The New Emerging Best Practices for Digital Asset Handover by EPCs to Owners

Mac McGarrigle
Business Process Consultant
HxGN PPM Digital Transformation Practice
CFIHOS is finally a pragmatic compilation of Industry Standards (ISO 15926, ISO 14224, API, ISA, IEEE, STEPLIB, Posc Caesar etc.)

- CFIHOS is a joint project between USPI (NL) and ENAA (Japan)
- Started with Shell contribution of the CFIHOS Master Class Library (V1.0). This was created using Intergraph Smart ® Information Management and Design Tools. Already in place and working well - 60+ Projects, 10+ Assets. Compliance to CFIHOS handover is a start-up requirement.
- ExxonMobil, BP, Total, Chevron actively contributing content – Giving up IP
- Under the umbrella of an official standards body based in NL: USPI-NL
• 98% of Mega-Projects incur cost overruns or delays, with average cost increases of 80% over budget and average slippage of 20 months from the original schedule
• Operational Readiness costs 3% of CapEx
• Traditional Handover is 2% to 4% of CapEx
• Reduce risk to startup and ramp-up schedule
• Remove risks to cost overruns
• Total visibility into the Project
• Need to prepare for future reuse of data

Vendor Data Found in a Shipping Container

Small Refinery Upgrade
• “We requested different handover requirements on 2 projects with the same EPC”
• “As Operations we want consistent handover so we know what we are getting and that it is complete to support Operational readiness”
• “I (‘as Global Engineering Manager’) want to tell the Projects what they have to deliver. I don’t want them to be innovative or even the EPC be innovative. If they want it changed they have to change the standard.”
• “We need a basis to build ‘Big Data’ implementation we are planning.”
• “Operations complain that they never get what we really need.”
“Standardization on CFIHOS will help project work process optimization due to standardization of tag and document types. Helping estimation, project controls, project execution efficiency, project handover etc.”

“The O/O client knows what they get and helps with expectation management”

“The work force will have a standard (EPC company) way of doing things not learning each time what are client requirements”

“Reduces Engineering IT spin as they work out how to set up design tools and information management systems to provide handover requirements”

“Opportunities exist to move into operational readiness and CMMS population activities to demonstrate business value”

“REDUCED COSTS GAIN US BUSINESS AGAINST THE COMPETITION”
• “Elimination of customization by standardization on CFIHOS allows for reduction of costs to all our clients and allows us to focus on adding business value”
• “We have had conversations with multiple O/O clients requiring this from us”
• “Our EPC clients are adopting it to help reduce handover costs and gain business”
• “Control System Vendors are asking us to help improve the handover of Engineering Information to the Main Automation Contractors (M.A.C.)”
• “Digital Transformation requires standardized definitions. Leveraging CFIHOS we are able to develop a common language”
Status CFIHOS Project Team / Participation as per 08 Feb 2017

Core members (name, type, office)
- Shell Global Solutions Int, Oil & Gas, Operator, NL/UK
- KHNP, Hydro and Nuclear Industry, Operator, Korea
- Fujitsu Engineering Technologies, EPC, Japan
- Mitsubishi Heavy Industries, EPC, Equipm.Supplier, Japan
- EDF, Power generation, France
- Chevron, Oil & Gas, UK/USA
- INPEX, Oil & Gas, Japan
- AmecFosterWheeler, UK
- Phusion IM, UK
- Total, Oil & Gas, France
- BP, Oil & Gas, UK
- ExxonMobil, Oil & Gas, USA
- CB&I, EPC Contractor, NL, USA
- Advisian/Worley Parsons, EPC, USA, UK
- Sellafield, Nuclear Owner Operator, UK

Review members
- Croon Elektrotechniek, EPC Contractor- Installations, NL
- KAIST, Korea Advanced Institute of Science and Technology, South Korea
- Cure Maintenance Consultants, NL
- HighSino, Engineering data services, China
- BlueCielo, Software supplier, NL
- Versatec Energy, Software supplier, NL
- Bentley Systems Software supplier, UK
- AVEVA, Software supplier, UK
- Datum360, UK
- Unasys, UK
- L&T Technology Services, India
- Petrofac, Engineering company, UK
- Intergraph PP&M, Software supplier, NL
- Kinsmen Group, Software supplier, UK, USA
- Sweco, Engineering design and services, NL, Belgium
- Kyungpook National University, South Korea
- ASSAI, Software supplier, NL

