```
**************************************************************************
USACE / NAVFAC / AFCESA / NASA      UFGS 25 10 10.00 24 (May 2013)
                                    based on UFGS-25 10 10 (November 2012)
                                    -------------------------------------
Preparing Activity:  NAVFAC NW

                 UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use this section for NAVFAC NW projects only.
**************************************************************************
```

SECTION TABLE OF CONTENTS

DIVISION 25 - INTEGRATED AUTOMATION

SECTION 25 10 10.00 24

ICS FRONT END INTEGRATION (NAVFAC NW)

05/13

-- End of Section Table of Contents --

```
**************************************************************************
USACE / NAVFAC / AFCESA / NASA      UFGS 25 10 10.00 24 (May 2013)
                                    based on UFGS-25 10 10 (November 2012)
                                    -------------------------------------
Preparing Activity:  NAVFAC NW
```

UNIFIED FACILITIES GUIDE SPECIFICATIONS

```
Use this section for NAVFAC NW projects only.
**************************************************************************
```

SECTION 25 10 10.00 24

ICS FRONT END INTEGRATION (NAVFAC NW)
05/13

```
**************************************************************************
```
            NOTE: This guide specification covers the
            requirements for a NAVFAC NW-compliant Industrial
            Control System (ICS) Front End using the following
            Open protocols at the building level(LonWorks,
            BACnet, Modbus, DNP and OPC), but integrating the
            data over the NAVFAC NW ICS using the Niagara
            Framework.

            This guide specification covers the requirements for
            Industrial Control Systems (ICS) for facilities and
            utilities under Commander Navy Region Northwest as
            well as for facilities at Naval Hospital Bremerton.
            The intent of this specification is for the project
            to:

            1. Interface and communicate with the existing
            NAVFAC ICS. The NAVFAC ICS utilizes Niagara AX based
            Architecture which use Transmission Control Protocol
            / Internet Protocol (TCP/IP) and Hypertext Transfer
            Protocol (HTTP) to communicate with Building Level
            Controllers via the NAVFAC ICS Network.

            2. Utilize Government certified software for the
            operation of the ICS as well as the programming of
            Building Level Controllers in order to maintain
            Fleet Cyber Command certification and accreditation
            of the ICS and Fleet Cyber Command Authority to
            Operate the ICS.

            3. Create a graphical user interface for this
            project that complies with the graphical interface
            standards listed in Appendix B. Create custom
            graphical page content similar to the examples in
            Appendix C for the systems installed or modified in
            this project. Create unique new graphical page
            content where the new function differs from that
            existing currently in the NAVFAC ICS, or variations
            of existing graphical pages are required based on
            Government review comments.

PART 1   GENERAL

1.1   SUMMARY

The Industrial Control System (ICS) shall perform supervisory monitoring
and supervisory control of base-wide building control systems and utility
control systems using the Niagara Framework with Fox protocol as specified.

NOTE: Appendices B - F referenced throughout this UFGS can be accessed from
the UFGS Graphics Table of Contents. TO DOWNLOAD UFGS GRAPHICS Go to
http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf.

1.1.1   System Requirements

Provide an ICS as specified and shown, and in accordance with the following
characteristics:

The Industrial Control System consists of a high-speed, peer-to-peer
network of workstations, servers, routers, network switches and stand-alone
supervisory controllers. This network provides the capability to integrate
BACnet, LonWorks, MODBUS, OPC and other open and proprietary communication
protocols into one open, interoperable system.

A web based controller and server with a network interface card gathers
data from this system and generates web pages accessible through an
Internet Explorer™ web browser on each workstation connected to the
network. Operators are able to perform normal and expanded operator
functions through this web browser interface.

The system installed in this project including all associated equipment and
accessories, shall tie into the existing Niagara-based Industrial Control
System. Each SC shall communicate to other open and legacy protocol
systems/devices installed in the facility.

The ICS is comprised of supervisory controllers which are based on a
hierarchical architecture incorporating Niagara AX Framework™ ("Niagara" or

"Niagara AX"). All new and replacement equipment shall be compliant with the Niagara AX Framework.

1.1.1.1   General System Requirements

a. The system shall perform supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.

b. The system shall include a Graphical User Interface which shall allow for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, and access to all supervisory monitoring and control functions. See Appendices A and B for additional information..

c. All software used by the ICS and all software used to install and configure the ICS shall be licensed to and delivered to NAVFAC NW CIO..

d. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government such that the Government or their agents are able to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor. Software licenses shall not require periodic fees and shall be valid in perpetuity.

e. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor.

f. The ICS shall interface directly to ASHRAE 135 (BACnet), CEA-709.1-C, Modbus, OPC DA, and Niagara Framework field control systems as specified and may interface to field control systems using other protocols via an M&C Software protocol driver or a Gateway.

g. For ICS systems with Monitoring and Control Software functionality implemented in Monitoring and Control (M&C) Controller Hardware, provide sufficient additional controller hardware to support the full capacity requirements as specified.

h. All Niagara Framework components shall have an unrestricted interoperability license with a Niagara Compatability Statement (NiCS) following the Tridium Open NiCS Specification and shall have a value of "ALL" for "Station Compatibility In", "Station Compatability Out", "Tool Compatability In" and "Tool Compatability Out". Note that this will result in the following entries in the license.dat file:
        "accept.station.in=*"
        "accept.station.out=*"
        "accept.wb.in=*"
        "accept.wb.out=*"

1.1.1.2   Common Installed Equipment in NAVFAC ICS Operations Centers

The following computer equipment and software exist at NAVFAC NW ICS Operations Centers, and shall be directly supported as part of this project:

a. The Niagara AX front-end system is composed of virtualized Windows

fail-over clusters, with each cluster composed of two or more
virtualized computers running the latest version of Windows Server
software and the Microsoft Hypervisor.

b. Niagara Servers:
    One serves to provide the situation screen wall displays.
    One serves the operator stations.
    One SQL Server: Stores all trending data in the ICS system.
    All data for the above servers and clusters is stored on a Storage Area
    Network (SAN) accessed via iSCSI.

1.1.1.3   Supervisory Controller Communication

All SC's shall be able to communicate to each of the following
languages/protocols: DNP, IEC-61850/MMS, Lon, BACnet, or Modbus.
Communications between SC's, and between SC's and Niagara servers, shall be
by Fox or other Niagara-compatible protocol, communications between
SC's/Servers and workstations shall be by HTTP or HTTPS. Sub-networks to
other devices via alternative protocols are strictly prohibited.

1.1.1.4   Niagara Framework Requirements

The ICS shall use the Niagara Framework and shall communicate with
Niagara Framework field control systems using the Fox protocoland HTTP over
the Government furnished IP network as indicated and specified.

1.1.2   Information Assurance Requirements

Information Assurance for the system shall be addressed in accordance with
the following requirements:

1.1.2.1   Cyber Security

Prior to initiating any work on site pertaining to the ICS each contractor
employee who will work on programming or existing ICS infrastructure shall:

a. Complete the SAAR-N form (provided by NAVFAC NW) and provide to
    Contracting Officer;
b. Complete the annual Department of Defense Information Assurance
    Awareness training at http://iase.disa.mil/eta/iaav9/iaa_v9/index.htm;
c. Have proof of a clean background investigation with a least a Facility
    Access Determination (FAD)

Contractor should plan on the clearance activities listed above taking 12
weeks for personnel not already holding a Government security clearance.
Clearance activities can take longer than 12 weeks for individuals found to
have clearance issues during their background check.

Admin Rights: Contractors will not be granted full admin rights to any
government-owned computer. Local accounts on government computers are not
allowed; contractors whose personnel who have submitted their forms and
have a proper background check or clearance will be granted NAVFAC NW
Domain accounts for their access needs for the duration of the project. In
order to receive the domain accounts for the Contractor's employees, the
Contractor shall complete one copy of the Contractor Domain Account Request
form (provided by NAVFAC NW).

USB 'thumb' drives are prohibited on Government equipment.
Government-supplied USB hard drives are acceptable and can be checked out

from CIO.

The Contractor shall not connect contractor owned computer equipment to the Industrial Controls System, nor leave behind any telecommunication infrastructure (i.e., cellular modems) that allows remote access into installed equipment.

The Contractor will be allowed to check out ICS laptops for field use. Laptops for field use while on-site may be checked out from the ICS laptop pool managed by NAVFAC NW CIO at NBK-Bangor, WA. Laptop check-out reservations should be scheduled at least one week in advance of need to assure availability.

Provide secure password protection for each device/system; provide all integration necessary to incorporate centralized authentication with the NAVFAC NW Windows Domain Controllers. Password information shall be need-to-know, and the Contractor shall not disclose it to others. Password information shall be submitted via hard copy correspondence or CD to the Contracting Officer. Passwords shall not be conveyed by e-mail or 3rd party means.

If at any of the above security requirements are violated, the individual(s) will have (at a minimum) their Government computer access privileges revoked. All IT related possessions may be confiscated pending an investigation.

1.1.2.2   ICS Network

Upon request by the Contractor, the Government will provide IP addresses for each Ethernet-addressable device. The Contractor shall first provide a spreadsheet with the MAC address, serial number, device nomenclature, firmware revision, planned port on switch to which it is connected, system function being served by each device installed, and a blank field for the IP address. NAVFAC NW CIO will provide a blank template spreadsheet for completion by the Contractor. The government will return the spreadsheet to the Contractor with IP addresses filled in. IP addresses will not be provided electronically.

