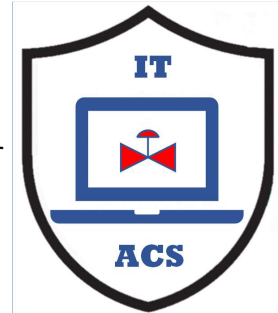




Level 1 & 2 Field Device and Network Design

MLM-078-B

Industry	– All
Principal Role	– Owner, EPC, and Vendor
Professional Role	– Control Engineer
Enterprise Phase	– Design



Turn on your audio and
click start to begin video

START

This MLM describes ways to engineer Intelligent Industrial Devices at Level 1 and 2 of the PERA model using the ISA 108 standard and recommended data management practices.

Click the NEXT button when you are ready to advance to the next slide.

How to Engineer Intelligent Industrial Devices and Networks?



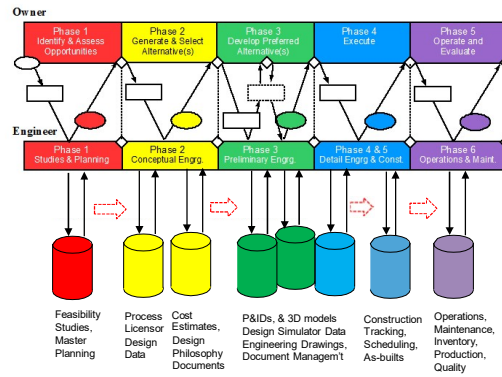
- Can existing automation practices and systems address the problems of Intelligent Industrial Devices (IIDs) ?
- Owner/Operator's Critical Information Repository (CIR).
- Proposed new Work Process standards.
- Integration with other "Risk Based" standards.
- What is new and useful about ISA-108 ?



Can Existing Engineering Automation Tools Solve the “Data Management” Problem ?



Stage Gate Process
(for Engineered Facilities)



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



Can Existing Engineering Automation Tools Solve this Problem ?

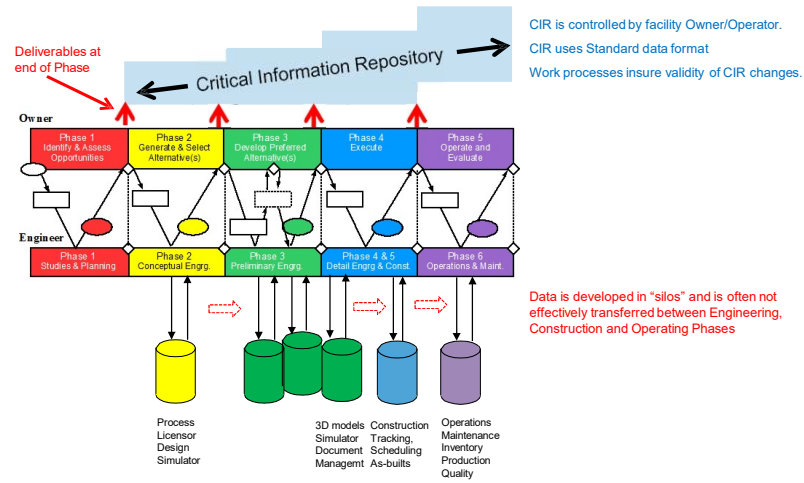


The large volume of project data requires use of automation tools (e.g. CADD, Databases, Modeling, etc.). Large projects must use them, so ISA 108 requirements must integrate with these tools as well as “traditional” engineering procedures.

- 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



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.)

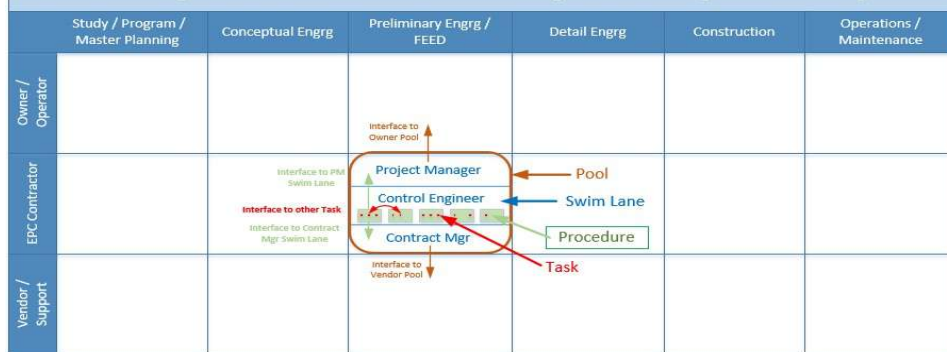
Procedures are composed of Tasks that are assigned to one person and can be completed without management supervision. In some cases, certified qualifications are required for the person who performs a Task.

