



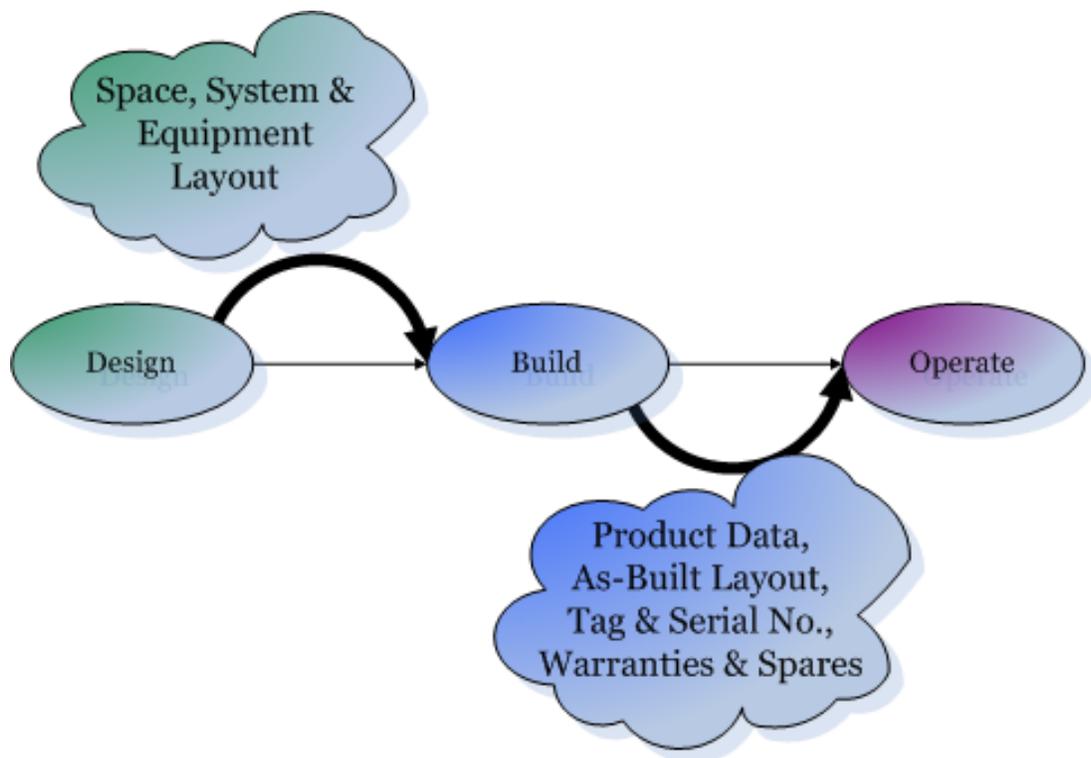
US Army Corps  
of Engineers®  
Engineer Research and  
Development Center

*Installation Technology Transfer Program*

## **Pilot Test of the Construction Operations Building Information Exchange (COBIE) Data Format for Army Installations**

E. William East

September 2008





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**Abstract:** The Construction Operations Building Information Exchange (COBIE) specification denotes how information may be captured during design and construction projects, and then transferred effectively and affordably to facility operators and owners at the conclusion of the project. COBIE has been demonstrated to eliminate the need for inefficient or redundant post hoc data capture on capital projects. A pilot project was conducted at Fort Lewis, WA, under the U.S. Army Installation Technology Transfer Program (ITTP), to investigate how the benefits of COBIE may be exploited by installation Departments of Public Works (DPWs) during the planning and execution of small capital projects, operations and maintenance work, and facility renovations. This ITTP demonstration encompassed the modification of project contract language to incorporate COBIE requirements, the development of draft COBIE data property set templates for typical equipment, and preparation of draft recommendations for incorporating the COBIE specification into installation-level design guidance. Issues related to the capture and use of electronic construction submittals to automatically create project handover information and coordination with maintenance management software vendors are also discussed.

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## **Preface**

This study was conducted for the Assistant Chief of Staff for Installation Management (ACSIM) under the U.S. Army Installation Technology Transfer Program (ITTP); Project “COBIE for Maintenance and Renovation”; Military Interdepartmental Purchase Request MIPR8DG7035, dated 29 January 2008. The ITTP technical monitor for ACSIM was Kelly M. Dilks, CEERD-CF-N.

The work was performed by the Engineering Processes Branch (CF-N) of the Facilities Division (CF), U.S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL). At the time of publication, Donald K. Hicks was Chief, CEERD-CF-N; L. Michael Golish was Chief, CEERD-CF; and Martin J. Savoie was the Technical Director for Installations. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti and the Director was Dr. Ilker Adiguzel.

COL Gary E. Johnston was the Commander and Executive Director of ERDC, and Dr. James R. Houston was the Director.

## Unit Conversion Factors

Multiply	By	To Obtain
cubic feet	0.02831685	cubic meters
cubic inches	1.6387064 E-05	cubic meters
cubic yards	0.7645549	cubic meters
feet	0.3048	meters
gallons (U.S. liquid)	3.785412 E-03	cubic meters
inches	0.0254	meters
pounds (mass)	0.45359237	kilograms
square feet	0.09290304	square meters
square yards	0.8361274	square meters
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

# 1 Introduction

## 1.1 Background

At the fiscal completion stage of a capital project on Army installations, a cache of paper documents is delivered to the installation Departments of Public Works (DPW) by the U.S. Army Corps of Engineers (USACE). This mass of “handover” documents encompasses a wide variety of crucial information about the facility, its key systems, and its furnishings. Examples include warranty certificates, preventive maintenance schedules, spare parts supplier lists, and emergency equipment shutdown procedures. These bales of paper documents also incorporate important information required for efficient asset management and space utilization planning.

These conventional facility information exchange procedures are inherently incomplete and inefficient, however. Paper documents are not readily searchable when specific information is needed rapidly by project participants or facility end users. Single copies of important installer, operator, or maintainer documents usually must be filed and disseminated as paper duplicates, and are subject to all the typical probabilities of getting lost or misfiled. Furthermore, conventional handover information exchange procedures are not suited to take advantage of electronic information transfer and search capabilities; it is often the case that even information captured in Portable Document Format (PDF) or spreadsheet files is duplicated and shared as paper copies, stripping away the potential efficiency and cost benefits of electronic information management. These and related problems with facility information exchange have been well documented.\*

Figure 1 visually illustrates a central problem with the traditional delivery and storage procedure for construction handover documents. The gentleman in the photograph, a member of the Fort Lewis DPW staff, provides a visual reference to illustrate the physical size of representative handover documentation for a small capital project. A conservative estimate of its size might be 72 cubic feet of paper (6 x 6 x 2 feet), all of which is of little

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\* East, E. William. 2007. *Construction Operations Building Information Exchange (COBIE): Requirements Definition and Pilot Implementation Standard*. ERDC/CERL TR-07-30. Champaign, IL: U.S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory.

use to DPW staff unless it is carefully filed and readily retrievable on demand. An additional issue is that this cache of paper documents may not contain key information for important phases of later maintenance, repair, and renovation projects.



Figure 1. Pallets of construction handover data extending approximately 12 ft from front to rear.

A demonstration of commercial software implementation of the Construction Operations Building Information Exchange (COBIE) was held at the National Academies of Science in July 2008\*. This meeting showed that COBIE is now ready to be used by government contract partners during design, construction, and operations phases. COBIE was developed by researchers at the U.S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL) working through buildingSMART Alliance in collaboration with a diverse partnership of public-sector and private industry stakeholders†. The *COBIE Pilot Standard* was published in March 2007 by the National Institute of Build-

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\* <http://www.buildingsmartalliance.org/news/20080723.php> (referenced 30 Sep 08)

† <http://www.buildingsmartalliance.org/projects/projdetail.php?p=8> (referenced 30 Sep 08)

ing Sciences and referenced in the National Building Information Modeling Standard (NBIMS)\*.

COBIE data can be delivered using various means, such as a spreadsheet file containing key data with references to related manufacturer and design documents. Three basic modes of COBIE data may be used to improve the affordability and effectiveness of asset management throughout a facility's life cycle:

- *as-built* data, furnished to the owner upon completion a new capital project
- *as-maintained* data, captured as part of ongoing facility maintenance and repair (M&R) activities
- *as-renovated* data, captured as part of a facility renovation project.

Each mode of data listed above is project-specific. In the aggregate, the project data comprise a facility's *as-is* COBIE data — a detailed, accurate snapshot of building information essential to the owner for effective facility utilization and upkeep. At any point in the building life cycle the COBIE as-is data are available to operations, maintenance, and renovation construction personnel for further exchange, use, and updating during M&R and renovation projects. The availability of this information has enormous potential to reduce the mobilization time and costs required to execute maintenance projects. The individual records incorporated in a COBIE export file will include the Army's Globally Unique Identifiers (GUIDs) for assets and equipment. In the case of a needed equipment replacement, for example, the as-is COBIE data will facilitate the replacement and the updating of COBIE data based on matching GUIDs. For example, if a worn pump is replaced, then the manufacturer, model number, serial number, and related data for the new pump will be input to update the existing asset data. When new, previously uninstalled equipment is added, however, the COBIE data will be used to generate a new Army-specific GUID.

In order for COBIE data to be available for everyday use at the Army installation level, the COBIE-formatted data must be transferable with established Army-standard software tools used for facility operations, maintenance, and asset management. Through the NBIMS initiative, commercial-off-the-shelf (COTS) software packages for maintenance

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\* <http://facilityinformationcouncil.org/bim/publications.php> (referenced 30 Sep 08)

management, design, and engineering systems are beginning to incorporate the COBIE standard. The established Army software tools used at the installation level, however, are not COBIE-compliant, and developers require assistance to implement the standardized COBIE formats.

COBIE-compliant applications for capital projects have successfully been used since FY2007 by the Overseas Buildings Operations office of the U.S. Department of State, General Services Administration. MILCON Transformation projects within the U.S. Army have included COBIE as an option included in design-build Requests For Proposal. The systematic capture and application of COBIE data in Army installation capital, renovation, and M&R projects has not previously been attempted. In Fiscal Year 2008, the U.S. Army Installation Technology Transfer Program (ITTP) funded a pilot project for that purpose entitled "COBIE for Maintenance and Renovation."

## **1.2 Objectives**

The overall objective of this ITTP work was to facilitate the implementation of COBIE on real-world capital construction, M&R, and renovation projects at Fort Lewis, WA, in order to demonstrate the benefits of broader adoption of COBIE by Army installation DPWs.

This report documents progress toward implementing COBIE at Fort Lewis, lessons learned and recommendations. A separate report, scheduled for publication during the first quarter of FY09, will document the specific technical efforts required to implement COBIE within the specific Computerized Maintenance Management System (CMMS) used at the Fort Lewis DPW, the MAXIMO product provided through IBM.

## **1.3 Approach**

The work was executed jointly by ERDC-CERL, the Fort Lewis DPW, and Seattle District. ERDC-CERL was responsible for providing technical implementation assistance and documentation, including coordination with commercial software vendors. The Fort Lewis DPW was responsible for capturing sample data, modifying pilot data capture projects to demonstrate the benefits of COBIE data application, and identifying best-practices for DPW use of COBIE across the Army. Seattle District was responsible for working with ERDC-CERL and Fort Lewis to identify capital projects suitable for this ITTP COBIE pilot implementation project.

First ERDC-CERL with current and prospective future work order planning software system developers to support exchanges of as-built, as-maintained, as-renovated, and as-is modes of COBIE data as explained above. This coordination included developers of the MAXIMO commercial work order management system in place at DPWs and the Army's General Fund Enterprise Business System (GFEBs).

The next task was to produce two example files for each of the four COBIE information exchange modes. Each test file was to be created from live project information provided by the Fort Lewis DPW. Then, information specifically identifying any Fort Lewis facility or occupant was redacted from the original files to create generic example files for use by software developers, design firms, construction companies, commissioning consultants, and others to assist in evaluating and testing the creation and use of COBIE data.

Another task was to provide a simplified data specification based on COBIE spreadsheet format that could be used by installation maintenance personnel to add or revise COBIE data without needing to work directly in a spreadsheet program. It was proposed that an Adobe Acrobat fillable electronic form could be used by DPW operations and maintenance personnel to efficiently import the limited set of data returned by maintenance personnel upon completion of a work or service order.

The project team also investigated the feasibility of using web-based COBIE-compliant software created for the National Aeronautics and Space Administration (NASA), NASA Public Works Centers and the Overseas Buildings Operations office of the U.S. Department of State. This software is part of the ProjNet<sup>SM</sup> project collaboration site\*. ProjNet<sup>SM</sup> is currently used by DPW personnel when performing DrChecks<sup>SM</sup> design reviews. The generic COBIE data import file was to be loaded into ProjNet<sup>SM</sup> so the construction contractor could provide submittals, manuals, and other data through ProjNet<sup>SM</sup>. That data could then be exported from ProjNet<sup>SM</sup> to the COBIE data disk needed by Army Facility Managers.

Finally, the efforts of facility maintainers and renovation contractors to provide COBIE data through the maintainers' form-based approach or the

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\* <https://www.projnet.org/> (referenced 30 Sep 08)

renovators' ProjNet<sup>SM</sup>-based web software were to be documented and evaluated.

A separate deliverable at the conclusion of this project was COBIE technical documentation compiled for use by software vendors to implement COBIE allowing direct export from designer to builder to facility operator.\* This detailed documentation is a machine-to-machine information transfer format using the EXPRESS data format (ISO 10303-11). The EXPRESS format is the basis for Industry Foundation Class (IFC) model that provides open-standard Building Information Models. Exchange of information in the EXPRESS format will ensure that COBIE data is interchangeable with the large set of commercial BIM and GIS software supporting that IFC standard. The translation between different file formats such as EXPRESS, ifcXML, and the COBIE spreadsheet implementation were to have been demonstrated.

#### **1.4 Scope**

This report describes the execution and results of the pilot project to implement COBIE for use by DPW personnel to exchange as-built, as-maintained, as-renovated, and as-is data. Portions of the original ITTP project plan were not completed during the performance period for reasons discussed in the main text.

The COBIE documentation deliverable is scheduled for separate publication during the first quarter of FY09.

#### **1.5 Mode of technology transfer**

To achieve the benefits of COBIE at Army-wide scale, Army, USACE, and DPW standard operating procedures (SOP) and contract specifications will need to incorporate the COBIE national standard for building data interchange.

To import facility data into the Army's General Fund Enterprise Business System (GFEBS) users must currently partition COBIE spreadsheets and conduct several uploads that require manual data entry based upon GFEBS reports. Explicit requirements for direct import of COBIE spreadsheets, without the need for manual intervention by DPW staff, should be

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\* This documentation is scheduled for publication during the first quarter of FY09.

placed on the GFEBS contractor. An initiative to field COBIE as an integral part of GFEBS would be greatly facilitated by a relatively modest training effort. Real Property Accountable Officers and DPW O&M managers would need sufficient computer skills to receive, validate, and upload data into GFEBS in accordance with new SOP.

COBIE implementation would not require any reorganization at the installation level. However, productivity improvements as projected in this report could free up the time of one full-time data transcription clerk at each DPW that uses computerized maintenance management systems. That productive capability could be redirected toward addressing DPW work backlogs.

COBIE would be highly effective as an integral part of the HVAC commissioning process.

Effective COBIE implementation at the DPW level depends on appropriate orientation and training for DPW project managers and personnel. USACE may need to provide some initial COBIE training and orientation to contractors. The self-evident efficiency and cost benefits of using COBIE for building information exchange should provide a high incentive for designers, builders, and owners to adopt the necessary business practices once the core requirements and capabilities are understood.