All devices installed by this project shall have Ethernet interfaces capable of functioning normally during heavy network traffic situations without failing or requiring manual reset.

The Contractor shall provide and program initial usernames and passwords for Ethernet switches, and submit this information to the Contracting Officer as part of the request to have the device(s) connected to the network.

1.1.3   ICS Programming Software

For software used for controllers below the supervisory controller and is not already existing on site, the Contractor shall provide 6 copies of the software. For a list of software currently installed on Government workstations and laptops see Appendix F.

For software used to program and create graphical content on the supervisory controller and is not already existing on site, the Contractor shall provide 3 copies of the software.

The installed version of the programming software for each device shall be

licensed to NAVFAC NW CIO. Software shall be submitted on CD-ROM, and one
hard copy and one electronic copy of the software user manual shall be
submitted for each piece of software provided.

1.1.4   Symbols, Definition and Abbreviations

Symbols, definitions, and engineering unit abbreviations used in displays,
submittals and reports shall be as currently used in the existing ICS
graphical user interface unless noted otherwise. See Appendix B for more
information.

1.1.5   System Units and Accuracy

Displays, print-outs and calculations shall be performed in English
(inch-pound)units. Calculations shall have accuracy equal to sensor
accuracy. Displays and printouts shall present values to at least one
significant figure.

1.1.6   Data Packages/Submitals Requirements

****
**NOTE: Coordinate the review of all submittals with
the project site. The site may have a System
Integrator or other individual/office that should
review all submittals before acceptance of the
system.**

**In the NW AOR, Rich Trimble is the ICS Program
Manager. He maintains a portal site with
information and resources to assist anyone involved
in coordinating an ICS project. It can be viewed by
going to this portal address:
https://portal.navfac.navy.mil/portal/page/portal/navfacnw/pwbl/ics
On this page is a section titled "Project Review by
Core" which lists the PW and CIO Core personnel who
should be included on submittal review (including
the SAES, RFP or DBB documentation).**

**The acquisition of all technical data, data bases
and computer software items that are identified
herein will be accomplished strictly in accordance
with the Federal Acquisition Regulation (FAR) and
the Department of Defense Acquisition Regulation
Supplement (DOD FARS). Those regulations as well as
the Services implementations thereof should also be
consulted to ensure that a delivery of critical
items of technical data is not inadvertently lost.
Specifically, the Rights in Technical Data and
Computer Software Clause, DOD FARS 52.227-7013, and
the Data Requirements Clause, DOD FAR 52.227-7031,
as well as any requisite software licensing
agreements will be made a part of the CONTRACT
CLAUSES or SPECIAL CONTRACT REQUIREMENTS.**

**In addition, the appropriate DD Form 1423 Contract
Data Requirements List, will be filled out for each
distinct deliverable data item and made a part of
the contract. Where necessary, a DD Form 1664, Data**

****

Technical data packages consisting of computer software and technical data (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications shall be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered shop drawings under the Federal Acquisition Regulation Supplement (FARS) and shall contain no proprietary information and shall be delivered with unrestricted rights.

1.2   REFERENCES

****
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135   (2010; INT 1-3 2011; Addenda AD & AE 2011; Errata 2012; INT 5 2012) BACnet—A Data

Communication Protocol for Building
Automation and Control Networks

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-C   (2010) Control Network Protocol
                                 Specification

CEA-709.3   (1999; R 2004) Free-Topology Twisted-Pair
                                 Channel Specification

CEA-852-B   (2010) Tunneling Component Network
                                 Protocols Over Internet Protocol Channels

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1815   (2012) Electric Power Systems
                                 Communications-Distributed Network
                                 Protocol (DNP3)

IEEE C62.41   (1991; R 1995) Recommended Practice on
                                 Surge Voltages in Low-Voltage AC Power
                                 Circuits

LONMARK INTERNATIONAL (LonMark)

LonMark Interoperability Guide   (2005) LonMark Application-Layer
                                 Interoperability Guide and LonMark Layer
                                 1-6 Interoperability Guide; Version 3.4

LonMark SNVT List   (2003) LonMark SNVT Master List; Version
                                 113

LonMark XIF Guide   (2001) LonMark External Interface File
                                 Reference Guide; Revision 4.402

MODBUS ORGANIZATION, INC (MODBUS)

Modbus   (2006) Modbus Application Protocol
                                 Specification; Version 1.1b and Modbus
                                 Messaging on TCP/IP Implementation Guide;
                                 Version V1.0b

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 262   (2011) Standard method of Test for Flame
                                 Travel and Smoke of Wires and Cables for
                                 Use in Air-Handling Spaces

NFPA 70   (2011; Errata 2 2012) National Electrical
                                 Code

OPC FOUNDATION (OPC)

OPC DA   (2002) OPC Data Access (DA) Specification;
                                 Version 2.05a

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA J-STD-607   (2002a) Commercial Building Grounding
                                       (Earthing) and Bonding Requirements for
                                       Telecommunications

TIA-568-C.1   (2009; Add 2 2011; Add 1 2012) Commercial
                                       Building Telecommunications Cabling
                                       Standard

TIA/EIA-606   (2002a; Errata 2007; R 2007; Adm 1 2008)
                                       Administration Standard for the
                                       Telecommunications Infrastructure

TRIDIUM, INC (TRIDIUM)

Niagara Framework   (2012) NiagaraAX User's Guide

Tridium Open NiCS   (2005) Understanding the NiagaraAX
                                       Compatibility Statement (NiCS)

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC EMC   (2002) FCC Electromagnetic Compliance
                                       Requirements

FCC Part 15   Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 60950   (2000; Reprint Oct 2007) Safety of
                                       Information Technology Equipment

1.3   DEFINITIONS

  The following list of definitions may contain terms not found elsewhere in
  this Section but are included here for completeness. Some terms are
  followed with a protocol reference in parenthesis (for example: (BACnet))
  indicating to which protocol the term and definition applies.

1.3.1   Alarm Generation

  The process of comparing a point value (the point being alarmed) with a
  pre-defined alarm condition (e.g. a High Limit) and performing some action
  based on the result of the comparison.

1.3.2   Advanced Metering Infrastructure (AMI)

  AMI is the monitoring of utility metering for both billing and operations
  functions. AMI Meters (electricity, gas, steam, and water) installed in
  the NAVFAC NW AOR in 2011 - 2014 under the ARRA funded regional project all
  report their data over a separate wireless (AMI) network and not over the
  ICS network. The two networks are distinct and are not currently
  interconnected.

1.3.3   Alarm Handling

  see Alarm Routing

1.3.4   Alarm Routing

Alarm routing is M&C software functionality that starts with a notification that an alarm exists (typically as the output of an Alarm Generation process) and sends a specific message to a specific alarm recipient or device.

1.3.5   BACnet

The term BACnet is used in two ways. First meaning the BACnet Protocol Standard - the communication requirements as defined by ASHRAE 135 including all annexes and addenda. The second to refer to the overall technology related to the ASHRAE 135 protocol.

1.3.6   BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more BACnet services intended to define a higher level of interoperability. BIBBs are combined to build the BACnet functional requirements for a device in a specification. Some BIBBs define additional requirements (beyond requiring support for specific services) in order to achieve a level of interoperability. For example, the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by an M&C client, not only requires the client to support the ReadProperty Service, but also provides a list of data types (Object / Properties) which the client must be able to interpret and display for the user.

1.3.7   BACnet Testing Laboratories (BTL)(BACnet)

Established by BACnet International to support compliance testing and interoperability testing activities and consists of BTL Manager and the BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.3.8   BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been certified by BACnet® Testing Laboratory. Devices may be certified to a specific device profile, in which case the certification indicates that the device supports the required capabilities for that profile, or may be certified as "other".

1.3.9   Binary

A two-state system or signal; for example one where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

1.3.10   Binding (LonWorks)

The act of establishing communications between CEA-709.1-C devices by associating the output of a device to the input of another so that information is automatically (and regularly) sent without being requested by the recipient.

1.3.11   Broadcast

Unlike most messages, which are intended for a specific recipient device, a broadcast message is intended for all devices on the network.

1.3.12   Building Control Network (BCN)

  The network used by the Building Control System. Typically the BCN is a
  BACnet ASHRAE 135 or LonWorks CEA-709.1-C network installed by the building
  control system contractor.

1.3.13   Building Control System (BCS)

  One type of Field Control System. A control system for building electrical
  and mechanical systems, typically HVAC (including central plants) and
  lighting. A BCS generally uses Direct Digital Control (DDC) Hardware.

1.3.14   Building Point of Connection (BPOC)

  A FPOC for a Building Control System. (This term is being phased out of
  use in preference for FPOC but is still used in some specifications and
  criteria.)

1.3.15   Clearance

  Security Clearance

1.3.16   Control Logic Diagram

  A graphical representation of control logic for multiple processes that
  make up a system.

1.3.17   Facility Point Of Connection (FPOC)

  The FPOC is the point of connection between the ICS IP Network and the
  field control network (either an IP network, a non-IP network, or both).
  The hardware at this location which provides the connection is generally
  one of a control protocol router, a control protocol gateway, or an IT
  device such as a switch, IP router, or firewall.

  In general, the term "FPOC Location" means the place where this connection
  occurs, and "FPOC Hardware" means the device that provides the connection.
  Sometimes the term "FPOC" is used to mean either and its actual meaning
  (i.e. location or hardware) is determined by the context in which it is
  used.

1.3.18   Field Control Network

  The network used by a field control system.