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.



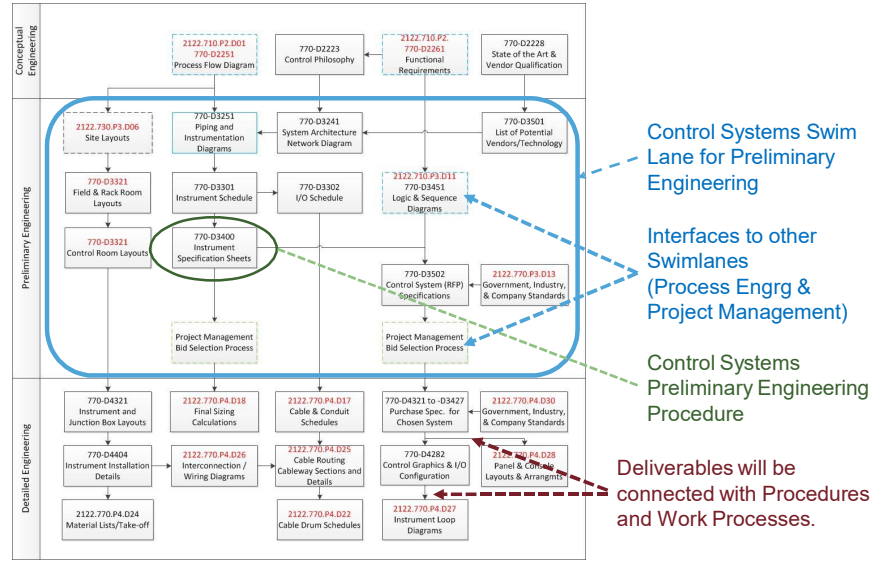
"Work Process Diagrams" for Stakeholders involved with Intelligent Device Configuration and Change Control



- 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.

(c) Enterprise Consultants International, Ltd.

Example Control System Procedures & Deliverables



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.



[illegible]

For more information, see OGI Pilot Spec Sheets

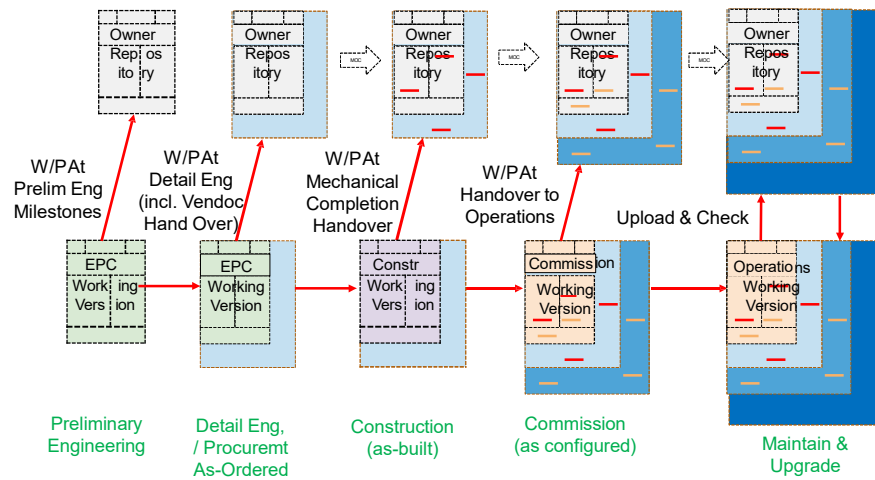
Intelligent Device Process Data			

Intelligent Device Asset & Maintenance Data			

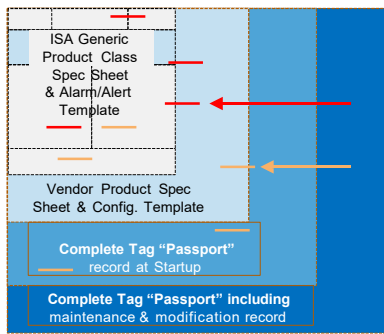
Intelligent Device Criticality			



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.*



Author



Gary has more than 40 years of experience with enterprise integration and optimization projects, including PERA master planning and project management.

As one of the initial authors of the PERA Handbook of Master Planning, he has used PERA Enterprise Architecture and Master Planning methodologies throughout his career including control and information systems for oil production, pipelines, refining and marine loading, petrochemicals, coal, gas, and oil-fired power plants, polyethylene, ammonia, explosives, paint, pulp and paper, food and beverage, and pharmaceuticals. LNG facilities included world-scale arctic, European, and US Gulf coast complexes.

infrastructure facilities included Fire, Police, and Emergency Response systems for major US cities, as well as emissions reporting and trading systems for more than 100 US Power Plants,

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