COBIE is an emerging standard and should fit very well with Department of Defense (DoD) and Army systems and business transformation initiatives, including the DoD Business Enterprise Architecture.

## **2 Information Exchange for Fort Lewis Capital Facility Design**

### **2.1 Scope**

Fort Lewis, ERDC-CERL, and Seattle District identified two pending capital projects suitable for pilot testing of COBIE data capture. COBIE requirements were added to the contracting documents for one of the projects — the design of a rail yard maintenance building. The other project — design of a child care facility — was delayed due to a contracting issue, and it could not be included in the current ITTP demonstration due to the limited amount of time allocated for this work.

### **2.2 Results and analysis**

The first product of this demonstration was a sample COBIE file identifying spaces, equipment types, and specifically named equipment. A generic version of this file, with project- and installation-specific attributes removed, was created and used by commercial software vendors to check the formatting of their output files. The generic sample file is currently hosted on the COBIE page of the Whole Building Design Guide.\*

The second result of this project was the preparation of a how-to presentation documenting how information was manually transcribed from 2D design drawings to the COBIE spreadsheet. A security review of the presentation was performed by the Fort Lewis public affairs office and approved for public release on 27 May 2008. This how-to file is now also hosted on the COBIE page of the Whole Building Design Guide.\*

Discussion with DPW staff about the availability of pre-built capital project information, as represented in the generic COBIE file, was very positive. DPW personnel indicated that such pre-built information would enable them to reliably project future staffing needs based on the established requirements of standard maintenance programs for similar equipment installed on site.

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\* <http://www.wbdg.org/resources/cobie.php> (referenced 30 Sep 08)

A draft COBIE specification for federal projects was previously written by the author of this report and reviewed by several federal agency participants in the COBIE project. The consensus specification was published on the COBE page of the Whole Building Design Guide and was also provided to an industry audience at the July 2008 demonstration. Applying the generic federal COBIE specification to Army installations would require modifications to a number of those specifications. Those specifications include the (1) MILCON project design guide, (2) DPW-based IDIQ\* design and renovation contracts, and (3) operations and maintenance contracts.

The author evaluated the requirements of the federal COBIE specification for capital projects and has recommended changes to the established Fort Lewis Design Standards that would facilitate the implementation of COBIE. Those recommended changes are provided in Appendix A, and they are currently under review for potential adoption by Fort Lewis. Although the specific recommended changes pertain directly to DPW capital project guidelines, the same types of changes would be needed to incorporate COBIE into O&M projects and renovation contracts.

### **2.3 Implications of using COBIE for capital projects**

In order to accommodate conventional project information exchange, the DPW employs two personnel whose primary job is to recreate data that could be provided automatically through COBIE. One is a data entry clerk who enters data into the maintenance management system on a full-time basis. Implementation of COBIE would essentially eliminate the need for manual intervention into project information exchange, freeing up a full-time equivalent capability to focus on work backlogs and other high priorities. The other is a draftsman dedicated approximately half-time to creating equipment layout drawings because as-built drawings are not provided to the DPW until fiscal completion of a project. On capital projects, fiscal completion may lag years behind the facility occupancy date. An extended version of COBIE that provides locally referenced bounding box and centerline geometries through the COBIE Coordinate worksheet could be used to automatically create 3D equipment layout drawings without any manual intervention.

There also would be long-term impacts of implementing COBIE on installations. Currently DPWs can only collect information about a small subset

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\* IDIQ: indefinite delivery/indefinite quantity.

of the materials, products, and equipment being installed in their buildings. These untracked assets need to be maintained and, eventually, replaced, but much important information about them at Fort Lewis is lost despite the best efforts of two full-time data entry personnel. COBIE could provide the complete set of information about everything being installed for a capital project with speed, accuracy, and cost-efficiency not possible using conventional project information management methods.

One costly data requirement that, currently, must be met manually for real property transfer documents (DD Form 1354, "Transfer and Acceptance of Military Real Property") is the compiling of replacement costs for installed fixtures and equipment. Examination of documents at Fort Lewis indicates real property records are maintained only down to the building level of detail; information about real property installed within a building is not captured because the cost of obtaining it is unaffordable. This problem is especially troublesome if the detailed information is not provided by the Architect/Engineer (A/E) firms. COBIE deliverables could provide accurate and comprehensive information from which reports could be generated at any level of detail.

One additional long-term benefit of receiving COBIE capital project data at the installation DPW would be to make upward reporting faster, more accurate, and less labor-intensive. A robust COBIE data set can readily be parsed and output to comply with Army Real Property Inventory Requirements (RPIR)\*. Appendix B contains a detailed evaluation of the COBIE data set and explains how this information would be rolled up into RPIR data.

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\* [http://www.defenselink.mil/dbt/products/Sept-06-BEA\\_ETP/etp/App\\_E/QuadCharts/RPIR\\_Chart.html](http://www.defenselink.mil/dbt/products/Sept-06-BEA_ETP/etp/App_E/QuadCharts/RPIR_Chart.html)  
(referenced 30 Sep 08)

### **3 Information Exchange for Fort Lewis Operations and Maintenance Projects**

#### **3.1 O&M pilot project execution**

Although the project team was able to capture COBIE data as part of a capital design project for Fort Lewis, the objective of including COBIE data requirements in the contract language for small IDIQ design, renovation, or O&M projects was not accomplished by the Fort Lewis DPW during the ITTP demonstration performance period. As a result, sample O&M data sets are not available for use by software vendors interested in incorporating the COBIE data exchange format in O&M project management packages.

This portion of the work produced subsidiary findings and insights that will inform subsequent efforts to incorporate the COBIE format into maintenance management software systems. These are reported below.

#### **3.2 Results and analysis**

Implementation of COBIE at the DPW to support O&M business processes will require the development of a simple, user-friendly electronic data entry form to accompany the maintenance management system's work order ticket. The form would enable personnel and contractors to capture equipment nameplate data and other information needed by the DPW, along with the documentation of work order data completion.

In the process of conducting light-duty equipment surveys, the Fort Lewis DPW captured information property sets for use in this study. The equipment survey data were developed into draft property set templates through a collaborative effort by O&M personnel, engineers, DPW environmental personnel, and resource managers. Appendix C presents the draft templates, which will be evaluated for inclusion into standard property sets for data that are directly populated by equipment manufacturers. A preliminary review of the draft property sets provides interesting insights. The templates compile important specifier's and operator's properties, but they may not be complete enough to communicate the full set of information required for O&M project management.

Consider an off-the-shelf centrifugal pump and motor as depicted in Figure 2. The draft specification template for the pump listed in Appendix C (Table A34) includes fields for the type of pump, material, configuration of the pump and motor, size of the pump inlet and outlet, and other properties. Although the basic data fields in the property template are useful, they are not sufficient to assure an efficient or seamless direct replacement of the pump.

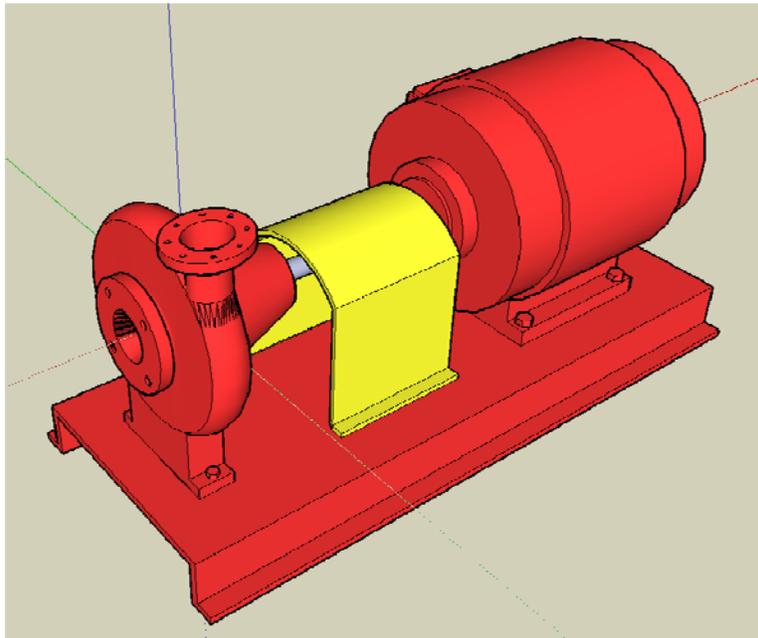


Figure 2. Centrifugal pump drawing showing design details not captured in Fort Lewis property information. (Source: public domain model from [Google 3D Warehouse](#)).

First, note the number and relative spacing of bolt holes at the base of the pump (left) and motor (right). In a real-world application, a large pump is often affixed to a concrete equipment pad with threaded studs directly embedded into the concrete. If the bolt holes in the base of the replacement pump and motor do not exactly match those mounting details, installation may require partial tear-out of the equipment pad for adjustment of the bolt spacing, possibly adding unanticipated time and expense to a relatively simple replacement project.

Even if the mounting details are not critical, as for a smaller pump with more flexible mounting options, installers may need other important information that is missing from the draft property set template (still referring to Table A34). Note the position of the pump inlet orifice at the left, aligned coaxially with the motor shaft. Compare that with the position of the outlet pipe flange, which from the viewpoint of the inlet orifice is to the

right and above. Unless the selected replacement pump maintains the original spatial relationship between the inlet and outlet, plumbing modifications will be required at the time of equipment replacement. If the property set template included a way to describe the spatial orientation of the inlet and outlet, then the DPW could know in advance which pump was best suited to the existing plumbing configuration, and could anticipate whether to allow for plumbing modifications in the O&M project schedule.

### **3.3 Further property set development**

A separate effort to fully develop draft COBIE property set templates is currently underway through the buildingSMART Alliance\*. The refined and completed templates would provide the means for product manufacturers to directly furnish data to contractors and end users in COBIE format. Upon completion of this effort, implementation by the DPW should eliminate the need to manually capture light-duty equipment nameplate data using the draft templates.

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\* <http://www.buildingsmartalliance.org/projects/projdetail.php?p=36> (referenced 30 Sep 08)

## 4 Discussion

### 4.1 Alternate COBIE implementation approaches

The key premise underlying the design and development of COBIE is that the process of creating, filing, and exchanging COBIE data can be significantly more accurate and less expensive than the cost of producing and using paper documents. As the standard is adopted and the premise validated, it becomes highly likely that COBIE data can be created as part of existing contracts without adding any cost.

One way to capture COBIE data is to have the contractor survey the project site and transcribe equipment nameplate data into the spreadsheet at the conclusion of a capital project or larger renovation. The contractor's office engineer also would need to digitally scan the paper submittals used on the project in order to produce the required Adobe Portable Document Format (PDF) files that need to accompany the COBIE spreadsheet. That method would mimic current inefficient manual processes of producing handover data as a separate business activity.

The most effective method for incorporating COBIE data, as described in the COBIE pilot implementation standard\*, is to capture the information as it is added during the project. This would, for example, involve providing construction contractors the designer's "pre-built" COBIE spreadsheet as Government Furnished Information. Contractors would capture submittals electronically — especially efficient since the material is all created from electronic sources — and use that information both for submittal and handover documentation. The contracting documents would require that make, model, and serial number be included in the COBIE spreadsheet at the time equipment is paid for. Finally, the contracts would require that the commissioning agent enter testing reports, job plans, and other information directly into the COBIE spreadsheet. Again, these would not be "new" requirements, in a real sense, but a new and less costly way of providing information that is now already required in a paper form.

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\* East, E. William. 2007. *Construction Operations Building Information Exchange (COBIE): Requirements Definition and Pilot Implementation Standard*. ERDC/CERL TR-07-30. Champaign, IL: U.S. Army Engineer Research and Development Center – Construction Engineering Research Laboratory.

Discussions between the author and a number of different designers, contractors, operators, and commissioning agents points to a savings of between \$50,000 and \$75,000 per capital project for the use of this improved COBIE business process. Assuming that industry-wide use of COBIE would probably not reduce the bid prices for projects, the efficiencies gained from implementing COBIE would provide an incentive to contractors in the direct form of lower overhead costs. The key to linking the designer-side and construction contractor activities in terms of construction handover documentation within existing contracts, and COBIE, is an effective submittal register.

## 4.2 Integration with ProjNet<sup>SM</sup>

During the development of the COBIE requirements, the author identified that a first-order savings could be achieved by the elimination of paper duplication and post-construction equipment surveys. A much higher-order savings could, however, be achieved by the construction team if a fully electronic submittal register were created. Such a fully electronic register could eliminate all gathering and post-processing of COBIE related handover data. This is because virtually all information (with the exception of spare parts and warranty suppliers) required by COBIE is must be specifically submitted during the construction contract and tracked through the contractor's submittal register.

Figure 3 shows one way that the ProjNet<sup>SM</sup> submittal register may be used to support the capture of DPW product information during the process of minor renovation projects. It is important to note that the submittal register and COBIE tools provided with the ProjNet<sup>SM</sup> suite support the direct exchange of information among all the team members identified in Figure 3.

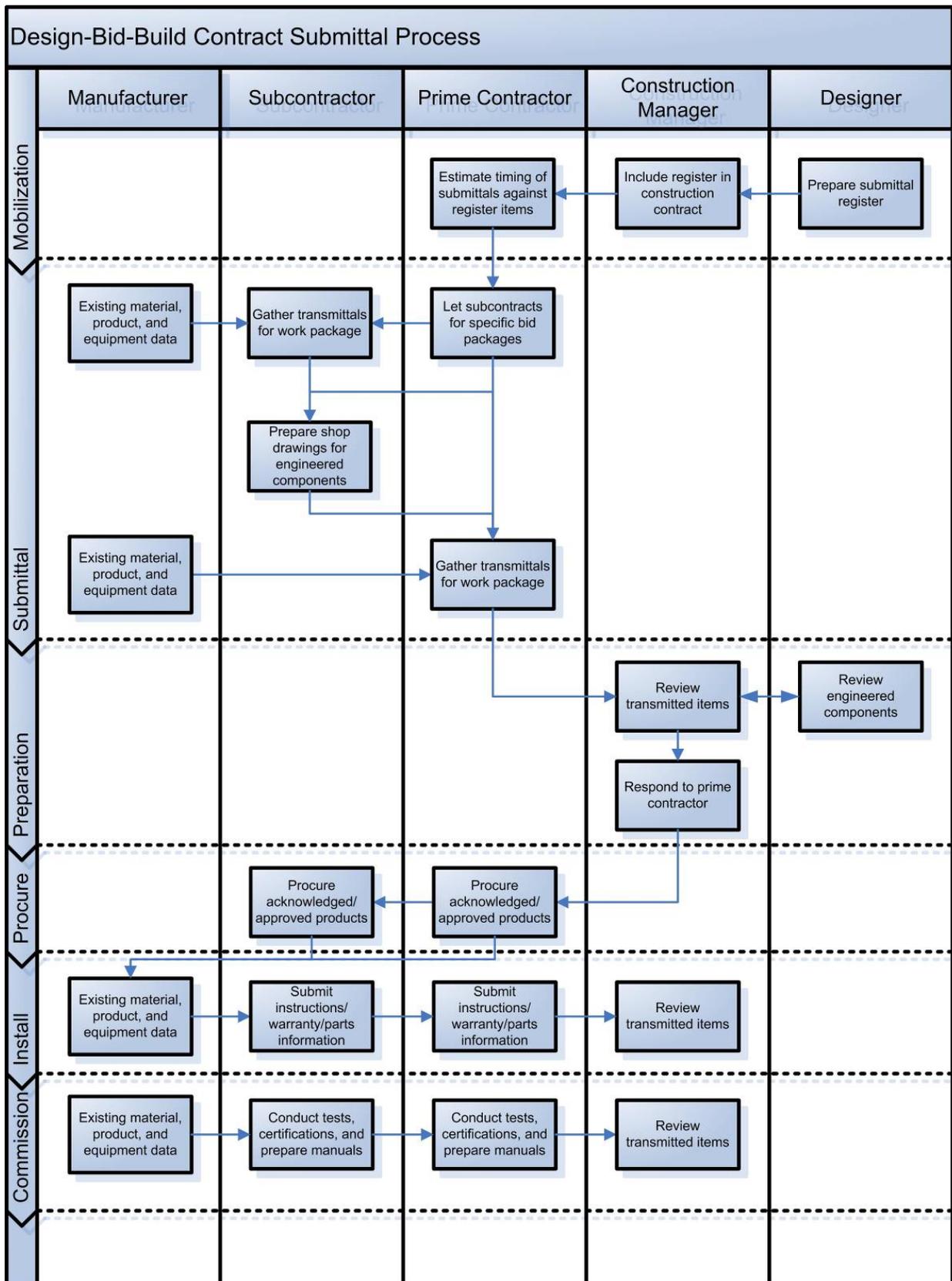


Figure 3. Automated handover data capture process.