1.3.19   Field Control System (FCS)

  A building control system or utility control system.

1.3.20   Fox Protocol (Niagara Framework)

  The protocol used for communication between components in the Niagara
  Framework. By default, Fox uses TCP port 1911

1.3.21   Gateway

  A device that translates from one protocol to another. Devices that change
  only the transport mechanism of the protocol - "translating" from LonWorks
  over TP/FT-10 to LonWorks over IP for example - are not gateways as the

underlying protocol (data format) does not change. Gateways are also called Communications Bridges or Protocol Translators.

1.3.22   Industrial Control System (ICS)

The NAVFAC NW Industrial Control System is an integration of SCADA (Supervisory Control And Data Acquisition - for Utility System control) and DDC (Direct Digital Control - for Facility mechanical and electrical control) devices and the individual control systems, networks, field equipment, sensors and actuators that provide monitoring and control function for mechanical and electrical systems. All control systems are part of the ICS, whether part of a utility or a facility. AMI is part of the ICS program, but is not part of this guide specification.

1.3.23   Information Assurance (IA)

Information assurance is the practice of assessing and managing risks related to the use, processing, storage, and transmission of information or data and the systems and processes used for those purposes.

1.3.24   iSCSI

Internet Small Computer System Interface is an Internet Protocol (IP)-based storage networking standard for linking data storage facilities.

1.3.25   JACE (Niagara Framework)

Java Application Control Engine. Note: The Niagara Framework parent corporation Tridium's product line of supervisory controllers are called "JACE" so the term "JACE" should be avoided when discussing supervisory controllers/gateways generally.

1.3.26   LDAP

Lightweight Directory Access Protocol. LDAP is used to authenticate supervisory controllers and computers to the NAVFAC ICS Windows Domain.

1.3.27   LonMark International (LonWorks)

Standards committee consisting of independent product developers, system integrators and end users dedicated to determining and maintaining the interoperability guidelines for LonWorks. Maintains guidelines for the interoperability of CEA-709.1-C devices and issues the LonMark Certification for CEA-709.1-C devices.

1.3.28   LonWorks (LonWorks)

The term used to refer to the overall technology related to the CEA-709.1-C protocol (sometimes called "LonTalk"), including the protocol itself, network management, interoperability guidelines and products.

1.3.29   Modbus

A basic protocol for control network communications generally used in utility control systems. The Modbus protocol standard is maintained by The Modbus Organization.

1.3.30   Master-Slave/Token Passing (MS/TP)(BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds (data rates) are permitted by the BACnet MS/TP standard.

1.3.31   Monitoring and Control (M&C) Software

The ICS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

1.3.32   NAVFAC NW CIO (CIO)

NAVFAC NW CIO (CIO) is the authority having jurisdiction over all ICS IT (Information Technology) and OT (Operational Technology).

1.3.33   Network

The ICS is composed of Ethernet TCP/IP router-switch-and-cable network running over copper and fiber media, and serial networks running over a variety of media.

1.3.34   Network Variable (LonWorks)

See 'Standard Network Variable Type (SNVT)'.

1.3.35   Niagara AX (Niagara Framework)

The current version (release) of the Niagara Framework. While it is often used to refer to just the front end, it includes all components of the Niagara Framework. (Note: The previous version of the Niagara Framework is "R2".)

1.3.36   Niagara Framework (Also called "Niagara")

A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The Framework consists of front end (M&C) software, web based clients, field level control hardware, and engineering tools. While the Niagara Framework is not adopted by a recognized standards body and does not use an open licensing model, it is sufficiently well-supported by multiple HVAC vendors to be considered a de-facto Open Standard.

1.3.37   Override

To change the value of a point outside of the normal sequence of operation where this change has priority over the sequence. An override can be accomplished in one of two ways: the point itself may be Commandable and written to with a priority or there may be a separate point on the controller for the express purpose of implementing the override.

Typically this override is from the Industrial Control System (ICS) Monitoring and Control (M&C) Software. Note that this definition is not standard throughout industry.

1.3.38   Point, Calculated

A value within the M&C Software that is not a network point but has been calculated by logic within the software based on the value of network

points or other calculated points. Calculated points are sometimes called
virtual points or internal points.

1.3.39   Point, Network

A value that the M&C Software reads from or writes to a field control
network.

1.3.40   Polling

A requested transmission of data between devices, rather than an
unrequested transmission such as Change-Of-Value (COV) or Binding where
data is automatically transmitted under certain conditions.

1.3.41   Property (BACnet)

A BACnet Property - a data element associated with an Object. Different
Objects have different Properties, for example an Analog Input Object has a
Present_Value Property (which provides the value of the underlying hardware
analog input), a High_Limit Property (which contains a high limit for
alarming), as well as other properties.

1.3.42   Protocol Implementation Conformance Statement (PICS)(BACnet)

A document, created by the manufacturer of a device, which describes which
potions of the BACnet standard are implemented by a given device.

1.3.43   Repeater

A device that connects two control network segments and retransmits all
information received on one side onto the other.

1.3.44   Router(LonWorks)

A device that connects two channels and controls traffic between the
channels by retransmitting signals received from one subnet onto the other
based on the signal destination. Routers are used to subdivide a control
network and to control bandwidth usage.

1.3.45   Router (BACnet)

A device that connects two or more BACnet networks and controls traffic
between the networks by retransmitting signals received from one network
onto another based on the signal destination. Routers are used to
subdivide an internetwork and to control bandwidth usage.

1.3.46   SAAR-N Form (SAAR)

A System Authorization Access Request - Navy form and any required
addendums. These forms are used to request ICS access and validate that an
individual has the appropriate security clearance in place prior to
performing any work related to the ICS. A SAAR form is also used to request
a domain account for a new user.

1.3.47   Segment

A 'single' section of a control network that contains no repeaters or
routers. There is generally a limit on the number of devices on a segment,
and this limit is dependent on the topology/media and device type. For

example, a TP/FT-10 segment with locally powered devices is limited to 64 devices, and a BACnet MS/TP segment is limited to 32 devices.

1.3.48   Service (BACnet)

A BACnet Service. A defined method for sending a specific type of data between devices. Services are always defined in a Client-Server manner, with a Client initiating a Service request and a Server Executing the Service. Some examples are ReadProperty (a client requests a data value from a server), WriteProperty (a client writes a data value to a server), and CreateObject (a client requests that a server create a new object within the server device).

1.3.49   Service Pin (LonWorks)

A hardware push-button on a device which causes the device to broadcast a message containing its Node ID and Program ID. This broadcast can also be initiated via software.

1.3.50   Standard BACnet Object/Property/Service (BACnet)

BACnet Objects, Properties, or Services that are standard Objects, Properties, or Services enumerated and defined in ASHRAE 135. Clause 23 of ASHRAE 135 defines methods to extend ASHRAE 135 to non-standard or proprietary information. Standard BACnet Objects/Properties/Services specifically exclude any vendor specific extensions.

1.3.51   Standard Network Variable Type (SNVT) (LonWorks)

Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

1.3.52   Supervisory Controller (Also called "SC")

A controller implementing a combination of supervisory logic (global control strategies or optimization strategies), scheduling, alarming, event management, trending, web services or network management. Note this is defined by use; many supervisory controllers have the capability to also directly control equipment. Supervisory controllers can also be gateways and typically are in a Niagara Framework-based ICS.

1.3.53   TP/FT-10 (LonWorks)

A Free Topology Twisted Pair network (at 78 kbps) defined by CEA-709.3. This is the most common media type for a CEA-709.1-C control network.

1.3.54   TP/XF-1250 (LonWorks)

A high speed (1.25 Mbps) twisted pair, doubly-terminated bus network defined by the LonMark Interoperability Guidelines. This media is typically used only as a backbone media to connect multiple TP/FT-10 networks.

1.3.55   VLAN

A virtual LAN is a group of hosts with a common set of requirements that
communicate as if they were attached to the same broadcast domain,
regardless of their physical location. A VLAN has the same attributes as a
physical LAN, but it allows for end stations to be grouped together even if
they are not located on the same network switch. The ICS network is
divided into multiple VLANs, which include Administration, Utility systems,
Facility systems and metering systems, printers, each type of server,
workstations internal to the Operations Center, workstation external to
Operations Center and more. Multiple VLANs are in use, and are subject to
change by CIO.

1.4   SUBMITTALS

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are for information only. Submit
the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES and
TABLE 1: PROJECT SEQUENCING

Provide one copy of required paper and electronic submittals.

Drawings:
Provide drawings as PDF compatible files by e-mail and optical disk and
each drawing on 11" x 17" paper. Provide navigational outline submittals in
Microsoft Excel or Word format and graphic submittals in full
pixel-for-pixel lossless resolution in a standard format such as .bmp, .psd,
or .gif as appropriate for the specific graphic being submitted.

Where existing systems are being modified, shop drawings shall consist of
edits to existing record drawings.

SD-02 Shop Drawings

ICS Contractor Design Drawings; G

Draft As-Built Drawings; G

Final As-Built Drawings; G

   Final As-Built Drawings in hard copy and on CD-ROM in PDF and AutoCAD format.

Navigational Outline, G

   Provide the complete graphic Navigational Outline for the project, including all pages created by the project, and all existing pages that will be modified or deleted.   See Appendix E for an example navigational outline.

Graphics, G

   Provide graphics pages for the project at actual graphics resolution and format, including all common pieces of equipment, page backgrounds, and menu structures.

