**Projects:** March 2018
Semiconductor Client

**Scope:** Dimensional Control Compliance & COBie Workflow
Combination of 3 related scopes of work which covers several facilities.

From Design to Construction...to 0 Error QC Reports to Maximo
IFC AIM with COBie?
What they meant was…

1. As-Built BIM that matched the installation.

2. A method to keep updating this model due to constant retrofit.

3. Drawings generated from the model! (COBie Validation)

4. Lean method for CMMS data integration.

5. Simply to know when the FM & OM practice is at a steady state.
Typical Scheduled CMMS at Steady State.
Scheduled CMMS at Steady State using COBie data.
COBie XLSX for Maximo
Standard MEP and Architectural in Revit
Folks think if you have it in the model then it exports in IFC? Wrong!

Software API's are not always built to support our wants.

In this case the software was designed to create drawings and fabrication models.
New Method due to requirements and Process Plant Environment...

Data wrangling and wizardry required!

Should not be this way...technically this can be done in better ways with other ISO 10303 Parts. Too many variables...mostly cultural and human on largest scale.
New Method

Some COBie data captured from design models.

The rest forced in the Coordination Model View using Revit.

COBie files 100% Verified = Zero Error QC Reports.

Validating the files proved to be very difficult. (Many times no Drawings) Mix of field validation and e.g. Drawing Schedules, etc.

After speaking with FM data integrator, much of data could be excluded. (He was happy enough if we could automate what equipment was in each space.)
## Unified Theory of BIM

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HVACie = COBie + IfcPort + CV

U=IFC

Coordination View

COBie

HVACie

IfcPort

ENTITY IfcPort

(* SCHEMA IPC4; *)

ENTITY IfcPort
ABSTRACT SUPERTYPE OF (ONEOF
{IfcDistributionPort})
SUBTYPE OF (IfcProduct);
INVERSE
  ContainedIn : SET [0:1] OF IfcRelConnectsPortToElement FOR RelatingPort;
  ConnectedFrom : SET [0:1] OF IfcRelConnectsPorts FOR RelatedPort;
  ConnectedTo : SET [0:1] OF IfcRelConnectsPorts FOR RelatingPort;
END_ENTITY;
\[ \text{WSie} = \text{COBie} + \text{IfcPort} + \text{CV} \]

\[ \text{U=IFC} \]

Coordination View

**ENTITY IfcPort**

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(* SCHEMA IPC4; *)
ENTITY IfcPort
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    ConnectedTo : SET [0:1] OF IfcRelConnectsPorts FOR RelatingPort;
END_ENTITY;
```
Used the AutoCorr semantic point cloud to validate models and installation.
Equipment not in IFF model.
Obviously could not capture any COBie data for this equipment!
Sometimes there are no issues found within the specified tolerance.
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Deviations in the IfcValve = IfcFlowController
Pipework change required.
Equipment not in IFF model. Obviously could not capture any COBie data for this equipment!
Equipment not in IFF model. Obviously could not capture any COBie data for this equipment!
AutoCorr automatic BCF files help a lot! Otherwise, many issue are never found...until its too late.
AutoCorr automatic BCF files help a lot!
AutoCorr automatic reports helped account for all models issues. All GUID's accounted for. This can then be correlated with installation schedules.
Original Point Cloud - State in time the measurement came from.

Coordination models before and after fix.

AutoCorr Point Cloud showing before and after object within tolerance.

All views of every object before and after fix.

Reports of every object before and after fix.

Reports of any scan and model failures during the analyses.
All of this led to accurate COBie files for design and construction data.

Design models were backfilled with the Construction data.

Some job crawls for COBie construction data.

Maybe one day they will use the COBie eBook!
Lessons learned...

Would **NOT** do that again! ...(New facility being built.)

At a deeper level of STEP there are better ways to go about this, however, current software are not really built with all this in mind.

Also, the GLOBAL supply chain is extremely complex, hard to get all on board.

As cumbersome as it was, there were lean workflows to come out of this, and planned for new facility implementation.

Most of these workflows can be found in the recent COBie books and BIM&Scan .com!