SECTION 15925 - INTEGRATED INTELLIGENT BUILDING SOLUTION (I2BS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of sub-contract, including Conditions of sub-contract and Division 1 Specification Sections, apply to this Section.

1. Lighting Control
2. ACS
3. VSS
4. PA
5. FAS
6. BMS=
HVAC + VAraible Speed Drive+
Packaged generator + UPS+ CBS
7. SCADA= Utility and infra + PLC

1.02 SUMMARY

A. The objective of the Integrated Intelliger
of integrating ELV Building Services Sy
shall enable the centralized collection
promote better operation of the facilitie
cost of operation, provide enhanced ener
upgrade/expand and provide freedom
Services Systems. A single operator i
monitoring and control of the ELV Bui
which controller or system is the sourc

B. The I2BS shall serve the Security Forc
the I2BS

C. The ELV Building Services Systems shall communicate with the I2BS on the Converged IP network. The ELV Building Services Systems shall communicate with the I2BS on the Converged IP network.

D. The facilities within the Security Forces Medical Center shall have Extra Low Voltage (ELV) Building Services Systems as detailed in the table above. Except where noted otherwise in these documents the I2BS shall provide a common Management Level for these systems.

FAS

E. The I2BS shall provide a management level hardware and software function for the FAS in each of the facilities. Each facility shall have FAS hardware panels as required by code. The FAS field panels shall communicate with the converged IP network that shall enable the communication of alarms from the FAS to the I2BS. Such alarms shall initiate action by the I2BS via the associated ELV Building Services Systems Automation Level controllers. The FAS shall be a self-contained stand-alone system in each facility that shall not be dependent on the I2BS for meeting code requirements. It shall not be possible to undertake any functions at the I2BS that would invalidate the FAS rating (UL, FM, etc.) or that would be contrary to NFPA codes. Under no circumstances shall the interface between the FAS and the I2BS be used to replace or to circumvent the hardwired interlocks required by the appropriate codes.

SACS

F. The SACS shall have its own Management Level hardware and software and there will be an interface between the SACS Management Level and the I2BS to enable the communication of alarms from the SACS to the I2BS. Such alarms shall initiate action by the I2BS via the associated ELV Building Services Systems Automation Level controllers and other events monitored by the I2BS shall initiate action by the SACS and CCTV systems. The SACS operator interface shall be duplicated at the I2BS and, subject to access control restrictions, shall enable the operator to perform the same monitoring and control functions at the I2BS workstation as at the SACS workstation.

CCTV

G. The CCTV system shall have IP addressable cameras. All video images shall be available via the Security Forces Medical Center LAN. Network Video Recording shall be accessible via the Security Forces Medical Center LAN. Video management system software shall be provided at the I2BS such that the I2BS operators shall be able via the Graphical User Interface (GUI), subject to password access control, to select any camera for which they have access privileges via maps showing camera locations, to control PTZ cameras via a virtual “joystick”, programme camera tours, access historical video recording and to perform other functions such as are typically undertaken with CCTV systems. Similarly the GUI shall enable the operator to search, play back and export recordings from the Network Video Management system. The operator shall also be able to program video analytics functions such as motion detection via the GUI.

H. The I2BS components shall be installed by a specialist Contractor, hereafter referred to as the I2BS Contractor, and shall comprise hardware and software components as necessary to ensure the transfer of data between the various Extra Low Voltage Building Services Systems and to provide centralized monitoring and control of the ELV Building Services Systems. Transfer of data between ELV Building Services Systems shall be via the I2BS Application Servers.

1.03 RELATED WORK

A. The following Sections contain requirements that relate to this Section:

1. Division 16 “Basic Electrical Materials and Methods"
2. Division 16 “Grounding and Bonding"
3. Division 16 “Conductors and cables"
4. Division 16 “Raceways and Boxes"
5. Division 16 “Cable trays and ladders"
6. Division 16 “Static UPS"
7. Division 16 “Low voltage Distribution Components and Accessories"
8. Division 16 "Structured Cabling Networks"
9. Division 15 "Building Management System (BMS), Instrumentation And Controls for Large Scale Projects"
10. Division 16 “Emergency Central Battery System”
11. Division 13 "Closed Circuit Television Video"
12. Division 13 "Clock Control"
13. Division 13 “Fire Alarm"
14. Division 14 "Elevators"
15. Division 16 "Management Information System"
16. Division 16 "Computer Network Equipments"
17. Division 15 “Centrifugal Water Chillers”
18. Division 13 “Security and Access Control System”
19. Division 13 “Lighting Controls”
20. Division 16 “Public Address System”

1.04 ABBREVIATIONS

A/C	-	Air Conditioning
ACP	-	Access Control Panel
API	-	Application Programming Interface
BMS	-	Building Management System
CCS	-	Clock Control System
CFMMS	-	Computerized Facility Maintenance Management System
CCTV	-	Closed Circuit Television

CD-RW	-	Compact Disk with Read and Write capability
CPU	-	Central Processing Unit
CUC	-	Central Utility Complex
DDE	-	Dynamic Data Exchange
DDR	-	Double Data Rate
ECBS	-	Emergency Central Battery System
EIB	-	European Installation Bus
ELV	-	Extra Low Voltage
EMCS	-	Elevator Monitoring and Control System
FAS	-	Fire Alarm System
GMR	-	Ground Movement Radar
HVAC	-	Heating, Ventilating and Air Conditioning
ICT	-	Information and Communication Technology
IDE	-	Integrated Drive Electronics (hard disk)
IEE	-	Institute of Electrical Engineers
ISO	-	International Standards Organization
ID	-	Identification
I/O	-	Input/Output
IS	-	Integration System
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LCS	-	Lighting Control System
LED	-	Light Emitting Diode
LON	-	Local Operating Network
LSF	-	Low Smoke and Fire
LV	-	Low Voltage
MATV	-	Master Antenna Television
MIS	-	Management Information System
MOI	-	Ministry of Interior
MTBF	-	Mean Time Between Failures
NIU	-	Network Integration Unit
NEMA	-	National Electrical Manufacturers Association
NTP	-	Network Time Protocol
ODBC	-	Open Data Base Connectivity
OEM	-	Original Equipment Manufacturer
OIW	-	Operator Interface Workstation
OLE	-	Object Linking and Embedding
OPC	-	OLE for Process Control
PABX	-	Private Automatic Branch eXchange
PAS	-	Public Address System
PC	-	Personal Computer
PCI	-	Peripheral Component Interconnect
PEG	-	Packaged Engine Generator
RAID	-	Redundant Array of Inexpensive Disks
RAM	-	Random Access Memory
RH	-	Relative Humidity
SACS	-	Security Access Control System
SCN	-	Structured Cable Network
SCSI	-	Small Computer System Interface
SDK	-	Software Development Kit
SFMC	-	Security Forces Medical Center
SMS	-	Short Message Service (cellular phones text messaging)
SNMP	-	Simple Network Management Protocol
SOAP	-	Simple Object Access Protocol

SQL	-	Structured Query Language
SSPC	-	Standing Standard Project Committee
SVGA	-	Super Video Graphics Adapter
TCP/IP	-	Transmission Control Protocol/Internet Protocol
UART	-	Universal Asynchronous Receiver-Transmitter
UPS	-	Uninterruptible Power Supply
VDU	-	Video Display Unit
VPN	-	Virtual Private Network
WAN	-	Wide Area Network
XIF	-	eXternal Interface File
XML	-	eXtensible Mark-up Language

1.05 DEFINITIONS

A. Aviation Systems: The group name that differentiates those systems associated with aircraft operations as opposed to those systems which are collectively referred to as the Extra Low Voltage Building Services Systems and which are primarily associated with the operation of the buildings.

B. I2BS Contractor: This shall be the Contractor responsible for the supply and installation of the work detailed in these documents.

C. BACnet: The Building Automation and Control Network open protocol communication standard developed by ASHRAE (ASHRAE SSPC/135) and which is now an ISO and ANSI standard. BACnet can operate over media including Ethernet, ArcNet and MSTP. The BACnet components shall be fully compliant with British standards DD ENV 1805-1:1998 (Data communication for HVAC Application Management Net. Building automation and control networking), DD ENV 13321-1:1999 (Data communication for HVAC application automation net.

D. BACnet Conformance: A description of the capabilities of a device for communicating information to other BACnet devices. It is usually a set of requirements to be met in order for a device to conform to BACnet standards. There are 6 levels of conformance for standard BACnet objects and services. The higher the conformance classes the more features that are covered.

E. BACnet Interoperability Building Blocks (BIBBs): A BIBB defines a small portion of BACnet functionality needed to perform a particular task. BIBBs come in pairs, A and B, which reflect the client/server nature. The A BIBB represents the client, i.e. the device requesting information or commanding an action. The B BIBB represents the server, i.e. the device furnishing the information or executing the command. For two devices to be interoperable the A BIBB and the B BIBB must be the same.

F. BACnet Object: A physical or virtual point with a set of associated properties such as a temperature sensor that has properties including, name, current value, maximum and minimum values, high and low alarm levels, etc.

G. BACnet/IP: The building automation and control network open protocol communication standard that complies with Annex J to the ASHRAE SSPC/135 standard.

H. BAS: This shall mean the complete Building Automation System including the components at the Field, Automation and Management Levels (as applicable).

I Component: Any individual element of the I2BS furnished under this sub-contract including hardware, software and materials.

J. Diagnostic Program: Machine-executable instructions used to detect and isolate system and component malfunctions.

K. MOI/SFMC: This refers to the Owner and/or the Owner's nominated representative.

L. Extra Low Voltage Building Services Systems: The group name that differentiates those systems associated with building operations as opposed to those systems that are collectively referred to as the Aviation Systems and which are associated with the aircraft operations. The ELV Building Services Systems shall comprise field and Automation Levels only, except for the Fire Alarm System that shall also include the Management Level, unless indicated otherwise. The Management Level functions shall be provided via a common platform, which is referred to as the Integrated Intelligence Building Solution (I2BS).

M. Furnish: Purchase and deliver to the appropriate installing trade, complete with every appurtenance, document, commission and warranty.

N. Gateway: A device that contains an input/output (I/O) software driver to translate input data from one communications protocol to output data in a second communications protocol.

O. Integration: Establishing communication and meaningful data transfer between two devices based on a standard protocol or through the use of a standard based gateway.

P. Interoperability: The ability of systems from different manufacturers and of different types to share information with each other without losing any of their independent functional capabilities and without the need for complex programming.

Q. Intranet: Computer network based on TCP/IP technology which is not accessible from the public Internet.

R. LonWorks: The overall communications technology for control systems developed by Echelon Corporation. The technology employs routers, gateways, bridges, and multimedia transceivers to permit topology and media-independent control solutions. Refer to standard ANSI/EIA - 709.1.

S. Middleware: Connectivity software that allows multiple processes running on one or more machines to interact across a network. Middleware provides communication across heterogeneous platforms and enables interoperability.

T. Native BACnet: This term is used to imply that BACnet devices (i.e. BAS controllers and workstation) only communicate in BACnet protocol and do not require a gateway for protocol conversion. The BACnet devices shall be connected on a peer-to-peer network using one of the approved Network technologies such as Ethernet, ARCNET, MSTP, LonTalk or BACnet/IP.

U. Network: A system of distributed control units that are linked together on a communication bus. A network allows sharing of point information between all control units. Additionally, a network provides central monitoring and control of the entire system from any distributed control unit location.

V. Operating System (OS): Software that controls the execution of computer programs and which provides scheduling, debugging, input/output controls, accounting, compilation, storage assignment, data management, and related services.

W. Operator Interface Workstation (OIW): The OIW consists of a high-level processing personal computer and peripheral I/O devices that enable access to the PC and to the entire Network.

X. Peripheral I/O: Input/Output (I/O) equipment used to communicate to and from the computer and make hard copies of system outputs and magnetic files. Peripherals include VDU, printers, hard drives, disk drives, and modems, etc.

Y. Provide: Furnish, install, commission, test and warrant. Refer to the definition of "furnish".

Z. Router: An intelligent network hub that examines each packet of data it receives and forwards it to the correct destination.

AA. Software: Generic term used for those components of the computer systems that are intangible rather than physical. The term "software" is used to refer to the programs executed by the computer systems as distinct from the physical hardware of the computer systems and encompasses any programs such as operating systems, applications programs, operating sequences and databases. The term "software" shall be interpreted to include firmware if, in the context in which it is used, the term "software" does not exclude the use of read-only memory and the use of firmware meets all of the applicable criteria detailed in these specifications.

BB. Thin Client: Thin client technology involves delivering windows applications to client workstations from a centrally based server. The thin client workstation has the ability to process information but data storage, applications and administrative functions reside on the I2BS Application Server. The applications run on the server and screen updates are sent from the server to the client. The thin client workstation displays the screen updates and sends Operator entered requests/commands via the keyboard and mouse back to the server for execution.

CC. Virtual Private Network (VPN): This is a network that uses encryption and other technologies to provide secure communications over the Internet or an Intranet.

DD. XML/SOAP: Simple Object Access Protocol (SOAP) is a simple eXtensible Mark-up Language (XML) based protocol that enables applications to exchange information over HTTP. Or more simply: SOAP is a protocol for accessing a Web Service.

EE. The above definitions shall apply to the words:

1. When they are in upper case, when they are in lower case and when they are capitalized.
2. In the singular and in the plural.
3. In all grammatical tenses.

1.06 WORK OF THE I2BS CONTRACTOR

A. The I2BS Contractor shall integrate the Extra Low Voltage Building Services Systems in the Security Forces Medical Center buildings into the I2BS. All other Security Forces

Medical Center ELV Building Services Systems shall be integrated into the I2BS by MOI/SFMC. The Phase 1 Security Forces Medical Center ELV Building Services Systems are as detailed in the table above.

B. The I2BS Contractor shall provide the necessary quantity of Network Integration Units (NIU) at each building or group of buildings. Communication between NIU's shall be encrypted and shall be peer-to-peer. The NIU shall provide wired and wireless communication between the I2BS and the ELV Building Services Systems automation controllers. Data from the ELV Building Services Systems shall be communicated to the NIU in one of the following protocols:
   1. LonWorks.
   2. Modbus.
   3. EIB.
   4. BACnet
   5. OPC
   6. RS232/485
   7. TCP/IP

C. The I2BS shall poll the NIU on an as required basis so as to provide the necessary data at the I2BS. Polling shall be undertaken using XML. Polling shall be undertaken on a scheduled basis (e.g. the download of historical data from the NIU to the I2BS Data Servers), when a workstation Operator requests specific data and when data is required to update dynamic data displays at the workstations. Alarm data shall be forwarded to the I2BS by the NIU immediately and shall not be dependent on the XML polling. The NIU shall provide the interface between the I2BS Management Level and the ELV Building Services Systems Automation Level, and provide global supervisory control functions over the control devices connected to the NIU and/or control devices communicating with and mapped to a NIU. It shall be capable of executing application control programs to provide:
   1. Calendar functions.
   2. Scheduling.
   3. Trending.
   4. Alarm monitoring and routing.
   5. Time synchronization.
   6. NIU shall not be used for sequence of operation programming except as required to facilitate or implement global data sharing or global operating sequences. Sequences of operation shall reside at the Automation Level controllers.

D. Coordinate with and cooperate with all Extra Low Voltage Building Systems Contractors that furnish systems communicating on the Converged IP network to ensure that data exchange between the various ELV Building Services Systems meets the requirements of these specifications. The I2BS Contractor shall have responsibility for providing an interoperable system that enables the sharing of information between the different ELV Building Services that use different communications protocols.

E. Provide a fully functioning I2BS that will include the following:

1. Central Control Room at the Engineering Building (B08.08) equipped with:
   a. Three (3) Operator Workstations (OWS) The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.