   Also provide the entire station copy (including images, px pages, and the *.bog file) of the graphical user interface along with the administrative credentials.

Component Wiring Diagrams, G

   Provide wiring diagrams and layouts for each control panel. Show termination numbers

   Provide riser diagrams showing control network layout, communication protocol, and wire types.

   Provide network diagrams of wiring between an existing ICS network drop and the one proposed for this project. Edit an existing riser diagram to show overall network connectivity and routing. Network diagram edit can be done manually, but shall be done clearly enough to be used for record drawing(s) by the BOSC or shop.

   Riser diagrams showing control network layout, communication protocol, and wire types.

SD-03 Product Data

Product Data Sheets; G

   Copies of all manufacturer catalog cuts and specification sheets

for all products (equipment) specified in PART 2 and supplied under this contract. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable model selected and options selected by highlighting or by other means.

Computer Software; G

   The most recent versions of all computer software provided under this specification delivered as a Technical Data Package. The user manuals for all software delivered for this project shall be submitted with the software.

SD-06 Test Reports

   Start-Up and Start-Up Testing Report;G

   The Start-Up and Testing report may be submitted as a Technical Data Package.

   Password Log; G

   Provide a preliminary list of all passwords (and associated software, device or system) created in executing the work of this contract.

   PVT Phase I Procedures; G

   The PVT Procedures may be submitted as a Technical Data Package.

   PVT Phase I Report; G

   Pre-Construction QC Checklist

   Post-Construction QC Checklist; G

SD-10 Operation and Maintenance Data

   Operation and Maintenance (O&M) Instructions; G

   Two bound O&M Instructions and one copy of the Instructions in PDF format on CD-ROM. Bound Instructions shall be indexed and tabbed. Instructions in PDF form shall be a single PDF file, or multiple PDF files with a PDF file table of contents containing links to the other files] O&M Instructions may be submitted as a Technical Data Package.

SD-11 Closeout Submittals

   Closeout QC Checklist; G

   Final Commissioning Report; G

   Password Log; G

   Provide a final, complete list of all passwords (and associated software, device or system) created in executing the work of this contract.

1.5   PROJECT SEQUENCING

TABLE I: PROJECT SEQUENCING specifies the sequencing of submittals as
specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column)
and activities as specified in PART 3: EXECUTION (denoted by an 'E' in the
'TYPE' column).

a. Sequencing for submittals: The sequencing specified for submittals is
    the deadline by which the submittal must be initially submitted to the
    Government. Following submission there will be a Government review
    period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the
    submittal is not accepted by the Government, revise the submittal and
    resubmit it to the Government within 14 days of notification that the
    submittal has been rejected. Upon re-submittal there will be an
    additional Government review period. If the submittal is not accepted
    the process repeats until the submittal is accepted by the Government.

b. Sequencing for Activities: The sequencing specified for activities
    indicates the earliest the activity may begin.

c. Abbreviations: In TABLE I the abbreviation AAO is used for 'after
    approval of' and 'ACO' is used for 'after completion of'.

****
         NOTE:
         If requiring a Factory Test in PART 3 EXECUTION,
         keep "Acceptance of Factory Test Report" in the
         DESCRIPTION column for item 1. If NOT requiring a
         factory test keep "Notice to proceed" or edit to
         indicate other starting condition.

         Complete TABLE I by entering the appropriate number
         of days in the spaces provided in the SEQUENCING
         column.
****

****
         NOTE: The PROJECT SEQUENCING table may not display
         properly in SpecsIntact. If it appears empty
         right-click on the table and select "Make All Rows
         Same Height" to make the entire table appear and
         then adjust row heights as needed (such as reducing
         row height for rows with less text).
****

                       TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1	S	Design Drawings	
2	S	Product Data Sheets	
3	S	ICS IP Network Bandwidth	
4	S	Pre-construction QC Checklist	

                  SECTION 25 10 10.00 24 Page 23

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
5	E	Install ICS	AAO #1 thru #4
6	E	Start-Up and Start-Up Testing	ACO #5
7	S	Post-Construction QC Checklist	
8	S	Computer Software	
9	S	Start-Up and Start-Up Testing Report	
10	S	Draft As-Built Drawings	
11	S	PVT Phase I Procedures	14 days before scheduled start of #12 and AAO #9
12	E	PVT Phase I	AAO #11 and #10
13	S	PVT Phase I Report	7 days ACO #12
14	S	O&M Instructions	AAO #9
15	S	Final As-Built Drawings	21 days AAO #13
16	S	Closeout QC Checklist	ACO #14

1.6   QUALITY CONTROL (QC) CHECKLISTS

The Contractor's Chief Quality Control (QC) Representative shall complete
the QC Checklist in Appendix A, and shall submit the Pre-Construction QC
Checklist, Post-Construction QC Checklist and Closeout QC Checklist as
specified. The QC Representative shall verify each item in the Checklist
and initial in the provided area to indicate that the requirement has been
met. The QC Representative shall sign and date the Checklist prior to
submission to the Government.

1.6.1   Standard Products

Provide material and equipment that are standard products of manufacturers
regularly engaged in the manufacturing of such product, using similar
materials, design and workmanship. The standard products (excluding
software) shall have been in commercial or industrial use for 1 year prior
to bid opening, unless otherwise approved by the Government. The 1-year use
shall include applications of similarly sized equipment and materials used
under similar circumstances. The 2-year experience must be satisfactorily
completed by a product that has been sold on the commercial market through
advertisements, manufacturers' catalogs, or brochures.

Provide materials and equipment that are manufacturer's products currently
in production, and supported by a local service organization. Contractor
supplied units of the same type of equipment shall be products of a single
manufacturer. Each major component of equipment shall have the
manufacturer's name and the model and serial number in a conspicuous
place. Materials and equipment shall be new standard unmodified products

of a manufacturer regularly engaged in the manufacturing of such products.

1.6.2   Contractor's Qualifications

The Contractor or subcontractor that will perform the work shall have
completed at least three systems installations of the same type and design
specified, that have successfully operated the required sequence of
operation for at least one year. The installer shall be a Honeywell Niagara
AX Contractor-Partner.

The programmer responsible for programming the SC's shall have a minimum of
2 years experience in programming SC's for similar systems of the same
manufacturer. Programmer shall have successfully completed the Niagara AX
Certification Training Course and be certified.

1.6.3   Support

Certified local technical support shall exist within 50 miles of the site.

1.6.4   Commissioning

****
          **NOTE: Only choose third party commissioning if job
          will have third party commissioning agent of the DDC
          or SCADA system. LEED certified building projects
          would have this and so would other larger ECIPS,
          MCONS, etc..**
****

The Contractor shall provide [**third-party**] commissioning of the Industrial
Control System (ICS) installed by this project and the [**third-party**]
Commissioning Agent shall create testing requirements as necessary to
verify the installed ICS system meets the contract requirements.

1.7   DELIVERY, STORAGE, AND HANDLING

Stored products shall be protected from the weather, humidity and
temperature variations, dirt and dust, and other contaminants, within the
storage condition limits published by the equipment manufacturer.

1.8   OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The ICS Operation and Maintenance Instructions shall include:

a.   Procedures for the ICS system start-up, operation and shut-down.

b.   Final As-Built drawings.

Qualified service organization list including points of contact with phone
     numbers.

e.   Start-Up and Start-Up Testing Report.

f.   Performance Verification Test (PVT) Procedures and Reports.

1.9   WARRANTY

****
          NOTE: Coordinate 'warranty' paragraph below with

   The warranty shall be for no less than a period of 12 months after project
   completion.

1.10   RECOMMENDED DIVISION OF WORK

   The Division 23, 26, and 33 contractors (when separate from the ICS
   contractor) shall be responsible for all controllers, control devices,
   control panels, controller programming, controller programming software,
   controller input/output and power wiring and controller network wiring.
   The design and installation of these systems are covered in Parts 3 and 4
   of this RFPDivision 23, 26 and 33 UFGS'.

   The ICS contractor shall be responsible for the SC, software and
   programming of the SC, the graphical user interface, development of all
   graphical screens, Web browser pages, setup of schedules, alarms, LonWorks
   network management and connection of the SC into the ICS network. The ICS
   contractor shall integrate all data, monitoring and control provided by the
   Division 23, 26 and 33 contractor devices and make it available onto the
   ICS network.

PART 2   PRODUCTS

2.1   MATERIALS

   Use new products the manufacturer is currently manufacturing and selling
   for use in new installations. Do not use this installation as a product
   test site unless explicitly approved in writing by the Government.

   The Contractor shall select software, materials and equipment that are
   compatible with the existing ICS system. If the Contractor incorporates
   equipment or devices which require software and programming tools different
   than those currently in use, the Contractor shall provide compatible
   software for every server, laptop and desktop workstation in the existing
   ICS, any specialized training, and all ICS modifications or specialized
   programming needed to support the unique equipment.

   Contractor shall utilize as few unique pieces of equipment as possible.
   Wherever possible, the Contractor shall utilize a typical piece of
   equipment in numerous locations.

2.1.1   Product Certifications

   Computing devices, as defined in FCC Part 15, supplied as part of the ICS
   shall be certified to comply with the requirements of Class B computing
   devices.

2.1.2   Ownership of Proprietary Material

  Project-specific software and documentation shall become the Government's
  property. This includes, but is not limited to: graphics, record
  drawings, database(s), application of programming code, and documentation.