As the contracts are being let for construction, the submittal register is provided by the designer through the contract to the prime contractor. This submittal register identifies the complete set of information that is to be provided to the construction manager — in this case the DPW — during the project. Note that all of the materials provided as paper handover documents are actually already listed in a standard submittal register.

During the current submittal process for a DPW-based project, the prime contractor and subcontractors obtain existing electronic records, usually PDF files, and then make multiple paper copies of them. Those paper copies are submitted to the construction manager for acknowledgment or review. Note that if a process for the capture of electronic submittals were put in place, the contractor would immediately avoid the cost of producing paper copies and eliminate mailing delays related to transmittal of the paper. Such a process would also capture O&M handover data, eliminating the need for a separate process later.

Once the construction manager completes the review and approval, the contractor procures and installs the materials, products, and equipment. At this point a great deal of product data become available from the manufacturers in electronic form, ready to be captured directly into the project records. Various project installation manuals and user guides often contain invaluable operations documentation as well as information on replacement parts and warranties. The typical current practice, however, is to send paper copies of this information to be filed by the construction manager. Electronic filing and storage of the information would offer the full range of benefits described above pertaining to the submittal process.

Finally, the testing reports, certifications, job plans, safety plans, troubleshooting guides provided by either the product manufacturers or third-party commissioning agents are all created electronically. The process currently in place within the DPW accepts this information as paper copies. If the information is needed in electronic format the DPW currently has to provide a data entry clerk to transcribe the paper data into the DPW's CMMS. Typically, the boxes of paper documents are stored in their facility's mechanical rooms as shown in Figure 1. As a result a substantial amount of the information is simply lost over time since there are insufficient resources for retyping all the required information.

As part of this ITTP project, the ProjNet<sup>SM</sup> submittal register was to be tested for DPW-based projects at Fort Lewis. Information on the status of this test may be obtained by directly contacting the Chief, DPW, Fort Lewis, WA.

In evaluating the potential use of any type of electronic submittal processing for the wider range of capital projects accomplished through the Corps of Engineers, there is a critical information technology hurdle to overcome. The Corps Resident Management System (RMS) is mandated by the Corps for use, but it supports tracking of only milestone dates related to submittals. RMS does not support any electronic exchange of submittals. RMS architecture also does not support the full range of business partners represented in Figure 3. As a result, the RMS, as currently configured, cannot help Corps project stakeholders to achieve the significant savings inherent in the business process-based design of the COBIE format.

## 5 COBIE Technical Documentation for Software Developers

A significant amount of COBIE technical documentation had been produced by FY2008 to support the adoption of the COBIE format by commercial software vendors. The technical documentation, called a “Model View Definition,” is available through the Whole Building Design Guide’s COBIE project page.\*

COBIE Technical documentation produced during FY2008 for this and a related project is scheduled for publication during the first quarter of FY09. The first part of that report will review the performance of design, construction, and maintenance management software for compliance with the COBIE data specification. Participating commercial software vendors demonstrated their compliance with three information exchange specifications in July 2008 at the National Academies of Science.† The second part of the report will provide a detailed description of the procedures and interim file formats needed for the ITTP effort at the Fort Lewis DPW to directly import COBIE data into MAXIMO. Import into MAXIMO was required as part of this ITTP project since that is the CMMS system selected for use by the Fort Lewis, DPW. The identification of custom configurations needed for MAXIMO to import of COBIE data was not accomplished as readily as expected because the developer of MAXIMO, IBM Corp., was not directly forthcoming with the necessary technical contacts during the ITTP project performance period. Direct contact between the author and IBM’s Army account manager, and between Fort Lewis DPW personnel and IBM technical support, were required to achieve a minimally sufficient data import capability.

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\* <http://www.wbdg.org/resources/cobie.php> (referenced 30 Sep 08)

† <http://www.buildingsmartalliance.org/news/20080723.php> (referenced 30 Sep 08)

## **6 Conclusions and Recommendations**

### **6.1 Conclusions**

It is concluded that this ITTP project has clearly documented and demonstrated the business case for using COBIE on capital projects administered by the installation DPW. The pilot project involving the use of the COBIE standard in the design of a rail yard maintenance building produced good results, as reported in Chapter 2.

The receipt of “prebuilt” and “as-built” electronic lists of equipment, real property, replacement parts, and warranty information could free up the labor of one full-time data entry clerk in the Fort Lewis DPW by eliminating redundant data entry tasks. With the additional specification of the COBIE Coordinate worksheet, a draftsman’s efforts could be redirected to reducing work backlogs. If the Fort Lewis DPW is representative, then these savings could be replicated many times throughout the Army.

The difficulty with executing the O&M portion of this pilot project appears to have been related to the duration of the performance period versus the time actually needed to build institutional momentum toward a significant business process revision. Contract language specifying the use of COBIE in Fort Lewis O&M projects was not completed. A lesson learned is that direct advocacy and in-progress monitoring would be required by stakeholders at the regional level within U.S. Army Installation Management Command (IMCOM), and also the Fort Lewis chain of command, in order to promote timely progress toward this business process transformation. Pertinent administrative recommendations along these lines have been provided separately to ACSIM and IMCOM.

One other unanticipated issue during project execution was the unavailability of IBM account and technical representatives to work with the author and DPW personnel regarding the import and export of COBIE-compatible data by MAXIMO.

### **6.2 Recommendations**

The following recommendations are made based on the results of this project:

1. Given the compelling benefits to be achieved by implementing COBIE, it is recommended that ASCIM and IMCOM move in a timely manner mandate the use of COBIE on all capital projects.
2. To facilitate the implementation of COBIE for O&M projects, it is recommended that ASCIM and IMCOM form a national team to include champions at the Deputy Garrison Commander and DPW Chief level to develop and implement COBIE for installations. Such a team could be formed within 2 months and full implementation guidance could be completed by the team within 10 months.
3. To facilitate the implementation of COBIE for installation capital projects, it is recommended that a “tiger team” including representatives of ASCIM, IMCOM, USACE, and the Association of General Contractors be established for up to 2 years to immediately start incorporating COBIE requirements into major construction contracts.
4. For the Corps to effectively implement COBIE on capital projects in a way that provides cost savings to construction contractors and commissioning agents, the limitations imposed on electronic submittal processing and team collaboration by the current architecture of the Resident Management System should be included in the “tiger team” discussions.



## Appendix A: Recommended Changes to DPW Design Guide

*Note: This appendix contains recommended changes to the Fort Lewis DPW Design Guide to facilitate the inclusion of COBIE data in DPW capital projects. The language shown here would also pertain to M&R and renovation projects, but may have to be reformatted for proper inclusion in the associated guidance documents. The changes recommend here represent a draft that is currently under review by Fort Lewis for potential adoption.*

### 1. Miscellaneous Fort Lewis References

Add: Construction Operations Building Information Exchange link it to <http://www.wbdg.org/resources/cobie.php>

### 2. Introductory Guide

Change: “Designers are encouraged to read the current policy for "Green Design", i.e. the use of available recycled construction materials, etc. and apply it to all projects as much as possible.”

To: “Designers are encouraged to read the current policy for "Green Design", i.e. the use of available recycled construction materials, etc. and apply it to all projects as much as possible. Designers are expected to be familiar with the exchange of electronic data as presented in the reference Manual on Construction Operations Building Information Exchange, and the use of COBIE spreadsheets in the design documents, as well as the construction specifications.”

### 3. Division 1, Section 01330, Submittal Procedures:

To Design Requirements Subsection Add:

“The design agency shall provide a basic COBIE spreadsheet, filled out with all required data for location and equipment header information. These “seed” spreadsheets shall be included in the design package for use by the contractor. Blank and example forms (designer and contractors) are available at <http://www.wbdg.org/tools/cobiex.php>.

The COBIE spreadsheets shall be listed as “GA” in the Submittal Register.”

4. Fort Lewis DOC, Section 1330, Submittal Procedures:

Add: “1.1.11 SD-20 Construction Operations Building Information Exchange spreadsheets. COBIE spreadsheets submit location, equipment, maintenance, and other documentation information in a standard format for import into maintenance management systems.”

Paragraph 1.3 Approved Submittals: Add: For COBIE spreadsheets, the government check will be for valid formatting and referential integrity of the spreadsheet data.”

5. Division 1, Section 01701, Operations And Maintenance Manuals

To 1.1 submittals, add:

“Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made. For maintenance and safety or emergency procedures required in the COBIE spreadsheets, the dates provided for maintenance or inspection cycles shall coincide with commissioning and maintenance cycles performed by the contractor prior to final inspection.”

6. Add the following new specification section “Electronic O&M Data”

In lieu of the submission of paper handover documents, the contractor shall provide all required O&M data to the government electronically in the Construction Operations Building Information Exchange (COBIE) format. The specification of the COBIE format may be found on the "Tools" section of the Whole Building Design Guide (WBDG) ([www.wbdg.org](http://www.wbdg.org)). Training and documentation materials, as well as sample files are also provided on the COBIE pages of the WBDG.

a. Four (4) copies of the COBIE data set shall be provided.

(1) The technology used for the data transmission shall be selected to ensure that the data is provided on one single "disk" or "drive." The contractor shall provide data on either disk-based (CD or DVD) or portable hard

drive media. The selection of disk-based on drive-based media shall be made by the government.

(2) If disk-based media is provided, a printed label on the data disk shall list the name of the project, project location, contract number, prime contractor name, title of submission, and security classification. To insure that any problems with the data or media can be easily resolved the label shall also include the name and contact information of the individual who produced the final data disk.

(3) If drive-based media is provided, the drive shall be legibly hand labeled with a permanent marker. The label shall include the phrase "COBIE DATA" and the appropriate contract or task order number.

(4) An ASCII file named "readme.txt" file shall be provided in the same directory as the COBIE spreadsheet. The "readme.txt" file shall list the name of the project, the contract number, the name of the prime contractor company. To insure that any problems with the data or media can be easily resolved the label shall also include the name and contact information of the individual who produced the final data disk.

\*\*\*\*\*

**SPECIFIER INSTRUCTION:** Include the following section below the initial section "a" if COBIE data is required in contracts for DESIGN SERVICES.

\*\*\*\*\*

c. The Designer shall submit four (4) copies of each COBIE data set listed below.

(1) Schematic Design Set. This data set shall include those COBIE "designer" worksheets related to architectural program. The designer shall specifically identify spatial and systems zoning to reflect the space circulation zones and building service zones that are reflected in the design drawings and specifications.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include the following section below the initial section "a" if COBIE data is required in contracts for CONSTRUCTION services.

\*\*\*\*\*

c. The government shall provide those worksheets identified as "designer" worksheets as Government Furnished Data (GFD). The contractor shall not modify "designer" worksheet data unless construction modifications result in deviations of as-built conditions from the original design. If deviations from GFD are required deviations shall be done in accordance with referenced COBIE standard.

d. The Contractor shall submit four (4) copies of each COBIE data set listed below.

(1) Operations Planning Set. This data set shall be an update to the designer's GFD worksheets. This set shall be provided at 70% fiscal completion or four (4) months prior to beneficial occupancy, whichever is earlier. The following worksheets shall be provided.

- (a) Document - Documents referenced in this file
- (b) Installation - Location and serial no. of installed components
- (c) Manual - Instruction manuals for sets of/or components
- (d) Warranty - Warranty information for sets of/or components
- (e) Spare - Spare/parts reordering info for sets of/or components

(2) Beneficial Occupancy Set. This data set shall be an update to the Operations Planning Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. The following worksheets shall be provided.

- (a) Document - Documents referenced in this file
- (b) Installation - Location and serial no. of installed components

- (c) Manual - Instruction manuals for sets of/or components
- (d) Warranty - Warranty information for sets of/or components
- (e) Spare - Spare/parts reordering info for sets of/or components
- (f) Instruction – Installation/operating instructions
- (g) Test – System/component test results
- (h) Certification – Installation certifications
- (i) Material – Special materials needed for a given Job Plan Task
- (j) Tool – Special tools needed for a given Job Plan Task
- (k) Training – Special training needed for a given Job Plan Task
- (l) PM – Identifies specific PM tasks and frequency
- (m) Safety – Identifies required safety tasks
- (n) Trouble – Start-up procedures
- (o) Start-Up – Shut-down procedures
- (p) Shut-Down - Emergency operating procedures

(3) As-Built Set. This data set shall be an update to the Beneficial Occu-  
pancy Set. Tag numbers for valves, controls, or other "tagged" items shall  
be individually identified in the "Component" worksheet. All worksheets  
required for the Beneficial Occupancy set shall be updated to fully reflect  
as-built conditions.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** If the project contains government fur-  
nished equipment then include the paragraph below.

\*\*\*\*\*

(4) Government Furnished Products. The As-Built data set shall include the associated COBIE data for all [Government Furnished Contractor Installed Equipment] [Government Furnished Government Installed Equipment] included in this project.

e. All project handover documents, including those previously provided in paper format, shall be obtained directly from product manufacturers, prepared, or scanned for inclusion on the COBIE data disk. These documents shall be provided in individual Portable Document Format (PDF). Documents created by members of the project team directly using word processors shall use their word processor to create the PDF document directly. Text documents that must be scanned shall be processed through an optical character recognition program prior to creating the PDF file.

d. Data shall be provided for all COBIE worksheets and data fields identified as "required" in the COBIE specification. Optional fields may be provided, if appropriate, at the discretion of the contractor. Reference fields shall be mandatory, if applicable.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include agency-specific instructions for the use of optional fields in new paragraphs below.

\*\*\*\*\*

f. The naming of rooms in COBIE (i.e. "Space" worksheet) shall match the room numbers identified associated design or underlying Building Information Model. As room numbers change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE requirements) to reflect the changes to these room numbers. If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

g. The naming and location of designer' named materials, products, and equipment in COBIE (i.e. "Component" worksheet) shall match the final naming and location of each piece of equipment individually identified on associated design or underlying Building Information Model. As the naming and location of materials, products, and equipment change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE

requirements). If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

h. At all submissions of contractor COBIE data the identification of named equipment and tagged valves, controls, or other items in the Component worksheet shall match the actual physical location of the item on the project site.

i. Contracts that require independent commissioning agents shall include commissioning documentation within the COBIE disk. In particular, the submission of system specific maintenance and other plans shall be provided in the "Job Plans" COBIE worksheets. Paper submissions of these job plans shall not be required, provided the plans are fully provided on the appropriate COBIE worksheet. {end of section}

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include the following section if COBIE data is required in contracts for Design-Build services.