- Desk and chair for each workstation.
- Mouse with biometric fingerprint reader for each workstation.
- Keyboard for each workstation.

b. I2BS application servers, which shall run web services. The I2BS Application Servers shall comprise, at minimum, two (2) redundant, I2BS Application Servers configured in a clustering fail over configuration together with peripheral I/O devices that facilitate Thin Client architecture complete with all applicable software as detailed herein. The servers shall use the latest version of Microsoft Windows Enterprise Edition operating software and hardware. Provide I2BS Application Servers that are certified by a Microsoft OEM and provide as a complete package. The 2 Servers shall be located within different Telecom rooms in the Engineering Building. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

c. I2BS Data Servers. The I2BS Application Servers shall comprise, at minimum, two (2) redundant I2BS data Servers configured in a clustering fail over configuration. The I2BS Contractor shall provide all software for these servers. Databases shall be SQL compliant and shall be standard. Proprietary databases shall not be acceptable. The I2BS Data Server software shall be proven for use in a multi-vendor environment. The I2BS Data Server operating system shall be Microsoft Windows 2003 Enterprise edition or the latest version of this software at the time of implementation. The 2 servers shall be located within different Telecom rooms in the Engineering Building. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

d. Routers, hubs, switches, etc. as necessary to implement a fully functional I2BS system meeting the requirements of these documents. MOI/SFMC shall provide data ports for the connection of the I2BS components to the Converged IP network.

e. Laptop computer that shall be a Thick Client of the I2BS Application Server.

f. Laptop computer that shall store configuration software for the ELV Building Services Systems Automation Level controllers that is not configurable from the I2BS workstations.

g. One (1) report and one (1) alarm printer.

h. Provide software (operating system, applications programmes, middleware, graphical user interface, diagnostic tools, protocol analyzer, network tuning tools, etc,) as necessary for the implementation of a fully functional I2BS system meeting the requirements of these documents.

i. Two (2) wireless Hand Held Devices shall be provided. These shall be Thin Clients of the I2BS Application Servers.

j. Two (2) LCD Wall Screens 46”

2. Hospitals’ Central Control Room at the Car Park Structure of the Administration Building (B07.03) equipped with:

a. Four (4) Operator Workstations (OWS) The OWS shall incorporate the following:

- One (1) Personal Computer at each workstation
- One (1) monitor for each OWS..
- Desk and chair for each workstation.
- Mouse with biometric fingerprint reader for each workstation.
- Keyboard for each workstation.

b. Hospitals’ I2BS application servers, which shall run web services. The I2BS Application Servers shall comprise, at minimum, two (2) redundant, I2BS Application Servers configured in a clustering fail over configuration together with peripheral I/O devices that facilitate Thin Client architecture complete with all applicable software as detailed herein. The servers shall use the latest version

of Microsoft Windows Enterprise Edition operating software and hardware. Provide I2BS Application Servers that are certified by a Microsoft OEM and provide as a complete package. The 2 Servers shall be located at the Administration Building (B01.01) I2BS Servers Room. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

c. Hospitals' I2BS Data Servers. The I2BS Application Servers shall comprise, at minimum, two (2) redundant I2BS data Servers configured in a clustering fail over configuration. The I2BS Contractor shall provide all software for these servers. Databases shall be SQL compliant and shall be standard. Proprietary databases shall not be acceptable. The I2BS Data Server software shall be proven for use in a multi-vendor environment. The I2BS Data Server operating system shall be Microsoft Windows 2003 Enterprise edition or the latest version of this software at the time of implementation. The 2 Servers shall be located at the Administration Building (B01.01) I2BS Servers Room. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

d. Routers, hubs, switches, etc. as necessary to implement a fully functional I2BS system meeting the requirements of these documents. MOI/SFMC shall provide data ports for the connection of the I2BS components to the Converged IP network.

e. Laptop computer that shall be a Thick Client of the I2BS Application Server.

f. Laptop computer that shall store configuration software for the ELV Building Services Systems Automation Level controllers that is not configurable from the I2BS workstations.

g. One (1) report and one (1) alarm printer.

h. Provide software (operating system, applications programmes, middleware, graphical user interface, diagnostic tools, protocol analyzer, network tuning tools, etc,) as necessary for the implementation of a fully functional I2BS system meeting the requirements of these documents.

i. Two (2) wireless Hand Held Devices shall be provided. These shall be Thin Clients of the I2BS Application Servers.

j. Two (2) LCD Wall Screens 46"

3. Research Center Control Room at the Research Center Building (B03.01) equipped with:

a. Two (2) Operator Workstations (OWS) The OWS shall incorporate the following:

- One (1) Personal Computer at each workstation
- One (1) monitor for each OWS..
- Desk and chair for each workstation.
- Mouse with biometric fingerprint reader for each workstation.
- Keyboard for each workstation.

b. Research Center's I2BS application servers, which shall run web services. The I2BS Application Servers shall comprise, at minimum, two (2) redundant, I2BS Application Servers configured in a clustering fail over configuration together with peripheral I/O devices that facilitate Thin Client architecture complete with all applicable software as detailed herein. The servers shall use the latest version of Microsoft Windows Enterprise Edition operating software and hardware. Provide I2BS Application Servers that are certified by a Microsoft OEM and provide as a complete package. The 2 Servers shall be located at the Research Center's IT Room or at the Data Center Servers Room. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

c. Research Center's I2BS Data Servers. The I2BS Application Servers shall comprise, at minimum, two (2) redundant I2BS data Servers configured in a

clustering fail over configuration. The I2BS Contractor shall provide all software for these servers. Databases shall be SQL compliant and shall be standard. Proprietary databases shall not be acceptable. The I2BS Data Server software shall be proven for use in a multi-vendor environment. The I2BS Data Server operating system shall be Microsoft Windows 2003 Enterprise edition or the latest version of this software at the time of implementation. The 2 Servers shall be located at the Research Center's IT Room or at the Data Center Servers Room. Coordinate with MOI/SFMC and the Telecom Contractor for server room location and data ports.

d. Routers, hubs, switches, etc. as necessary to implement a fully functional I2BS system meeting the requirements of these documents. MOI/SFMC shall provide data ports for the connection of the I2BS components to the Converged IP network.
e. Laptop computer that shall be a Thick Client of the I2BS Application Server.
f. Laptop computer that shall store configuration software for the ELV Building Services Systems Automation Level controllers that is not configurable from the I2BS workstations.
g. One (1) report and one (1) alarm printer.
h. Provide software (operating system, applications programmes, middleware, graphical user interface, diagnostic tools, protocol analyzer, network tuning tools, etc,) as necessary for the implementation of a fully functional I2BS system meeting the requirements of these documents.

4. Satellite Control Room at the Main Hospital Car Park Structure (B07.04) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.
      - Mouse with biometric fingerprint reader for each workstation.
      - Keyboard for each workstation.

   b. One (1) report and one (1) alarm printer.

5. Satellite Control Room at the Women and Children Hospital Car Park Structure (B07.05) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.
      - Mouse with biometric fingerprint reader for each workstation.
      - Keyboard for each workstation.

   b. One (1) report and one (1) alarm printer.

6. Satellite Control Room at the Hospital of Hope Car Park Structure (B07.06) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.

- Mouse with biometric fingerprint reader for each workstation.
- Keyboard for each workstation.

b. One (1) report and one (1) alarm printer.

7. Satellite Control Room at the College of Applied Medical Sciences (B02.01) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.
      - Mouse with biometric fingerprint reader for each workstation.
      - Keyboard for each workstation.

   b. One (1) report and one (1) alarm printer.

8. Satellite Control Room at the Sports and Recreation Center (B05.04) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.
      - Mouse with biometric fingerprint reader for each workstation.
      - Keyboard for each workstation.

   b. One (1) report and one (1) alarm printer.

9. Satellite Control Room at the Visitor Hospitality Center (B02.02) equipped with:
   a. One (1) Operator Workstation (OWS). The OWS shall incorporate the following:
      - One (1) Personal Computer at each workstation
      - Two (2) monitors for each OWS.
      - Desk and chair for each workstation.
      - Mouse with biometric fingerprint reader for each workstation.
      - Keyboard for each workstation.

   b. One (1) report and one (1) alarm printer.

F. Interface with the Computerized Facility Maintenance Management System (CFMMS) provided by others. The CFMMS shall generate work orders, reports, etc. based on real time and calendar time requirements.

G. Provide practical and theoretical training and documentation to MOI/SFMC s nominated supervisory and operations personnel such that they can undertake the tasks detailed within these specifications.

H. Provide a minimum 2 year warranty for all hardware and software components as

detailed within these specifications.

I. All items of equipment furnished under this contract shall be connected to UPS and emergency power by the electrical trade. Coordinate with the electrical trade

J. Provide maintenance during the warranty period as detailed within these specifications.

K. Provide maintenance following the warranty period as detailed within these specifications if MOI/SFMC elects to purchase this service.

L. Provide all licenses for all software necessary for the legal operation of the components furnished under this contract. The licenses shall cover all protocols handled by the I2BS Application Servers at the time of installation and shall cover all new protocols that may be added to the I2BS Application Servers in the future. MOI/SFMC shall be able to add as many thin client workstations and thick client workstations and Automation Level controllers to the networks as required without the need to obtain additional licenses or pay additional fees. It shall be possible to add as many monitoring and control points and virtual points, including calculated points, to the I2BS without the need to obtain additional licenses or pay additional fees.

M. Provide comprehensive commissioning and testing.

N. Report to MOI/SFMC for the coordinated and timely execution of the Work. Attend all meetings as requested by MOI/SFMC.

O. Provide complete documentation to the ELV Building Services System Contractors regarding the ID and all other relevant information pertinent to the data transfer from the I2BS to the ELV Building Services Systems.

P. Apply to MOI/SFMC for IP addresses for the I2BS equipment. Coordinate all requirements with the Telecom Contractor.

Q. Provide a test facility that shall be used to test communication between the I2BS and each type of controller proposed by the ELV Building Services Systems Contractors. The I2BS Contractor shall participate in testing of the ELV Building Services Systems controllers to ensure that the ELV Building Services Systems controllers can provide data in accordance with the requirements of these Contract documents.

R. Provide practical and theoretical training to MOI/SFMC's nominated supervisory and operations personnel such that they can undertake the tasks detailed within these specifications. .

S. Provide all operations and maintenance manuals and as-built drawings.

1.07 EQUIPMENT AND SERVICES PROVIDED BY OTHER CONTRACTORS FOR THE USE OF THE I2BS CONTRACTOR

A. The Telecom Contractor shall provide converged IP network using fibre optic cable

B. The I2BS Contractor shall provide integral data ports to enable the necessary connections at the I2BS components and the Telecom Contractor shall provide all other components and services associated with the connection of the I2BS into the Data Networks. Advise

the Telecom Contractor of data port requirements and coordinate all aspects of this work with the Telecom Contractor.

C. MOI/SFMC shall allocate a range of IP addresses to the I2BS and other ELV Building Services System Contractors.

D. Appropriate air conditioning will be provided for the equipment rooms. Advise the Mechanical trade of equipment heat outputs.

E. The Electrical Contractor shall provide UPS for all I2BS components. Coordinate requirements with the Electrical Contractor.

F. The I2BS Contractor shall coordinate mains power requirements with the Electrical Contractor.

G. The ELV Building Services Systems Contractors shall provide comprehensive documentation to the I2BS Contractor regarding the protocol and the format/address of the data communicated to the NIU. In particular an ELV Building Services System Contractor who provides Automation Level controllers that communicate using BACnet MSTP shall provide complete details of all BACnet object IDs, the ELV Building Services System Contractor who provides Automation Level controllers that communicate using LonTalk shall provide details of all LON SNVT IDs and an ELV Building Services System Contractor who provides Automation Level controllers that communicate using another approved protocol shall provide all necessary details regarding the protocol and the IDs of all data.

H. The ELV Building Services Systems Contractors shall provide a matrix identifying the actions of the various ELV Building Services Systems in the event of each type of alarm generated by another ELV Building Services System.

I. System diagrams shall be submitted to the I2BS Contractor by the ELV Building Services Systems Contractors in AutoCAD format and will clearly indicate the location and ID of data points.

1.08 MATERIAL AND EQUIPMENT - GENERAL

A. All components of the I2BS shall operate on UPS. The UPS shall be not be provided by the I2BS Contractor except as noted below. The I2BS Contractor shall advise the Electrical trade within 2 weeks of award of sub-contract what the I2BS load will be for UPS power. I2BS servers shall be provided with integral UPS in addition to the UPS provided by others as specified in these contract documents.

B. The I2BS components shall be the most recent products offered which meet these specifications. If there are improved models of any I2BS components that become available before the on-site commencement of installation then these shall be offered to MOI/SFMC at no additional cost to MOI/SFMC. MOI/SFMC shall have the option to accept or decline the offer. The components offered shall have been in successful operation in at least 2 similar applications for a minimum of 12 months.

C. All electrical equipment, devices and components and their installation shall comply with the latest edition of the IEE Wiring Regulations (BS 7671:1992 Requirements for electrical installations) and all associated addenda, the electrical sub-contract specifications for the Security Forces Medical Center project and all other applicable codes, regulations and statutes.

D. All components shall be IP 2X finger protected to BS 60529 such that live components cannot be accidentally touched. Interior enclosures shall be, at minimum, IP 45 to BS 60529 and exterior enclosures shall be weather proof IP 65 to BS 60529 unless specifically noted otherwise within these sub-contract documents.

E. All work shall conform to the requirements detailed in the electrical specifications. Where there is any conflict between the requirements of the different project trade sub-contract documents, statutes, codes, regulations, local ordinances and any requirement of an agency having jurisdiction over the project, the most stringent requirement shall apply unless determined otherwise by MOI/SFMC. Advise MOI/SFMC of any discrepancy or conflicts between the various requirements for the project.

F. Each component shall meet, at minimum, the following requirements:
1. Manufactured by companies experienced in the manufacture of the specific component and facilities.
2. Designed to minimize the requirement for field repair or maintenance.
3. Modular design.
4. Electronic components shall have internal failure diagnostics.
5. Each component shall be maintainable without significantly affecting the ongoing operation of the other components.
6. Components, test ports and cable terminations shall be readily accessible.
7. Damage caused by the failure of one component will be limited to the component that has failed without affecting the ongoing operation of the other components.

G. Equipment, devices and materials shall conform to all performance requirements of the specifications when exposed to the following interferences:
1. Project lighting, telephone and elevator equipment.
2. VHF and UHF signals as generated by external or internal portable or fixed transmitters.
3. AM signals as generated from transmitters.
4. Electrical noise on the building power system, both spurious and harmonics.
5. The installations shall not radiate signals that cause interference to the correct operation of MOI/SFMC's or other Contractor's on-site equipment.
6. The I2BS and all individual electrical equipment, devices and components shall comply with the requirements of BS EN 50081-1 (General Emission Standard) and BS EN 50082-1 and 2 (General Immunity Standard), the requirements of the Federal Communication Commission rules and regulations Part 15, sub part J and all other applicable codes and statutes with respect to the radiation and conduction of radio frequency interference.

H. Provide adequate earthing on all equipment to prevent the build-up of electromagnetic voltage potentials. Provide screening of panels, enclosures, devices, or components that emit interferences. All monitoring and control and communication cables shall be screened with one end earthed.

I. All equipment and materials shall be new and without any defect. Where practical all components of one type shall be products of one manufacturer.

J. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB, or other hazardous materials as determined by MOI/SFMC , a written application shall be made by the I2BS Contractor to MOI/SFMC providing all relevant details concerning a proposed product or material that contains

hazardous material prior to installation.

K. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

1.09 I2BS EXPANSION

A. The components installed under this contract shall be capable of expansion as follows:
   1. The addition of an unlimited number of thin and thick client workstations to the Converged IP network. It shall be possible to add an unlimited number of thin and thick client workstations without requiring additional licenses.
   2. The addition of ELV building services systems in such quantities as to increase the monitoring and control at the I2BS system to 1,000,000 monitoring and control points excluding virtual and calculated points. It shall be possible to add an unlimited number of thin and thick client workstations without requiring additional licenses.
   3. It is the intent of MOI/SFMC to add "services" to the I2BS. Such software programmes will permit the automatic generation of utility invoices, SMS texting, etc. The system shall be able to accept third party software and implement services based on monitoring and control data acquired by the I2BS system.

B. Subsequent to the expansion detailed in A. above it shall be possible to add software to enable the translation of any other protocols.

C. Subsequent to the potential expansion detailed in B. above:
   1. The performance of the I2BS Application Servers shall not be degraded in any manner and shall meet all performance criteria detailed in these specifications.
   2. The equipment furnished under this contract shall not become redundant as a result of implementing these expansion requirements.

D. If the expansion of the I2BS exceeds that detailed above such that the Basis 100% loaded, then the I2BS shall meet all of the operating criteria detailed within these specifications. If the Basis more than 100% loaded following the expansion detailed above, the I2BS shall undertake tasks in accordance with the previously assigned priorities. MOI/SFMC shall assign the task priorities. Request the necessary information at least 4 weeks before it is required. It shall be possible to assign a minimum of 16 priority levels.

E. The above expansion requirements shall be undertaken without the need to obtain additional licenses or pay additional fees

1.10 MAKING GOOD DEFECTS DURING THE DEFECTS LIABILITY PERIOD

A. Repair work shall only be undertaken at times approved by MOI/SFMC.

B. Replace or repair all supplied defective installations. Respond and be on site within 2 hours of MOI/SFMC placing a system trouble call for items of an immediate nature (e.g.: failed component, non-functioning server, etc.). Response to warranty call out by MOI/SFMC shall be within 24 hours for items not requiring immediate attention. Work

to troubleshoot and identify the cause of the I2BS system or component failure shall begin immediately and shall continue until repaired to the satisfaction of MOI/SFMC.

C. The warranty and defects liability period shall be a minimum of 2 years following substantial completion for all components. The warranty period for the I2BS shall commence on the same date for all components.

1.11 ROUTINE MAINTENANCE DURING THE DEFECTS LIABILITY PERIOD

A. Routine software and hardware maintenance during the defects liability period shall be provided at no extra cost to MOI/SFMC.

B. Components of the I2BS shall be selectively inspected and serviced during the Defects Liability Period. Provide, at minimum, four (4) preventative service inspections during the Defects Liability Period. Perform, at minimum, the following during each preventative service inspection:

1. Verify the proper operation of the workstation including:
   a. Cooling fans.
   b. Power supplies.
   c. PC diagnostics.
2. Clean housings, keyboard, etc. Change or clean filters.
3. Provide a comprehensive written report to MOI/SFMC indicating the results of each inspection and all repairs and adjustments made.
4. Perform complete backup of all software.

C. The routine maintenance services during the Defects Liability Period shall include 60 hours per year of programming changes to the I2BS as requested by MOI/SFMC. This time shall not include the modification of faulty software and shall not include the time to implement software upgrades as detailed below.

D. Any software upgrades and new software programmes that become standard product offerings from the I2BS Contractor during the Defects Liability Period shall be brought to the attention of MOI/SFMC together with the cost and, if MOI/SFMC wishes, MOI/SFMC shall purchase the software. If at any time during the Defects Liability Period, software patches that correct software errors become available MOI/SFMC shall be notified immediately and they shall be made available to MOI/SFMC at no additional cost.

E. Update as-built documentation, submitted at the time of taking-over of the Works as necessary to reflect any changes that may have been introduced during the Defects Liability Period.

F. Detail the minimum number of hours to be spent on routine maintenance during the Defects Liability Period in the tender submittal.

G. Maintain an inventory of common components in the local office for the replacement of failed components as detailed under “Spare Parts”.