In process of formalising
- Reliance Industries Ltd, Oil & Gas, India
- Yokogawa, Mac Vendor, Japan, NL
- Technip, EPC, USA
- Fluor, EPC, USA, NL

In process of consideration
- Woodside, Owner Operator, Australia
- SAIPEM, Engineering Contractor, Italy
- Dassault Systèmes, Software supplier, USA
- SAP, ERP software, Germany
- Petronas, Oil & Gas, Malaysia
- Wipro, Cloud consulting, Global
<table>
<thead>
<tr>
<th>Owner/Operators</th>
<th>EPC</th>
<th>Software Vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Advisian</td>
<td>ASSAI</td>
</tr>
<tr>
<td>Chevron</td>
<td>Amec Foster Wheeler</td>
<td>AVEVA</td>
</tr>
<tr>
<td>Covestro</td>
<td>CB&amp;I</td>
<td>Bentley Systems</td>
</tr>
<tr>
<td>Eastman</td>
<td>Croon Elektrotechniek</td>
<td>BlueCielo</td>
</tr>
<tr>
<td>EDF</td>
<td>Cure Maintenance Consultants</td>
<td>Dassault Systèmes</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>Fluor</td>
<td>Datum360</td>
</tr>
<tr>
<td>INPEX</td>
<td>Fujitsu Engineering Technologies</td>
<td>Hexagon</td>
</tr>
<tr>
<td>KAIST</td>
<td>Kyungpook</td>
<td>Kinsmen Group</td>
</tr>
<tr>
<td>KHNP</td>
<td>L&amp;T Technology Services</td>
<td>Phusion</td>
</tr>
<tr>
<td>National Oilwell</td>
<td>McDermott</td>
<td>Versatec Energy</td>
</tr>
<tr>
<td>Reliance</td>
<td>Mitsubishi Heavy Industries</td>
<td>Honeywell</td>
</tr>
<tr>
<td>Sellafield</td>
<td>Pengruin Ltd</td>
<td>Yokogawa</td>
</tr>
<tr>
<td>Shell</td>
<td>Petrofac</td>
<td>SAP</td>
</tr>
<tr>
<td>SIAPEN</td>
<td>Sweco</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>Technip</td>
<td></td>
</tr>
<tr>
<td>Woodside</td>
<td>Unasys</td>
<td></td>
</tr>
<tr>
<td>BHP Billiton</td>
<td>WorleyParsons</td>
<td></td>
</tr>
<tr>
<td>ENI</td>
<td>WIPRO</td>
<td></td>
</tr>
<tr>
<td>Marathon Petroleum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petronas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nova Chemicals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What is CFIHOS?

- Generic Scope of Work
- Generic Technical Specification
- Common Database Definition – Reference Data Library (RDL), Master Objects, Property, and Picklist definitions
- Tag Class, Tag Types and Properties per Tag type
- Equipment Class, Equipment Types and Properties per Equipment Type
- Document Types and properties
- Required Documents per Tag Class
- Model, Manufacturer
- Discipline, Discipline to Document Type
- Data Validation Rules
Owner Operator
SDx

Owner Operator Master Class and Reference Data Library

CFIHOS Design Data

Identify Any Changes

Handover Requirements

Data Handover
CFIHOS Rules Checking

EPC SDx

Owner Operator Master Class and Reference Data Library

CFIHOS Design Data
HxGN Representation

- Name : P-101
- Description : Water Pump
- Corrosive Liquid : yes
- Explosive Gas Group : IIA
- Norm Op Inlet Pressure : 7.5 barg
- Height : 1000 mm

