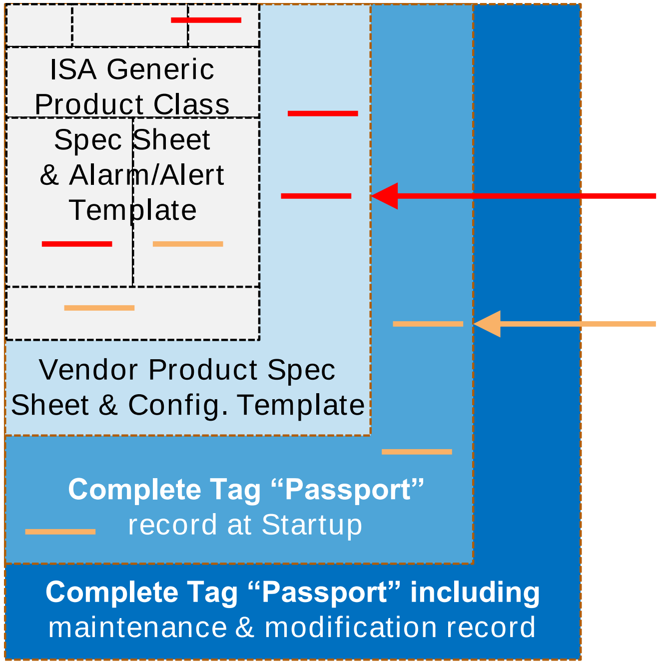
For more information, see OGI Pilot Spec Sheets



# Data is Delivered to Owner/Operator at the end of each Enterprise Life Cycle Phase



# Development of IID Data During Each Phase




Colored lines indicate changes

1) by EPC during Engineering and Construction Phases,
2) by Owner at hand-over at the end of each Phase, and
3) possibly at milestones during each phase.
4) Note that once accepted to the CIR, changes cannot be made without an auditable Engineering Management of Change procedure.

# Integration of Other Risk-based Engineering Standards and Work Processes

- ISA 108 must integrate with existing control system standards and associated Work Processes, including:
  - ISA 84 (Safety Instrumented Systems),
  - ISA 95 (moving control domain data to MES)
  - ISA 99 (Industrial Cyber Security),
  - ISA 100 (Industrial radio LANs, etc.)

- ISA 108 is structured to be similar to ISA 84 to facilitate management of intelligent SIS/SIL devices and use by control engineers familiar with ISA 84, etc.

# Integration of Other Risk-based Engineering Standards and Work Processes

- ISA 108 uses a similar Risk Assessment methodology. When the risk of a certain device is assessed, it could be:
  - a safety system that must work very reliably (ISA 84),
  - a cyber security risk (ISA 99) or
  - a risk of major financial loss that could be prevented by IID maintenance monitoring and diagnostics (ISA 108).

| RISK ASSESSMENT MATRIX | | | | |
|---|---|---|---|---|
| SEVERITY PROBABILITY | Catastrophic (1) | Critical (2) | Marginal (3) | Negligible (4) |
| Frequent (A) | High | High | High | Medium |
| Probable(B) | High | High | Medium | Medium |
| Occasional (C) | High | Medium | Medium | Low |
| Remote (D) | Medium | Medium | Low | Low |
| Improbable (E) | Medium | Low | Low | Low |

# Integration of Other Risk-based Engineering Standards and Work Processes

- The same risk assessment Procedure can decide if a risk requires ISA 84, 99 or 108 (or possibly all three).
- If ISA 84 or 99 are required, the user is referred to the appropriate standard, however, neither of these define the full set of IDM requirements (and IIDs are usually involved).
- ISA 108 procedures may then refer the user to appropriate other standards, and/or require procedures defined in ISA 108.
- *An Alarm/Alert "Template" (with appropriate "defaults") will be* automatically determined from the Risk Assessment. Correctly *selected defaults should dramatically reduce the "Alarm/Alert Flood" experienced when vendors "turn on everything" by default.*

# What is New and Useful about ISA 108 ?

## ISA 108 will provide:

- Standardized Work Processes/Procedures/Tasks for managing the continuity of IDM information through all phases from design to operations and maintenance.
- Standardized Tasks (within Work Processes) requiring special training and certification.
- Examples of Roles associated with Work Processes and Tasks, and interfaces between Roles including “Swim Lane Charts” and Work Flow Diagrams. These examples (and those that follow) will be structured by “Industry” (e.g. Oil Fields or Pipelines) or Technology (e.g. Smart Valves).
- Example(s) of how a Critical Information Repository can be used by the Owner/Operator to manage IID Information.
- Example standard formats for Engineering data (e.g. STEP, ISO, etc.) to be defined in the Enterprise IDM Program.

# What is New and Useful about ISA 108 ?

## ISA 108 will provide:

- Example procedure for regular upload and comparison of actual Field Device Configuration and Authorized version (in CIR).
- Examples of use of standard multi-vendor field device communication protocols (e.g. FDI, OPC UA, etc.) to be used in the Enterprise IDM Program.
- Work Processes for Management of Change (MoC) for IID Information during Engineering and Operations Phases.
- Requirements and examples for setup of an IDM Program and ongoing management of such a Program.
- KPI's and Audit requirements for Intelligent Device Management Programs.

# What is New About ISA 108 ?

ISA 108 will provide:

- Risk-based Work Processes that integrate with other engineering standards, and eliminate Alarm/Alert “flooding” early in design.
- A way for maintenance to immediately determine whether they may immediately replace an IID “like-for-like” or only after engineering”.
- A way to facilitate “handover” of information between Phases (especially between Project and Operations phases).
- A way to detect and address inadvertent changes in IDM configuration and/or Facility Design Parameters at any Phase.
- Implementation examples for different industries