H. Replace all used consumable items during the Defects Liability Period. Consumable items shall include but not be limited to the following:

1. Toner/ink for those printers furnished under this Contract.
2. Paper for printers furnished under this Contract.

3. Filters for PC furnished under this Contract.
4. Batteries for equipment furnished under this Contract.
5. CD/Tapes for back up of data and software furnished under this Contract.
6. Other consumable items furnished under this contract that have a life expectancy that would render them less than 100% effective before the end of the Defects Liability Period.

1.12 MAINTENANCE SERVICE CONTRACT AFTER THE DEFECTS LIABILITY PERIOD (OPTIONAL PRICE)

A. Submit an Optional price to extend the Defects Liability Period and the maintenance during that period for ten (10) one (1) year periods. The maintenance service contract shall be an all-inclusive labour and parts contract but MOI/SFMC reserves the right to obtain parts from alternative sources. The requirements during each additional year shall be exactly the same as those detailed in Part 1.10 of this Section.

B. The I2BS Contractor shall enter into a direct contract with MOI/SFMC to provide the maintenance services for a minimum period of ten (10) years. Signing of a maintenance services contract- if MOI/SFMC so chooses - shall be a pre-requisite to obtaining substantial completion. MOI/SFMC shall have the option to renew each year if MOI/SFMC so wishes. The I2BS Contractor shall submit the cost for the maintenance service agreement in one of the following ways:
   1. A fixed price for a ten (10) year Agreement with a break-out between labour and parts, or
   2. A fixed price for the first year of the ten (10) year Agreement with a break-out between labour and parts for the first year and a percent value or a table of percent values that the labour portion of the cost would be escalated at during the succeeding nine (9) years and a percent value or a table of percent values that the parts portion of the cost would be escalated at during the succeeding nine (9) years, or
   3. A fixed price for the first year of the ten (10) year Agreement with a break-out between labour and parts for the first year with the annual increase for labour and parts over the succeeding nine (9) years based on the annual percent increase in a cost of living index from one year to the next, the cost of living index to be used is to be specified by the I2BS Contractor in the tender submittal.

C. If at any time during the maintenance service contract, software patches that correct software errors become available MOI/SFMC shall be notified immediately and they shall be made available to MOI/SFMC at no additional cost.

1.13 CODES, PERMITS AND APPROVALS

A. Obtain all required permits and inspection certificates. All permits and certificates shall be made available to MOI/SFMC.

B. The latest requirements of all national, municipal and other authorities having jurisdiction shall be met.

C. Work shall be performed in compliance with MOI/SFMC's insurance underwriters' requirements.

D. All electrical work shall comply with the latest edition of the IEE wiring regulations (BS 7671).

1.14 SCHEDULE

A. Complete all requirements of the I2BS sub-contract in accordance with the project programme and prior to the scheduled Substantial Completion date for each phase.

B. Attend project meetings as requested by MOI/SFMC.

C. Provide MOI/SFMC with a schedule indicating the sequence of work, durations of individual tasks, delivery dates for all material, devices and equipment and detail any interface that must be coordinated with any other ELV Building Services System Contractors.

D. Provide written status reports at required intervals and in a format acceptable to MOI/SFMC. An updated schedule of work shall be included in each status report.

E. Comply with the Project Construction Schedule. Provide additional staffing or work overtime as required to comply with the Project Schedule so as not to interfere with other on-site trades in their effort to comply with the Project Schedule. Confirm, prior to tender submittal that all equipment, devices, material and services proposed are available and will be delivered accordingly to comply with the Project Schedule.

F. Provide written Request for Information notices to MOI/SFMC when specific information or clarification of the specifications is required. Request for Information notices shall be provided at least two weeks prior to the need for the information.

1.15 I2BS CONTRACTOR QUALIFICATIONS

A. The I2BS Contractor shall:

1. Have a local staff, within 100 kilometers of the project site, of trained personnel capable of giving instructions and providing routine and emergency maintenance on all components and software/firmware and all other elements of the I2BS. The staff shall be manufacturer certified and shall be experienced in the installation, maintenance, programming and all other aspects of the I2BS equipment proposed for this project.
2. Have a proven record of experience in the supply and installation of equivalent systems over a minimum period of 5 years in the Middle East Region.
3. Have comprehensive local service and support facilities for the total I2BS that shall be capable of responding to Security Forces Medical Center call-out within 2 hours, 7 days a week.
4. Maintain local, or have approved local sub-contracted access to, supplies of essential expendable parts.
5. Undertake to maintain necessary project staff and maintenance personnel as per MOI/SFMC's requirements.
6. The I2BS shall have an established relationship with the software and hardware vendors/manufacturers.
7. The software and hardware proposed by the I2BS Contractor shall have a proven record in similar applications and shall be products with which the I2BS

Contractor is familiar and has installed in other projects within the region.

B. The I2BS shall be listed and manufactured to ISO 9001 and ISO 9002.

C. All equipment shall meet UL 916 and UL864 UUKL requirements and all electrical components shall be UL listed and shall carry the UL label.

1.16 HEALTH AND SAFETY

A. Work shall comply with all the requirements of the Health and Safety Commission and with all of the instructions of MOI/SFMC and Project Manager.

1.17 PERFORMANCE CERTIFICATION

A. Certify in writing with the tender submittal that all components proposed for this project comply with all of the following requirements:
   1. Complete and thorough testing has proven that performance shall not be affected when the building electrical distribution system experiences disturbances of the type and magnitude normally encountered in buildings of this nature.
   2. Power line disturbance tests involving the cycling of mains voltage showed that all components operated satisfactorily when the voltage dropped to 75% or less of the nominal mains voltage and normal operation resumed when the voltage returned to less than 85% of the nominal mains voltage. Following these brownout conditions the components were free of any stress and/or damage, operated as normal and no data was lost or corrupted.

B. The I2BS Contractor shall certify in writing with the tender submittal that all components are free of date related problems and that the I2BS complies with all aspects of British Standards Institution standard BSI DISC PD2000-1.

1.18 AMBIENT CONDITIONS

A. Provide equipment, devices and materials for interior and exterior applications that shall be capable of withstanding and operating satisfactorily in, at minimum, the following ambient conditions:
   1. Outside Temperatures Summer:
      Dry Bulb: 46 deg. C
      Wet Bulb: 17.8 deg. C
      Daily Range: 14 deg K

   2. Outside Temperatures Winter:
      Dry Bulb: 5 deg. C

B. Electrical power service of single phase 230 Vac, 60 Hz nominal with tolerances in compliance with the applicable statutes, codes and regulations.

1.19 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of the sub-contract

Documents.

B. Accept products on site and verify damage.

C. Protect products from construction operations, dust, and debris by storing in conditioned space.

1.20 SPARE PARTS

A. As soon as practicable after approval of materials and equipment and, if possible, not later than 4 months prior to the date of beneficial use, submit spare parts data for each different item of equipment furnished. Data to include a complete list of the sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 360 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the guarantee condition.

1.21 COMPUTER ANTI VIRUS SOFTWARE

A. Provide antivirus software for all components that are vulnerable to viruses. Anti virus software shall be provided with free virus definition updates for the duration of the warranty. Antivirus software should automatically scan the computer bios and all files opened, created, copied, and/or received for viruses. Include directions for updating virus definition files upon expiration of warranty within the record documentation.

1.22 QUALITY ASSURANCE

A. General: maintain a complete test, inspection and documentation program covering all phases of the I2BS implementation. Quality control and assurance programs are to be fully documented in a project procedures manual that is to be submitted for approval.

B. Project procedure manual is to detail, but is not necessarily limited to, the following:
   1. Equipment selection criteria.
   2. Design standards.
   3. Installation standards.
   4. Qualification procedures for personnel such as software programmers, trainers, maintenance staff and all other categories of staff that will participate in this project.
   5. System test and start-up procedures.
   6. Interoperability assurance procedures.

C. Start up procedures: portions of the manual may be equipment dependent such as start up procedures. In such cases submit these portions in accordance with the requirements of sub-section SUBMITTALS. However, selection criteria and design and installation standards are to be established and approved before detailed design starts.

D. Inspection: MOI/SFMC has the right, at all times, to inspect the work, equipment, or quality assurance procedures as applicable to confirm that requirements as set forth are being complied with. Provide all tools, instruments and equipment necessary to facilitate these inspections.

E. Inspection: cooperate with MOI/SFMC in establishing when the various inspections or tests will be performed during progress of the work.

F. Obligations: the presence or activities of MOI/SFMC are in no way to relieve the Contractor of his obligations.

G. Inspection duties assigned to the Contractor's personnel are to include, but are not limited to, the following:
   1. Verify that personnel are qualified for the work being done.
   2. Verify that all components received comply with the Specification and receipt, inspection and storage of materials comply with requirements of the Specification.
   3. Verify that the Contractor's storage facilities are maintained in a satisfactory condition.
   4. Verify that all electrical tests are conducted in accordance with the Specification.
   5. Verify that all wiring insulation tests are performed in accordance with the Specification and that all test reports are properly filled in, signed and submitted for approval.
   6. Witness the system operational tests on a sub-system basis to assure operational integrity and conformance to operational requirements as specified.
   7. Verify all plant documentation required for plant acceptance is in accordance with sub-section SUBMITTALS for completeness and conformance.

1.23 TECHNICAL PROPOSALS

A. Technical proposals shall be prepared in accordance with these specifications. Three copies of the proposal shall be submitted. The technical proposal shall include the following data/information as a minimum. The order of listing here is not intended to indicate, nor should it be construed to indicate, the relative importance of the data/information:
   1. Information on organizational capability to handle this project (management, personnel, manufacturing, single source responsibility, etc.).
   2. Information on training program to demonstrate specification compliance.
   3. System Configuration as proposed with specific reference to interoperability:
      a. Describe system architecture including a schematic layout with location and type of all components.
      b. Describe system operation and functions.
      c. Modularity.
      d. Provisions against obsolescence due to technological advancement.
   4. Technical data to support the information on the hardware configuration in 3. above.
   5. Detailed description of all software provided for this project. In particular detail the protocols that can be handled by the I2BS for the receipt and distribution of data.
   6. Identify any software that will be written specifically for this project.
   7. Indicate any anticipated deviations from the specified response times.
   8. A signed certificate stating the Contractor "has read the performance and functional requirements, understands them and his technical proposal will comply with all parts of the specification".
   9. Provide necessary documentation in the technical submittal to convince MOI/SFMC that the I2BS proposed will meet all of the requirements detailed

herein for the exchange of data between various ELV Systems that operate with different protocols.

10. Details of all protocols that are supported by the I2BS over an Ethernet TCP/IP backbone. Highlight any of the protocols listed in Part 1.06 that are not supported by the I2BS.
11. Description of data handling procedures in the event of failure of network communications, power failure, receipt of undecipherable messages and conflicts in data received (e.g. two aircraft scheduled for the same gate at the same time).
12. Pertinent data regarding system performance such as mean time between failures and mean time to repair. Such data shall be based on manufacturers' published and proven data and the I2BS Contractor's experiences with systems of a similar nature.
13. Details of, at minimum, 2No. I2BS installed of a similar nature. Provide contact details for references. MOI/SFMC may choose to visit one of the sites. Ensure that such a visit will be possible and select the reference sites accordingly.
14. Certifications by the original manufacturers and software providers that the I2BS Contractor is certified to undertake the work of this contract and that they endorse the design proposed by the I2BS Contractor.
15. Details of the proposed integration test facility.
16. Details of the alarm capability of the servers in terms of events per second.
17. Details of any limitations on the I2BS software and hardware.
18. Action procedures in case of multiple system failures or multiple device failures in a system or in multiple systems.
19. Other requirements for inclusion in the technical proposal are located throughout this specification.

B. Submit technical proposals with pricing and all information in accordance with Instructions to Bidders. The above requested information shall be in addition to that requested in the Instructions to Bidders.

1.24 UNIT PRICES

A. The I2BS Contractor shall submit a unit price to transfer data between an ELV Building Services System not presently covered by this sub-contract and an ELV Building Services System that is covered by this sub-contract. This shall involve, at minimum, the following work:

1. Obtain the protocol, data IDs, component addresses and database information and all pertinent documentation from each sending ELV Building Services System Contractor and ensure that the data IDs and the component addresses are unique. Map the points into the I2BS, provide graphical display of points as necessary, undertake interoperability testing and provide all appropriate data to each receiving ELV Building Services System Contractor so that each receiving ELV Building Services System Contractor can map the points into the receiving ELV Building Services Systems. Provide all relevant documentation meeting the requirements detailed in these documents, provide a warranty similar to that provided for all other components and provide all other services and provide all other components as necessary to have a fully functional transfer of data between each sending ELV Building Services System and the I2BS and between the I2BS and each receiving ELV Building Services System.
2. Note that these unit prices shall only apply to an ELV Building Services System that is not covered by this sub-contract and which provides data in a protocol that is compatible with the I2BS.

B. The I2BS Contractor shall submit a unit price to perform the following work:
   1. The cost to add a new protocol to the I2BS. This shall be in addition to the protocols listed in Part 1.06.

C. The I2BS Contractor shall submit a unit price to receive a piece of data from an ELV Building Services System presently covered by this sub-contract and to send the data to another ELV Building Services System covered by this contract. This shall involve, at minimum, the following work:
   1. Obtain the data ID, component address and database information and all pertinent documentation from each sending ELV Building Services System Contractor and ensure that the data IDs and the component addresses are unique. Map the points into the I2BS and provide all appropriate data to each receiving ELV Building Services System Contractor so that each receiving ELV Building Services System Contractor can map the point into the receiving ELV Building Services System.
   2. Note that this unit price shall only apply to an ELV Building Services System that is already covered by this sub-contract and shall apply only to the transfer of data that has not already been specified to be part of this sub-contract and shall apply only to work following the substantial completion of the contract. Prior to the substantial completion of the contract the I2BS Contractor shall implement the transfer of data between systems as detailed within these documents and as amended and added to by MOI/SFMC.

D. Manpower costs: The I2BS Contractor shall submit a cost per hour for each category of personnel that will work on this project including, but not limited to:
   1. Software engineer.
   2. Hardware engineer.
   3. Maintenance technician.
   4. Supervisor.

E. Workstation: The I2BS Contractor shall submit a unit price for a workstation meeting the relevant specifications detailed in Part 1.06 and Part 2.

F. Unit prices shall be maintained valid for a period of 3 years following the completion of the Defects Liability period.

1.25 DEVELOPMENT OF AN ARABIC LANGUAGE GRAPHICAL USER INTERFACE

A. Submit an Optional price to create an Arabic language Graphical User Interface (GUI). The Graphical User Interface shall meet, at minimum, the requirements specified in Section 2.15 of this document.

PART 2 - PRODUCTS

2.01 LABELING

A. Provide labeling for all servers, gateways, routers, hubs, panels, enclosures, etc. Labeling shall meet, at minimum, the following requirements:
   1. Plastic laminated label that shall be affixed to the panel or enclosure with rivets or permanent adhesive.
   2. Lettering 6mm (0.25 inch) high that sharply contrasts the background colour.

3. Consistent throughout the project.
4. Indicated on the record documentation.

B. Provide labeling of all cabling and containment. Labeling shall meet, at minimum, the following requirements:
1. Identified all cables with permanent tag or self-adhesive label within a panel.
2. Provide laminated record drawing within the panel enclosure that is cross-referenced on the associated record documentation.
3. The I2BS Contractor shall provide labeling for all cable furnished and installed for the use of the I2BS Contractor.

C. The labeling shall be coordinated with the ELV Building Services Systems Contractors. A single uniform system shall be used and shall be subject to the approval of MOI/SFMC. Submit a proposed scheme for the label nomenclature to MOI/SFMC for approval. Modify as requested by MOI/SFMC. Labeling details shall be submitted with the shop drawings.

2.02 CONDUIT, TRUNKING AND FITTINGS

A. Containment has been provided throughout the Medical Center facilities. If additional containment is required in addition to that installed by others, the I2BS Contractor shall provide containment as necessary for a fully functioning system as detailed in these specifications. Coordinate with the Building Contractor for the use of containment installed by others and for additional containment requirements. All electrical components including cable, conduit, trunking, etc. shall meet the requirements of the Division 16 Contract Documents and the specifications detailing the work of the Telecom Contractor.

B. Flexible metallic rustproof conduit shall be provided for the final one (1) meter before connection from a non-vibrating location to equipment subject to vibration or movement. Flexible metallic conduit shall be provided for between the last 300mm and the last 1000mm of connection to field instrumentation, relays and final control elements as necessary to facilitate the removal of devices without the disconnection or the bending of the non-flexible conduit. Water tight conduits to be provided where appropriate.

C. Conduit and trunking shall be securely mounted in accordance with IEE Regulations and shall be concealed in all areas to which the public have access.

D. Conduit and trunking shall run parallel or perpendicular to the building lines and shall be installed in a workmanlike manner. Avoid obstructions and crossovers where possible.

E. Conduit/trunking shall be installed such that any condensation in the conduit cannot run into I2BS equipment. Where necessary conduit shall enter enclosures from the bottom or shall be sloped up to the enclosure.

F. Junction and pull boxes shall be securely fastened to the conduit, shall be accessible, and shall be provided where required by code and where necessary to facilitate the pulling of cables.

G. Coordinate installation of conduit/trunking with building structure and other trades. Conduit/trunking installation above accessible ceilings shall be such that there will be no interference with the installation of lighting fixtures, fire protection devices, air distribution devices or any other devices.

H. Colour code all conduit/trunking at least every 3,000 mm (10 feet) along the conduit with a blue and green band at least 50mm wide and colour code every junction box in a bright yellow and in accordance with the Division 16 Contract documents.

I. Containment shall be provided for all I2BS cable except where specifically noted otherwise.

J. Cable shall not share conduit with cable carrying voltages in excess of 48 volts and shall be partitioned from higher voltage cable in trunking.