\*\*\*\*\*

c. The Contractor shall submit four (4) copies of each COBIE data set listed below.

(1) Operations Planning Set. This data set shall be an update to the designer's GFD worksheets. This set shall be provided at 70% fiscal completion or four (4) months prior to beneficial occupancy, whichever is earlier. The following worksheets shall be provided.

(f) Document - Documents referenced in this file

(g) Installation - Location and serial no. of installed components

(h) Manual - Instruction manuals for sets of/or components

(i) Warranty - Warranty information for sets of/or components

(j) Spare - Spare/parts reordering info for sets of/or components

(2) Beneficial Occupancy Set. This data set shall be an update to the Operations Planning Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. The following worksheets shall be provided.

- (q) Document - Documents referenced in this file
- (r) Installation - Location and serial no. of installed components
- (s) Manual - Instruction manuals for sets of/or components
- (t) Warranty - Warranty information for sets of/or components
- (u) Spare - Spare/parts reordering info for sets of/or components
- (v) Instruction – Installation/operating instructions
- (w) Test – System/component test results
- (x) Certification – Installation certifications
- (y) Material – Special materials needed for a given Job Plan Task
- (z) Tool – Special tools needed for a given Job Plan Task
- (aa) Training – Special training needed for a given Job Plan Task
- (bb) PM – Identifies specific PM tasks and frequency
- (cc) Safety – Identifies required safety tasks
- (dd) Trouble – Start-up procedures
- (ee) Start-Up – Shut-down procedures
- (ff) Shut-Down - Emergency operating procedures

(3) As-Built Set. This data set shall be an update to the Beneficial Occupancy Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. All worksheets

required for the Beneficial Occupancy set shall be updated to fully reflect as-built conditions.

h. At all submissions of contractor COBIE data the identification of named equipment and tagged valves, controls, or other items in the Component worksheet shall match the actual physical location of the item on the project site.

i. Contracts that require independent commissioning agents shall include commissioning documentation within the COBIE disk. In particular, the submission of system specific maintenance and other plans shall be provided in the "Job Plans" COBIE worksheets. Paper submissions of these job plans shall not be required, provided the plans are fully provided on the appropriate COBIE worksheet. {end of section}

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include the following section if COBIE data is required in contracts for COMMISSIONING services. Typically this will not be included in the O&M Handover specification but in a separate Commissioning specification section.

\*\*\*\*\*

### Electronic Commissioning Data

In lieu of the submission of paper handover documents, the commissioning agent shall provide all required commissioning data to the government electronically in the Construction Operations Building Information Exchange (COBIE) format. The specification of the COBIE format may be found on the "Tools" section of the Whole Building Design Guide (WBDG) ([www.wbdg.org](http://www.wbdg.org)). Training and documentation materials, as well as sample files are also provided on the COBIE pages of the WBDG.

a. Commissioning agent data shall be provided as part of the following contractor COBIE data set deliverables:

(1) Beneficial Occupancy Set.

(2) As-Built Set.

b. The commissioning agent shall include the results of each tests and certifications as individual documents that are to be linked to one or more of the following COBIE spreadsheets:

- (1) Installation - Location and serial no. of installed components
- (2) Manual - Instruction manuals for sets of/or components
- (3) Instruction – Installation/operating instructions
- (4) Test – System/component test results
- (5) Certification – Installation certifications

c. The commissioning agent shall provide all necessary job plan tasks as specific tasks in the appropriate COBIE "Job Plan" worksheets. If needed attached PDF files may provide additional details on the performance of individual planned tasks. The commissioning agent shall provide the list of all tasks, with associated sequence, in the following COBIE worksheets:

- (1) PM – Identifies specific PM tasks and frequency
- (2) Safety – Identifies required safety tasks
- (3) Trouble – Start-up procedures
- (4) Start-Up – Shut-down procedures
- (5) Shut-Down - Emergency operating procedures

d. If the commissioning agent identifies specific materials, tools, or training associated with individual job plan tasks, then the commissioning agent shall that requirement in one of the following COBIE worksheets:

- (1) Material – Special materials needed for a given Job Plan Task
- (2) Tool – Special tools needed for a given Job Plan Task
- (3) Training – Special training needed for a given Job Plan Task

{end of section}

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS: Include the following section if COBIE data is required in contracts for Maintenance & Renovation Contract Services.**

\*\*\*\*\*

### Electronic O&M Data

In lieu of the submission of paper documentation, the contractor shall submit the following information to the government electronically in the Construction Operations Building Information Exchange (COBIE) format: (1) the make, model and serial number of each piece of installed equipment, (2) the location of any equipment installed in the building, and (3) manufacturer's documents including cut sheets, installation instructions, and recommend maintenance tasks, testing or other reports. The specification of the COBIE format may be found on the "Tools" section of the Whole Building Design Guide (WBDG) ([www.wbdg.org](http://www.wbdg.org)). Training and documentation materials, as well as sample files are also provided on the COBIE pages of the WBDG.

- a. A partially completed COBIE data set shall be provided as Government Furnished Data (GFD) in either spreadsheet or PDF form formats. This file will be provided in conjunction with the work order ticket.
- b. Upon completion of the maintenance or repair action, the contractor shall complete changes to the COBIE data needed to reflect the current as-maintained or as-repaired conditions.
- c. The COBIE data set shall be emailed or posted to an address provided by the Department of Public Works within 1/2 hour of completing the work order.
- d. Failure to receive the COBIE data set prior to submitting the work order completion ticket will result in a minimum retaining being held on the work order payment of \$250.

{end of section}

6. Division 1, Section 01705, EQUIPMENT-IN-PLACE LIST:

1.1 SUBMITTALS, add:

Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made. Equipment-in-place lists are in the format of the COBIE spreadsheets and shall be provided for commissioning (at 70% completion), and as final list.

3.2 EQUIPMENT-IN-PLACE LIST, replace all with:

\*\*\*\*\*

**SPECIFIER INSTRUCTION:** Include the following section if COBIE data is required in any contract.

\*\*\*\*\*

**Electronic Equipment-in-place Data**

In lieu of the submission of paper handover documents, the contractor shall provide all required Equipment-in-place data to the government electronically in the Construction Operations Building Information Exchange (COBIE) format. The specification of the COBIE format may be found on the "Tools" section of the Whole Building Design Guide (WBDG) ([www.wbdg.org](http://www.wbdg.org)). Training and documentation materials, as well as sample files are also provided on the COBIE pages of the WBDG.

a. Four (4) copies of the COBIE data set shall be provided.

(1) The technology used for the data transmission shall be selected to

ensure that the data is provided on one single "disk" or "drive." The contractor shall provide data on either disk-based (CD or DVD) or portable hard drive media. The selection of disk-based on drive-based media shall be made by the government.

(2) If disk-based media is provided, a printed label on the data disk shall list the name of the project, project location, contract number, prime contractor name, title of submission, and security classification. To insure that

any problems with the data or media can be easily resolved the label shall also include the name and contact information of the individual who produced the final data disk.

(3) If drive-based media is provided, the drive shall be legibly hand labeled with a permanent marker. The label shall include the phrase "COBIE DATA" and the appropriate contract or task order number.

(4) An ASCII file named "readme.txt" file shall be provided in the same directory as the COBIE spreadsheet. The "readme.txt" file shall list the name of the project, the contract number, the name of the prime contractor company. To insure that any problems with the data or media can be easily resolved the label shall also include the name and contact information of the individual who produced the final data disk.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** If the agency has specific circulation zones identified, add the following sentence.

\*\*\*\*\*

(a) The designer shall ensure that the following space zones are identified through the Space Reference ID Column of the COBIE Space worksheet:  
[provide space zone list here]

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** If the agency has specific building service zones identified, add the following sentence.

\*\*\*\*\*

(b) The designer shall ensure that the following building service zones are identified through the System Reference ID Column of the COBIE System worksheet: [provide service zone list here]

(c) The following COBIE worksheets shall be provided in the Schematic Design Set:

(i) Facility - Facility(ies) referenced in the file

(ii) Floor - Description of vertical levels

(iii) Space - Spaces referenced in a project

(iv) System - Systems referenced in a project

(2) Design Development Set. The Design Development Set shall be an update to the Schematic Design Set. The Register worksheet shall identify the types of equipment to be installed. The Component worksheet shall identify the major individual pieces of equipment individually identified at the Design Development Stage. The following worksheets shall be provided.

(a) Facility - Facility(ies) referenced in the file

(b) Floor - Description of vertical levels

(c) Space - Spaces referenced in a project

(d) System - Systems referenced in a project

(e) Register - Material/equipment/etc. types (submittal register)

(f) Component - Individually named materials and equipment

(3) Construction Documents Set. The Construction Document set shall be an update to the Design Development data set. All named products and equipment appearing in design schedules shall be listed in the Components Table. The following worksheets shall be provided.

(a) Facility - Facility(ies) referenced in the file

(b) Floor - Description of vertical levels

(c) Space - Spaces referenced in a project

(d) System - Systems referenced in a project

(e) Register - Material/equipment/etc. types (submittal register)

**(f) Component - Individually named materials and equipment**

\*\*\*\*\*

**SPECIFIER NOTE:** In section that requires Submittal Register, add reference to require the provision of the Submittal Register in the COBIE spreadsheet.

\*\*\*\*\*

**d.** The designer shall ensure that all submittal register items required elsewhere in the contract are listed in the COBIE "Register" worksheet. Each register row that relates to a specific building system will be so identified in the appropriate COBIE "Register" worksheet column.

**e.** The designer shall ensure that the list of equipment provided in the COBIE "Component" worksheet includes all equipment specifically identified on the design drawings or BIM.

\*\*\*\*\*

**SPECIFIER INSTRUCTION:** Include the following paragraph to the paragraph above, if space programming checks are accomplished using COBIE data exchange. The agency will need to select the required space measurement standards from the list below.

\*\*\*\*\*

**f.** The designer shall provide space classification and space measurement data to verify compliance with architectural programming requirements.

**(1)** The designer shall map the program requirements into the most appropriate Space Function of the COBIE Space worksheet.

**(2)** The designer shall provide space measurement, and associated units, according to the [BOMA/IFMA Working Group Space Measurement] Standard. The calculation method used shall be explicitly identified in the Calculation Method of the COBE Space worksheet. The following specific space measurement data columns (and associated units) shall be required for every COBIE data disk submission:

- (a) Usable Height
- (b) Exterior Gross Area
- (c) Interior Gross Area
- (d) Plannable Gross Area
- (e) Rentable AreaUsable Area
- (f) Interior Plannable Area

{end of section}

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include the following section below the initial section “a” if COBIE data is required in contracts for CONSTRUCTION services.

\*\*\*\*\*

**c. The government shall provide those worksheets identified as "designer" worksheets as Government Furnished Data (GFD). The contractor shall not modify "designer" worksheet data unless construction modifications result in deviations of as-built conditions from the original design. If deviations from GFD are required deviations shall be done in accordance with referenced COBIE standard. d. The Contractor shall submit four (4) copies of each COBIE data set listed below.**

**(1) Operations Planning Set. This data set shall be an update to the designer’s GFD worksheets. This set shall be provided at 70% fiscal completion or four (4) months prior to beneficial occupancy, whichever is earlier. The following worksheets shall be provided.**

- (a) Document - Documents referenced in this file
- (b) Installation - Location and serial no. of installed components
- (c) Manual - Instruction manuals for sets of/or components

- (d) Warranty - Warranty information for sets of/or components
  - (e) Spare - Spare/parts reordering info for sets of/or components
- (2) Beneficial Occupancy Set. This data set shall be an update to the Operations Planning Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. The following worksheets shall be provided.
- (a) Document - Documents referenced in this file
  - (b) Installation - Location and serial no. of installed components
  - (c) Manual - Instruction manuals for sets of/or components
  - (d) Warranty - Warranty information for sets of/or components
  - (e) Spare - Spare/parts reordering info for sets of/or components
  - (f) Instruction – Installation/operating instructions
  - (g) Test – System/component test results
  - (h) Certification – Installation certifications
  - (i) Material – Special materials needed for a given Job Plan Task
  - (j) Tool – Special tools needed for a given Job Plan Task
  - (k) Training – Special training needed for a given Job Plan Task
  - (l) PM – Identifies specific PM tasks and frequency
  - (m) Safety – Identifies required safety tasks
  - (n) Trouble – Start-up procedures
  - (o) Start-Up – Shut-down procedures
  - (p) Shut-Down - Emergency operating procedures

(3) As-Built Set. This data set shall be an update to the Beneficial Occu-  
pancy Set. Tag numbers for valves, controls, or other "tagged" items shall  
be individually identified in the "Component" worksheet. All worksheets  
required for the Beneficial Occupancy set shall be updated to fully reflect  
as-built conditions.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** If the project contains government fur-  
nished equipment then include the paragraph below.

\*\*\*\*\*

(4) Government Furnished Products. The As-Built data set shall include  
the associated COBIE data for all [Government Furnished Contractor In-  
stalled Equipment] [Government Furnished Government Installed  
Equipment] included in this project.

e. All project handover documents, including those previously provided in  
paper format, shall be obtained directly from product manufacturers, pre-  
pared, or scanned for inclusion on the COBIE data disk. These documents  
shall be provided in individual Portable Document Format (PDF). Docu-  
ments created by members of the project team directly using word proces-  
sors shall use their word processor to create the PDF document directly.  
Text documents that must be scanned shall be processed through an opti-  
cal character recognition program prior to creating the PDF file.

d. Data shall be provided for all COBIE worksheets and data fields identi-  
fied as "required" in the COBIE specification. Optional fields may be pro-  
vided, if appropriate, at the discretion of the contractor. Reference fields  
shall be mandatory, if applicable.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include agency-specific instructions for the  
use of optional fields in new paragraphs below.

\*\*\*\*\*

f. The naming of rooms in COBIE (i.e. "Space" worksheet) shall match the room numbers identified associated design or underlying Building Information Model. As room numbers change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE requirements) to reflect the changes to these room numbers. If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

g. The naming and location of designer' named materials, products, and equipment in COBIE (i.e. "Component" worksheet) shall match the final naming and location of each piece of equipment individually identified on associated design or underlying Building Information Model. As the naming and location of materials, products, and equipment change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE requirements). If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

h. At all submissions of contractor COBIE data the identification of named equipment and tagged valves, controls, or other items in the Component worksheet shall match the actual physical location of the item on the project site.

i. Contracts that require independent commissioning agents shall include commissioning documentation within the COBIE disk. In particular, the submission of system specific maintenance and other plans shall be provided in the "Job Plans" COBIE worksheets. Paper submissions of these job plans shall not be required, provided the plans are fully provided on the appropriate COBIE worksheet.

{end of section}

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS: Include the following section if COBIE data is required in contracts for Design-Build services.**

\*\*\*\*\*

c. The Contractor shall submit four (4) copies of each COBIE data set listed below.

(1) Operations Planning Set. This data set shall be an update to the designer's GFD worksheets. This set shall be provided at 70% fiscal completion or four (4) months prior to beneficial occupancy, whichever is earlier. The following worksheets shall be provided.