2.1.3   General Requirements

  Provide components that meet the following requirements:

  ****
            NOTE: In particularly hot or cold environments,
            increase the temperature range requirements for
            equipment in unconditioned space
  ****

  a.   Portions of the data communications equipment system installed in
       unconditioned spaces shall operate properly in an environment with
       ambient temperatures between 0 and +49 degrees C +32 and 120 degrees F
       and ambient relative humidity between 10 percent and 90 percent
       noncondensing.

  b.   Components shall accept 100 to 125 volts AC (Vac), 60 Hz, single phase,
       three wire with a three-pronged, dedicated circuit outlet or be
       provided with a transformer to meet the component's power requirements.

  c.   The equipment shall meet the requirements of NFPA 70, UL 60950, NFPA 262,
       FCC EMC, and FCC Part 15.

2.1.4   Nameplates

  Nameplates shall be laminated plastic and shall identify the function,
  network address, if applicable, and identifier of the device. Laminated
  plastic shall be at least 3 mm 0.125 inch thick, white with black center
  core. Nameplates shall be a minimum of 25 by 75 mm 1 by 3 inch with minimum
   6 mm 0.25 inch high engraved block lettering.

2.2   MANAGED ICS ETHERNET SWITCH

  ****
            NOTE: Always keep this switch section (next
            paragraph) in the project unless the designer knows
            that an existing switch should not be upgraded. The
            switch product info would only be deleted if the
            facility is already on ICS network. In that case
            the existing switch may remain, but check with CIO
            to make sure the existing switch meets current
            criteria. If it doesn't, project documentation
            should state to replace the existing switch and this
            paragraph should remain.
  ****

2.2.1   General

  Provide with configurable session timeouts for each service such as SSH,
  Telnet, and TFTP; multi-level user passwords; support authentication for
  console access; SSH version2/SSL (128-bit encryption); support SNMPv3 with
  SHA Authentication Protocol and AES Privacy; enable/disable ports, MAC

based port security, VLAN (802.1Q) to segregate and secure network traffic, RADIUS centralized password management, console timeout must be configurabel; FIPS 140-2 compliant; support multiple NTP server to synchronize time; compatible with Solar Winds Orion network performance monitoring (SolarWinds Network Configuration Manager SNMPv3), a login banner, and 56-bit encryption.

Provide two year manufacturer's warranty.

2.2.2   Software

Operating System Software shall allow plug and play operation and have automatic learning, negotiation and crossover detection and shall support MSTP 902.1Q-2005, RSTP (802.1w) and Enhanced Rapid Spanning Tree network fault recover (<5ms), SNMPv3 SHA Authentication Protocol, AES Privacy Protocol, Quality of Service (802.1p) for real time traffic, VLAN (802.1Q) with double tagging and GVRP support, Link aggregation (802.3ad), IGMP Snooping for multicast filtering, and provide port configuration, status, statistics, mirroring, and security.

Provide a switch which uses programming software provided by Cisco, GarrettCom, or RuggedCom.

2.2.3   Ports

Ports shall be non-blocking, store and forward switching, with long haul optics allow Gigabit distance up to 70km and multiple connector types. Gigabit fiber ports (ICS Fiber Switch only) shall be configured for SFP, and the Contractor shall provide an SFP transceiver for each SFP port.

All ports on each switch shall be fully populated with ports and/or transceivers in the switch configuration prior to commissioning. Provide a minimum of one spare ports of each type (fiber, copper) on each installed switch.

2.2.4   Types of Managed ICS Switches

2.2.4.1   Switches serving a Substation

Switch shall be ruggedized to support immunity to EMI and heavy electrical surges and the temperature and humidity environment commonly found in substation installations. Specifically switches shall comply with the following industry standards: IEEE 1613 Class 2 (electric utility substations) and IEC 61850-3 (electric utility substations).

2.2.4.2   Switches Located in Unconditioned Enclosures in Ambient Conditions

Switch shall be ruggedized to withstand minus 40 degrees Celsius to 85 degrees Celsius operating temperatures.

2.2.4.3   ICS Fiber Optics Switch

Switch shall have 24 SFP port capable of supporting 1000BASE-T, 1000BASE-SX, or 1000BASELX/LH Small-Form Factor Pluggable (SFP) optics.

Provide minimal of ICS Fiber Optics Switch with 6 SFP included. The SFP should be 1000BASE-LX (single mode), unless otherwise noted.

2.2.4.4   ICS DDC Switch

Switch shall have minimum of six (6) 10/100/100 Ethernet ports.

2.3   SUPERVISORY CONTROLLER AND GATEWAY (SC)

The SC shall provide the interface between the ICS network and the field
control devices, and provide global supervisory control functions over the
control devices connected to the SC.

2.3.1   Communication/Ports

All controllers shall have the appropriate RS485, RS232, FTT-10 and/or
Ethernet ports as needed for the project scope. If only one Ethernet port
is provided on the SC, provide an extra Ethernet port on the network switch.

2.3.2   Features

Use of a computer or a device with a non-embedded operating system is
prohibited.

2.3.3   Required Functionality:

a. Sequencing and complex programming between the various device-level
    controllers and the head-end server
b. Real-time control of devices
c. Communicate directly in a peer-to-peer fashion with other SC's in the
    same or other buildings. "Polling" by a host to pass data is
    unacceptable.
d. Store data at 15 minute intervals for all hardware, software,
    calculated, command (trend only change in command) and proof points in
    the system for a minimum of 14 days.
e. All stored data shall be automatically submitted to the head-end server
    each day at a set time.
f. Function as the web server for the graphical user interface for that
    building.
g. Time synchronization
h. Integration of data from connected devices using Modbus, BACnet,
    LonWorks technology, or other technology through installed software
    driver(s).

2.3.4   Hardware Minimum Requirements:

a. 128MB of RAM
b. 250 MHz processor
c. Capacity: Controllers shall be sized to accommodate an additional 20%
    of the number of sub-level controllers and points identified in Part 3
    of this RFP.
d. One port compatible with the field level control system to be
    integrated using this product.
e. Embedded operating system
f. Two Ethernet ports

2.3.5   Software, Protocols, and Drivers:

All software used to access the programming of managed devices shall have
open licensing and not be restricted to only the installing vendor or
manufacturer.

All SC's are required to have both Niagara and an embedded operating system.

Software included on the SC may include any of the following:

    LonWorks
    BACnet
    Modbus
    Other protocol drivers as needed
    oBix
    Fox
    Java Virtual Machine
    Tunnel service to allow programming of device level controllers by a
    person on a remote computer on the Ethernet network using the
    appropriate programming tool.
    LDAP Support shall be integrated
    Web services
    Database services

2.3.6   Control Protocol Gateways

 The Control Protocol Gateway shall perform bi-directional protocol
 translation between Niagara Framework and one of the following protocols:
 CEA-709.1-C, ASHRAE 135, Modbus, Fox protocol, and OPC DA.

 All software required for gateway configuration shall be provided and
     licensed to the Government.

 b. Gateways shall retain their configuration after a power loss of an
     indefinite time, and shall automatically return to their pre-power loss
     state once power is restored.

 Gateways shall, in addition, meet all requirements specified (in the
     following subparagraphs) for each of the two protocols it translates.

2.3.6.1   Gateway for CEA-709.1

 In addition to the requirements for all gateways, Gateways that use
 CEA-709.1-C shall meet the following requirements:

 a. It shall allow bi-directional mapping of data in the Gateway to
     Standard Network Variable Types (SNVTs) according to the
     LonMark SNVT List.

 b. Gateways communicating CEA-709.1-C over an IP network shall communicate
     in accordance with CEA-852-B.

 c. It shall allow of its standard network variables (SNVTs) and support
     transmitting data using the "min, max, and delta" (throttling and
     heartbeat) methodology.

 d. It shall provide the ability to label SNVTs.

 e. It shall supply a LonMark external interface file (XIF) as defined in
     the LonMark XIF Guide for use with LNS tools and utilities.

 f. It shall have a "service pin" which, when pressed, will cause the
     Gateway to broadcast its 48-bit NodeID and ProgramID over the network.

 g. It shall provide a configurable self-documenting string.

2.3.6.2   Gateway for ASHRAE 135

In addition to the requirements for all gateways, Gateways that use
ASHRAE 135 shall meet the following requirements:

a. It shall allow bi-directional mapping of data in the Gateway to
    Standard Objects as defined in ASHRAE 135.

b. All ASHRAE 135 Objects shall have a configurable Object_Name Property.

c. It shall be BTL Listed.

d. Gateways communicating ASHRAE 135 over an IP network shall communicate
    in accordance with ASHRAE 135 Annex J.

e. Gateways communicating ASHRAE 135 to a field control systems shall
    support the DS-RP-A (Data Sharing–Read Property–A) BIBB and the DS-WP-A
    (Data Sharing–Write Property–A) BIBB.

f. Gateways communicating ASHRAE 135 to the M&C Software or to a BACnet
    Supervisory Controller shall support the DS-RP-B (Data Sharing–Read
    Property–B) BIBB for Objects requiring read access from the M&C
    Software and the DS-WP-B (Data Sharing–Write Property–B) BIBB for
    Objects requiring write access from the M&C Software

2.3.6.3   Gateway for Modbus

In addition to the requirements for all gateways, Gateways that use Modbus
shall allow bi-directional mapping of data in the Gateway to Modbus
registers using the four standard Modbus register types (Discrete Input,
Coil, Input Register,and Holding Register). Gateways communicating Modbus
to the M&C Software shall communicate via Modbus over TCP/IP.