Classified As : centrifugal pump

CFIHOS Exchange

- Name : P-101
- Description : Water Pump
- CFIHOS-40000066 : CFIHOS-60001421
- CFIHOS-40000110 : CFIHOS-60000631
- CFIHOS-40000162 : 7.5 barg
- CFIHOS-40000496 : 1000 millimetres

Classified As : CFIHOS-30000521
# Validation Report

## Job Details

<table>
<thead>
<tr>
<th>Job Name</th>
<th>Job Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>import linelist</td>
<td>05/25/2018 10:42:28</td>
</tr>
</tbody>
</table>

## Validation Summary

<table>
<thead>
<tr>
<th>Object Type</th>
<th>No. of Failures</th>
<th>Failures by Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping Specification</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Linelist</td>
<td>734</td>
<td></td>
</tr>
</tbody>
</table>

### Failures by Severity

- **Severity Level: Error**
- **Severity Level: Warning**
- **Severity Level: Information**
- **Severity Level: Other**
Design & Procure  
Commissioning & Startup  
Operate, Maintain, & Optimize  
Construction  

I.F.C.  
As Built

Only 50% needed by the Facility  
Mech. Comp  
Assimilate As-Built Updates  
M.C. + X days  
As Built

Capture As-Built Information  
Mech. Comp

Incremental Data Handover  
Continuous Handover to SAP, Reliability and Integrity Management Systems

CFILOS Rules discover issues before Mechanical Completion. Automated Tag/Document extraction during Squad Check Work Process reduces cost

Start Loading Information into Facility Systems  
Start Loading Information into Facility Systems  
Start Loading Information into Facility Systems  
Start Loading Information into Facility Systems

Information loaded and available  
Capture As-Built Information

Operate, Maintain, & Optimize  
Operate, Maintain, & Optimize  
Operate, Maintain, & Optimize  
Operate, Maintain, & Optimize

Start Loading Information into Facility Systems
CFIHOS Defines exactly what Deliverables to Create compared to Traditional Methods of “Give me everything”

CFIHOS Definition Reduces Cost to Construction and Commissioning Activities

Only 50% needed by the Facility

Shorten Start-up Schedule

Information Requirements Definition
Only 1% lower data accuracy vs. plan will require 10% more resources to complete a handover to the same data quality. (Source C.M.I.I.)
Collaborate/Compare/Consolidate/Extract Approved Data for Operations

Review/Clean/Validate based Engineering Rules

Project Controls/Construction/Systems Completion

Publish

Approved Data for Operations

SAP (PM & BoM)

Pre-FEED/FEED

Basic Design/Detailed Design

Construction/Commissioning

Operational Readiness/Start-up

Owner/Operator Master Class Library

Master Data Registers

• Master Data Registers
• Operational Readiness Registers
• Process Safety Information
• Key Performance Indicators

SEED Databases

2D S3D

Publish

Extract Tag/Document

Reliability, Operational Readiness, DCS, PSM etc.

High Level Work Processes – Implementation Guidance

Project Controls/Construction/Systems Completion

Extract Tag/Document

Reliability, Operational Readiness, DCS, PSM etc.

SEED Databases

2D S3D

Publish

Extract Tag/Document

Reliability, Operational Readiness, DCS, PSM etc.

SEED Databases

2D S3D

Publish

Extract Tag/Document

Reliability, Operational Readiness, DCS, PSM etc.