(f) Document - Documents referenced in this file

(g) Installation - Location and serial no. of installed components

(h) Manual - Instruction manuals for sets of/or components

(i) Warranty - Warranty information for sets of/or components

(j) Spare - Spare/parts reordering info for sets of/or components

(2) Beneficial Occupancy Set. This data set shall be an update to the Operations Planning Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. The following worksheets shall be provided.

(q) Document - Documents referenced in this file

(r) Installation - Location and serial no. of installed components

(s) Manual - Instruction manuals for sets of/or components

(t) Warranty - Warranty information for sets of/or components

(u) Spare - Spare/parts reordering info for sets of/or components

(v) Instruction – Installation/operating instructions

(w) Test – System/component test results

(x) Certification – Installation certifications

(y) Material – Special materials needed for a given Job Plan Task

(z) Tool – Special tools needed for a given Job Plan Task

(aa) Training – Special training needed for a given Job Plan Task

(bb) PM – Identifies specific PM tasks and frequency

(cc) Safety – Identifies required safety tasks

(dd) Trouble – Start-up procedures

(ee) Start-Up – Shut-down procedures

(ff) Shut-Down - Emergency operating procedures

(3) As-Built Set. This data set shall be an update to the Beneficial Occupancy Set. Tag numbers for valves, controls, or other "tagged" items shall be individually identified in the "Component" worksheet. All worksheets required for the Beneficial Occupancy set shall be updated to fully reflect as-built conditions.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** If the project contains government furnished equipment then include the paragraph below.

\*\*\*\*\*

(4) Government Furnished Products. The As-Built data set shall include the associated COBIE data for all [Government Furnished Contractor Installed Equipment] Government Furnished Government Installed Equipment] included in this project.

d. All project handover documents, including those previously provided in paper format, shall be obtained directly from product manufacturers, prepared, or scanned for inclusion on the COBIE data disk. These documents shall be provided in individual Portable Document Format (PDF). Documents created by members of the project team directly using word processors shall use their word processor to create the PDF document directly. Text documents that must be scanned shall be processed through an optical character recognition program prior to creating the PDF file.

e. Data shall be provided for all COBIE worksheets and data fields identified as "required" in the COBIE specification. Optional fields may be provided, if appropriate, at the discretion of the contractor. Reference fields shall be mandatory, if applicable.

\*\*\*\*\*

**SPECIFIER INSTRUCTIONS:** Include agency-specific instructions for the use of optional fields in new paragraphs below.

\*\*\*\*\*

f. The naming of rooms in COBIE (i.e. "Space" worksheet) shall match the room numbers identified associated design or underlying Building Information Model. As room numbers change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE requirements) to reflect the changes to these room numbers. If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

g. The naming and location of designer' named materials, products, and equipment in COBIE (i.e. "Component" worksheet) shall match the final naming and location of each piece of equipment individually identified on associated design or underlying Building Information Model. As the naming and location of materials, products, and equipment change, the subsequent COBIE deliverable shall be updated (according to referenced COBIE requirements). If there is a conflict between drawings, schedules, and specifications, then schedules trump drawings, specifications trump schedules.

h. At all submissions of contractor COBIE data the identification of named equipment and tagged valves, controls, or other items in the Component worksheet shall match the actual physical location of the item on the project site.

## **Appendix B: Evaluation of Real Property Inventory Requirements (RPIR) to COBIE**

As part of this project the requirements submitted by designers and contractors through a COBIE file were evaluated against the requirements of the RPIR. This work was accomplished with the assistance of Mr. Deke Smith who, at the time was a member of the Department of Defense, Office of Secretary of Defense for Installation and Environment. In this analysis each COBIE worksheet is listed with any related RPIR data.

### **01 Contact Worksheet**

This COBIE worksheet contains the names of anyone on the project team entering or providing data about the building during the course of the project are identified here. This worksheet also identifies any of the companies such as vendors of replacement parts or warranty guarantors referenced elsewhere in the worksheet.

RPIR contains address used for buildings. There is some minor differences in the address field lengths provided for COBIE and RPIR, however, the content of the data is such that COBIE Contact information will not be appropriate to add into the RPIR dataset. RPIR does not require names of designers, contractors, product manufacturers, or warranty service providers.

### **02 Facility Worksheet**

This COBIE worksheet is used by the projects' designers, contractors, and subcontractors as a header against which specific project data will be created. Since COBIE is used on a wide number of projects by many participants, the COBIE specification provides locally unique identifiers that are of value only to the extent that the information with a given worksheet is related to other information within that worksheet.

To allow COBIE data, created and used by designers and construction contractors, to relate to enterprise business systems an "ExternalSystemName" and "ExternalSystemID" field is provided. With the enforcement of consistent internal indexing in the COBIE file, the ExternalSystemID is the key to allow facility data to roll from the individual "door" and "knob" level

of detail in COBIE to the building-wide level provided by enterprise business systems.

RPIR requires the use of The “Real Property Unique Identifier (RPUID) that has associated with it a “RPA Name” and “RPA Description Text.” The RPUID can be entered in the COBIE spreadsheet if the data is provided as “government furnished information” or required of the designer or construction contractor to add to the Facility worksheet.

Given that the official property transfer occurs when property is transferred from the construction manager to the DoD Installation, through the use of the DD 1354 form it is likely that the RPUID only need to be associated with the project during the loading of COBIE data into the Installations’ asset management system.

#### **06 Register Worksheet**

The Register worksheet uses the term “asset” that is also used in RPIR. In the Register worksheet an “asset” is a specific type of material, product, or equipment installed within a facility. This “low level” description of an asset is appropriate in the context of the construction of one individual building, but is too low a scale of information to be of interest (as found in COBIE) to RPIR. If COBIE is adopted as a RPIR compliant information exchange format, however, RPIR can be assured to have the most accurate possible information available directly from the types of doors and windows in a buildings to the boilers and chillers.

#### **14 Installation Worksheet**

The COBIE Installation Worksheet refers to an individual make, model, and serial number of a specific piece of equipment installed in the building. The installation worksheet also captures the location of “tagged” valves and other building products. The use of the term “installation” in COBIE refers to the “installed equipment.” The term “installation” in RPIR refers to the hundreds of buildings that are part of a military base. Thus the data contained in COBIE related to “installation” is too low a level of information to be of interest to the RPIR data set.

## **21 Material Worksheet**

The COBIE Material Worksheet refers to the materials that are required to be available in order for specific maintenance tasks to be accomplished. For example, if maintenance task for a specific piece of equipment requires a specific type of lubricant, then that Material will be identified in the COBIE Material Worksheet.

RPIR identifies the predominate structural material of which the building is made. As with the discussion of the COBIE Installation Worksheet, the level of detail required in the COBIE Material Worksheet by those actually designing and building the facility is too low a level of detail to be of interest to RPIR.



# Appendix C: Property Set Templates

Table A1. Cold Food Table Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	COLDFOOD	Cold Food Table				
<b>Sub-Assembly of</b>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VOLTAGE_G	Voltage	ALN	120	VOLTS	1	Y
			120/208			
			120/240			
			208			
			240			
			277			
			277/480			
			480			
AMPDRAW	Amp Draw of Unit	NUM		AMP	2	N
ORIGREFER	Original Refrigerant	ALN	R11	n/a	3	N
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	5	Y
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	7	N

Table A2. Food Display Case Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment					
<b>CMMS Sub-Classification</b>	FOODCASE	Food Display Case					
<i>Sub-Assembly of</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
VOLTAGE_G	Voltage	ALN	120	VOLTS	1	Y	
			120/208				
			120/240				
			208				
			240				
			277				
			277/480				
			480				
AMPDRAW	Amp Draw of Unit	NUM		AMP	2	N	
ORIGREFER	Original Refrigerant	ALN	R11	n/a	3	N	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N	
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	5	Y	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N	
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	7	N	

Table A3. Freezer Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment					
<b>CMMS Sub-Classification</b>	FREEZER	Freezer					
<b>Sub-Assembly of</b>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
FSETYPE1	Food Service Equipment Type 1	ALN	Walk-in	n/a	1	Y	
			Reach-in				
			Undercounter				
FRZRCNTRLRTYPE	Type of Freezer Controller	ALN	Capillary	n/a	2	Y	
			Electric				
VOLTAGE_G	Voltage	ALN	120	VOLTS	3	Y	
			120/208				
			120/240				
			208				
			240				
			277				
			277/480				
			480				
AMPDRAW	Amp Draw of Unit	NUM		AMP	4	N	
ORIGREFER	Original Refrigerant	ALN	R11	n/a	5	N	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	6	N	
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	7	N	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	8	N	
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	9	N	
PLACEMENT	Placement of Equipment	ALN	Kitchen	n/a	10	N	
			Dining Area				
			Ration Room				
			Dock				

Table A4. Ice Cream Maker Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	ICECREAM	Ice Cream Maker				
<i>Sub-Assembly of</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FSETYPE2	Food Service Equipment Type 2	ALN	Table Floor	n/a	1	Y
FSETYPE3	Food Service Equipment Type 3	ALN	Single Double Triple	n/a	2	Y
VOLTAGE_G	Voltage	ALN	120 120/208 120/240 208 240 277 277/480 480	VOLTS	3	Y
AMPDRAW	Amp Draw of Unit	NUM		AMP	4	N
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	5	N
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	6	N
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	7	Y
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	8	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	9	N

Table A5. Ice Maker Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	ICEMAKER	Ice Maker				
<b>Sub-Assembly of</b>						

<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FSETYPE2	Food Service Equipment Type 2	ALN	Table Floor	n/a	1	Y
VOLTAGE_G	Voltage	ALN	120 120/208 120/240 208 240 277 277/480 480	VOLTS	2	Y
AMPDRAW	Amp Draw of Unit	NUM		AMP	3	N
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	4	N
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	5	N
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	6	Y
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	7	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	8	N

Table A6. Juice Dispenser Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	JUICDISP	Juice Dispenser				
<i>Sub-Assembly of</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FSETYPE4	Food Service Equipment Type 4	ALN	Single	n/a	1	Y
			Double			
			Triple			
			Quadruple			
VOLTAGE_G	Voltage	ALN	120	VOLTS	2	Y
			120/208			
			120/240			
			208			
			240			
			277			
			277/480			
			480			
AMPDRAW	Amp Draw of Unit	NUM		AMP	3	N
ORIGREFR	Original Refrigerant	ALN	R11	n/a	4	N
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	5	N
CURRENTREFR	Current Refrigerant	ALN	R11	n/a	6	Y
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	7	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	8	N

Table A7. Milk Dispenser Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment					
<b>CMMS Sub-Classification</b>	MILKDISP	Milk Dispenser					
<b>Sub-Assembly of</b>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
FSETYPE4	Food Service Equipment Type 4	ALN	Single	n/a	1	Y	
			Double				
			Triple				
			Quadruple				
VOLTAGE_G	Voltage	ALN	120	VOLTS	2	Y	
			120/208				
			120/240				
			208				
			240				
			277				
			277/480				
			480				
AMPDRAW	Amp Draw of Unit	NUM		AMP	3	N	
ORIGREFER	Original Refrigerant	ALN	R11	n/a	4	N	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	5	N	
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	6	Y	
			R12				
			R134a				
			R401a/MP39				
			R402a/HP80				
			R404a/HP62				
			R414b/Hotshot				
			R500				
			R502				
			R22				
			R410A				
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	7	N	
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	8	N	

Table A8. Refrigerator Spec Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	REFER	Refrigerator				
<i>Sub-Assembly of</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FSETYPE1	Food Service Equipment Type 1	ALN	Walk-in	n/a	1	Y
			Reach-in			
			Undercounter			
VOLTAGE_G	Voltage	ALN	120	VOLTS	2	Y
			120/208			
			120/240			
			208			
			240			
			277			
			277/480			
			480			
AMPDRAW	Amp Draw of Unit	NUM		AMP	3	N
ORIGREFER	Original Refrigerant	ALN	R11	n/a	4	N
			R12			
			R134a			
			R401 a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	5	N
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	6	N
			R12			
			R134a			
			R401 a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	7	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	8	N
PLACEMENT	Placement of Equipment	ALN	Dining Area	n/a	9	N
			Kitchen			
			Ration Room			
			Dock			

Table A9. Sandwich Prep Table Template.

<b>CMMS Classification</b>	FSE	Food Service Equipment				
<b>CMMS Sub-Classification</b>	SANDPREP	Sandwich Prep Table				
<i>Sub-Assembly of</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VOLTAGE_G	Voltage	ALN	120	VOLTS	1	Y
			120/208			
			120/240			
			208			
			240			
			277			
			277/480			
			480			
AMPDRAW	Amp Draw of Unit	NUM		AMP	2	N
ORIGREFER	Original Refrigerant	ALN	R11	n/a	3	N
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	5	Y
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N
MANRECCHARGE	Manufacturers Recommended Charge	NUM		OZ	7	N

Table A10. Equipment Screen (All Equip).

<b>Facility</b>														
<b>Equipment Location</b>														
<b>Equipment Number</b>		<b>Descriptions</b>												
<b>Belongs To</b>														
<b>Vendor</b>														
<b>Manufacturer</b>														
<b>Manufacturer Order Number</b>		(Invoice Number)												
<b>Serial Number</b>														
<b>Model Number</b>		Side of Building (East/West):												
<b>Installation Date</b>		(dd/mm/yyyy)												
<b>Actual Installation Date?</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No													
<b>Life Expectancy</b>		(Years)												
<b>Warranty Date</b>		(dd/mm/yyyy)												
<b>Equipment Condition</b> (Circle One)	<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">1</td></tr> <tr><td style="text-align: center;">2</td></tr> <tr><td style="text-align: center;">3</td></tr> <tr><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">5</td></tr> <tr><td style="text-align: center;">6</td></tr> </table>	1	2	3	4	5	6	<table border="1" style="margin: auto;"> <tr><td>Failure</td></tr> <tr><td>Imminent Failure</td></tr> <tr><td>Heavy Deterioration Evident</td></tr> <tr><td>Little Deterioration Evident</td></tr> <tr><td>Used, Good Condition</td></tr> <tr><td>New</td></tr> </table>	Failure	Imminent Failure	Heavy Deterioration Evident	Little Deterioration Evident	Used, Good Condition	New
1														
2														
3														
4														
5														
6														
Failure														
Imminent Failure														
Heavy Deterioration Evident														
Little Deterioration Evident														
Used, Good Condition														
New														

<b>Action</b>	
<b>Reason for Change</b>	<b>PM Needed?</b>
<b>Remove/Instal/Found</b>	
<b>Moved From Location</b>	
<b>Moved To Location</b>	
	<input type="checkbox"/> Yes <input type="checkbox"/> No

<b>Inventoried By</b>	
<b>Print</b>	
<b>Signature</b>	
<b>Date Inventoried</b>	

<b>Real Property Use Only</b>	
<b>Equipment In Place</b>	
<b>Installed Equipment</b>	

<b>Supervisor</b>	
<b>Print</b>	
<b>Signature</b>	

Table A11. Air Conditioner Spec Template.