2.3.6.4   Gateway for OPC

In addition to the requirements for all gateways, Gateways that use OPC DA
shall allow bi-directional mapping of data in the Gateway using OPC DA tags
and shall communicate over an IP network in accordance with OPC DA.

2.3.6.5   Gateway for DNP3

In addition to the requirements for all gateways, Gateways that use
DNP3 shall allow bi-directional mapping of data in the Gateway to DNP3
object groups and variations as defined by IEEE 1815. Gateways
communicating DNP3 over an IP network shall communicate in accordance with
the LAN/WAN Networking volume of IEEE 1815.

2.3.6.6   Niagara Framework Gateway

****
          NOTE: FYI - The Niagara Framework Supervisory
          Gateway is known by many names within industry, and
          this specification uses the name "Niagara Framework
          Supervisory Gateway" in order to remain vendor
          neutral. Probably the most common term used for
          this device in industry is a "Java Application
          Control Engine", or JACE but DO NOT USE that term.
****

Niagara Framework Gateway Hardware shall:

a. be direct digital control hardware.

b. have an unrestricted interoperability license and its Niagara
    Compatability Statement (NiCS) shall follow the Tridium Open NiCS
    Specification.

c. manage communications between a field control network and the Niagara
    Framework Monitoring and Control Software and between itself and other
    Niagara Framework Supervisory Controllers. Niagara Framework
    Supervisory Controller Hardware shall use Fox protocol for
    communication with other Niagara Framework Components.

d. be fully programmable using the Niagara Framework Engineering Tool and
    shall support the following:

    (1) Time synchronization, Calendar, and Scheduling using Niagara
        Scheduling Objects

    (2) Alarm generation and routing using the Niagara Alarm Service

    (3) Trending using the Niagara History Service and Niagara Trend Log
        Objects

    (4) Integration of field control networks using the Niagara Framework
        Engineering Tool

    (5) Configuration of integrated field control system using the Niagara
        Framework Engineering Tool when supported by the field control
        system

  provide access to field control network data and supervisory functions via
    web interface and support a minimum of 16 simultaneous users.

2.4   SOFTWARE

2.4.1   Niagara Framework Engineering Tool

  The Niagara Framework Engineering Tool shall be Niagara Workbench or an
  equivalent Niagara Framework engineering tool software and shall:

a. have an unrestricted interoperability license and its Niagara
   Compatability Statement (NiCS) shall follow the Tridium Open NiCS
   Specification.

b. be capable of performing network configuration for Niagara Framework
   Supervisory Controllers and Niagara Framework Monitoring and Control
   Software.

c. be capable of programming and configuring for Niagara Framework
   Supervisory Controllers and Niagara Framework Monitoring and Control
   Software.

d. be capable of discovery of Niagara Framework Supervisory Controllers and
   all points mapped into each Niagara Framework Supervisory Controller
   and making these points accessible to Niagara Framework Monitoring and
   Control Software.

2.4.2   Monitoring and Control (M&C) Software

The Software shall be Niagara Framework AX Web Supervisor and shall communicate with Niagara Framework field control systems using the Fox protocol. The M&C Software may support other field control protocols.

2.4.2.1   M&C Software License

The M&C Software shall be licensed as specified.

Web Clients: It shall support no less than 15 simultaneous web clients with no limit on the total number of web clients. It shall be capable of expansion to support no less than 25 simultaneous web clients.

c.   Calculations: It shall support no less than one calculated point for every ten network points.

Alarming: It shall support the handling (routing) of alarms for no less than 10,000 points.

e.   Trending: It shall support a minimum of 8,000 simultaneous trends.

f. Niagara Framework Open License: It shall have an unrestricted interoperability license and its Niagara Compatability Statement (NiCS) shall follow the Tridium Open NiCS Specification.

2.4.2.2   Supported Field Control Protocols

The M&C Software shall support field control protocols as follows:

a. The Software shall use the Niagara Framework and shall communicate with Niagara Framework Supervisory Controllers using the Fox protocol.

b. The M&C Software may, in addition, include drivers to other protocols.

2.4.2.3   Point Information

Every point, both network and internal, in the M&C Software shall contain the following fields:

a. Name: A configurable name used for identification of the point within the M&C Software. Refer to Appendix D for more information on NAVFAC NW ICS Point Naming Conventions.

b. Description: A configurable description of no less than 80 alpha-numeric characters.

c. Value: A field containing the current point value.

d. Units: A field containing the engineering units.

e. Source: A field identifying the source of the point. For network points, this is generally the address or identification of the field device (for example, the Domain-Subnet-Node address for LonWorks field control devices or the DeviceID for BACnet devices).

2.4.2.4   Point Calculations

M&C software shall have capability of performing calculations and computing the value of a calculated point based on the values of two or more network points and calculated points. Mathematical operators shall include: addition, subtraction, multiplication, division, exponentiation (y^x, power), square root, reciprocal, natural logarithm, sin, cos, tan, arcsin, arccos, arctan, and parenthesis. Pi and e shall be available as constants for use in calculations.

2.4.2.5   Passwords

The M&C software shall provide user-based access control to M&C functionality. The M&C Software shall recognize at least 1,000 separate users and have at least 4 levels of user permissions covering a minimum of 20 permission groups.

Passwords shall not be displayed and shall not be logged. The system shall maintain a disk file on the server hardware logging all activity of the system.   This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. If the file format is not plain ASCII text, provide a means to export or convert the file to plain ASCII text. The system shall provide a mechanism for archiving the log files for long term record storage.

2.4.2.6   Scheduling

  a.   The M&C software shall be capable of performing time synchronization
       and configuring Niagara Framework Schedule Objects in Niagara Framework
       Supervisory Controllers.

2.4.2.7   Alarms

  a.   The M&C software shall be capable of configuring alarms in Niagara
       Framework Supervisory Controllers using the Niagara Alarm Service.

  b.   The M&C software shall be capable of handling (routing) alarms received
       from a Niagara Framework Supervisory Controller.

  c.   The M&C software shall support Niagara Framework Alarm Classes.

  The creation, modification, and handling (routing) of alarms shall be fully
       accessible and fully adjustable from the graphical user interface.

  f.   Alarm Data. Alarm data to be displayed and stored shall include:

       (1) Identification of alarm including building, system (or
           sub-system), and device name.

       (2) Date and time to the nearest second of occurrence.

       (3) Alarm type:

           (a) Unreliable: Indicates that the source device has failed due
           to the sensing device or alarm parameter being out-of-range or bad
           data.

           (b) High Alarm.

           (c) Low Alarm.

       (4) Current value or status of the alarm point, including engineering
           units

       (5) Alarm limits, including engineering units.

       (6) Alarm priority.

       (7) Alarm Message: A unique message with a field of at least 60
           characters. Assignment of messages to an alarm shall be an
           operator editable function.

       (8) Acknowledgement status of the alarm including the time, date and
           user of acknowledgement.

2.4.2.8   Trending

  The M&C software shall be capable of using the Niagara history service to
  create, modify, upload and archive trend log objects in Niagara Framework
  Supervisory Controllers.

  The M&C Software shall include a graphical display for trend configuration,
  creation and deletion accessible through the graphical user interface.

Each trend shall be user-configurable for:

a. Point to trend.

b. Sampling interval shall be adjustable between 1 second and 1 hour.

c. Start and Stop Time of Trend: Start and stop times shall be determined by one or more of the following methods:

    (1) Start time and stop time

    (2) Start time and duration

    (3) Start time and number of samples

The M&C software shall be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software shall be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, provide a means to export or convert the file to plain ASCII text in a CSV format.

2.5   UNINTERRUPTIBLE POWER SUPPLY (UPS)

A UPS is an IA requirement.

Equipment connected to the UPS shall not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power.

a. UPS shall support the connected load for at least a minimum runtime of 20 minutes.
b. UPS shall have 445 Joules of surge protection.
c. UPS shall be default to a power-on mode following each power outage.
d. UPS status shall be integrated into the SC.
e. UPS shall support the SC, Ethernet switchh(es), and other system components as feasible.

2.6   LOCKED RACKS AND ENCLOSURES

A locked enclosure or rack is an IA requirement.

The enclosure shall be securely attached, and keying of the lock shall match that currently in use at the installation. The door of the enclosure shall have an intrusion detection sensor, and this sensor shall be integrated into the control system, and shall report alarms on open, and change of state. This point status shall be tracked in a Base-level Unit Summary screen.

Enclosures supplied as an integral (pre-packaged) part of another product are acceptable. Keys for lockable enclosures shall be furnished.

2.6.1   Locking Cabinet Rack

Nineteen inch (19") 6U wall-mount rack enclosure, lockable, with passive venting to house each installed switch and other Ethernet-connected

equipment impacted by the project.

Passive venting shall provide adequate cooling to maintain the
manufacturer's maximum thermal limitations for all installed equipment in
the cabinet based on calculated total wattages and adequate convective
cooling. Top mounted louvers without allowing for a bottom ventilation air
circulation path are not allowed.

Racks shall be either aluminum or steel with bolted or welded
construction. Steel equipment racks shall be painted with a
flame-retardant paint. Guard rails shall be included with each equipment
rack and have a copper grounding bar installed and grounded to the earth.

2.6.2   Locking Enclosure

Device enclosures located outdoors or in wet ambient conditions shall be
mounted in rainproof (NEMA 3R) enclosures. Device enclosures located
outdoors or in wet ambient conditions AND within 100 feet of waterfront
shall be mounted in rain-tight corrosion-resistant (NEMA 4X) enclosures.
Device enclosures used in conditioned space can be mounted in
dust-protective (NEMA 1) enclosures.