K. LAN cable shall not share conduit with any other cable or shall be in a dedicated partitioned compartment in trunking.

L. All trunking, conduit and accessories shall comply with all applicable codes and standards.

M. Containment shall meet all of the requirements detailed in the electrical sub-contract documents.

2.03 CABLE – COPPER

A. Cable has been provided throughout the MOI/SFMC facilities. If additional cable is required in addition to that installed by others, the I2BS Contractor shall provide cable as necessary for a fully functioning system as detailed in these specifications. Coordinate with the Building Contractor for the use of cable installed by others and for additional cable requirements.

B. Copper cable shall meet, at minimum, the following requirements:
   1. Minimum 98% conductivity copper.
   2. Stranded conductors.
   3. Proper impedance for the application as recommended by the I2BS component manufacturer.
   4. Continuous runs without splices.
   5. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.
   6. All cabling installed without conduit shall be suitably rated for the application and the cable jacket shall be clearly marked. Use unique colour schemes for easy identification and prevention of inadvertent splicing of cabling. If there is no conflict with other colour schemes, the colour for exposed I2BS cable shall be purple.

C. Power wiring shall be sized in accordance with the applicable codes and shall be a minimum of 2.5 sq.mm-stranded copper. The I2BS Contractor shall provide all power cable and containment and shall terminate the power cable at a power outlet close to the component to be powered and shall provide the power outlet. The MEP trade shall terminate the power cable at the MCC/distribution board as applicable.

D. Cable for all applications shall be plenum rated and shall be LSF and low halogen.

E. Terminations shall be mechanically and electrically secure. Twist type wire nuts shall not be acceptable. Insulated tinned copper lugs shall be provided.

F. Cable within panels or enclosures shall be installed in wiring guides.

G. All wiring terminations within field panels shall be terminated at terminal stripes and shall be identification tagged on both sides of the terminal strip.

H. Cable run in vertical trunking shall have means of cable support, at minimum, every 3m.

I. Copper cables shall comply with all applicable codes including, but not limited to, the IEE wiring regulations latest edition. The cables shall meet the requirements of the Telecom Contractor documents and the electrical sub-contract documents. Where there is a conflict between any specifications, codes, standards, ordinances or regulations, the most stringent requirements shall apply as long as they meet the requirements of the jurisdiction having authority.

2.04 CABLE - FIBRE OPTIC

A. Fibre optic cable may be used for data communication. Fibre optic cable has been provided throughout the MOI/SFMC facilities. If additional fibre optic cable is required in addition to that installed by others, the I2BS Contractor shall provide fibre optic cable as necessary for a fully functioning system as detailed in these specifications. Coordinate with the Building Contractor for the use of fibre optic cable installed by others and for additional fibre optic cable requirements.

B. Fibre optic cable (data transmission) shall meet, at minimum, the following requirements:
1. 50 micron core (multi-mode/single mode fibre as necessary to match the fibre provided by the Telecom Contractor).
2. 850 nm or 1300 nm LED compatible operation, as required.
3. Minimum 125 micron cladding.
4. Maximum attenuation of 4.5 db/km (850 nm).
5. Outdoors and below grade fibers shall be run in gel filled tube to protect against moisture and micro bending. Tube and fibre shall have a Kevlar braid surrounding, with suitable outside protective jacketing.
6. Cable shall contain 100% more fibers than required for a single point-to-point communications connection.
7. Outdoor fibre shall be equipped with a central non-conducting member for long pull applications.

C. Fibre optic cable shall comply with BS EN 60794-1-2:1999 (Optical fibre optic cables. Generic specification - Basic optical cable test procedures) and all other applicable codes.

D. Fibre optic cables shall comply with all applicable codes including, but not limited to, the IEE wiring regulations latest edition. The cables shall meet the requirements of the Telecom Contractor documents and the electrical sub-contract documents. Where there is a conflict between any specifications, codes, standards, ordinances or regulations, the most stringent requirements shall apply as long as they meet the requirements of the jurisdiction having authority.

2.05 I2BS MONITORING AND CONTROL CENTRES

A. There is one I2BS Monitoring and Control Centre at the Engineering Building (B08.08)

and another one dedicated for the Hospitals at the Car Park Structure (B07.03) of the Administration Building.

B. The I2BS Application Servers shall be placed in Telecom rooms at the Engineering Building, Administration Building and at Research Center or Data Center. Coordinate with the Telecom Contractor.

C. The I2BS Data Servers shall be placed in Telecom rooms at the Engineering Building, Administration Building and at Research Center or Data Center. Coordinate with the Telecom Contractor. Coordinate with the Telecom Contractor.

D. The Telecom Contractor shall be responsible for the connection of the I2BS Application and I2BS Data Servers into the Converged IP network. The I2BS Contractor shall provide dual redundant integral data ports to enable the necessary connections and the Telecom Contractor shall provide all other components and services associated with the connection of the Servers into the Security Forces Medical Center Network. Coordinate all aspects of this work with the Telecom Contractor.

E. UPS shall power the Servers and all other associated components. The Electrical Contractor shall provide the UPS. The I2BS servers shall be provided with integral UPS in addition to the UPS provided by others as specified in these contract documents.

F. The I2BS Contractor shall coordinate mains power requirements with the Electrical Contractor. Provide emergency power to all components.

G. The servers shall be mounted in racks provided by others in the Telecom rooms.

2.06 I2BS APPLICATION SERVER HARDWARE

A. Provide two single fault tolerant I2BS Application Servers. The terminal servers shall be configured to provide Thin Client architecture. The I2BS Application Servers shall be configured in a clustering fail over configuration using the latest version of the operating system software. Each server shall meet, at minimum, the following requirements:

1. 64 bit Quad Processor capable motherboard with a minimum of 4 PCI slots, 1 AGP slot and 32-gigabyte memory capacity.
2. Quad Xeon MP Processors minimum speed of 3.6 GHz. with ball bearing type CPU fan/heat sinks.
3. 16 megabyte L3 Cache.
4. 8 gigabytes of installed dual channel DDR memory.
5. Two 120 Gigabyte hard disks connected to a hardware based Raid 1 controller. These drives shall be used for the operating system software and the application software.
6. Three 320 Gigabyte hard disks connected to hardware based Raid 5 controller. Use these disks for database storage.
7. Tower or rack mounting case with minimum of 3 Internal 5¼” drive bays, 500 watt or greater capacity, UL rated redundant hot swap power supplies, 3 Internal cooling fans and external keyboard lock.
8. 2 Serial (16550 UART) and 1 Parallel ports.
9. 4 USB 2.0 Ports.
10. One 1.44 floppy disk drive.
11. Dual layer +/- RW DVD Drive
12. Dual redundant auto sensing full duplex fibre data ports with maximum

bandwidth available at the time of installation. Coordinate with IT & T Contractor for fibre data ports and fibre patch cables at the switches.

13. SVGA adapter shall have 256Mb RAM.
14. Redundant power supplies.
15. All necessary mounting hardware and cables for all components.
16. Complete assembly, testing and 72-hour burn in, with complete diagnostic report detailing burn in procedures and results.
17. SCSI II DAT Tape Backup Unit or Magneto Optical Disk and compatible software with sufficient capacity perform full daily-unattended backup of the database to one tape or disk. Provide 10 tapes or disks with unit.
18. Provide software for automatic operation of redundant components should primary components fail.
19. Built in dual redundant integrated network ports.
20. The servers shall handle, at minimum, 100 events per second.
21. Servers shall be provided with integral UPS, in addition to the UPS provided by the electrical contractor. Integral UPS shall provide, at minimum, ten (10) minutes of backup for the server and all components powered by the server such as USB powered accessories (e.g. keyboard, mouse, etc.). The server shall annunciate a critical alarm at all workstations in the event of a power loss and perform a systematic shutdown prior to loss of all power.

B. The following peripheral I/O devices shall be provided at one of the I2BS Server locations as determined by the MOI/SFMC:

1. Keyboard and mouse. Mouse shall be provided with biometric fingerprint reader.
2. 432mm (17 inch) flat panel LCD video display unit.

C. The Servers shall be the latest model at the time of purchase and shall be from a recognized computer manufacture. Purchase of the Servers shall be delayed until the latest time possible without causing a delay in the schedule in order to ensure that they are state-of-the-art and are based on the latest proven technology.

D. It shall be possible to remove one of the redundant servers for maintenance without interrupting the operation of the other server. Upon its reinstatement, the database shall be automatically synchronized, without any interruption to the system operation.

E. A method of manually initiating a failover shall be provided.

F. The I2BSApplication Servers shall be responsible for communication and integration between the ELV Building Services Systems. The I2BS Application Servers shall incorporate a graphical user interface (GUI) that will permit the Operator at a thin client workstation to monitor and control any point on an ELV Building Services System Automation Level controller that communicates with the I2BS Application Server via the Data Network.

G. The I2BSContractor shall provide firewall utilities for internet/intranet security.

H. All the project data shall be stored at the I2BSData Servers.

I. The I2BS Application Server shall be responsible for system integration, data communications, and shall provide watchdog functions. The communication watchdog function at the I2BS shall send an “Are you there?” signal on an operator determined frequency, which shall be set initially at 30 seconds, to the integrated ELV systems and the ELV systems shall respond within 5 seconds with an “I am here” signal. If the ELV

system does not respond within 5 seconds the I2BS shall raise an alarm. If the ELV systems do not receive the "Are you there" signal within 5 seconds of the expected time they shall generate an alarm. The frequency at which the watchdog signal is output from the I2BS to the ELV Systems shall be communicated to the ELV Systems.

J. The I2BS Application Server shall be provided with a built in Protocol analyzer facility, which will run automatically on the network to check the health of the data network.

K. In the event of failure of the primary I2BS Application Server, the operation shall automatically switch to the Backup I2BS Application Server without manual intervention and without any loss of data.

L. Redundancy with automatic switchover in the event of failure shall be provided at all single points of failure.

M. In case of data saturation, system shall automatically resolve the network issues thru built-in protocol analyzer utility or other software based tuning tool and generate an alarm at the Management Level.

2.07 I2BS DATA SERVER HARDWARE

A. Provide two fault tolerant I2BS Data Servers. The I2BS Data Servers shall be configured in a clustering fail over configuration using Microsoft's latest 64 bit server operating system. Provide I2BS Data Servers that are certified by a Microsoft OEM and provided as a complete package. Each I2BS Data Server shall meet, at minimum, the following requirements:

1. 64 bit Quad Processor capable motherboard with a minimum of 4 PCI slots, 1 AGP slot and 32-gigabyte memory capacity.
2. Quad Xeon MP Processors minimum speed of 3.6 GHz. with ball bearing type CPU fan/heat sinks.
3. 16 megabyte L3 Cache.
4. 8 gigabytes of installed dual channel DDR memory.
5. Two 120 Gigabyte hard disks connected to a hardware based Raid 1 controller. These drives shall be used for the operating system software and the application software.
6. Three 320 Gigabyte hard disks connected to a hardware based Raid 5 controller. Use these disks for database storage.
7. Tower or rack mounting case with minimum of 3 Internal 5¼" drive bays, 500 watt or greater capacity, UL rated redundant hot swap power supplies, 3 Internal cooling fans and external keyboard lock.
8. 2 Serial (16550 UART) and 1 Parallel ports.
9. 4 USB 2.0 Ports.
10. One 1.44 floppy disk drive.
11. Dual layer +/- RW DVD Drive
12. Dual redundant auto sensing full duplex fibre data ports with maximum bandwidth available at the time of installation. Coordinate with IT & T Contractor for fibre data ports and fibre patch cables at the switches
13. SVGA 256 Megabyte AGP video adapter.
14. Redundant power supplies.
15. All necessary mounting hardware and cables for all components.
16. Complete assembly, testing and 72-hour burn in, with complete diagnostic report detailing burn in procedures and results.
17. SCSI II DAT Tape Backup Unit or Magneto Optical Disk and compatible

software with sufficient capacity to perform full daily-unattended backup of the database to one tape or disk. Provide 10 tapes or disks with unit.

18. Provide software for automatic operation of redundant components should primary components fail.
19. Built in dual redundant integrated network controllers.
20. The servers shall handle, at minimum, 100 events per second.
21. Servers shall be provided with integral UPS, in addition to the UPS provided by the electrical contractor. Integral UPS shall provide, at minimum, ten (10) minutes of backup for the server and all components powered by the server such as USB powered accessories (e.g keyboard, mouse, etc.). The server shall annunciate a critical alarm at all workstations in the event of a power loss and perform a systematic shutdown prior to loss of all power.

B. The following peripheral I/O devices shall be provided at the OIW:
   1. Keyboard and mouse. Mouse shall be provided with biometric fingerprint reader.
   2. 432mm (17 inch) flat panel LCD video display unit.

C. The servers shall be the latest model at the time of purchase and shall be from a recognized manufacture of servers. Purchase of the servers shall be delayed until the latest time possible without causing a delay in the schedule in order to ensure that they are state-of-the-art and are based on the latest proven technology.

D. One I2BS Data Server shall always be available to the I2BS Application Servers for data replication and data management, while the other one shall remain as a backup Database Server. The databases at the back up Data Server shall be identical to those at the primary Data Server.

E. In the event of failure of the primary I2BS Application Server, the operation shall automatically switch to the Backup I2BS Application Server without manual intervention and without any loss of data.

F. All the software available at the I2BS Application Server shall also be available at the I2BS Data Servers as a means of disaster recovery.

G. The I2BS Data Servers shall support following databases:
   1. SQL / Common RDBAS structure.
   2. XML File
   3. Sybase SQL Anywhere
   4. Oracle
   5. Text File

2.08 I2BS THIN CLIENT OPERATOR WORKSTATIONS

A. Provide Operator Workstation at the following locations:
   - Three (3) OWS at the Engineering Building (B08.08)
   - Four (4) OWS in the Hospital's Control Room at Car Park Structure (B07.03)
   - Two (2) OWS at the Research Center Control Room (B03.01)
   - One (1) at the Car Park Structure (B07.04) of the Main Hospital
   - One (1) at the Car Park Structure (B07.05) of Women and Children Hospital
   - One (1) at the Car Park Structure (B07.06) of the Hospital of Hope
   - One (1) OWS at the College of Applied Medical Sciences (B02.01)
   - One (1) OWS at the Sports and Recreation Center (B05.04)

B. Each of the consoles shall have 1 PC. Each PC shall be a node on the associated Data Network and shall enable monitoring and control of all associated ELV Building Services Systems.

C. Each PC shall be a Thin Client of the associated I2BS Application Servers and shall have a Microsoft Windows XP Pro operating system or the latest version of this software at the time of implementation and a standard web browser and shall have, at minimum, the following facilities:

1. Double or Duo Core Processor with a minimum of 4 PCI slots. Flash BIOS support. 4 gigabyte RAM memory capability.
2. Minimum Processor speed of 3.0 GHz with CPU fan/heat sinks.
3. 2 megabyte L2 Cache.
4. 180 Gigabyte hard disk.
5. 2 gigabytes SDRAM memory.
6. 10/100/1000Mbps Ethernet adapter.
7. SVGA 512-megabyte DRAM video adapter.
8. One internal analogue 56 Kbps modem, dedicated for Operator call in.
9. 1 Serial and 1 Parallel port.
10. 4 USB 2.0 ports.
11. One 1.44 floppy disk drive.
12. 16X Speed or better. Dual layer, DVD+/-RW drive.
13. Real time software or hardware clock.
14. Tower Case with minimum of 3 external 5¼" and 2 Internal 5¼" drive bays, 300 watt or greater capacity power supplies, internal cooling fan and external keyboard lock.
15. All necessary mounting hardware and cables for all components.
16. Integral power supplies which shall be suitably rated for the service.
17. Sound card for the annunciation of audible WAV file tones or pre-recorded messages at the integral VDU stereo speakers.
18. Workstation hardware shall support multi monitors (3No.)
19. Provide stereo speakers.

D. Workstations shall be on UPS but should a PC be powered down for any reason it shall return to a fully operational status without Operator intervention within two (2) minutes of the return of mains power. Software changes, including modifications to database(s), shall not be lost in a power failure.

E. All PC shall be the latest model at the time of purchase and shall be from a recognised manufacture of PCs. Purchase of the PC shall be delayed until the latest time possible without causing a delay in the schedule in order to ensure that it is state-of-the-art and is based on the latest proven technology. All PC shall be suitable for rugged and continuous operation.

F. 3 No. 533mm (21 inch) flat panel LCD video display units shall be provided at one OIW and 1 No. 533mm (21 inch) flat panel LCD video display unit shall be provided at the other. These monitors shall use the multi monitor feature of Microsoft Windows.

G. The OIW PC shall be a Thin Client of the associated I2BS Application Servers. It shall only be necessary to have a standard web browser, such as the latest version of Microsoft Internet Explorer or Netscape Navigator, and the latest version of Windows XP Pro operating system for the OIW PC to operate as a Thin Client. No special software shall be required at the OIW PC to enable it to function as a Thin Client.

2.09 PORTABLE OPERATORS' TERMINALS (POT)

A. Provide two laptop PC's at the Engineering Building I2BS Control Centre meeting the following requirements:

1. Intel Duo Core Processor with minimum speed of 2.33 GHz.
2. 80 Gigabyte hard disk.
3. 4 Gigabytes SDRAM memory.
4. Internal 100/1000 Ethernet adapter.
5. Internal dual band wireless card (a/g).
6. 512MB Video Card.
7. Minimum 350mm inch active matrix display with minimum 1280x800 resolution.
8. Internal 8X Speed DVD+/-RW drive.
7. Integral power supplies which shall be suitably rated for the service.
8. Integral QWERTY keyboard with full ASCII character set.
9. Integral touchpad.
10. Fingerprint reader and cable lock slot for security.
11. Powered by a rechargeable battery and shall also be powered by a 120 Vac, nominal 60 Hz, source. Provide batteries adequate for a minimum of 4 hours of operation. Provide a spare battery.
12. One (1) Serial Port
13. Four (4) USB 2.0 Ports
14. Integral Bluetooth
15. Integral 56Kbps modem

B. Laptop shall be certified against tough military standards for durability and reliability. Laptop shall be built and tested to meet MIL-STD 810F.