SEED Databases

2D S3D

Publish

Extract Tag/Document

Reliability, Operational Readiness, DCS, PSM etc.
<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Description</th>
<th>Attribute</th>
<th>Master Tag Register</th>
<th>Vendor Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>1409-P-J02</td>
<td>Wash COLUMN PUMP</td>
<td>OVERALL LENGTH</td>
<td>520 m</td>
<td>520 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DESIGN TEMP_MIN</td>
<td>95 C</td>
<td>95 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DESIGN TEMP_MAX</td>
<td>125 C</td>
<td>125 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DESIGN PRESSURE_MIN</td>
<td>15 barg</td>
<td>15 barg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DESIGN PRESSURE_MAX</td>
<td>237.5 barg</td>
<td>237.5 barg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MATERIAL</td>
<td>17MnO</td>
<td>17MnO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OVERALL WIDTH</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OVERALL WIDTH OR DIA</td>
<td>0.4 m</td>
<td>0.4 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TAG FUNCTION_LOCATION</td>
<td>7m TO BLR FRONT</td>
<td>7m TO BLR FRONT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TAG CLASSIFICATION</td>
<td>PUMP</td>
<td>PUMP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TAG DESCRIPTION</td>
<td>WATER WASH PUMP</td>
<td>WATER WASH PUMP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-182</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-183</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-184</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-185</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-186</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-187</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-188</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-189</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409-P-J25</td>
<td>Wash COLUMN PUMP</td>
<td>OVERALL LENGTH</td>
<td>520 m</td>
<td>520 m</td>
</tr>
</tbody>
</table>
## TAG COMPLETENESS REPORT

<table>
<thead>
<tr>
<th>Tag Information</th>
<th>XC</th>
<th>CFT</th>
<th>MA</th>
<th>DS</th>
<th>3D Model</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1409 E-1308 Exchanger</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1409 P-221 WASH COLUMN PUMP</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 E-224 Exchanger</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 F-445A Furnace</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 E-227C Exchanger</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 E-226A Exchanger</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 P-227A Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 V-227 Vessel</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 P-222 WASH COLUMN PUMP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 P-9001C Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 P-422 Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>9802 80 PV 003 Vertical Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1409 P-426A Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1509 F-221 Furnace</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>9807 25 PV 003 Vertical Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>1509 V-224 EXCHANGER COLUMN</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Bulk Document and Data Register Loader

Virus Scan

Safe Files

Validate Meta-Data Extract & Load

New Revision

Respond to reviewers

EPC makes fixes

Simultaneous Reviewers

Review at IFA

Automatic review plan per reviewer

Approved For Operations

No Handover Required

High Level Squad Check Work Processes
Classically:

- 12 to 14 months, 4 people, $2 million
- $20 - $30 /tag = 50K Tags = $1.5 million
Handing Over Data and Documents for Operational Readiness

- Inefficient handover – handover costs high
- Only Document Deliverables handed over, not Data
- Handover occurs late – Dump truck approach
- Missed startup due to missing information
- Data not available to load operational systems – Keyed in manually
- Status of Data and Documents unknown prior to debottlenecking

Potential Savings:

- Handover Design Tool databases not electronic deliverables
- Automated creation of Tag/Document relationships
- Reduced Data Register requirements
- Automated Data Validation – Based on CFIHOS Rules
- Automated ‘Squad Check’ with Distribution and Verification Work Processes
- Incremental data handover as Data and Documents mature – not ‘big bang’ handover
- Data reused to populate Operational systems (SAP, Reliability etc.).

Reduced Project Handover (80% - 95%)

Capital Project Budget $1000 m

2% - 4% Handover

80% to 95%

= $16 m to $38 m

$$$ Saving
• Digital Transformation Practice Consultancy Services that develop a ‘Client Focused’ CFIHOS Based Handover Strategy (EPC or Owner):
  • Strategic Data and Documents for Operations
  • Capital Facility Information Handover to Information Management
  • Best Practice Handover Methodology, QA/QC rules, Handover Timing etc.
  • **Obtain Your Free Example Copy:** Contact your local Sales representative!
• Actively contributing Intellectual Property (IP)
• Educating O/O, EPC clients, and Vendors
  • Prepare them for what they will see, explain where it fits
  • Lunch and learn, WebEx, Webinar - Worldwide
• SDx Operations is CFIHOS ready OOTB today
• CFIHOS defines the standards used to manage asset related information & documents that are mandatory for facilities regulatory compliance
• CFIHOS is driven by OO’s – so real world pain is the focus – its pragmatic
• CFIHOS increases EPC efficiency and consistency by utilizing standard set of requirements for data handover
• CFIHOS reduces OO’s cost and effort in specifying consistent information requirements
• Adoption of CFIHOS will shorten the operational readiness timeline of a facility