<b>CM MS Classification</b>	AIRCOND	Air Conditioner					
<b>CM MS Sub-Classification</b>	(Null)						
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
ACTYPE1	Air Conditioner Type 1	ALN	Package Split	n/a	1	Y	
ACTYPE2	Air Conditioner Type 2	ALN	Roof Pad Mounting Window	n/a	2	Y	
ACCOILSZBTU	Indoor Coil Size in BTU's	NUM		BTU	3	N	
ECONOMIZER	Economizer	ALN	Yes No	n/a	4	N	
SEERKBTU	Seasonal Enrgy Effcncy in KBTU	NUM		KBTU	5	N	
EERATEPERC	Enrgy Effcncy Rating in PERC	NUM		PERC	6	N	
VOLTAGE_G	Voltage	ALN	120 120/208 120/240 208 240 277 277/480 480	VOLTS	7	N	
CAPBTU	Capacity in BTU's	NUM		BTU	8	Y	
CAPHP	Capacity in HP	NUM		HP	9	Y	
CAPTON	Capacity in Tonnage	NUM		TON	10	Y	
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hots hot R500 R502 R22 R410A	n/a	11	N	
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	12	N	
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hots hot R500 R502 R22 R410A	n/a	13	N	
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	14	N	

Table A12. Air Handler Unit Spec Template.

<b>CMMS Classification</b>	AHU	Air Handler Unit				
<b>CMMS Sub-Classification</b>	(Null)					
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
AHUTYPE	Air Handler Unit Type	ALN	Heating	n/a	1	Y
			Cooling			
			Heating/Cooling			
			Make-up			
			Heat Recovery			
AHUHEATTYPE	Air Handler Type of Heating	ALN	Steam	n/a	2	Y
			Hot Water			
			Electric			
			DX Coil			
AHUCOOLTYPE	Air Handler Type of Cooling	ALN	Chill Water	n/a	3	Y
			DX Coil			
PHYPLACE	Physical Placement in Building	ALN	Roof	n/a	4	Y
			Attic			
			Ceiling			
			Room			
			Basement			
			Floor			
			Ground Mount			
CAPCFM	Capacity in CFM	NUM		CFM	5	Y
CAPTON	Capacity in Ton's	NUM		TON	6	Y
COILCAPHEATBTU	Coil Heating Capacity in BTU's	NUM		BTU	7	N
COILCAPCOOLBTU	Coil Cooling Capacity in BTU's	NUM		BTU	8	N
HUMIDITYCTRL	Humidity Control	ALN	Humidify	n/a	9	N
			Dehumidify			
			None			
ECONOMIZER	Economizer	ALN	Yes	n/a	10	N
			No			

Table A13. Boiler Spec Template.

<b>CMMS Classification</b>	BOILER	Boiler				
<b>CMMS Sub-Classification</b>	(Null)					
<b>Belongs To</b>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
BLRHEATTYPE	Type of Heat	ALN	Steam Hot Water	n/a	1	Y
BLRTYPE1	Type of Boiler	ALN	Fire Box Scotch Marine	n/a	2	Y
BLRTYPE2	Boiler Tube Type	ALN	Fire Tube Water Tube Copper Fin Tube Sectional	n/a	3	Y
BLRTYPE3	Boiler Spacial Position	ALN	Horizontal Vertical	n/a	4	Y
NUMPASS	Number of Passes	NUM	2 3 4	EA	5	N
BLRCTRLS	Boiler Controls	ALN	DDC Single Loop Pneumatic Local/Stand alone	n/a	6	N
INPUTMBH*	Input in MBH	NUM		MBH	7	Y
OUTPUTMBH*	Output in MBH	NUM		MBH	8	N
INPUTBTU*	Input in BTU's	NUM		BTU	9	Y
OUTPUTBTU*	Output in BTU's	NUM		BTU	10	Y
OUTPUTBHP	Output in Boiler HP	NUM		BHP	11	N
NORMOPPRESS	Norm Op Pressure Set Point	NUM		PSI	12	N
MAXALLOWPRESS	Maximum Allowable Pressure	NUM		PSI	13	N
STEAMOUTPUTPPH	Steam Boiler Output in PPH	NUM		PPH	14	N
NATLBRDNUM	National Board Number	ALN		n/a	15	N
STATENUM	State Number	ALN		n/a	16	N
CHEMTREAT	Chemical Treatment	ALN	Bio-Guard Glycol Nitrite None POSCA	n/a	17	N
*Note: Calculation for Boiler Horse Power is MBH x 1000 = BTU / 33,475 = BHP						

Table A14. Burner Spec Template.

<b>CMM S Classification</b>	BURNER	Bumer					
<b>CMM S Sub-Classification</b>	(Null)						
<b>Belongs To</b>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
FUELTYPE	Type of Fuel	ALN	Electric	n/a	1	Y	
			Methane				
			Natural Gas				
			Gas/Oil #2				
			Gas/Oil #4				
			Gas/Oil #6				
			Oil#2				
			Propane				
BRNTYPE1	Type of Bumer 1st Description	ALN	Natural Draft	n/a	2	Y	
			Induced Draft				
			Pressurized Draft				
			Power (Forced Draft)				
BRNTYPE2	Type of Bumer 2nd Description	ALN	Atmospheric	n/a	3	N	
			C				
			CR				
			F				
			H				
			R				
			S				
			SR				
EMISTYPE	Emission Type	ALN	Low Nox - FGR	n/a	4	N	
			Low Nox - P remix				
			None				
INPUTMBH**	Input in MBH	NUM		MBH	5	Y	
INPUTBTU**	Input in BTU's	NUM		BTU	6	Y	
GASTRAINTYPE	Type of Gas Train	ALN	UL	n/a	7	N	
			FM				
			IRI				
BRNMGMTCTRL	Flame Safe Guards	ALN	Honeywell	n/a	8	N	
			Fireye				
			Clever Brooks				
			Gordon Piatt				
BRNMGMTCTRLMDL	Flame Safe Guards Model Number	ALN		n/a	9	N	
METERPRESS	Meter Set Pressure	NUM	0.25	PSI	10	N	
			2				
			5				
			10				
			125				
METERNUM	Meter Number	NUM		n/a	11	N	
BRNOPMODES	Bumer Modes of Operation	ALN	Fix Fire	n/a	12	N	
			Full Modulation				
			Lead Lag				
			Low-Hi-Off				
			Low-Hi-Low				
			Low-Hi				
			RALFS				

Table A15. Compressor-Air Spec Template.

<b>CMMS Classification</b>	CMPRSR	Compressor				
<b>CMMS Sub-Classification</b>	CMPAIR	Air				
<b>Belongs To</b>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
CMPRSTAGE	Compressor Stage	ALN	Single Stage Two Stage	n/a	1	Y
CMPRCNTRL	Compressor Controller	ALN	Rotary Recipricating	n/a	2	Y
CAPCFM	Capacity in CFM	NUM		CFM	3	Y
COOLINGMEDIA	Type of Cooling Media	ALN	Air Water	n/a	4	Y
MAXALLOWPRESS	Maximum Allowable Pressure	NUM		PSI	5	Y
TANKMNTG	Type of Tank Mounting	ALN	Horizontal Vertical Base	n/a	6	N
TANKSIZE	Tank Size in Gallons	NUM		GAL	7	N
OILTYPE	Type of Oil	ALN		n/a	8	N
OILWEIGHT	Oil Weight	ALN		n/a	9	N
BELTNUM	Number of Belts	NUM		EA	10	N
BELTSIZE	Size of Belt	ALN		n/a	11	N

Table A16. Compressor-Refrig Spec Template.

<b>CMMS Classification</b>	CMPRSR	Compressor					
<b>CMMS Sub-Classification</b>	CMPREFR	Refrigerant					
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
CMPRSEALTYPE	Type of Compressor Seal	ALN	Hermetically Semi-Hermeticaly	n/a	1	Y	
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	2	N	
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	3	N	
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	4	Y	
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	5	N	
OILTYPE	Type of Oil	ALN		n/a	6	N	
OILWGT	Oil Weight	ALN		n/a	7	N	
BELTNUM	Number of Belts	NUM		EA	8	N	
BELTSIZE	Size of Belt	ALN		n/a	9	N	

Table A17. Condenser-Air Spec Template.

<b>CMMS Classification</b>	CONDENSR	Condenser				
<b>CMMS Sub-Classification</b>	AIRCOOL	Air Cooled				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
CONDENSERTYPE	Type of Condenser	ALN	Open Loop Closed Loop	n/a	1	Y
CONDENSERMEDIA1	Condenser Media Type 1	ALN	Refridgerant Water	n/a	2	Y
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	3	N
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	5	N
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N
SEERKBTU	Seasonal Energy Effcncy in KBTU	NUM		KBTU	7	N
COOLTONS	Number of Tons of Cooling	NUM		TON	8	N
COOLMBH	Number of MBH of Cooling	NUM		MBH	9	N
CHEMTREAT	Chemical Treatment	ALN	Bio-Guard Glycol Nitrite None POSCA	n/a	10	N

Table A18. Condenser-Water Spec Template.

<b>CMMS Classification</b>	CONDENSR	Condenser				
<b>CMMS Sub-Classification</b>	WTRCOOL	Water Cooled				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
CONDENSERTYPE	Type of Condenser	ALN	Open Loop	n/a	1	Y
			Closed Loop			
CONDENSERMEDIA2	Condenser Media Type 2	ALN	Glycol	n/a	2	Y
			Water			
ORIGREFER	Original Refrigerant	ALN	R11	n/a	3	N
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N
CURRENTREFER	Current Refrigerant	ALN	R11	n/a	5	N
			R12			
			R134a			
			R401a/MP39			
			R402a/HP80			
			R404a/HP62			
			R414b/Hotshot			
			R500			
			R502			
			R22			
			R410A			
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N
SEERKBTU	Seasonal Enrgy Effcncy in KBTU	NUM		KBTU	7	N
COOLTONS	Number of Tons of Cooling	NUM		TON	8	N
COOLMBH	Number of MBH of Cooling	NUM		MBH	9	N
CHEMTREAT	Chemical Treatment	ALN	Bio-Guard	n/a	10	N
			Glycol			
			Nitrite			
			None			
			POSCA			

Table A19. CNTRL-Bldg. Spec Template.

<b>CMMS Classification</b>	CNTRLR	Contrdler					
<b>CMMS Sub-Classification</b>	BLDG	BLDG					
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
CNTRLR TYPE	Type of Controller	ALN	Analog	n/a	1	Y	
			DDC				
			PLC				
			Pneumatic				
			Single Loop				
			TCU				
			VFD				
CNTRLRPROTOCOL	Control Protocd	ALN	BACnet	n/a	2	N	
			LON				
			Mod Bus				
			N2				
			Proprietary				
CNTRLMDLEXPAN	Cntrl Mod Expansion Capability	NUM		EA	3	N	
NUMEXPANMODULE	Number of Expansion Modules	NUM		EA	4	N	
ANALOGINPUTS	Analog Inputs	NUM		EA	5	N	
DIGITALINPUTS	Digital Inputs	NUM		EA	6	N	

Table A20. CNTRLR-Plant Spec Template.

<b>CMMS Classification</b>	CNTRLR	Controller				
<b>CMMS Sub-Classification</b>	PLANT	Plant				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
CNTRLRTYPE	Type of Controller	ALN	Analog	n/a	1	Y
			DDC			
			PLC			
			Pneumatic			
			Single Loop			
			TCU			
			VFD			
CNTRLPROTOCOL	Control Protocol	ALN	BACnet	n/a	2	N
			LON			
			Mod Bus			
			N2			
			Proprietary			
CNTRLMDEXPAN	Cntrl Mod Expansion Capability	NUM		EA	3	N
NUMEXPANMODULE	Number of Expansion Modules	NUM		EA	4	N
ANALOGINPUTS	Analog Inputs	NUM		EA	5	N
DIGITALINPUTS	Digital Inputs	NUM		EA	6	N

Table A21. CNTRLR-Process Spec Template.

<b>CMMS Classification</b>	CNTRLR	Controller				
<b>CMMS Sub-Classification</b>	PROCESS	Process				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
CNTRLRTYPE	Type of Controller	ALN	Analog	n/a	1	Y
			DDC			
			PLC			
			Pneumatic			
			Single Loop			
			TCU			
			VFD			
CNTRLPROTOCOL	Control Protocol	ALN	BACnet	n/a	2	N
			LON			
			Mod Bus			
			N2			
			Proprietary			
CNTRLMDEXPAN	Cntrl Mod Expansion Capability	NUM		EA	3	N
NUMEXPANMODULE	Number of Expansion Modules	NUM		EA	4	N
ANALOGINPUTS	Analog Inputs	NUM		EA	5	N
DIGITALINPUTS	Digital Inputs	NUM		EA	6	N

Table A22. Evaporator Spec Template.

<b>CMMS Classification</b>	EVPRTTR	Evaporator				
<b>CMMS Sub-Classification</b>	(Null)					
<b>Belongs To</b>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
EVPRTTRTYPE	Type of Evaporator	ALN	Open Loop Closed Loop	n/a	1	Y
EVPRTRMEDIA	Type of Evaporator Media	ALN	Refridgerant Water	n/a	2	Y
ORIGREFER	Original Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	3	N
ORIGCHARGELBS	Original # LBS of Refrigerant	NUM		LBS	4	N
CURRENTREFER	Current Refrigerant	ALN	R11 R12 R134a R401a/MP39 R402a/HP80 R404a/HP62 R414b/Hotshot R500 R502 R22 R410A	n/a	5	N
CURRENTCHARGELBS	Current # LBS of Refrigerant	NUM		LBS	6	N
SEERKBTU	Seasonal Enrgy Efcncy in KBTU	ALN		KBTU	7	N
COOLTONS	Number of Tons of Cooling	NUM		TON	8	N
COOLMBH	Number of MBH of Cooling	NUM		MBH	9	N
CHEMTREAT	Chemical Treatment	ALN	Bio-Guard Glycol Nitrite None POSCA	n/a	10	N

Table A23. Fan Spec Template.

<b>CMMS Classification</b>	FAN	Fan					
<b>CMMS Sub-Classification</b>	(Null)						
<b>Belongs To</b>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
FANTYPE1	Fan Type 1	ALN	Exhaust	n/a	1	Y	
			Return				
			Supply				
FANTYPE2	Fan Type 2	ALN	Kitchen	n/a	2	Y	
			Latrine				
			Exhaust Hood				
			Dehumidifying				
			Vehicle Exhaust				
			Air Handler				
			Ventilation-Bldg				
FANMOUNTTYPE	Type of Fan Mount	ALN	Roof Mount	n/a	3	Y	
			Wall Mount				
			Duct/Hood Mount				
			Attic				
			Ceiling Mount				
FANMOUNTSIZE	Size of Opening, L x W Inches	ALN		IN	4	N	
FANSIZECFM	Size of Fan in CFM	NUM		CFM	5	Y	
FANDRIVETYPE	Type of Fan Drive	ALN	Direct Drive	n/a	6	N	
			Belt Drive				
BELTNUM	Number of Belts	NUM		EA	7	Y	
BELTSIZE	Size of Belt	ALN		n/a	8	Y	
PROPLLRTYPE	Type of Propeller	ALN	Blade	n/a	9	N	
			Squirrel				
BEARINGTYPE	Type of Bearings	ALN	Pillow Block	n/a	10	N	
			Fixed Mount				

Table A24. Furnace-Electric Spec Template.