C. One (1) laptop at each location shall be used for the installation of Configuration Tools software for each of the ELV Building Services Systems.

D. One (1) laptop at each location shall have a copy of the I2BS Application Server software installed.

E. The laptop computers shall connect to the Data Network via WIFI ports and hardwired connection at data ports at each control panel and at each mechanical and electrical room. Provide 2No. spare cables for the hardwired connection of each POT to the Data Network.

F. The laptop PC shall be the latest model at the time of purchase and shall be from a recognized manufacture of laptop PCs. Purchase of the laptop PC shall be delayed until the latest time possible without causing a delay in the schedule in order to ensure that it is state-of-the-art and is based on the latest proven technology

2.10 HAND HELD WIRELESS TERMINAL (HHWT)

A. Provide 2No. HHWT. This device shall not be used by the I2BS Contractor for commissioning the I2BS or for any other purpose and shall be delivered new to the Employer immediately prior to acceptance testing.

B. The operator shall be able to communicate with the I2BS via the HHWT using the Thin Client operator interface from any place in the airport. The hand held wireless terminal shall be a Thin Client device and shall have a web browser. The operator shall, subject

to password access control, be able to undertake the same functions from the hand held terminal as from a thin client OIW. Detail any limitations of this device in the tender submittal.

C. The required transceiver hubs shall be provided by others. The I2BS Contractor shall advise MOI/SFMC of any distance limitations on the hand held wireless terminal. The operator shall, subject to password access control, be able to undertake all functions from the hand held terminal as from a thin client OIW.

D. The HHWT shall meet, at minimum, the following requirements:
1. Weight, including carrying case, not to exceed 0.2kg.
2. Provide a carrying case designed specifically for the HHWT that ensures adequate protection.
3. HHWT shall be powered by a rechargeable battery and shall also be powered by a 220 Vac, nominal 50 Hz source. Provide batteries adequate for a minimum of 4 hours of operation.
4. The HHWT shall have an LCD screen with a minimum display of 12 lines of up to a minimum of 20 characters minimum per line.
5. Minimum communications speed shall be 10Mbps.
6. This device shall be a PDA.

E. The HHWT shall also be able to communicate in wired mode via the Converged IP network.

F. The HHWT shall have the same login and access protections as the OIW.

2.11 NETWORK INTEGRATION UNITS (NIU)

A. The I2BS Contractor shall supply one or more Network Integration Units (NIU) in each Phase 1 building as part of this contract. The number of NIU's required will be dependent on the type and quantity of ELV Building Services Systems Automation Level controllers and the number of points. It is the responsibility of the I2BS Contractor to determine the number of NIU's required. The number of nodes connected to a NIU shall not exceed 80% of the manufacturer's stated maximum capability. The NIU shall be the latest product of the manufacturer and shall have the latest software version available. The NIU shall be based on the same operating system as the I2BS server. Note that each of the buildings will have its own SACS.

B. The NIU shall provide the interface between the ELV Building Services Systems Automation Level controllers and the Converged IP networks and shall provide global supervisory control functions over the Automation Level controllers connected to the NIU. The NIU shall also interface at the Management Level where applicable. The NIU shall be capable of executing application control programs to provide:
1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration of Modbus, EIB, LonWorks and BACnet Automation Level controller data.
7. Graphics. (These shall reside at both the NIU and the I2BS Application Servers)

C. The NIU shall provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2008 BACnet, LonWorks technology, MODBUS and other standard communication protocols.

D. The NIU shall incorporate the following hardware features as a minimum:
   1. Ports appropriate for the ELV Building Services Systems Automation Level controller networks, e.g. Ethernet for BACnet IP, RS-485 for BACnet MSTP, LonWorks Interface Port, RS-232 for Fire Alarm System interface, etc.
   2. Battery Backup or UPS.
   3. Hardware clock.

E. The NIU shall provide multiple Operator access to the system and support for ODBC or SQL. A database resident on the NIU shall be an ODBC-compliant database.

F. The NIU shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous Operators.

G. Event Alarm Notification and actions
   1. The NIU shall provide alarm recognition, storage; routing, management, and analysis to supplement the distributed capabilities of the Automation Level controllers.
   2. The NIU shall be able to route any alarm condition to the I2BS Application Servers.
   3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
      a. Point in alarm
      b. Return to normal
      c. Hardware or software fault
   4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
   5. Provide timed (schedule) routing of alarms by class, object, group, or node.
   6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The Operator shall be able to reset runtime or event count values with appropriate password control.

H. Control equipment and network failures shall be treated as alarms and annunciated.

I. A log of all alarms shall be maintained by the NIU and the I2BS Application Servers and shall be available for review by the Operator.

J. Data Collection and Storage - The NIU shall have data storage and collection capabilities as follows:
   1. The NIU shall have the ability to collect data for any property of any object and store this data for future use.
   2. The data collection shall be performed by log objects, resident in the NIU that shall have, at a minimum, the following configurable properties:
      a. Designating the log as interval or deviation.
      b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
      c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
      d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
      e. Each log shall have the ability to have its data cleared on a time-Based event or by an Operator-defined event or action. The I2BS Contractor shall set the NIU to download the data to the I2BS Data Servers at 0200hours. The time shall be changeable by an Operator having the required password access level.

3. All log data shall be stored in a relational database in the NIU and the data shall be accessed from the I2BS servers.
4. All log data, when accessed from the server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the Operator in the following data formats:
   a. HTML.
   b. XML.
   c. Plain Text.
   d. Comma or tab separated values.
6. Systems that do not provide log data in XML formats at a minimum shall not be acceptable.
7. The NIU shall have the ability to archive its log data at the I2BS Data Servers. Provide the ability to configure the following archiving properties, at a minimum:
   a. Archive on time of day. The I2BS Contractor shall set the NIU to download the data to the I2BS Data Servers at 0200 hours every day. The time shall be changeable by an Operator having the required password access level.

K. The object library shall include objects to support the integration of devices connected to the Network Integration Unit (NIU). At a minimum, provide the following as part of the standard library included with the programming software:
1. LonMark/LonWorks devices. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
2. For BACnet devices, provide the following objects at a minimum:
   a. Analogue In
   b. Analogue Out
   c. Analogue Value
   d. Binary
   e. Binary In
   f. Binary Out
   g. Binary Value
   h. Multi-State In
   i. Multi-State Out
   j. Multi-State Value
   k. Schedule Export
   h. Calendar Export
   i. Trend Export
   j. Device
3. The NIU shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device. Provide the required objects in the library to support the integration of the Modbus system data. Objects provided shall include at a minimum:
   a. Read/Write Modbus Analogue Input Registers
   b. Read/Write Modbus Analogue Output Registers
   c. Read/Write Modbus Binary Input Registers
   d. Read/Write Modbus Binary Output Registers
   e. The NIU shall perform scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices.
4. The NIU shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP as required by the device. Provide the required objects in the library to support

the integration of the OPC system data. Objects provided shall include at a minimum:

a. Read/Write OPC Analogue Input Object
b. Read/Write OPC Analogue Output Object
c. Read/Write OPC Binary Input Object
d. Read/Write OPC Binary Output Object
e. Read/Write OPC Date/Time Input Object
f. Read/Write OPC Date/Time Output Object
g. Read/Write OPC String Input Object
h. Read/Write OPC String Output Object
i. The NIU shall perform scheduling, alarming, logging and global supervisory control functions, of the OPC system devices.

2.12 WORKSTATION CONSOLES

A. Provide modular trader desk style consoles within the Central Control Room and the at the Satellite Control Rooms.

B. Provide mounting racks and adjustable monitor arms as necessary to mount the equipment within the console. Consoles and equipment racking shall be factory made having adequate ventilation for the installed equipment. Provide complete top, side and back panels. All cabinet space below the work surface shall have lockable doors.

C. Provide fans within the console to provide ventilation for the equipment installed. Include all installation details, including ventilation fan locations, within the shop drawing submittals.

D. The consoles shall meet the following additional requirements:

1. Flat work surface with impact resistant polyurethane nosing.
2. One shallow pullout pencil drawer.
3. Shallow pullout keyboard tray.
4. Corner trim as required to provide finished appearance.
5. Top, side, back and work surfaces shall be enameled metal panels or MDF finished in a high-pressure laminate. Blank off sections shall be enameled finish metal. The Architect shall select all colours.
6. Mobile CPU trolleys from back of console.
7. Gas strut assisted access doors allowing the removal of the mobile CPU trolleys from the back of console.
8. Fully articulating flat screen monitor arms.

E. The consoles shall be earthed in accordance with IEE regulations.

F. Console shall be Winsted or approved equal.

G. Provide work surface with drawers, shelves and filing space below for printers and miscellaneous equipment. Coordinate requirements with MOI/SFMC. Work surface shall match the consoles.

2.13 PERIPHERAL I/O DEVICES

A. Provide a keyboards meeting the following requirements:
1. Provide a keyboard for Operator access to the I2BS. This shall be in addition to

any other Operator input device such as a mouse. A keyboard shall be provided at each Operator Interface Workstation (OIW) and at each Application and I2BS Data Server.

2. The keyboard shall be in a standard typewriter (QWERTY) configuration with a full alphanumeric standard ASCII character set and with additional dedicated keys for other functions associated with the I2BS such as print screen.
3. Keyboards at Operator Interface Workstations shall be connected to a Keyboard-Mouse Switch that will enable the single keyboard to interface with any of the PC as selected by the Operator.

B. Provide a mouse meeting the following requirements:
1. Provide a mouse at the I2BS Application Server location and configure the system such that cursor control can be undertaken from both the keyboard and mouse as selected by the Operator. A keyboard shall be provided at each Operator Interface Workstation (OIW) and at each Application and I2BS Data Server.
2. A mouse at an Operator Interface Workstations shall be connected to a Keyboard-Mouse Switch that will enable the single mouse to interface with any of the PC as selected by the Operator.
3. Provide mouse with biometric fingerprint reader.

C. Provide a flat panel LCD video display unit meeting the following requirements:
1. Provide a high-resolution LCD TFT display VDU at each PC and at each Application and I2BS Data Server. The monitor shall be a flat panel type.
2. The VDU shall be used for the display of Operator entered and requested data and the output of I2BS generated alarm and other information.
3. The VDU shall have a minimum screen diagonal measurement of 533mm (21 inches) at the OIW and 432mm at the Application Servers.
4. The VDU shall have a minimum resolution of 1280 by 1024 pixels with 80 Hz minimum refresh rate.
5. The unit shall be capable of displaying both schematic and alphanumeric data at the same time.
6. A minimum of 16.7 million discrete colours shall be available for display selection.

2.14 SECURITY FORCES MEDICAL CENTER NETWORK TIME PROTOCOL (NTP) CLOCK

A. Provide a Network Time Protocol clock to enable the synchronization of all clocks on the I2BS Network. All components including antenna and master clock shall be from the same manufacturer. Master clock shall synchronize with GPS satellites.

B. The times at all nodes on the Converged IP network, including the I2BS Application and I2BS Data Servers, shall have their real time clocks updated by the master clock for time and date.

C. The real time hardware and software clocks shall be updated using a multicast technique on an operator-defined frequency that shall be set initially at every 120 minutes.

D. Provide an antenna, which shall be located outside at a point approved by MOI/SFMC. Antenna shall be weather proof; marine rated and shall have appropriate mounting kit supplied by manufacturer. Provide cable from antenna to clock, which shall meet the manufacturer's recommendations. Antenna shall be appropriate for the distance between the clock and the antenna. Assume that the antenna and the master clock shall be within

50m of one another.

E. Master clock shall:
1. Be rack mounted
2. Have battery back-up
3. Have an integral crystal oscillator to maintain time in the event of a loss of communication with the GPS satellite. Oscillator shall have an accuracy of 10 seconds per year.
4. Have a 6 numbers time display (hh:mm:ss)
5. Have automatic adjustment for leap years.

F. The I2BS Contractor shall provide the interface between the I2BS clock and the Converged IP network. Provide software at each clock to enable decoding of the time signal by the clocks. Coordinate with the ELV Building Services Systems Contractors.

G. The I2BS shall **not** synchronize the FAS clocks unless an instruction to do so is received in writing from MOI/SFMC.

2.15 SOFTWARE OPERATING SYSTEMS AND PROTOCOLS

A. The I2BS Application Servers shall provide thin client architecture and shall be enterprise servers using Microsoft's latest 64 bit server operating system. The I2BS workstation PC shall be thin clients of the Terminal Servers and shall operate on Windows 2003. The I2BS Application Servers operating system shall be the latest version of Microsoft Windows, Enterprise version compatible with the application. The I2BS Application Servers applications software shall be suitable for thin client architecture and shall have a history of application in multi-vendor environments.

B. The I2BS workstation PCs shall be web clients of the I2BS Application Servers and shall have the latest version of Microsoft Windows XP Pro.

C. The I2BS Contractor shall provide a site-wide software license that shall permit the MOI/SFMC to add an unlimited number of Client workstations to the WAN network without the requirement to obtain an additional software license.

D. The I2BS Data and Application Servers shall be configured in a clustering fail over configuration.

E. The I2BS Application Servers shall poll the NIU's whenever data is required at the I2BS Application Servers. Data shall be output to the receiving ELV Building Services Systems Automation Level controllers at an Operator assigned frequency with the default rate being the rate at which it is polled. It shall be possible to schedule the polling of points and the exporting of points on a time basis. It shall be possible to assign multiple schedules to each point. It shall be possible to assign multiple schedules to each point. Data already on display shall be updated within 2 seconds of a change of data in the field and without having to refresh the page manually.

2.16 GRAPHICAL USER INTERFACE

A. The Operator interface shall be English language with metric units. It shall be possible for the Operator interface to be converted to the Arabic language in the future if required by MOI/SFMC. The contractor shall provide an optional price to create an Arabic

language Graphical User Interface as specified.

B. The GUI shall provide a browser approach. Pull-down menus and toolbars shall employ buttons (“icons”) and commands to enable the Operator to perform tasks with a minimum knowledge of the system architecture, computers and the systems monitored and controlled by the ELV Building Services Systems controllers.

C. Information shall be output from the I2BS when:

1. Requested by an I2BS Operator.
2. Scheduled by an I2BS Operator. An example of this might be the output of a report at an Operator-defined time of day.
3. An alarm condition has been detected by the I2BS or the workstation PC such as a failure of communications between the I2BS Application Servers and one or more of the associated thin client PC or between the I2BS and one or more of the ELV Building Services Systems.
4. Initiated by a predefined event.

D. The graphical user interface shall be "Operator friendly" and shall be located at the I2BS Application Servers and shall be accessed as required by the I2BS Operator workstation PC in compliance with thin client principals. The interface shall be such that there is no need for an I2BS Operator to reference documentation other than "help" menus on the system in order for an I2BS Operator to perform his normal duties after the training has been received, as detailed in Part 1of these specifications.

E. The performance criteria detailed in these specifications for an I2BS Operator interface shall apply when all components are in their completed form and all software and hardware functions are operational.

F. The software shall be the product of a third party organization and shall be acceptable to all potential ELV Building Services Systems Contractors. The programs shall be designed to provide industrial quality real time data presentation. The software shall enable the I2BS Contractor to develop customized graphical views of the air, water and electricity, fire alarm systems, lighting control systems, security access and surveillance systems and other systems as identified in these documents. The I2BS Application Server software shall include an advanced graphics library that contains all potentially required images.

G. Operator access to the functions of any PC shall be as follows:

1 Access at the workstation PC and at the servers shall be protected by a password based access system and a biometric fingerprint reader – administrator selectable. An Operator shall not be able to access information or perform any tasks at the I2BS Operator workstation until a valid password or valid biometric has been entered. Access shall terminate when an Operator signs off or after a time-out period, initially set at 10 minutes after the last Operator access, whichever occurs first. The time out period shall only be changeable by MOI/SFMC personnel with the highest level of password. The password shall not be echoed at any terminal when it is entered. Any Operator functions, whether or not detailed within these specifications, shall be subject to an I2BS Operator's password being of a sufficiently high level to enable an I2BS Operator to perform the function.

2. Each password shall have up to 6 No. alphanumeric characters, at minimum, with at least 500 million different combinations and it shall be possible to have a minimum of 10,000 active passwords at any time.

