

Life Cycle information exchange (LCie): System Operation

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BACKGROUND

The compilation of commissioning information requires the collection of a variety of different types of information from product manufactures. This information includes: product attributes, replacement parts, warranty terms and conditions, and preventative maintenance tasks. Currently such information is provided by manufacturers in documents whose information cannot be effectively compiled during the construction commissioning stage or effectively used by the facility manager during the operations stage of the building.

BUSINESS CASE

Commissioning agents can directly create system-specific operations manuals in a format that can be used within CMMS systems, eliminating the requirement to manually load such information into owner CMMS systems. This increases the value of commissioning practices and should improve reliability of system operation.

Facility operators frequently do not have access to system operations manuals when attempting to troubleshoot or operate building systems. As building systems become more complex the requirement for facility managers to have accurate facility-specific information at the fingertips of building operators is of increasing importance.

EXAMPLE CONTRACT CLAUSE

Construction Contractor shall provide system start-up, shut-down, emergency operations, and standard operations procedures required in the contract in electronic format in accordance with the System Operations specification of the LCie model.

ORGANIZATION

The buildingSMART international Information Delivery Manual process identifies information exchanges according to the table shown below. Use this table to determine if this information exchange applies to your area of responsibility for a given project.

Code	Phase	Used
0	Portfolio requirements	
1	Conception of need	
2	Outline feasibility	
3	Substantive feasibility	
4	Outline conceptual design	
5	Full conceptual design	
6	Coordinated design and procurement	
7	Production information	
8	Construction	✓
9	Operation and maintenance	
10	Disposal	

The buildingSMART alliance classifies information exchanges according to a number of different classification tables, called OmniClass, provided by the Construction Specification Institute. In addition to OmniClass references to the subject exchange, the buildingSMART alliance provides an overall business activity diagram node referenced in the table below.

LCie Worksheet	OmniClass Table 31 Phase	OmniClass Table 34 Actors	OmniClass Table 32 Services	Activity Node Tree
System operations	31-40 50 00 Commissioning Phase	34-35 17 00 Sub Contractor	32-21 00 00 Execution Services	4.4 Perform Commissioning

EXCHANGES

The sections below describe the inputs required to apply this information exchange. The processing that is accomplished to process these inputs, and the resulting outputs that should be expected as a result of performing this information exchange. This information exchange can be characterized as a “transactional” update of the as-built construction building model. A general description of the requirements for transactional exchanges is found in the LCie Overview (URL).

Inputs

System Operation requires the user authentication and project authorization wrappers described in the LCie Overview (URL). In addition, the information below is the minimum data set that will be processed; however, additional worksheets may be provided by the creator of the COBie file. Please note that additional worksheets may be needed to produce a proper ifc file.

- Job worksheet.
- Resource worksheet.
- Document worksheet.

The following table summarizes the expected content in the COBie file. Referenced rows are for informational purposes and should not be changed. New rows require the addition of new row items to the designated worksheet. Updated rows require the addition of information to an existing row item. It may also be appropriate to add a new row item to a worksheet as part of an update. Optional rows are not required but will be processed if provided.

Key: Referenced Rows= Y or – (not reqd.)

New Rows= Y or – (not reqd.)

Updated Rows = Y or – (not reqd.)

Optional Rows = Y or – (not reqd.)

Worksheet	Referenced Rows	New Rows	Updated Rows	Optional Rows
Facility	Y	-	-	-
Floor	-	-	-	-
Space	-	-	-	-
Zone	-	-	-	-
Type	Y	-	-	-
Component	Y	-	-	-
System	Y	-	-	-
Spare	-	-	-	-
Resource	-	Y	-	-
Job	-	Y	-	-
Document	-	Y	-	-
Attribute	-	-	-	-
Connection	-	-	-	-
Coordinate	-	-	-	-
Issue	-	-	-	-

Processing

The capture of this transactional information may be seen as a type of building information survey where the appropriate portion of the building information is requested to generate a data entry form, the user completes that form, and the information is returned to update the building information.

Preparation of building information template

The first stage is the preparation of a template data set from the current building information. Implementation of the template information may be accomplished through specific software solutions using appropriate menus. To create realistic examples, bimServices demonstration scripts automatically create COBie spreadsheets containing the minimum set of information needed to provide the required BIM sub-set.

- Select current project from building information database
- Select specific system from current project
- Generate system operation data entry form
- Provide system operation data entry form

Building information capture

The second stage is the capture of the required new information in the data entry form. As with step one this would be expected to be accomplished within proprietary software solutions. To provide a realistic example the COBie file provided in the first step may be used to:

- Access system operation data entry form
- Provide required resource data
- Provide required job data
- Provide required document data

Building information transmission and processing

The final stage is the transmission and processing of that information by the target information system. For this specific information exchange the following steps are required. To provide a realistic example the completed COBie building information survey form is used as the input artifact that updates the model.

- Access system operation data entry form
- Provide user credential information (if needed)
- Provide required resource data
- Provide required job data
- Provide required document data
- Send information to the building information server

Processing information sent to the building information server will require the following steps.

- User authentication
- User authorization
- Checking file compliance with COBie
- Checking file compliance with LCie exchange requirements
- Checking the requested transaction with targeted information
- Backing-up prior building information
- Identification of matching system
- Updating resource data
- Updating job data
- Updating document data
- Completion of the transaction and reporting

Output

There are two types of outputs created with this transaction. The first is the creation of the system operation form. This output may be shown on a screen as part of an information system or may be produced as a standalone template file, as is accomplished with the bimServices engine.

The second outputs are files that demonstrate proper processing of the submitted information. The following reports would be expected:

- Incoming file compliance with COBie
- Incoming file compliance with information exchange requirements (identification of optional data)
- Verification of mapping to target model
- Results of completing the transactions
- Comparison of prior and current model states.

Follow On

The following processes are expected to occur after or concurrently with this process:

- Other system operation reports
- Space condition
- Product parts replacement

EXAMPLES

The LCie project has two example projects, a duplex apartment and a medical clinic. For the duplex apartment example project, a system operation COBie file has been created. The type, component, system, resource, job, and document worksheets in each project definition file have been completed in accordance with the COBie instruction worksheet. The system operation file for the duplex apartment example project can be found below.

Duplex Apartment

- Example 1:
 - Input:
 - Prior building model (DuplexApartment_SystemOperation_Flat_1_Heating_before)
 - Exported template for X (URL)
 - Completed template for x (DuplexApartment_SystemOperation_Flat_1_Heating)
 - Output:
 - Incoming file compliance with COBie
 - Incoming file compliance with exchange requirements (identification of optional data)
 - Verification of mapping to target model
 - Results of completing the transactions
 - Comparison of prior and current model states.

Medical Clinic

- Example 1: There is no system operation COBie file for this example project.

Software Implementation Guidance

SCRIPTED PROCESS

To recreate the example files identified in this information exchange documentation the bimServices engine was used based on information from two projects a Duplex Apartment building and a Clinic building. The following batch file was used to process the appropriate files through the bimServices engine.

```
echo off
set a0=SystemOperation
rem Replace %1 with MedicalClinic or DuplexApartment
set a1=%1
rem Replace %2 with appropriate system name
set a2=%2

call goCl      %a1% %a0%_%a2%
call goMerge2  %a1% %a0% %a2%
call goIC      %a1% %a0%_%a2%

time /t
```

Figure 1 doSystemOperation batch file