<b>CMMS Classification</b>	FURNACE	Furnace				
<b>CMMS Sub-Classification</b>	ELECTRIC	Electric				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FURNTYPE2	Type of Furnace 2	ALN	Horizontal Upflow Downflow	n/a	1	Y
FURNSIZE1	Size of Furnace in Watts	NUM		WATTS	2	Y
FURNSIZE2	Size of Furnace in BTU's	NUM		BTU	3	Y
INPUTBTU	Input in BTU's	NUM		BTU	4	Y
FURNAMPS	Amperage of Furnace in AMPS	NUM		AMP	5	N
ELEMVOLT	Voltage of Element	NUM	110 208 220 440	VOLTS	6	N
CNTRLCIRCTYPE	Type of Control Circuit	ALN	Low Line	n/a	7	N
FURNSTAGE	Furnace Stage	ALN	One Stage Two Stage Three Stage	n/a	8	N
EERATEPERC	Energy Efficiency Rating in PERC	NUM		PERC	9	N
AIRFLOWCFM	Airflow in CFM	NUM		CFM	10	N
AIRFILTERSIZEINCH	Air Filter Size in Inches	NUM		IN	11	N
AIRFLOWTON	Airflow in Ton's	NUM		TON	12	N

Table A25. Furnace-Nat. Gas Spec Template.

<b>CMMS Classification</b>	FURNACE	Furnace					
<b>CMMS Sub-Classification</b>	NATGAS	Natural Gas					
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
FURNTYPE1	Type of Furnace 1	ALN	Natural Draft	n/a	1	Y	
			Induced Draft				
			Pressurized Draft				
			Power (Forced Draft)				
FURNTYPE2	Type of Furnace 2	ALN	Horizontal	n/a	2	Y	
			Upflow				
			Downflow				
INPUTBTU	Input in BTU's	NUM		BTU	3	Y	
BELTYPE	Type of Belt	ALN	Direct Drive	n/a	4	N	
			Belt Drive				
BELTSIZE	Size of Belt	ALN		n/a	5	N	
EERATEPERC	Energy Efficiency Rating in PERC	NUM		PERC	6	N	
AIRFLOWCFM	Airflow in CFM	NUM		CFM	7	N	
AIRFLOWTON	Airflow in TON	NUM		TON	8	N	
AIRFILTERSIZEINCH	Air Filter Size In Inches	NUM		IN	9	N	
FUELFILTERNUM	Fuel Filter Number	ALN		n/a	10	N	

Table A26. Furnace-Oil #2 Spec Template.

<b>CMMS Classification</b>	FURNACE	Furnace				
<b>CMMS Sub-Classification</b>	OILNUM2	Oil #2				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FURNTYPE1	Type of Furnace 1	ALN	Natural Draft	n/a	1	Y
			Induced Draft			
			Pressurized Draft			
			Power (Forced Draft)			
FURNTYPE2	Type of Furnace 2	ALN	Horizontal	n/a	2	Y
			Upflow			
			Downflow			
INPUTBTU	Input in BTU's	NUM		BTU	3	Y
BELTTYPE	Type of Belt	ALN	Direct Drive	n/a	4	N
			Belt Drive			
BELTSIZE	Size of Belt	ALN		n/a	5	N
AIRFLOWCFM	Airflow in CFM	NUM		CFM	6	N
AIRFLOWTON	Airflow in TON	NUM		TON	7	N
AIRFILTERSIZEINCH	Air Filter Size In Inches	ALN		n/a	8	N
FUELFILTERNUM	Fuel Filter Number	ALN		n/a	9	N

Table A27. Furnace-Propane Spec Template.

<b>CMMS Classification</b>	FURNACE	Furnace				
<b>CMMS Sub-Classification</b>	PROPANE	Propane				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
FURNTYPE1	Type of Furnace 1	ALN	Natural Draft	n/a	1	Y
			Induced Draft			
			Pressurized Draft			
			Power (Forced Draft)			
FURNTYPE2	Type of Furnace 2	ALN	Horizontal	n/a	2	Y
			Upflow			
			Downflow			
INPUTBTU	Input in BTU's	NUM		BTU	3	Y
BELTTYPE	Type of Belt	ALN	Direct Drive	PH	4	N
			Belt Drive			
BELTSIZE	Size of Belt	ALN		n/a	5	N
EERATEPERC	Energy Efficiency Rating in PERC	NUM		PERC	6	N
AIRFLOWCFM	Airflow in CFM	NUM		CFM	7	N
AIRFLOWTON	Airflow in TON	NUM		TON	8	N
AIRFILTERSIZEINCH	Air Filter Size In Inches	NUM		IN	9	N
FUELFILTERNUM	Fuel Filter Number	ALN		n/a	10	N

Table A28. Heat Exchanger Spec Template.

<b>CMMS Classification</b>	HTEXCHNGR	Heat Exchanger				
<b>CMMS Sub-Classification</b>	(Null)					
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
HEATEXTYPE	Type of Heat Exchanger	ALN	HW/HW Steam/HW	n/a	1	Y
HEATEXTYPE2	Type of Construction	ALN	Plate/Frame Fin Tube Shell Tube	n/a	2	Y
INPUTBTU	Input in BTU's	NUM		BTU	3	Y
OUTPUTBTU	Output in BTU's	NUM		BTU	4	Y
NUMPASS	Number of Passes	NUM	2 3 4	EA	5	N
PIPESIZEIN	Pipe Size into Heat Exchanger	NUM		IN	6	N
PIPESIZEOUT	Pipe Size out of Heat Exchanger	NUM		IN	7	N
MAXWORKTEMP	Maximum Working Temperature	NUM		DEG	8	N
NORMOPPRESS	Normal Operating Pressure	NUM		PSI	9	N
MAXALLOWPRESS	Maximum Allowable Pressure	NUM		PSI	10	N
FLUFLOWRATE	Fluid Flow Rating	NUM		GPM	11	N

Table A29. Heater-IR NatGas Spec Template.

<b>CMMS Classification</b>	HEATER	Heater					
<b>CMMS Sub-Classification</b>	HTRIRGAS	Infrared, Natural Gas					
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
HTRTYPE1	Type of Heater 1	ALN	Catalytic	n/a	1	Y	
			Vacuum				
			Pressurized Draft				
			Power (Forced Draft)				
INFRAINTEN	Infrared Intensity	ALN	High	n/a	2	Y	
			Low				
HTRSTAGE	Stages of Heater	ALN	One Stage	n/a	3	N	
			Two Stage				
			Three Stage				
INPUTBTU	Input in BTU's	NUM		BTU	4	Y	

Table A30. Hot Water Heater Spec Template.

<b>CMMS Classification</b>	HTWTRHTR	Hot Water Heater					
<b>CMMS Sub-Classification</b>	(Null)						
<b>Belongs To</b>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
TANKSIZE	Size of Tank in Gallons	NUM		GAL	1	Y	
HWHTYPE1	Hot Water Heater Tube Type	ALN	Fire Tube Water Tube Copper Fin Tube Sectional Tubo Power Module	n/a	2	Y	
HWHTYPE2	HWH Spacial Position Type	ALN	Horizontal Vertical	n/a	3	Y	
NUMPASS	Number of Passes	NUM	2 3 4	EA	4	N	
HWHCNTRL	Hot Water Heater Controls	ALN	DDC Single Loop Pneumatic Local/Standalone	n/a	5	N	
INPUTMBH*	Input in MBH	NUM		MBH	6	Y	
OUTPUTMBH*	Output in MBH	NUM		MBH	7	N	
INPUTBTU*	Input in BTU's	NUM		BTU	8	Y	
OUTPUTBTU*	Output in BTU's	NUM		BTU	9	Y	
NORMOPPRESS	Norm Op Pressure Set Point	NUM		PSI	10	N	
MAXALLOWPRESS	Maximum Allowable Pressure	NUM		PSI	11	N	
NATLBRDNUM	National Board Number	ALN		n/a	12	N	
STATENUM	State Number	ALN		n/a	13	N	
*Note: Calculation for Boiler Horse Power is MBH x 1000 = BTU / 33,475 = BHP							

Table A31. JACE Spec Template.

<b>CMMS Classification</b>	JACE	Java Application Control Engine					
<b>CMMS Sub-Classification</b>	(Null)						
<i>Belongs To</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
JACETYPE	JACE Type	ALN	Honeywell Tridium	n/a	1	N	
JACECONFIG	JACE Configuration	ALN	Network Stand Alone Network/Stand Alone	n/a	2	Y	
JACEWEBENABLED	JACE Web Enabled?	ALN	Yes No	GAL	3	N	
JACEJOBBUILDVERSN	JACE Job Build Version	ALN		n/a	4	N	
JACESERIALPORTSUSED	Which JACE Serial Ports Used?	ALN		n/a	5	N	

Table A32. Dale-JACE PRGM Spec Template.

<b>CMMS Classification</b>	JACEPRGM	JACE Program					
<b>CMMS Sub-Classification</b>	(Null)						
<i>Sub-Assembly of</i>							
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>	
JACEPRGM DUPLICATE	Location of Duplicate JACE Programs	ALN	Shop 2012 COE	n/a	1	N	
JACEVNDPRGM	JACE Vendor w/Program	ALN	Sound Energy Holiday Parks Control Contractor, Inc	n/a	2	N	
JACENUMDUPPRGM	Number of Duplicate JACE Programs	NUM		n/a	3	N	
JACEPRGMEDIA TYPE	Type of JACE Program Media	ALN	Floppy CD Zip Drive	n/a	4	N	

Table A33. Meter Spec Template.

<b>CMMS Classification</b>	METER	Meter				
<b>CMMS Sub-Classification</b>	(Null)					
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
MTRTYPE1	Meter Type 1	ALN	Natural Gas	n/a	1	Y
			Electric			
			Water			
			Fuel Oil			
MTRNUM	Meter Number	ALN		n/a	2	N
MTRPRESSURE	Meter Pressure	NUM		PSI	3	Y
MTRPIPESIZE	Meter Pipe Size	NUM		IN	4	Y
MTRRATING1	Rating of Gas & Propane	NUM		CCF	5	Y
MTRRATING2	Rating of Water & Fuel Oil	NUM		GAL	6	Y

Table A34. Pump Spec Template.

CMMS Classification	PUMP	Pump					
CMMS Sub-Classification	(Null)						
Belongs To							
Attribute	Attribute Description		Value (Circle or Input One)	Measure Unit	Item Seq	Include in Equip Desc?	
PUMPTYPE1	Type of System	ALN	Heating	n/a	1	Y	
			Chill Water				
			Condensate				
			Domestic CW				
			Domestic HW				
			Cooling Tower/Condensing				
			Feedwater				
			Sump				
			Fuel Oil				
			Chemical				
PUMPTYPE2	Type of Pump	ALN	Centrifical	n/a	2	Y	
			Positive Displacement				
			Turbine				
SPACIALPOS	Spacial Positioning	ALN	Horizontal	n/a	3	Y	
			Vertical				
PUMPTYPE3	Type of Pump	ALN	Pressure	n/a	4	Y	
			Circulating				
			Vacuum				
PUMPTYPE4	Type of Pump	ALN	Submersible	n/a	5	N	
			Non-Submersible				
PUMPTYPE5	Type of Pump	ALN	Split Case	n/a	6	N	
			Non-Split Case				
PUMPSTAGE	Pump Stages	ALN	Single	n/a	7	N	
			Multiple				
PUMPBODY1	Material of Pump	ALN	Cast Iron	n/a	8	N	
			Bronze				
			Stainless Steel				
			Special Alloy				
			Plastic				
CAPACITYGPM	Pump Capacity	NUM		GPM	9	N	
MAXOPPRESSURE	Maximum Operating Pressure	NUM		PSI	10	N	
VACUUMCAP	Vacuum in Inches of Mercury (HG)	NUM		HG	11	N	
DISCHARGECAP	Feet of Head	NUM		FT	12	N	
MAXALLOWTEMP	Maximum Allowable Temperature	NUM		DEG	13	N	
PIPESIZEIN	Pump Pipe Size- Inlet	NUM		IN	14	N	
PIPESIZEOUT	Pump Pipe Size- Outlet	NUM		IN	15	N	
PUMPROTATION	Pump Rotation	ALN	Clockwise	n/a	16	N	
			Counter Clock wise				

Table A35. Steam Trap Spec Template.

<b>CMMS Classification</b>	STMTRP	Steam Trap				
<b>CMMS Sub-Classification</b>	(Null)					
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
STMTRPTYPE1	Steam Trap Type 1	ALN	Balance Pressure	n/a	1	Y
			Bimetalic			
			Float&Thermostatic			
			Inverted Bucket			
			Thermo-Dynamic			
			Liquid Expansion			
STMTRPTYPE2	Steam Trap Type 2	ALN		n/a	2	N
STMTRPSIZE	Steam Trap Size	NUM		IN	3	Y
STMTRPCONNECT	Steam Trap Connections	ALN	Threaded	n/a	4	N
			Horzonal			
			Vertical			
			Flanged			
			Socket Weld			
STMTRPBODYMAT	Steam TrapBody Material	ALN	Cast Iron	n/a	5	N
			Ductile Iron			
			Stainless Steel			
			Forged Steel			
MAXPSI	Max operating pressure	NUM		PSI	6	N
ADJSTMTRNGE	Adjustment Range	NUM			7	N

Table A36. Valve Spec Template.

Attribute	Attribute Description	Type	Value (Circle or Input One)	Measure Unit	Item Seq	Include in Equip Desc?
CMM S Classification	VALVE	Valve				
CMM S Sub-Classification	(Null)					
Belongs To						
VLVSYSTEM	Type of System	ALN	Heating HW Chill Water Domestic HW Cooling Tower Steam	n/a	1	Y
VLVUSE	Type of Use	ALN	Stop Throttle Check Mixing Diverting Safety Relief Non-Return Blow Down/ Surface Blow Down/ Bottom Regulating	n/a	2	Y
VLVTYPE	Type of Valve	ALN	Globe Ball 2-way 3-way Butterfly Gate Metering Lift Swing	n/a	3	Y
VLVBODY1	Valve Body Material	ALN	Brass Bronze Cast Iron Stainless	n/a	4	N
VLVBODY2	Connection	ALN	Threaded Flange Welded	n/a	5	N
VLVBODY3	Seat	ALN	Bronze Stainless Teflon Brass	n/a	6	N
VLVSIZE	Valve Size	NUM		IN	7	N
FLANGEMOUNT	Number of Holes	NUM		HOLE S	8	N
VLVRATING	Pressure Rating of Valve	NUM		PSI	9	N
VLVACTION	Valve Movement	ALN	Two Position Modulating Throttling Solenoid	n/a	10	N
MAXTEMPDEGF	Maximum Temperature	NUM		DEGF	11	N
MAXBODYPSI1	Maximum Steam Rating	NUM		PSI	12	N
MAXBODYPSI2	Maximum Water, Oil, Gas (WOG) Rating	NUM		PSI	13	N
VLVACTUATOR	Valve Actuator	ALN	Pneumatic Electronic Manual	n/a	14	N

Table A37. HVAC Sub-Assembly Flow Chart.

<b><i>HVAC Sub-Assembly Flow Chart</i></b>			
<b>Equipment Type</b>	<small>(If Necessary)</small> <b>Sub-Assembly 1</b>	<small>(If Necessary)</small> <b>Sub-Assembly 2</b>	<small>(If Necessary)</small> <b>Sub-Assembly 3</b>
Air Conditioner	Condenser	Motor	Evaporator
Air Handling Unit	?		
Alarm, Release DETEC	N/A		
Boiler	Burner	?	
BPA, Double Check VLV	N/A		
BPA, Reduce Pressure	N/A		
Burner	Motor	?	
Compressor, Air	?		
Compressor, REFR	?		
Condenser, Air	?		
Condenser, Water	?		
Controller, HVAC	N/A		
Evaporator	?		
Fan	Motor	?	
Food Display Case	N/A		
Freezer	N/A		

Furnace, OILNUM2	?		
Furnace, Propane	?		
FSS, Deluge	N/A		
FSS, Dry	N/A		
FSS, Preaction	N/A		
FSS, Wet	N/A		
Heat Exchanger	?		
Heater, Infrared	Motor	?	
Hot Water Heater	Burner	?	
Ice Cream Maker	N/A		
Ice Maker	N/A		
Juice Dispenser	N/A		
Meter	?		
Milk Dispenser	N/A		
Refrigerator	N/A		
Sandwich Prep Table	N/A		
Steam Trap	?		
Tank, Chemical	?		
Tank, Petroleum	Alarm, Release Detec		

Table A38. MSEQUIP Template.