3. It shall be possible to define the following for each password:
   a. I/O terminals that can be used for access. This shall be defined for any terminal that has access to the Data Networks.
   b. Functions that can be performed e.g. change run status of motor X but not motor Y.
   c. Points that can be monitored.
4. If the system has fixed defined function levels then there shall be at least five (5) levels. Only the highest level shall be able to undertake changes to the passwords.
5. An Operator with the highest level of password shall be able to make additions, deletions and changes to the passwords on-line using an interactive procedure including the changing of the time-out period. An Operator with the highest level of password shall be able to obtain a report detailing the passwords assigned to each Operator and all relevant details of the access privileges associated with each password.
6. An Operator with the suitable level of access shall be able to access the network to perform the following functions:
   a. Observe values of monitored points and calculated values.
   b. Add a point, delete a point and change a point in the I2BS Application Server database including a monitored, controlled, Operator assigned value (e.g. a setpoint, alarm limit, etc.) or calculated point.
   c. Observe and acknowledge alarm conditions.
   d. Initiate the output, addition, deletion and changing of reports.
   e. Observe, add, delete and change VDU system diagram displays.
   f. Other functions as expressly detailed in the I2BS specifications or as required, even if not expressed, in order to meet the intent of these specifications.
7 Operator access shall be by penetration through a hierarchy of menus and/or system displays on the VDU using cursor control and by means of a series of alphanumeric inputs at a keyboard. The menu selections shall be self-evident and shall easily guide an I2BS Operator through the execution of any of the functions. Graphics penetration shall be user friendly with key plans and dynamic spelldown menus. The alphanumeric input shall comprise short English language statements and/or readily understood abbreviations. Whichever approach is used, the process shall be via the most direct path and shall involve as few operations as possible. It shall not be necessary for an I2BS Operator to know the location, i.e. the Automation Level controller, at which a point is monitored/controlled in order to access any information concerning that point.
8. Following the completion of all steps by an I2BS Operator performing an Operator access function, the function shall commence within two (2) seconds and shall be completed within ten (10) seconds apart from those functions that are subject to the limitations of the output rate of the printers.
9. An Operator shall be able to edit his keyboard entries prior to attempted execution using standard keys such as "delete" and "backspace". However, if an Operator makes an incorrect entry then the I2BS will display a message that clearly details the nature of the error and identifies the appropriate "help" menu that will assist an I2BS Operator to successfully complete the entry.
10. All Operator entries shall be echoed, except passwords, at the VDU at the workstation PC and I2BS Application Server depending on where an I2BS Operator entry is made. If there are three (3) unsuccessful attempts to access the system the system shall be locked out until a password of the highest level has been successfully entered.

H. Operator requests for information shall meet the following requirements:

1. Each point in the I2BS Application Server database shall be accessed via the menu and the alphanumeric approaches as detailed in these specifications.
2. Access using the system schematic displays. Once the system display level is reached it shall be possible to progress to the individual point. Once a menu or system display selection is made it shall take no more than five (5) seconds before the next menu or display level appears on the VDU.
3. Access using the alphanumeric approach shall enable an Operator to access any point via a unique point name that may be a short English language descriptor or a readily understandable mnemonic of the type used to identify points in the field termination schedules and system diagrams.
4. Either approach shall enable an I2BS Operator to observe or change any parameter associated with a point and to add and delete points.

I. It shall be possible to use logic operation (Boolean Operators) to retrieve filtered data from the databases. E.g. it shall be possible to obtain details (time, date, value, etc.) of space temperatures that exceeded X Deg.C. in building Y when the outside air temperature was less than Z Deg.C.

J. An I2BS Operator shall be able to make on-line modifications, additions and deletions to all databases at I2BS Application and I2BS Data Servers using interactive procedures. Prior to the acceptance of the changes by the I2BS Application Server there shall be a restatement of the contemplated database modification, addition or deletion together with a question of the type "Do you wish to proceed?" which will require an affirmative answer before the change takes place.

K. Alarms shall meet the following requirements:

1. Cause of Alarm - Alarms shall be generated at the workstations upon the occurrence of one of the following events:
   a. Failure of a workstation PC or I2BS Application Server or any other I2BS or ELV Building Services Systems hardware components.
   b. Failure of communications between nodes on the Data Networks.
   c. A status point in the I2BS Application Servers database indicates an alarm condition.
   d. An analogue value is outside limits established by an I2BS Operator.
2. Alarm Annunciation - The occurrence of an alarm shall initiate the following actions at the I2BS Control Centre:
   a. A visual alarm indication at the I2BS workstation. An icon shall indicate that an alarm has occurred and is awaiting acknowledgement. The visual alarm indication at the Operator workstation shall cease after acknowledgment of an alarm unless another alarm is awaiting acknowledgment. “Clicking” on the icon will display the alarm details in a space dedicated for this use on the workstation monitor.
   b. An alarm message shall uniquely identify the cause of the alarm together with the time of detection by the ELV Building Services System. An I2BS Operator shall be able to associate an "event message" with any alarm occurrence.
   c. A distinct audible alarm will sound in the event of a critical alarm or a hardware component failure. This will be in addition to the visual alarm indication.
   d. All alarms shall be output at a printer. Alarms shall be output at the printer designated as the alarm printer unless directed elsewhere by the Operator.

e. Graphic displays at the Operator workstation will indicate a value in alarm or an item of equipment that is in alarm. Typically this will be done by the use of a colour code, e.g. a point on a table/report which is in alarm could be red whereas other points could be black and a fan which has failed could be shown as red on a graphical display whereas it might be is shown in green when operating normally and orange when shut off.

f. An I2BS Operator shall be able to designate which alarms annunciate at which workstation(s). Alarms shall remain on the I2BS workstation VDU alarm queue until the alarm has been acknowledged by an I2BS Operator and returned to the normal state. If the alarm returns to normal before Operator acknowledgment, then it shall be identified as such via different colour designation on the alarm queue. If the alarm is acknowledged before is has returned to normal, then is shall also be identified via a different colour designation.

g. An Operator with the required level of access shall be able to inhibit any alarm. This facility shall enable an Operator to inhibit an alarm on equipment which is out of service.

3. Alarm limits - An I2BS Operator shall be able to define alarm conditions for each analogue input point in the I2BS Application Servers database, at minimum, as follows:

a. The high limit above which the variable is in alarm.

b. The high high limit above which the variable is in critical alarm.

c. The low limit below which the variable is in alarm.

d. The low low limit below which the variable is in critical alarm.

e. An end or range alarm. This shall occur when the analogue signal goes to zero or to its maximum value.

f. An I2BS Operator shall be able to assign deviation limits to setpoint values. An alarm shall be generated when a controlled variable deviates from setpoint by more than an Operator-defined amount. A critical alarm shall be generated when the deviation from setpoint exceeds an even greater value as set by the Operator.

g. An I2BS Operator shall be able to assign alarm limits to analogue outputs. The I2BS shall generate an alarm when an analogue output reaches or exceeds an Operator assigned high limit and reaches or goes below an Operator assigned low limit.

h. An I2BS Operator shall be able to designate one state of a digital input as an alarm state.

i. An I2BS Operator shall be able to assign a time delay following detection by an ELV Building Services System controller of an alarm condition such that if there is a return to normal during the assigned time delay the alarm shall not be annunciated. If at the end of the time delay period the alarm condition still exists then the ELV Building Services System shall annunciate an alarm within 300 milli-seconds (end-to-end time). The time delay shall be individually assignable to each alarm condition. All monitored points shall meet these alarm annunciation criteria regardless of type of panel used to monitor the point. If the time delay is set at zero the alarm shall be annunciated as detailed within this paragraph within 300mSec of it being received by the I2BS. If the I2BS forwards data to another ELV Building Services System as a result of the alarm this shall occur within 300mSec of the alarm display at the I2BS. An alarm condition shall be displayed on a graphic within 700mSec of the alarm being received at the I2BS.

j. An I2BS Operator shall be able to assign a deadband to all analogue

high and low alarm limits so as to minimize the too frequent and unnecessary annunciation of alarms. An analogue alarm limit shall not have returned to normal until it is has returned beyond the alarm limit by a sufficient amount to have also cleared the deadband. The same shall also apply to analogue output high and low alarms.

4. Alarm Reports - A report shall be available to an I2BS Operator detailing points in alarm and a further report shall be available to an I2BS Operator detailing the alarm limits established for the monitored, controlled and calculated points. Alarms shall be output on the alarm printer. Alarms shall be stored at the I2BS Data Server so that they can be recalled for historical analysis. Refer to the section below on reports.
5. Alarm Priorities - Alarms shall be allocated priorities by the I2BS Operator on-line using an interactive procedure. If there are concurrent alarms then they shall be annunciated in order of their priority. An icon shall appear on the VDU when there are alarms other than those displayed. The cursor and icon shall enable an I2BS Operator to bring up an alarm report on the VDU at any time. There shall be at minimum, three levels of alarm priority. Alarms shall be prioritized in the following categories, with the following actions taking place:

Category	**Action Taken**
Critical	Printout on alarm printer, display on VDU, activate pager alarm. Clearly distinguish critical alarms on hard copy print outs and VDU displays and reports. Provide an audible annunciation
High	Printout on alarm printer, display on VDU. Provide an audible annunciation
Low	Print out at alarm printer. Display on VDU.
Hardware Failure	Printout on alarm printer, display on VDU, activate pager alarm. Clearly distinguish hardware components alarms on hard copy print outs and VDU displays and reports. Provide an audible alarm.

Each category of alarm shall have a minimum of 10 sub levels of priority.

6. Alarm Acknowledgement - A switch, button, icon or keyboard key shall be dedicated to the acknowledgment of alarms at the I2BS workstation. Operator actions of any alarms acknowledged shall be transmitted to all I2BS workstation locations. Any I2BS workstation, with appropriate password access, may acknowledge alarms and once acknowledged at one workstation need not be acknowledged at other workstations. All alarms shall be acknowledged individually and the acknowledgment shall be recorded on the alarm printer.
7. An alarm or event point defined in the I2BS, irrespective of the ELV system to which it is mapped, shall have option to associate a CCTV camera to it. I2BS

system shall be interfaced with CCTV system such that it shall be possible to initiate an automatic video recording of the associated camera at a definable frame rate and for a definable duration or until the alarm is reset whenever that point goes in to alarm.

8. It shall also be possible to automatically retrieve the recorded video clippings, in a popped-up picture in picture window, of an alarm/event by clicking on the camera icon displayed on the alarm line itself.

L. Reports shall meet the following requirements:

1. Reports shall be output when requested by an I2BS Operator, when scheduled by an I2BS Operator and when initiated by a predefined event.
2. Reports shall be provided as detailed throughout these specifications and shall be output at the VDU at the I2BS workstation and/or the printer designated by an I2BS Operator. The default output device for reports shall be one of the networked report printers at the I2BS control centre.
3. An I2BS Operator shall be able to select reports to be output in the following manner:
   a. For a specific point.
   b. For a specific item(s) of equipment.
   c. For all points located on a specific floor or area of the building.
   d. For all equipment serving a particular floor.
   e. For all points in a building
   e. For all points in the complex.
4. Reports shall all have the time and date at which they were output recorded on them. Reports shall be formatted in such a manner as to make them easily understandable to an I2BS Operator.
5. A menu of reports shall enable an I2BS Operator to access any report on the I2BS. Each report shall contain the date and time.
6. An I2BS Operator shall be able to configure customized reports. Standard and customized reports shall be configured through the I2BS Application Server.
7. It shall be possible to output reports in a Microsoft Excel format using all of the functionality of the Excel software such as the calculation of standard deviations, etc.
8. It shall be possible to store selected data in an ODBC format such that data can be output via an ODBC compliant report programme such as Crystal Reports.
9. At minimum the I2BS Contractor shall set up the reports referenced within these documents.
10. Provide an Operations Log feature that will enable an Operator to enter details relating to the operation of the facilities that he wishes to bring to the attention of the supervisory personnel.
11. Provide an action log that will track all Operator-initiated activities undertaken at the I2BS. The activities will be archived at the I2BS Data Servers and will, at minimum, include details of time and date, type of activity, e.g. setpoint adjustment, amend a schedule, etc. and the ID of the Operator who initiated the action. Action logs shall only be output when requested by an Operator with the highest level of password.
12. Provide a load shed saving profile report for each electrical meter detailing the following:
    a. Period start date as defined by operator.
    b. Daily profile time (on, off, mid-peak or all).
    c. Daily peak measured demand and its time of occurrence.

d. Daily peak projected demand and its time of occurrence.
e. Daily measured energy usage.
f. Daily projected energy usage.
g. Period profile time.
h. Period measured energy usage.
i. Period projected energy usage.
j. Period peak measured demand.
k. Period ratchet clause percentage and number.
l. Period billed demand.

These documented savings values to be automatically historically stored for the current defined period and a minimum of twelve past periods.

13. Provide a load control system report for each electrical meter detailing, at minimum, the following data:
    a. Demand interval.
    b. Current KW power.
    c. Current measured demand.
    d. Projected demand usage.
    e. Energy units defined for the energy system.
    f. Maximum expendable load.
    g. Average expandable load.
    h. Current expandable load.
    i. Maximum deferrable load.
    j. Average deferrable load.
    k. Current deferrable load.
    l. Demand limit status.
    m. Demand limit target value.
    n. Demand limit control action in the last minute.
    o. Duty Cycle status.
    p. Duty Cycle target value.
    q. Duty Cycle control action in the last minute.
    r. Convergence time.
    s. Restore bandwidth.
14. The I2BS shall output a report on a scheduled and request basis detailing the following electrical demand information for each meter:
    a. Demand (at each meter) at time of report.
    b. Usage for present day to time of report.
    c. Usage on previous day.
    d. Usage for present week to time of report.
    e. Usage for previous week.
    f. Usage for present month to time of report.
    g. Usage for previous month.
    h. Usage for year to time of report.
    i. Usage for previous year.
    j. Peak demand for the present day, week, month and year to time of report.
    k. Peak demand for the previous day, week, month and year.
15. A System Load Shed report shall be available on a scheduled or request basis at the I2BS workstation or at the POT. The following minimum information is to be included in the System Load Shed Summary:
    a. Expendable/deferrable load type.
    b. Point type.
    c. Point ID.
    d. Point status.
    e. Load rating.

f. Minimum off, maximum off and minimum on times.
g. Today's shed time for each load.
h. Today's shed frequency for each load.

16. A report shall be available detailing the criteria for each piece of equipment assigned to the equipment duty cycling program. Such information shall include, at minimum, the following:
    a. Maximum number of stops and starts allowed in a 24-hour period.
    b. Maximum and minimum On and Off times.
    c. Start and stop times initiated by the duty cycling function.
17. An optimal start/stop report shall be available at the I2BS and the POT that shall document, at minimum, the following for each item of equipment:
    a. Calculated optimal start time.
    b. Calculated optimal stop time.
    c. Scheduled start of occupancy.
    d. Scheduled end of occupancy.
    e. Time at which space achieved setpoint.
    f. Space temperature at scheduled start of occupancy.
    g. Space temperature at scheduled end of occupancy.
18. A supply air temperature setpoint reset report shall be available at the I2BS workstation and the POT. This report shall detail at minimum, the following data for each air-handling unit:
    a. Supply air temperature heating setpoints during the last 24-hours.
    b. Supply air temperature cooling setpoints during the last 24-hours.
    c. Space temperatures during the last 24-hours in the associated spaces. These documented savings values to be automatically historically stored for the current defined period and a minimum of twelve past periods.
19. The I2BS shall generate a report on a scheduled and request basis detailing equipment cumulative run times and number of stop/starts. This report shall be available on the following basis:
    a. An individual item of equipment
    b. All equipment of a similar nature in the same facility.
    c. All equipment in the same facility.
    d. All equipment in the complex.
20. The I2BS shall generate a report on a scheduled and request basis detailing the equipment start/stop schedules for equipment for each day of the week. This report shall be available on the following basis:
    a. An individual item of equipment
    b. All equipment of a similar nature in the same facility.
    c. All equipment in the same facility.
    d. All equipment in the complex.
21. The I2BS shall generate a lift analysis report. The lift analysis report shall include the following information at minimum:
    a. Average calls per hour – last hour, day to present time, yesterday, week to date, last week, month to date, last month, year to date, last year.
    b. Average calls per floor per hour – last hour, day to present time, yesterday, week to date, last week, month to date, last month, year to date, last year.
    c. Average waiting times– last hour, day to present time, yesterday, week to date, last week, month to date, last month, year to date, last year.
    d. Average waiting times per floor– last hour, day to present time, yesterday, week to date, last week, month to date, last month, year to date, last year.
    e. For each floor – average time from initiating call to arrival at ground floor.

f. Lift availability – percent time in service for each lift for month to date, last month, year to date and last year.
g. Mean time to repair and mean time between failures for each lift.

M. VDU displays shall meet the following requirements:

1. Provide a software package to enable the Operator to configure, modify and delete system diagrams. Real-time data shall be superimposed on the system diagrams within 1 second of opening and shall be updated at an operator assigned frequency ranging from every 2 seconds if the page is open. Graphic screens shall be constructed using a drawing package based on GIF, BMP or JPG file formats. The graphics shall be based on AutoCAD graphics that shall be provided by the ELV Building Services Systems Contractors. The AutoCAD graphics prepared by the ELV Building Services Systems Contractors shall clearly identify the location and nature of all monitored and controlled points. As a guideline the GUI at the I2BS shall provide the graphic display of information from the ELV Building Services Systems identified in the table in Part 1 of these specifications. If the I2BS is interfacing with the ELV Building Services System at the management level then the GUI shall mimic the displays at the ELV Building Services System. If the I2BS is providing the management level functions for an ELV Building Services System then the displays at the I2BS shall be of a standard, at minimum, equal to the displays that are normally provided at the ELV Building Services System management level.2. The data shall be positioned on the display at points indicative of the instrumentation locations on the system. VDU displays shall form the basis of the menu penetration means of Operator access. The menu penetration approach shall allow the operator to display a graphic of the complex and from there to select a building, a floor within the building, a zone within a floor and an item of equipment within a zone. The same graphics shall be used in the menu penetration regardless of the nature of the physical point, e.g. the graphics used to select a fire alarm point, a room temperature sensor and a door status in the same zone shall be the same until the final choice of equipment.
2. Provide a library of commonly used symbols in accordance with CIBSE standards including all symbols used in the compilation of the system diagrams for this project.
3. Each system diagram shall indicate real-time data including analogue and digital input and output points, setpoints and calculated values of the associated system.
   Preferably the status of motors, e.g. on, off, failed, etc., shall be indicated by colour changes such as green for on, blue for off and red for failed. Where necessary to enhance the understanding of the data displayed use alphanumeric text. The graphics shall be fully animated such that they clearly indicate the status of motors.
4. Provide a hierarchy of VDU displays that will enable an Operator, for example, to progress from a diagram of the complex, to a particular building, to a particular floor in the building, to a particular zone on the floor and to a particular item of equipment such as an air handling unit, door status monitoring sensor, etc. The selection at each stage shall be by cursor control using a mouse or keyboard arrow buttons.
5. Provide icons on displays to enable easy access from one display to a related display. For example, provide a target box on the system diagram for a group of VAV terminal units that will enable one-step access to the associated air-handling unit.
6. The time and date shall appear on the VDU at all times and when there are air and/or water distribution system diagrams displayed on the VDU the outside air

temperature and relative humidity shall also be displayed.