2.7   ICS NETWORK

Cabling between the network transport point of presence and the facility
shall be single mode fiber consisting of 24 pairs terminated in a patch
panel using an LC connector, unless an LC connector is unavailable on the
existing switch.

Cabling between the network switch and all IP-addressable devices shall
have the following minimum physical and media access requirements:

    Ethernet; IEEE standard 802.3
    Cable: 100 Base-T, UTP-8 wire, category 6
    Minimum throughput; 100 Mbps

2.8   PROGRAMMING SOFTWARE

For software used for controllers below the supervisory controller in the
Building Control System and is not already existing on site, the Contractor
shall provide 18736 copies of the software.

For software used to program and create graphical content on the
supervisory controller and is not already existing on site, the Contractor
shall provide 3 copies of the software to be installed on the ICS laptop
pool at

The installed version of the programming software for each device shall be
licensed to NAVFAC NW CIO. Software shall be submitted on CD-ROM, and one
hard copy and one electronic copy of the software user manual shall be
submitted for each piece of software provided.

****
          **NOTE: Other sections that could be included in this
          specification must be generated on a project by
          project basis as they are rare and their
          specifications are fluid.**

          These include: Servers; Desktop Workstations, and

Laptops.

If your project requires any of these, it requires CIO approval, so coordinate with CIO for the required details. An outline of how those systems could be specified is in the ICS Designer's Guide (under development).

****

PART 3   EXECUTION

3.1   EXAMINATION

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, and shall furnish all work necessary to meet such conditions.

3.1.1   Existing Conditions Survey

Perform a field survey, including but not limited to testing and inspection of equipment to be part of the ICS and notify the Government if conditions at the project site are not as represented.. For field control systems to be integrated to the ICS which are not already connected to the ICS IP network, verify the availability of the building network backbone at the FPOC location, and verify that FPOCs shown as existing are installed at the FPOC location.

3.2   DRAWINGS AND CALCULATIONS

3.2.1   ICS Contractor Design Drawings

Revise and update the Contract Drawings to include details of the system design and all hardware components, including contractor provided and Government furnished components. Drawings shall be on ANSI B (279 by 432 mm 11 by 17 inches) sheets. Details to be shown on the Design Drawing include:

a.   The logical structure of the network, including but not limited to the location of all Control Hardware (including but not limited to each Control Protocol Gateway, Control Protocol Router, Niagara Framework Supervisory Controller and Monitoring and Control (M&C) Controller).

b.   Manufacturer and model number for each piece of Computer Hardware and Control Hardware.

c.   Physical location for each piece of Computer Hardware and Control Hardware.

d.   Version and service pack number for all software and for all Control Hardware firmware.

3.2.2   As-Built Drawings

Prepare draft as-built drawings consisting of Points Schedule drawings for

the entire ICS, including Points Schedules for each Gateway, and an updated Design Drawing including details of the actual installed system as it is at the conclusion of Start-Up and Start-Up Testing. As-Built Drawings shall include details of all hardware components, including contractor provided and Government furnished components. In addition to the details shown in the design drawings, the as-built drawing shall include:

a. Niagara Framework Station ID for all Niagara Framework components including but not limited to Niagara Framework Supervisory Controllers and the AX Web Supervisor.

Prepare Draft As-Built Drawings upon the completion of Start-Up and Start-Up Testing and Final As-Built Drawings upon completion of PVT Phase II.

3.3   INSTALLATION REQUIREMENTS

3.3.1   General

****
            NOTE: Indicate the location of telecommunications
            closets on the contract drawings.
****

Install system components as shown and specified and in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Communication equipment and cable grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. Fiber Optic cables and wiring in exposed areas, including low voltage wiring but not including network cable in telecommunication closets, shall be installed in metallic raceways or EMT conduit as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Do not install equipment in any space which experiences temperatures or humidity outside of the rated operating range of the equipment.

3.3.2   Isolation, Building Penetrations and Equipment Clearance

The ICS shall be completely installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exteriors shall be made watertight. Holes in concrete, brick, steel and wood walls shall be drilled or core drilled with proper equipment; conduits installed through openings shall be sealed with materials which are compatible with existing materials. Openings shall be sealed with materials which meet the requirements of NFPA 70 and SECTION 07 84 00 FIRESTOPPING.

3.3.3   Nameplates

Provide Nameplates for all Control Hardware and all Computer Hardware. Attach Nameplates to the device in a conspicuous location.

3.3.4   ICS Network Connection

****
            NOTE: If the project has an existing ICS
            connection, keep the last paragraph. If not, delete
            it.

****

The Contractor shall provide all equipment and materials needed to complete
the connection to the NAVFAC ICS network, however only authorized
Government or BOSC service contractor personnel are allowed to complete the
actual physical connection between the Contractor's installation and the
government network. Provide two weeks' notice to the Contracting Officer
when scheduling this connection and include it in the project's schedule.

  [**NAVFAC NW CIO will identify to the Contractor the specific spare port they
  will be using on existing ICS network switches.**]

3.3.5   Installation Of Equipment

3.3.5.1   Wire and Cable Installation

  System components and appurtenances shall be installed in accordance with
  NFPA 70, manufacturer's instructions and as shown. Necessary
  interconnections, services, and adjustments required for a complete and
  operable signal distribution system shall be provided. Components shall be
  labeled in accordance with TIA/EIA-606. Penetrations in fire-rated
  construction shall be firestopped in accordance with Section 07 84 00
  FIRESTOPPING. Conduits, outlets and raceways shall be installed in
  accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Wiring
  shall be installed in accordance with TIA-568-C.1 and as specified in
  Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Wiring, and terminal blocks
  and outlets shall be marked in accordance with TIA/EIA-606. Non
  fiber-optic cables shall not be installed in the same cable tray, utility
  pole compartment, or floor trench compartment with power cables. Cables
  not installed in conduit or raceways shall be properly secured and neat in
  appearance.

3.3.5.2   Grounding

  Signal distribution system ground shall be installed in accordance with
  TIA J-STD-607 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Equipment
  racks shall be connected to the electrical safety ground.

3.3.5.3   Power-Line Surge Protection

  Equipment connected to ac circuits shall be protected against or withstand
  power-line surges. Equipment protection shall meet the requirements of
  IEEE C62.41. Fuses shall not be used for surge protection.

3.3.5.4   IP Addresses

  For all Control Hardware requiring an IP address on the ICS IP Network,
  coordinate with the NAVFAC NW CIO to obtain IP addresses. Requirements for
  this coordination are found in the Information Assurance portion of this
  UFGS.

3.3.5.5   Ethernet Switches

  If more than one switch will be installed in the same location, each switch
  shall be linked by two 1,000 Mb connections utilizing link aggregation.
  Switches linking substations or to the Operations Centers shall be
  configured with dedicated dual 10 GB fiber connections utilizing link
  aggregation on two separate fiber paths into and out of each of the primary
  substations, capable of and configured to provide 20 GB service and

automatic failover.

Ethernet switches located in Substations and water system buildings shall be tiered so that in the event one switch fails, the system will still share data through an alternate switch and data path, and connections shall be fault tolerant with dual path to each device including switches, relays and similar equipment that are available with 2 Ethernet ports.

3.3.5.6   Supervisory Controller(SC)

Provide one or more SC's as part of this contract. Number of controllers required is dependent on the type and quantity of devices installed.

Power supply shall be fused or current limiting and shall be rated at a minimum of 125% of SC power consumption.

Do not divide control of a single mechanical system such as an air handling unit, boiler, chiller, pump system, or terminal equipment between two or more controllers. A single controller shall manage control functions for a single mechanical system. It is permissible, however, to manage more than one mechanical system with a single controller.

Multiplexing of points is not allowed.

3.3.5.7   Software Installation

3.3.5.7.1   Engineering Tool

Install the Niagara Framework Engineering Tool on the AX Web Supervisor Server. The Niagara Framework Engineering Tool shall be installed on workstation hardware.

3.3.5.7.2   Monitoring and Control (M&C) Software Configuration

Configure the Monitoring and Control (M&C) Software as specified, as shown and as follows:

a. Set up M&C Software user accounts and passwords. Coordinate user accounts, passwords and permissions with the installation's BOSC or shop ICS supervisor.

b. Change the default password on all accounts.

c. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section.

3.4   COORDINATION

Contractor shall keep Operations Center ICS personnel apprised of on-going activities and any expected impacts to normal operation. Impacts to normal operation are required to be requested and coordinated in advance.

3.4.1   Coordination With Division 23, 26 And 33 Contractors

Coordinate with Division 23, 26, and 33 Contractors (when separate from ICS contractor) supplying products or systems in order to integrate their work into the ICS. Specifically:

+ Coordinate type and quantity of SC's required for a complete
installation.
+ Coordinate all ICS network schematic diagrams that include Division
23 or 26 work.
+ Coordinate all monitoring and control functions including scheduling,
alarms, and the level of device/equipment controllability.
+ Coordinate and integrate all factory-installed controllers furnished
with equipment (e.g., boiler control panels, chillers, packaged
air-handling units) into the ICS communication architecture.
+ Coordinate compatibility of factory-installed controllers prior to
shipment.
+ Coordinate specific maintenance timeframes and alarms for all new
equipment requiring maintenance.

3.5   INTEGRATION

Install, initialize, start up, and troubleshoot operator interface software
and functions (including operating system software, operator interface
database, and third-party software installation and integration required
for successful operator interface operation).