CMMS Spec #CL001031						
<b>CMMS Classification</b>	MSEQUIP	Maintenance and Service Equipment				
<b>CMMS Sub-Classification</b>	Null	Null				
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
MSTYPE1	Maintenance and Service Equipment Type 1	ALN	Backhoe	n/a	1	Y
			Car			
			Chipper			
			Compressor			
			Crane			
			Excavator			
			Forklift			
			Grader			
			Grinder			
			Loader			
			Mixer			
			Mower			
			Mud Pump			
			Roller			
			Saw			
			Sprayer			
			Spreader			
			Sweeper			
			Tractor			
			Trailer			
			Truck			
			Welder			
MSTYPE2	Maintenance and Service Equipment Type 2	ALN	3-Gang	n/a	2	Y
			5-Gang			
			Agricultural			
			Arc			
			Asphalt Patch			
			Backhoe			
			Brushcutter			
			Bucket Platform			
			Bulldozer			
			Cargo			
			Cleaner - Vacuum			
			Collection			
			Concrete			
			Deck			
			Dump			
			Extend-hoe			
			Front-mount			
			Fuel			
			Hazmat			
			Herbicide			
			Magnetic			
			Paint			
			Passenger			
			Pole Set			
			Propane			

Reel
Road
Rotary
Scoop
Sewer Cleaner
Street
Stump
Trailer-mounted
Transporter
Truck-mounted
Turf
Utility
Vacuum
Van
Vibratory
Wrecker

MSTYPE3	Maintenance and Service Equipment Type 3	ALN		n/a	3	Y
CAPCD	Capacity in Cubic Yards	NUM		CD	4	Y
FLOWCFM	Flow - Cubic Feet per Minute	NUM		CFM	5	Y
FLOWGPM	Flow - Gallons per Minute	NUM		GPM	6	Y
GVW	Gross Vehicle Weight	NUM		GVW	7	Y
HP	Horsepower	NUM		HP	8	Y
FTLENGTH	Length in Feet	NUM		FT	9	Y
CAPTON	Capacity in Tonage	NUM		TON	10	Y
CAPGAL	Holding Capacity in Gallons	NUM		GAL	11	Y
CAPPOUNDS	Capacity in Pounds	NUM		LBS	12	Y
CAPPASS	Capacity in number of passengers	NUM		PSNGR	13	Y
USANUM	USA Number	ALN		n/a	14	Y
LIN	Hand Receipt LIN	ALN		n/a	15	N
SUBLIN	Hand Receipt SUBLIN	ALN		n/a	16	N
NSN	National Stock Number	ALN		n/a	17	N
TDANUM	TDA/CTA Number	ALN		n/a	18	N
MSTYPE4	Further MS Equipment Detail	ALN		n/a	19	N

Table A39. BPA-Dbl Chk Vlv Template.

<b>CMMS Classification</b>	BPA	Backflow Preventer Assembly				
<b>CMMS Sub-Classification</b>	DCVA	Double Check Vlv				
<i>Belongs To</i>						
<b>Operating Location Safety Hazard</b>						
Boiler						
Fire Sprinkler						
Premise						
Irrigation						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
BPASIZEIN	BPA Pipe/Vlv Size in Inches	ALN		IN	1	Y
<p><b>Note: Items identified above will be readdressed by Sytem Manager for applicability</b></p>						

Table A40. BPA-Reduce Pressure Template.

<b>CMMS Classification</b>	BPA	Backflow Preventer Assembly				
<b>CMMS Sub-Classification</b>	RPBA	Reduced Pressure				
<i>Belongs To</i>						
<b>Operating Location Safety Hazard</b>						
Boiler						
Fire Sprinkler						
Premise						
Irrigation						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
BPASIZEIN	BPA Ppe/Vlv Size in Inches	ALN		IN	1	Y
<p><b>Note: Items identified above will be readdressed by Sytem Manager for applicability</b></p>						

Table A41. Fire Supp Sys-Deluge Template.

<b>CMMS Classification</b>	FSS	Fire Suppression System				
<b>CMMS Sub-Classification</b>	DELUGE	Deluge				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VLVSIZEIN	Valve Size in Inches	NUM		IN	1	Y
HOSEREELYN	Hosereel Installed	ALN	Yes No	n/a	2	N
FOAMTANKGAL	Foam Tank Size in Gallons	NUM		GAL	3	N
STANDPIPEYPE	Type of Standpipe	ALN	Dry Wet	n/a	4	Y
STANDPIPESIZEIN	Standpipe Size in Inches	NUM		IN	5	N

Table A42. Fire Supp Sys-Dry Template.

<b>CMMS Classification</b>	FSS	Fire Suppression System				
<b>CMMS Sub-Classification</b>	DRY	Dry				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VLVSIZEIN	Valve Size in Inches	NUM		IN	1	Y
HOSEREELYN	Hosereel Installed	ALN	Yes No	n/a	2	N
FOAMTANKGAL	Foam Tank Size in Gallons	NUM		GAL	3	N
STANDPIPEYPE	Type of Standpipe	ALN	Dry Wet	n/a	4	Y
STANDPIPESIZEIN	Standpipe Size in Inches	NUM		IN	5	N

Table A43. Fire Supp Sys-Preaction Template.

<b>CMMS Classification</b>	FSS	Fire Suppression System				
<b>CMMS Sub-Classification</b>	PREACT	Preaction				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VLVSIZEIN	Valve Size in Inches	NUM		IN	1	Y
HOSEREELYN	Hosereel Installed	ALN	Yes No	n/a	2	N
FOAMTANKGAL	Foam Tank Size in Gallons	NUM		GAL	3	N
STANDPIPE TYPE	Type of Standpipe	ALN	Dry Wet	n/a	4	Y
STANDPIPESIZEIN	Standpipe Size in Inches	NUM		IN	5	N

Table A44. Fire Supp Sys-Wet Template.

<b>CMMS Classification</b>	FSS	Fire Suppression System				
<b>CMMS Sub-Classification</b>	WET	Wet				
<i>Belongs To</i>						
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
VLVSIZEIN	Valve Size in Inches	NUM		IN	1	Y
HOSEREELYN	Hosereel Installed	ALN	Yes No	n/a	2	N
FOAMTANKGAL	Foam Tank Size in Gallons	NUM		GAL	3	N
STANDPIPE TYPE	Type of Standpipe	ALN	Dry Wet	n/a	4	Y
STANDPIPESIZEIN	Standpipe Size in Inches	NUM		IN	5	N

Table A45. Alarm-RLSEDETEC Spec Template.

<b>CMMS Classification</b>	ALARM	Alarm				
<b>CMMS Sub-Classification</b>	RLSEDETEC	Release Detection				
<b>Attribute</b>	<b>Attribute Description</b>	<b>Type</b>	<b>Value (Circle or Input One)</b>	<b>Measure Unit</b>	<b>Item Seq</b>	<b>Include in Equip Desc?</b>
REMOTEACCESST	Remote Access Type	ALN	Serial Port	n/a	1	Y
			Telephone Line			
			Network Adapter			
			No Remote Access			

Table A46. Chemical Tank Spec Template.

Attribute	Attribute Description	Type	Value	Measure Unit	Item Seq	Include in Equip Desc?
CMMS Classification	TANK		Tank			
CMMS Sub-Classification	CHEMICAL		Chemical			
TANKTYPE1	Type of Tank	ALN	AST UST Vaulted	n/a	1	Y
TANKUSAGE1	Usage of Substance in Tank	ALN	Storage Recycle Fire Suppression Chemical Tank	n/a	2	Y
TANKSUBST1	Substance Stored in Tank	ALN	Antifreeze Sodium Hypochlorite Sodium Bisulfite Sodium Thiosulfate Polymer De-Emulsifier Foam Dry Lime Lime Slurry Urea Fluorosilicic Acid Polyphosphate	n/a	3	Y
TANKSIZE	Size of Tank in Gallons	NUM		GAL	4	Y
TANKCONS	Tank Construction (Number of Walls)	ALN	Single Double Secondary Containment	n/a	5	N
TANKMATERIAL	Material of Tank	ALN	Steel Coated Steel Steel Clad w/ Fiberglass Fiberglass w/ Plastic Fiberglass/Fiberglass Polyurethane Concrete	n/a	6	N
TANKREDET	Type of Tank Release Detection	ALN	Weekly Manual Gauging Manual Inventory Control Automatic Tank Gauging Vapor Monitoring Groundwater Monitoring Interstitial Monitoring None	n/a	7	N
TANKCORPROT	Type of Tank Corrosion Protection	ALN	Sacrificial Anode Impressed Current Interior Lining Corrosion Resistant None Sacrificial Anode & Interior Lining Impressed Current & Interior Lining	n/a	8	N

TANKSPILPREV	Tank Spill Prevention	ALN	Spill Bucket/ Spill Box Filled By 25 Gallons or Less None	n/a	9	N
TANKOVERFILL	Tank Overfill Prevention	ALN	Automatic Shutoff Overfill Alarm Ball Float Valve Filled by 25 Gallons or Less None	n/a	10	N
PIPEMATER	Piping Material	ALN	Steel Coated Steel Fiberglass Flexible Piping No Piping attached to Tank	n/a	11	N
PIPECONSTR	Piping Construction	ALN	Single Wall Double Wall Secondary Containment Piping is Not Underground No Piping attached to Tank	n/a	12	N
PIPERELDET	Piping Release Detection	ALN	Automatic Line Leak Detection Suction System Pump Check Valve Vapor Monitoring Groundwater Monitoring Interstitial Monitoring No Piping attached to Tank	n/a	13	N
PIPECORPROT	Piping Corrosion Protection	ALN	Sacrificial Anode Impressed Current Corrosion Resistant None Coated Only No Piping attached to Tank	n/a	14	N
PUMPSYST	Pumping System	ALN	Pressurized System Suction System Check Valve near Pump Suction System Check Valve near Tank Gravity Delivery System Product Removed by Reclaimer	n/a	15	N
TANKSTAT	Tank Status	ALN	Operational Temporarily Closed Closed	n/a	16	N

Table A47. Petroleum Tank Spec Template.

Attribute	Attribute Description	Type	Value	Measure Unit	Item Seq	Include in Equip Desc?
CMMS Classification	TANK		Tank			
CMMS Sub-Classification	PETRO		Petroleum			
TANKTYPE1	Type of Tank	ALN	AST UST Vaulted	n/a	1	Y
TANKREG	Regulatory Status	ALN	Non-Regulated Regulated	n/a	2	Y
TANKUSAGE2	Primary Usage of Substance in Tank	ALN	Heating Fuel Curtailment Heating Fuel Emergency Power Hot Water Mobility Recycle/Reclamation	n/a	3	Y
TANKUSAGE4	Secondary Usage of Subst. in Tank	ALN	Curtailment Heating Fuel Emergency Power Hot Water Mobility Recycle/Reclamation	n/a	4	Y
TANKSUBST2	Substance Stored in Tank	ALN	Propane JP-8 Unleaded Gasoline Diesel B20 B100 E85 Motor Oil Aviation Fuel Kerosene Fuel Oil #2 Fuel Oil #4 Fuel Oil #6 Natural Gas	n/a	5	Y
TANKSIZE	Size of Tank in Gallons	NUM		GAL	6	Y
TANKCONS	Tank Construction (Number of Walls)	ALN	Single Wall Double Wall Single Wall w/Secondary Contain. Double Wall w/Secondary Contain.	n/a	7	N
TANKMATERIAL	Material of Tank	ALN	Steel Coated Steel Steel Clad w/ Fiberglass Fiberglass w/ Plastic Fiberglass/Fiberglass Polyurethane Concrete	n/a	8	N

TANKRELEDET1	Primary Type of Tank Release Detection	ALN	Weekly Manual Gauging	n/a	9	N
			Manual Inventory Control			
			Automatic Tank Gauging			
			Vapor Monitoring			
			Groundwater Monitoring			
			Interstitial Monitoring			
			None			
TANKRELEDET2	Secondary Type of Tank Release Detection	ALN	Weekly Manual Gauging	n/a	10	N
			Manual Inventory Control			
			Automatic Tank Gauging			
			Vapor Monitoring			
			Groundwater Monitoring			
			Interstitial Monitoring			
			None			
TANKCORPROT	Type of Tank Corrosion Protection	ALN	Sacrificial Anode	n/a	11	N
			Impressed Current			
			Interior Lining			
			Corrosion Resistant			
			None			
			Sacrificial Anode & Interior Lining			
			Impressed Current & Interior Lining			
TANKSPILPREV	Tank Spill Prevention	ALN	Spill Bucket/ Spill Box Filled By 25 Gallons or Less	n/a	12	N
			None			
TANKOVERFILL	Tank Overfill Prevention	ALN	Automatic Shutoff	n/a	13	N
			Overfill Alarm			
			Ball Float Valve			
			Filled by 25 Gallons or Less			
			None			
PEMATER	Piping Material	ALN	Steel	n/a	14	N
			Coated Steel			
			Fiberglass			
			Flexible Piping			
			No Piping attached to Tank			
PIPECONSTR	Piping Construction	ALN	Single Wall	n/a	15	N
			Double Wall			
			Secondary Containment			
			Piping is Not Underground			
			No Piping attached to Tank			
PIPEREDET1	Primary Piping Release Detection	ALN	Automatic Line Leak Detection	n/a	16	N
			Suction System Pump Check Valve			
			Vapor Monitoring			
			Groundwater Monitoring			
			Interstitial Monitoring			
			No Piping attached to Tank			
PIPEREDET2	Secondary Piping Release Detection	ALN	Automatic Line Leak Detection	n/a	17	N
			Suction System Pump Check Valve			
			Vapor Monitoring			
			Groundwater Monitoring			
			Interstitial Monitoring			
			No Piping attached to Tank			
PIPECORPROT	Piping Corrosion Protection	ALN	Sacrificial Anode	n/a	18	N
			Impressed Current			
			Corrosion Resistant			
			None			
			Coated Only			
			No Piping attached to Tank			
TANKSTAT	Tank Status	ALN	Operational	n/a	19	N
			Temporarily Closed			
			Closed			

# REPORT DOCUMENTATION PAGE

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<b>14. ABSTRACT</b> The Construction Operations Building Information Exchange (COBIE) specification denotes how information may be captured during design and construction projects, and then transferred effectively and affordably to facility operators and owners at the conclusion of the project. COBIE has been demonstrated to eliminate the need for inefficient or redundant post hoc data capture on capital projects. A pilot project was conducted at Fort Lewis, WA, under the U.S. Army Installation Technology Transfer Program (ITTP), to investigate how the benefits of COBIE may be exploited by installation Departments of Public Works (DPWs) during the planning and execution of small capital projects, operations and maintenance work, and facility renovations. This ITTP demonstration encompassed the modification of project contract language to incorporate COBIE requirements, the development of draft COBIE data property set templates for typical equipment, and preparation of draft recommendations for incorporating the COBIE specification into installation-level design guidance. Issues related to the capture and use of electronic construction submittals to automatically create project handover information and coordination with maintenance management software vendors are also discussed.					
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