7. System diagrams shall appear on the VDU complete with all associated data within three (3) seconds of the completion of an I2BS Operator entry/ menu selection.
8. The VDU displays shall be based on AutoCAD drawings provided by the ELV Building Services Systems Contractors. The I2BS Contractor shall create the displays for the Phase 1 buildings on the I2BS. The Contractor shall provide MOI/SFMC with all the necessary training and tools to develop new displays.
9. Fire Alarm System: The I2BS Contractor shall provide the GUI for the FAS at the I2BS. The Operator shall be able to amend, add and delete items on graphical displays at the I2BS. GUI at the I2BS shall display system information in a graphical (floor plan and elevations) form. A pull-down menu is to be included allowing selection of graphical views of the facility, or subset thereof. Each view, created in a CAD environment, is to include icons created for intelligent devices. These devices are to change in color when an event occurs. The device is to annunciate in RED when in alarm, BLUE for security activation, and YELLOW for trouble or to confirm acknowledgement. Each device in the graphic display is to support a text memo file where pertinent information about the location of the device may be stored. The graphic displays shall clearly identify the location and type of each FAS device (e.g. smoke sensor, heat sensor, pull-station, etc.). By selecting a device in the graphic presentation, the Operator of the GUI is to have the ability to log onto the corresponding node and interrogate the associated intelligent point. Selection and activation of a certain graphic display is to be either automatic (event driven) or by manual request via the terminal.
10. Lighting Controllers: The GUI at the I2BS shall provide a management level function for the lighting control system. The I2BS Contractor shall provide customized graphics screens giving a full graphics display of the lighting throughout the entire building along with floor plans, partition layouts, circuit layouts in the individual rooms, etc. The software shall provide real time monitoring of the entire system and shall display active status of each lighting circuit along with the run time hours and generate maintenance schedules when the circuits have reached their threshold set points for run hours. It shall be possible to change the status of a lighting zone by “clicking” on the appropriate zone on the associated graphic.
11. HVAC Controllers: A system diagram shall be provided for all equipment monitored and/or controlled. At minimum, this shall include the following:
    a. Each air-handling unit
    b. Each extract and supply fan system
    c. Each chiller and cooling tower
    d. Each chilled water and condenser water distribution system
    e. Each VFD
    f. Each VAV and FCU terminal unit. This shall show the location of each VAV and FCU on the floor, the zone temperatures, the mode of operation, e.g. occupied mode, unoccupied mode, standby mode, etc. of the terminal units. The zones covered by each VAV and FCU terminal unit shall be outlined and zones with temperatures in alarm shall be red.
    g. Each electricity distribution system
    h. Each system monitored and/or controlled by the HVAC controllers.
12. Security Access Control/CCTV Systems: The graphics shall incorporate the location of all security devices including sensors, card readers, CCTV cameras, etc. Equipment and security alarms shall be clearly indicated. The SACS graphics at the I2BS shall include all of the information that can be displayed at

the SACS Management Level. Clicking on a camera location shall automatically display the image from that camera.

13. Emergency Central Battery System: The graphics shall incorporate all ECBS monitoring and control points. For the ECBS this may be provided in a tabular form but the table must clearly identify points in alarm.
14. Uninterruptible Power Supply: The graphics shall incorporate all UPS monitoring points.
16. The Packaged Engine Generators: The GUI at the I2BS shall provide a management level capability for the I2BS operator. The operator shall be able to monitor the all of the Packaged Engine Generators points that can be monitored from the chiller system controller. All points shall be displayed on the graphics.
17. The Elevator Monitoring and Control System: The graphics shall incorporate all of the EMCS points. Provide a graphical display for each bank of elevators that shows the location, alarm and operating mode for each elevator.
18. In addition to the above graphical displays there shall also be the following composite schematics:
    a. Combined security and FAS on each floor. This shall show the location of each security and fire alarm device on the floor and the status of each security and fire alarm device. A device(s) that has indicated a security or a fire alarm shall be clearly identified. It shall be possible by clicking on the full floor display for the Operator to zoom in on a single room.
    b. Combined lighting and HVAC on each floor. This shall show the location of each HVAC and lighting device on the floor and the status of each HVAC and lighting. A device(s) that has indicated a lighting or an HVAC alarm shall be clearly identified. It shall be possible by clicking on the full floor display for the Operator to zoom in on a single room.
    c. Combined HVAC and FAS on each floor. This shall show the location of each HVAC device and fire alarm device. A device that is in alarm shall be clearly identified. It shall be possible by clicking on the full floor display for the Operator to zoom in on a single room.
19. The I2BS shall support a minimum of 20,000 graphic pages.
20. The I2BS Contractor shall submit all of the proposed graphics displays to MOI/SFMC at the shop drawing stage. The I2BS Contractor shall amend the graphics as instructed by MOI/SFMC. Only the highest quality of graphics displays will be acceptable to MOI/SFMC.
21. IP Television System: There are presently no IP Television systems monitored by the I2BS but provision shall be made for the future addition of the IP Television system monitoring. The graphics shall display all relevant information regarding the IP Television system. Provide a series of icons for each of the functions that can be performed at the I2BS so that, for example, when an operator wishes to change the channels available at the terminal building a list of the channels can be obtained by “clicking” on the appropriate icon and, when the list is displayed, it will indicate the availability/non-availability of each channel. Clicking on the channel will display the relevant information and will allow the operator to select/de-select the channel.
22. Parking Facility Management System: The graphics shall display the number of spaces available in the car parks, the location of car park system equipment and the location of alarms.
23. Public Address System: The graphics shall display the location of PAS components and shall identify the healthy/fault status of the components.
24. Graphic pages shall support script programming.

25. Graphic pages shall support dynamic displaying. Eg: a point id is displayed only when a mouse pointer in on top of it or color of the point icon changes dynamically as the state of the point changes.

N. Event messages shall meet the following requirements:
   1. An I2BS Operator shall create messages up to 64 characters in length, at minimum, which shall be displayed upon the occurrence of a particular event. There shall be capacity for 10,000 event messages at any one time and an I2BS Operator shall be able to associate a single message with more than one occurrence and shall be able to associate more than one event message with a particular event.
   2. The event message shall be output at all devices selected on-line by an I2BS Operator using an interactive procedure.
   3. An I2BS Operator shall be able to associate one or more event messages with the following events:
      a. An alarm
      b. A change of status.
      c. The return to normal of an alarm condition.
      d. An Operator entered schedule.
      e. Any other event initiated by an ELV Building Services System or monitored by the ELV Building Services System.

O. It shall be possible for an Operator to create a customized message to be displayed at one or more workstations on the Network or as an SMS message on a cell phone.

P. Graphics shall support scripting by Operators with the correct access level.

Q. The I2BS shall support point/tag names of, at minimum, 24 characters. Point descriptors shall be, at minimum, 72 characters.

2.17 I2BS DATA ANALYSIS, STORAGE AND PRESENTATION SOFTWARE

A. Data presentation software shall reside at the I2BS Application Server such that all PC on the Data Networks can present data in the same format. These features shall comprise the following:

   1. VDU system diagram displays
   2. Dynamic Trending
   3. Historical data trends

B. VDU system diagram display package

   1. Provide a software package to enable the Operator to configure, modify and delete system diagrams. Real-time data shall be superimposed on the system diagrams and shall be updated at intervals between 10 and 20 seconds. The data shall be positioned on the display at points indicative of the device locations.
   2. Provide a library of commonly used symbols in accordance with CIBSE and other standards including all symbols used in the compilation of the system diagrams for this project.
   3. Each system diagram shall indicate real-time data including analogue and digital

input and output points, setpoints and calculated values of the associated system. Where necessary to enhance the understanding of the data displayed use alphanumeric text. The graphics shall be fully animated such that they clearly indicate the normal/alarm and on/off status of equipment.

4. Provide a hierarchy of VDU displays that will enable an Operator, for example, to progress from a diagram of the Security Forces Medical Center to a specific building, to a particular floor in the building, to a particular zone on the floor, to a specific piece of equipment and to a specific object e.g. a camera, fire alarm detector, temperature sensor, etc. The selection at each stage shall be by cursor control using a mouse or keyboard arrow buttons.
5. Provide icons on displays to enable easy access from one display to a related display. For example, provide a target box on the system diagram for a group of VAV terminal units that will enable one-step access to the associated air-handling unit.
6. The I2BS Contractor shall submit a complete set of the proposed system diagrams at the shop drawing stage of the project. The I2BS Contractor shall modify the system diagrams as requested by MOI/SFMC following shop drawing review at no additional cost to MOI/SFMC.
7. The system diagrams shall be submitted to the I2BS Contractor by the ELV Building Services Systems Contractors in AutoCAD format and will clearly indicate the location and ID of data points. All monitoring and control objects shall appear on at least one graphical display. Colour changes and animation shall be employed to indicate alarm/normal status, on/off status, etc.

C. Dynamic trending

1. Provide a software package that emulates, at minimum, a 3 point strip chart recorder. This program shall concurrently display 3 or more (maximum of 6) plots of variables in a graphical format. The graphs shall be plotted as the values are sampled in a similar fashion to a chart recorder and when the plot reaches the right hand side of the X-axis, the X-axis shall scroll to the left so as to accommodate newly sampled data.
2. The variables to be plotted shall be selected by the Operator from any point in the I2BC I2BS Application Server database.
3. Each of the plotted variables shall be uniquely and clearly identified using a means of differentiation such as different colours for each variable or different symbols for the plotted points for each variable.
4. The X-axis shall be the time axis and shall have a scale selected by the Operator using an interactive procedure or shall be scaled automatically to accommodate a minimum of 30 plotted points for each variable. The plot rate shall be selected by the Operator using an interactive procedure and shall have the following minimum ranges:
    a. Plot rates for points shall range from their poll rate to at least once per day.
    b. Setpoints shall be plotted at the same rate as the associated variable.
    c. Plot rates for calculated points shall range from the rate at which the calculation is performed to at least once per day.
5. The Y-axis shall be the value of the plotted variable. If plotted variables have different ranges then provide separate Y-axes. The Y-axis for each plotted variable shall be defined by the Operator using an interactive procedure or shall be scaled automatically using a technique that displays the data in an optimum manner.
6. It shall be possible to have a minimum of 100 active trend plots at any OIW on the network.

7. As part of the work of this contract the I2BS Specialist shall implement all trend logs as requested by the MOI/SFMC. Submit in writing to the MOI/SFMC, at least 4 weeks prior to the acceptance testing, a request for points to be placed on the dynamic trending function. The written request will clearly indicate the information required from the MOI/SFMC and the format in which it is to be provided.

D. Historical data trends

1. Provide a software facility for the collection and storage of data at the I2BS Data Servers and its subsequent retrieval and display in tabular and graphical form as selected by the Operator. Data shall be stored at the NIU and downloaded to the Data Servers on a scheduled basis or on an as requested basis. Historical data stored at the NIU shall be downloaded at least once every 24 hours. The scheduled download time is to be established by MOI/SFMC and shall be changeable by an Operator with the required password level.
2. The Operator shall be able to assign on-line, using an interactive procedure, any monitored point, calculated variable or setpoint to the historical data trend facility. It shall be possible to have data collection and storage concurrently, at minimum, for one hundred thousand (100,000) variables.
3. Each variable shall be sampled at an Operator-defined frequency using an interactive procedure. The sampling frequencies shall be in the following ranges at minimum:
   a. For monitored points the sample rate shall be the controller poll rate to at least once per day.
   b. Setpoints shall be sampled at the same rate as their associated variable.
   c. For calculated points the sample rate shall be in the range of the calculation rate to once per day.
4. Storage shall be provided for at least three thousand (3,000) pieces of sampled data for each variable assigned to this feature. Recall of data shall be in either a tabular form or in a graphical form and shall be displayed on the VDU or output on one of the printers as selected by the Operator. Whichever form of output the Operator selects, it shall be possible to concurrently output data for a minimum of 3 variables. The time period to be covered by the data output shall be selected by the Operator using an interactive procedure. When the storage ccapacity for a variable is full the newly sampled data shall over-write the data first stored for that variable.
5. Data output in tabular form shall clearly distinguish between the variables and shall indicate the time and date at which each piece of data was sampled.
6. Data output in graphical form shall meet the same requirements as detailed above for the real-time plotting of data.
7. It shall be possible at any time to obtain a listing of which points have been assigned to this feature and their sampling rates.
8. It shall be possible to output the historical data in a Microsoft Excel format in a hardcopy and in an electronic format.
9. As part of the work of this contract the I2BS Specialist shall implement all historical data storage as requested by the MOI/SFMC. Submit in written to the MOI/SFMC, at least 4 weeks prior to the acceptance testing, a request for points to be placed on the historical data trending function. The written request will clearly indicate the information required from the MOI/SFMC and the format in which it is to be provided.

Details for FAS

2.18 FIRE ALARM SYSTEM

A. The FAS in each building shall communicate the following information to the I2BS when there is a change in the status of the fire alarm system or in the status of a fire alarm zone:
   1. Zone of Incidence.
   2. Time and Date.
   3. Indication of whether change of status is a fire alarm, return to normal or FAS fault.
   4. Address of device in alarm. The address shall be provided by the FAS Contractor for each device.
   5. Type of device in alarm, e.g. heat detector, smoke detector, fire pump, fire alarm panel, etc.

B. An alarm originating in the FAS shall be annunciated with the highest priority at the I2BS workstations. The I2BS shall:
   1. Assume that the equipment shutdown or started by a source other than the HVAC controllers within 10 seconds of the fire alarm annunciation was the result of FAS actions and alarms associated with that equipment shall be inhibited.
   2. A look-up table, based on information provided by the FAS Contractor shall identify which actions are initiated in the event of a fire. The I2BS shall monitor the actions of the FAS via the interfaces to other ELV Building Services Systems controllers, such as the lift controllers, HVAC controllers, etc., and shall generate a critical alarm if there are any anomalies such as the failure of equipment to start, failure of dampers to open, etc.

C. The FAS Contractor shall provide a matrix to the I2BS Contractor that identifies the FAS actions in the event of each type of alarm generated by the FAS. Each of these alarms shall generate a critical alarm at the I2BS workstations. Refer to the FAS documents for comprehensive details of the FAS. Alarms shall be generated by equipment and events such as:
   1. Smoke detector
   2. Heat detector
   3. Sprinkler system tamper switch
   4. Water flow switch
   5. Manual pull station
   6. Fire-pump power failure
   7. Fire-pump operation
   8. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system
   9. Operation of the kitchen fire suppression system or the clean agent fire suppression system.
   10. Component failure at a fire alarm control panel
   11. Battery failure at a fire alarm control panel
   12. Power failure at a fire alarm control panel
   13 Fire alarm system network failure
   14. Voice evacuation system failure
   15. Fire fighter phone system failure
   16. Fire alarm acknowledgement – it shall not be possible to acknowledge the alarm at an I2BS workstation but a message shall be output at the I2BS workstations when the alarm is acknowledged at the appropriate code approved fire alarm control panel.

D. In the event of an alarm, the FAS shall initiate one or more of the following actions via hardwired interlocks unless stated otherwise:
   1. The shut down and start up of air, water and electricity distribution equipment
   2. Unlocking of electric door locks (such as doors controlled by SACS) in designated egress paths
   3. The override control of lifts
   4. Release of fire and smoke doors held open by magnetic door holders
   5. CCTV camera(s) shall start recording the event (this shall be via the I2BS)
   6. Shutdown selected Baggage Handling System equipment as pre-scheduled and as per the Cause & Effect matrix
   7. Shut off public address and music equipment
   8. Shut off public address (PA) and music equipment and use PA system to broadcast the fire alarm evacuation/alert signals
   9. Shut off public address (PA) and music equipment and broadcast fire alarm evacuation/alert signals through voice/alarm communication system
   10. Close smoke dampers in air ducts of system serving zone where alarm was initiated
   11. Recording of the event in the system memory
   12. Initiate operation of smoke management system
   13. Operation of smoke curtains
   14. Recording of the event by the system printer (this shall be via the I2BS).
   15. Initiate other events as detailed in the FAS specification.

E. The I2BS shall not initiate any of the above actions but shall record the event at the alarm printer and in the I2BS database and shall monitor the actions to ensure that they proceed as intended. Any deviation from the alarm/action matrix shall cause the I2BS to generate a critical alarm.

F. If the CCTV system is in the manual mode (see below) the occurrence of a fire alarm shall cause an icon in the form of a camera to appear in the alarm notification area of the workstation screen. “Clicking” on this icon shall automatically display the images from the associated camera. Coordinate with the CCTV and FAS Contractors to establish a matrix relating the fire alarm systems devices to the CCTV camera locations.

G. In the event of a FAS equipment malfunction the information shall be automatically sent to the CFMMS and the CFMMS shall initiate the appropriate action.

2.19 LIGHTING CONTROLLER

A. The I2BS shall provide Management Level functions for the lighting control system in each building. It shall be possible for an Operator with the required password access level to access any individual room to monitor and control the lighting circuits. The lighting sub-contractor shall provide a BACnet, LonWorks, EIB, OPC or Modbus interface to the NIU.