Contractor to integrate all control points including those associated with
the sequence of operation, alarms and other data generated by field devices
(whether controlling or reporting) that were specifically listed or named
in the final approved shop drawings so that it is available on the ICS
network.

Fully integrate the field control systems in accordance with the following
three step sequence and as specified and shown.

STEP 1: Install and configure Control Hardware as necessary to provide
a Field Point of Connection to connect the field control system to the
ICS IP network and, when necessary, to provide control protocol
translation and supervisory functionality.

STEP 2: Add Field Control System to M&C Software: Perform system
discovery, system database merges, or any other actions necessary to
allow M&C Software access to the field control system.

STEP 3: Configure M&C Software to provide monitoring and control of the
field control system, including but not limited to the creation of
system displays and the configuration of scheduling, alarming, and
trending.

3.5.1   Integration Step 1: Install Control Hardware

Install Control Hardware as specified at the FPOC location to connect the
field control system to the ICS IP network and, if necessary, to provide
control protocol translation and supervisory functionality. Depending on
the field control system media and protocol this shall be accomplished
through one of the following:

a. Connect the field control network FPOC to the ICS IP network.

b. Install a Niagara Framework Supervisory Controller connected to both the
field control network and the ICS IP network.

3.5.1.1   Installation of Niagara Framework Supervisory Controller

Install Niagara Framework Supervisory Controller hardware to connect the field control network to the ICS IP network. Install additional field control system network media and hardware as needed to connect the Niagara Framework Supervisory Controller to the field control system.

3.5.2   Integration Step 2: Add Field Control System to M&C Software

Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to points and data in the field control system.

3.5.2.1   Integration of Field Control Systems Via Niagara Framework

For each Niagara Framework Supervisory Controller installed in integration step 1 for this project do both of the following:

a. Use the Niagara Framework Engineering Tool to fully discover the field control system and make all field control system information available to the Niagara Framework Supervisory Controller.

b. Create and configure points and establish network communication between the Niagara Framework Supervisory Controller and the field control system to provide points from the field control system to the M&C software and to provide support for supervisory functions, including but not limited to schedule objects, trend logs and alarming.

For each Niagara Framework Supervisory Controller to be integrated as part of this project, make all information in the Niagara Framework Supervisory Controller available to the M&C Software.

3.5.3   Integration Step 3: Configure M&C Software

Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.5.3.1   Configure M&C Software Communication

Create and configure points and establish network communication between M&C Software and Field Control Systems as specified to support M&C Software functionality:

a. Points on currently active displays shall be updated via polling as necessary to meet M&C Software display refresh requirements.

b. Points used for overrides shall be sent to the device receiving the override as shown on the Points Schedule.

3.5.3.2   Configure M&C Software Functionality

Configure M&C Software functionality as specified:

a. Create System Displays using the standardized displays in Appendices B and C. Label all points on displays with full English language descriptions. Configure user permissions for access to and executions of action using graphic pages. Coordinate user permissions with the BOSC or shop ICS supervisor.

b. Configure alarm handling.

   c. Configure all field devices to routinely send their data to the SQL
      server via the historical data archiving server.

3.6   PROGRAMMING

   Provide graphics as specified in Appendix B and Appendix C. Display on
   each equipment's graphic page all of the associated input and output points
   and relevant calculated points. Point information on graphics shall
   dynamically update.

   In addition to providing a graphical user interface specific to this
   project installation, update the existing ICS graphical user interface
   pages to incorporate the new work associated with this project. This shall
   include: 1-line diagrams corresponding to those already in the system,
   updating the values on graphical screens where there is now new data (or
   improved data), show amps/watts/kVA and other relevant data into and out of
   each substation or utility site, control of devices previously just
   monitored, and update data to be added to unit summary screens, utility
   screens, and all other aspects of the ICS system that are impacted by this
   project. See Appendix C for examples of existing screens.

   System shall generate maintenance alarms when equipment exceeds adjustable
   runtime, equipment starts, or performance limits.

3.6.1   Supervisory Controller

   Synchronize controller time clocks daily from the Windows domain servers
   where capable or from the Niagara servers in the Operations Center.

   Monitor controller and I/O point operation. System shall annunciate
   controller failure and I/O point locking (manual overriding to a fixed
   value).

3.6.2   Generators

   Design an appropriate graphical user interface in the Operations Center
   graphical user interface to support quickly and easily selecting which
   generator systems to bring online during an outage, and automatically
   select which circuit breakers or sectionalizing switches to open or close
   to best support the customers.

3.7   FIELD QUALITY CONTROL

   Demonstrate compliance of the installed ICS components with the contract
   documents. Furnish personnel, equipment, instrumentation, and supplies
   necessary to perform testing. Ensure that tests are performed by competent
   employees of the system installer or the system manufacturer regularly
   employed in the testing and calibration of Industrial Control Systems.

   All points shall work end-to-end. The Government may choose to witness the
   working of any and all points.

3.8   START-UP AND START-UP TESTING

   Test all equipment and perform all other tests necessary to ensure the
   system is installed and functioning as specified. Prepare a Start-Up and

Start-Up Testing Report documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

3.9   PERFORMANCE VERIFICATION TEST (PVT)

3.9.1   PVT Procedures

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures previously approved by the Government, demonstrate all physical and functional requirements of the project. Upon completion of PVT Phase I and as specified, prepare and submit the PVT Phase I Report documenting all tests performed during the PVT and their results. The PVT report shall include all tests in the PVT Procedures and any other testing performed during the PVT. Failures and repairs shall be documented with test results.

Where practical, create the field conditions for change of state for digital inputs and verify proper reporting at the control system interface.

The Contractor shall verify operation of systems in the specified failure modes upon system failure or loss of power, and verify that systems return to ICS control automatically upon a resumption of ICS operation or return of power.

The Contractor shall verify that each graphical page implemented or modified in the project conforms to the graphical standards in this document, and that graphic page content (the controlled equipment/systems and their related values) correctly reflects the actual look, feel and operation of the equipment/systems, and that all content matches that approved by the Government during submittal review.

Application Software Operation Test: Test compliance of the application software for:

a.   The ability to demonstrate seamless communications with the existing ICS servers at the Operations Center as well as direct connect via the Supervisory controller in the facility where the work is being accomplished.
b.   Editing Control programs: Demonstrate the ability to edit the control program off line.
c.   Reporting of alarm conditions: Cause alarm conditions for each alarm, and ensure that workstations receive the alarms.
d.   Reporting trend and status reports: Demonstrate ability of software to receive and save trend and status reports.

3.9.2   Work Coordination

Schedule and arrange work to cause the least interference with the normal Government business and mission. In those cases where some interference may be essentially unavoidable, coordinate with the Government to minimize the impact of the interference, inconvenience, equipment downtime, interrupted service and personnel discomfort.

3.10   TRAINING

Provide training on any programming or configuration software provided as part of this project that is NOT already in use by Government or BOSC personnel..

Provide a training course schedule, syllabus, and training materials 14 days prior to the start of training for a designated staff of Government and maintenance contractor personnel. Furnish a qualified instructor who is factory-trained and experienced in presenting this material to conduct training courses for designated personnel in the maintenance and operation of the installed system.

Do not commence training until the software licensed to the Government has been installed and is operating on all the available installation ICS laptops.

APPENDICES	
A	QC Checklist
B	Graphical User Interface Standard Requirements
C	Graphical Page Content Examples
D	Point, Server & Rack Naming Conventions
E	Example Navigational Outline
F	Existing Installed Government Software

NOTE: Appendices B - F referenced can be accessed from the UFGS Graphics Table of Contents. TO DOWNLOAD UFGS GRAPHICS Go to http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf.

APPENDIX A

QC CHECKLIST		
This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.		
This checklist is for (check one:)		
	Pre-Construction QC Checklist Submittal (Items 1-2)	( )
	Post-Construction QC Checklist Submittal (Items 1-6)	( )
	Close-out QC Checklist Submittal (Items 1-14)	( )
Instructions: Initial each item in the space provided (|____|) verifying that the requirement has been met.		
The following items shall be verified for Pre-Construction, Post-Construction and Closeout QC Checklist Submittals:		
1	Contractor Design Drawing Riser Diagram includes location and types of all Control Hardware and Computer Hardware.	|____|
2	M&C Software supports the Niagara Framework .	|____|
The following items shall be verified for Post-Construction and Closeout QC Checklist Submittal:		
3	Communication between the M&C Software and Niagara Framework field control systems uses only Fox protocol.	|____|
4	Connections to field control systems are via Niagara Framework Supervisory Controllers.	|____|
5	Computer workstations and servers are installed as shown on the ICS Riser Diagram.	|____|
6	(Only on software NOT previously used:))Training schedule and course attendee lists have been developed and coordinated with shops and submitted.	|____|
The following items shall be verified for Closeout QC Checklists Submittal:		
7	All points in field control systems have been discovered using the Niagara Framework Engineering Tool and are available at the M&C Software.	|____|

	QC CHECKLIST	
8	All software has been licensed to the Government.	|____|
9	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.	|____|
10	Final As-built Drawings accurately represent the final installed system.	|____|
11	Default trends have been set up (per Points Schedule drawings).	|____|
12	Scheduling has been configured at the M&C Software.	|____|
13	O&M Instructions have been completed and submitted.	|____|
14	(if providing:) Training courses have been completed.	|____|
	_____ _____	
	(QC Representative Signature) (Date)	

-- End of Section --