B. The lighting controller interface shall be set up so as to provide, at minimum, the following information to the I2BS:
   1. Lighting relay status for each individual relay.
   2. Lighting load (kW) for each zone.
   3. Lighting consumption (kWh) for each zone.
   4. Zone lighting levels
   5. Status (healthy/fault) of LCS components

C. The lighting controller interface for the systems shall be set up so as to enable the I2BS, at minimum, to undertake the following functions:
   1. Lighting relay on and off control for each zone.
   2. Set zone lighting levels.
   3. Change the schedule for any lighting zone.
   4. Ascertain the lighting status (on/off) and dimming status of any lighting zone.

D. The programmable lighting management system shall have I2BS based software for scheduled control and manual override control. The I2BS software shall provide a graphics based overview of the entire Security Forces Medical Center buildings, floors and the individual rooms. It shall be possible to pre-programme the lighting on/off and dimmer schedules in advance with special holiday programs, weekly programs, etc. up to the year 2040. In the event the I2BS is not operational or the Data Network is down, the standalone mode shall control the lighting circuits as per programmed times. This shall be ensured via a controller programmed with the same timer schedules as that of the I2BS software. Changes made to the schedules at the I2BS shall be automatically downloaded to the lighting controllers. It shall be possible to override control of devices that are controlled based on daylight, local switches, etc. when they are in the "Auto" mode of operation. The software shall provide customized graphics screens giving a full graphics display of the entire building along with floor plans, partition layouts, circuit layouts in the individual rooms, etc. The software shall provide real time monitoring of the entire system and shall display active status of each lighting circuit along with the run time hours and generate maintenance schedules when the circuits have reached their threshold set points for run hours.

E. Each circuit shall be graphically illustrated and shall contain operational characteristics available in the system. This information shall be displayed by passing the mouse cursor over the respective circuits.

F. The software shall enable repeat interrogatory sweeps to be programmed through the night or any other times to extinguish lighting which may have been left on locally.

G. The timer library in the software shall be programmable. It shall have the necessary timer modules to control any of the circuits individually or in the form of groups, which can be selected and changed as and when desired. It shall be possible to pre-program the time channels in advance with special holiday programs, weekly programs, etc. up to the year 2040. The Contractor shall programme the system to operate as per MOI/SFMC instruction at site and shall allow for reprogramming of the system if necessary during the maintenance period in accordance with the end user requirements. It shall be possible to program any of the devices on-line without affecting any of the system devices.

H. In the event of a fire alarm the I2BS switch all lights to full ON in the zones in alarm and on all escape routes.

I. In the event of a SACS intrusion alarm the I2BS shall set all lights in the zone to full ON.

J. In the event of lighting equipment malfunction the information shall be automatically sent to the CFMMS via the I2BS and the CFMMS shall initiate the appropriate action.

K. All lighting control system points shall be accessible from the I2BS and all data associated with these points shall be stored at the Data Server. The I2BS Contractor shall set up the Data Server database to store data on all lighting circuits such that all

lighting status changes and alarms are recorded for a minimum period of 1 year.

2.20 SECURITY ACCESS CONTROL AND CCTV SYSTEMS

A. The SACS systems shall be provided by the SACS Contractor with a stand-alone Management Level. The Management Level functions shall be duplicated at the I2BS. A single SACS shall serve the Security Forces Medical Center facilities. I2BS and SACS shall be interfaced at the management level such that I2BS workstation/GUI shall be the operators' GUI for day to day operation and maintenance. SACS contractor shall provide necessary SDKs/APIs for I2BS contractor to develop necessary GUI functionalities. In addition SACS contractor shall provide additional SACS work stations as specified in the SACS specifications including:
   1. One for photo ID badging station including card printer, camera and biometric enrolment station. This workstation shall be used for access level assignment and database download.
   2. One work station for MOI/SFMC engineer/supervisor for system programming.

B. The I2BS Contractor shall coordinate with the SACS/CCTV Contractor.

C. The SACS/CCTV shall report the following alarms to the I2BS:
   1. Intrusion alarm
   2. Panel and reader status alarms including tamper alarms.
   3. Loss or low video alarm
   4. Access Events (Access Granted/Denied/Granted but door not opened). Access events shall be reported with the associated card reader and card holder details as well as the time and date.
   5. Door Alarms (Door open, closed, held-open, forced)
   6. Power supply status
   7. Controller database loss of unavailability.
   8. Disarmed/armed status of zones and points.
   9. Status of auxiliary input and output points.
   10. Alarms from electric locking devices such as bond sensors, latch bolt monitors, etc.
   11. Motion detection alarms as detected by SACS hardwired points and CCTV video analytics software.

D. In the event of a SACS or CCTV equipment malfunction alarm the data shall automatically be sent to the CFMMS. The CFMMS shall initiate appropriate action.

E. It shall be possible for an I2BS Operator with the appropriate password level to request the following data from the SACS:
   1. Access events (Access Granted, Denied, Granted but door not opened) with cardholder number/details, time and date.
   2. Door Alarms (Door open/close, Door open too long, Door Forced Alarms, Door lock status, Cables open/short status).
   3. Panel and Reader status (communication/Fault).
   4. Panel and card reader tamper alarms.
   5. Power supply status (healthy/fault).
   6. Any configurable input/output status.
   7. Controller database loss or unavailability.

F. It shall be possible for an I2BS Operator with the appropriate password level to obtain the display of real time video and the replay of historical video from the Network Video

Recorders. This shall be possible via an interactive approach that will be initiated by "clicking" on the camera location on the associated graphic and responding to a question of the type: "current or historical video?" If historical video is requested then the interactive procedure shall enable the selection of the start time.

G. The FAS shall forward data to the SACS system when there is a fire alarm and shall provide details of the zone in alarm. The SACS shall inhibit alarms associated with the release of doors by the FAS. The SACS shall not override the hardwired interlocks between the FAS and the door hardware.

H. Provide a means by which the I2BS operator can select between the automatic and manual initiation of the display of the camera image associated with a SACS or FAS alarm. If the manual option is selected then the occurrence of a fire alarm or SACS alarm shall cause an icon in the form of a camera to appear in the alarm notification area of the I2BS workstation screen. "Clicking" on this icon shall automatically display the images from the associated camera. Coordinate with the SACS/CCTV and FAS Contractors to establish a matrix relating the fire alarm systems devices and the SACS monitoring points to the CCTV camera locations.

I. The SACS shall communicate selected data to the I2BS regarding the arrival and departure of personnel as monitored by the use of an access card. This data shall be used by the I2BS to initiate the control of lighting and air distribution within the person's work area. The I2BS Operator shall complete a matrix relating the person's SACS ID and the person's HVAC and lighting zone. The lighting and HVAC zone will be the room number which will be associated in a look-up table with an air distribution terminal unit and a lighting control relay.

J. The I2BS shall have an operator log that tracks operator actions on the workstation in addition to alarm and event logs.

K. It shall be possible to do following functions from I2BS GUI at minimum, depending on the password:

1. Open/Close door manually
2. Open /close doors on time schedule/calendar
3. Arm/disarm zones and points (manually or time schedule)
4. Monitor communication status of ACPs and card readers
5. Assign and monitor Guard tours
6. Reset ACPs
7. Activate auxiliary output points (manually or time scheduled)

L. Designated I2BS GUI, if programmed, shall automatically pop up card holder details (with photo) along with live video from associated CCTV camera as picture in picture, in case of invalid access attempts.

M. The data communication between the SACS and the I2BS shall be encrypted to prevent hacking/intrusion.

2.21 HVAC CONTROLLERS

A. The I2BS shall provide the Management Level function for the HVAC monitoring and controllers.

B. In the event of an HVAC controller equipment malfunction or the malfunction of

equipment monitored and/or controlled by the HVAC controllers, the data shall automatically be sent to the CFMMS. The CFMMS shall initiate appropriate action. An alarm shall be generated at the I2BS workstations.

C. All HVAC controller monitoring and control points shall be accessible from the I2BS and all data associated with these points shall be stored at the Data Server. The I2BS Contractor shall set up the Data Server database to store data on all HVAC points such that all values are recorded for a minimum period of 1 year. Refer to the BMS specifications for details of all monitoring, control and calculated points.

D. Equipment failures shall be communicated by the I2BS to the CFMMS. The CFMMS shall initiate appropriate action.

E. The I2BS shall monitor the run time of all equipment and shall monitor the number of stop starts of motors and shall update the CFMMS database at least once every 24 hours.

2.22 VARIABLE SPEED DRIVES

A. The I2BS shall provide Management Level functions for the VSD. The interface between the Automation Level Network and variable speed drives (VSD) shall be as follows:
   1. The variable speed drive suppliers shall provide a BACnet, LonWorks or Modbus interface to the NIU.
   2. The interface shall be set up so as to provide the I2BS, at minimum, with the following monitoring and control points:
      a. Start and stop control (Control Point).
      b. Speed control (Control Point).
      c. Speed reference feedback (Monitoring Point).
      d. Motor operating status (Monitoring Point).
      e. VSD alarm (Monitoring Point).
      f. Motor power in kW (Monitoring Point).
      g. Motor kWh (Monitoring Point).
      h. Motor current (Monitoring Point).
      i. Motor voltage (Monitoring Point).
      j. Hours run (Monitoring Point).
      k. DC link voltage (Monitoring Point).
      l. Thermal load on motor (Monitoring Point).
      m. Thermal load on VSD (Monitoring Point).
      n. Heat sink temperature (Monitoring Point).

B. The I2BS Contractor shall obtain all BACnet object or Lon SNVT Ids or Modbus IDs, as applicable, together with all other relevant information from the VSD Contractor and shall map the information to the NIU. The I2BS Contractor shall provide a schematic display of the points using the graphical user interface.

C. The VSD interfaces shall be at the NIU such that the failure of the I2BS Management Level Network shall not affect the interchange of information between the associated HVAC controllers and the VSDs.

D. Provide a graphic for each VSD and include all of the above dynamic data together with the associated static pressure as monitored by the HVAC Controllers. All data shall be stored at the Data Server and shall be available for historical data reports, graphs and tables.

2.23 PACKAGED ENGINE GENERATORS

A. The I2BS shall provide a Management Level function for the Packaged Engine Generators. The interface between the Management Level Network and the generators shall be as follows:

1. The emergency generator sub-contractor shall provide a BACnet, LonWorks or Modbus interface to the NIU.
2. The NIU shall be set up so as to provide, at minimum, the following monitoring points at the I2BS Management Level Network:
    a. Generator run status
    b. Generator operating mode (auto/manual, etc.)
    c. Generator set summary alarm (If available at the generator control centre the HVAC Controls Contractor may monitor this point via a volt free contact)
    d. Generator failure to synchronize alarm
    e. Generator set engine oil pressure alarm
    f. Generator set high water temperature alarm
    g. Generator set high engine temperature alarm
    h. Generator set low engine temperature alarm
    i. Generator set low fuel level alarm
    j. Generator set battery voltage alarm
    k. Generator over voltage alarm
    l. Generator over current alarm.
    m. Generator overload alarm
    n. Generator under voltage alarm
    o. Generator over frequency alarm
    p. generator under frequency alarm
    q. Generator battery failure alarm
    r. Generator set over crank alarm
    s. Generator set over speed alarm
    t. High oil temperature
    u. Low fuel pressure alarm
    v. low oil pressure alarm
    w. Generator set winding temperature alarm
    x. Generator set bearing temperature alarm
    y. Low coolant level alarm
    z. Generator set loss of field alarm
    aa. Engine fail to start alarm
    bb. Engine speed
    cc. Flue gas temperature
    dd. Phase-to-phase and phase-to neutral voltages
    ee. Phase-to-phase currents
    ff. Neutral current
    gg. Frequency
    hh. Load (kW)
    ii. Demand (kVA)
    jj. Power factor
    kk. kWh supplied
    ll. Hours run
    mm. Load shed priority signal.
    nn. Switch emergency generator control from automatic to manual and vice versa (control point)

oo. Start/stop an emergency generator (control point).
pp. Any other information available from the diesel generator controller.

B. The I2BS Contractor shall obtain all data object IDs from the emergency generator Contractor and shall map the objects to the NIU. The I2BS Contractor shall provide a schematic display of the points using the graphical user interface. All data shall be stored at the Data Server and shall be available for historical data reports, graphs and tables.

C. Coordinate with Packaged Engine Generator Contractor.

2.24 UNINTERRUPTIBLE POWER SUPPLIES

A. The UPS Contractor shall provide a BACnet, LonWorks or Modbus interface to the NIU. The I2BS shall provide Management Level functions for the UPS. The interface shall be set up so as to provide, at minimum, the following monitoring and control points:

1. Bypass Voltage X-Y
2. Bypass Voltage Y-Z
3. Bypass Voltage Z-X
4. Bypass Voltage X-N
5. Bypass Voltage Y-N
6. Bypass Voltage Z-N
7. Critical Voltage X-Y
8. Critical Voltage Y-Z
9 Critical Voltage Z-X
10 Critical Voltage X-N
11. Critical Voltage Y-N
12. Critical Voltage Z-N
13. Critical Current X
14. Critical Current Y
15. Critical Current Z
16. Critical Bus Frequency
17. Critical Bus KVA
18. Critical Bus KW
19. Critical Bus Capacity
20. UPM DC Voltage
21. UPM Battery Amperage
22. UPM Input Voltage X-Y
23. UPM Input Voltage Y-Z
24. UPM Input Voltage Z-X
25. UPM Battery Discharging
26. UPM Low Battery Warning
27. UPM Output Overload
28. UPM Fuse Failure
29. UPM Ambient over Temperature
30. UPM DC Ground
31. UPM Blower Failure
32. UPM Control Power Failure
33. UPM Overload Shutdown
34. SCC Output Overload
35. SCC Emergency off
36. SCC Load on Bypass
37. SCC Static Switch Disabled

38. SCC Output Over/under Voltage
39. SCC UPM Summary Alarm
40. UPS Common Fault
41. Incoming Power Fail
42. UPS on bypass
43. UPS Alarm
44. UPS in manual bypass mode

B. The I2BS Contractor shall obtain all BACnet object IDs or Lon SNVT IDs or Modbus IDs or OPC Object IDs from the UPS supplier and shall map the objects to the NIU. The I2BS Contractor shall provide a schematic display of the points using the graphical user interface.

C. In the event of a failure at a UPS serving the SACS, a critical alarm message shall be communicated to the SACS Management Level.

D. In the event of a failure at a UPS serving one of the Fire Alarm Systems, a critical alarm message shall be communicated to the Fire Control Centre by the I2BS.

2.25 EMERGENCY CENTRAL BATTERY SYSTEM (ECBS)

A. The ECBS Contractor shall provide a BACnet, LonWorks or Modbus interface to a Network Interface Unit that shall be provided by the I2BS Contractor. The I2BS shall provide Management Level functions for the ECBS. The interface shall be set up so as to provide, at minimum, the following monitoring and control points at minimum every 5 minutes:

1. Status (healthy/fault) of the ECBS.
2. Circuit earth leakage failure
3. Battery current drawn in emergency mode
4. Battery current drawn in test mode
5. Battery voltage
6. Battery test
7. Battery charge failure
8. Monitor all weekly/daily cycle tests and functions
9. Mains operation.
10 Mains failure.
11. Battery operation.
12. Summation fault.
13. Battery operation.
14. Summary fault.

C. It shall be possible to implement the following functions from the I2BS control rooms:

1. Earth leakage test on each circuit.
2. Display and programming the status of each circuit.
3. Communication and programming with each addressable ballast at the luminaires.
4. Automatic logging of all test results and incidents.
5. Manual test feature in addition to the automatic test feature.

D. The ECBS Contractor shall prepare a list of all items of information that are available at the ECBS and shall present the information to the Employer for the Employer's review. The Employer shall determine whether information in addition to that specified herein shall be transferred from/to the ECBS. The Employer shall be able to amend, add and delete information that is to be transferred from the ECBS to another ELVBS at any time

up to substantial completion.

E. The ECBS Contractor shall provide all BACnet object IDs or Lon SNVT IDs or Modbus IDs to the I2BS Contractor. Provide all necessary documentation regarding the data Objects that are to be communicated to the I2BS. The documentation shall be of such a standard that the Employer's staff who have received training on the operation of the I2BS shall be able to add, delete and amend information that is to be exchanged between the ECBS and the I2BS without a requirement for additional information or assistance from the ECBS Contractor.

2.26 COMPUTERISED FACILITY MAINTENANCE MANAGEMENT SYSTEM (CFMMS).

A. The I2BS Contractor shall supply, install, implement and train complete and functional software driven facility maintenance management system as specified herein.

B. The system shall provide the management of the maintenance related activities which include but are not limited to:
1. Reactive Maintenance.
2. Proactive Maintenance (Central Monitoring Station).
3. Planned Preventive Maintenance.
4. Small Jobs or Internal Projects
5. Call Center Management.
6. SLA Management.
7. Vehicle Movement Control.
8. Asset Registration Update and Tagging.
9. Crisis Management.
10. Other Miscellaneous works like issuance of Petrol Coupons, Food Coupons, etc.

C. The procedures, workflow, etc. for each function or activity shall be proposed by the bidder. Its incorporation in full or partial or with modification shall be the discretion of the client.

D. The system shall support automatic work order generation in CFMMS Computerized Facility Maintenance Management System) for an alarm condition, run time, and calendar time within the Systems integrated with CFMMS.

E. The system shall support modification of PPM scheduling based on the frequency of recurrence of fault with in that equipment.

F. The CFMMS database shall provide for an inventory tracking system. Work orders generated shall automatically up-date the inventory database.

G. The system shall support routing of work orders and preventive maintenance schedules directly to PC, Printer, PDA, fax machine, etc.

H. The system shall support receipt of work requests through web, emails, fax, telephone, SMS, etc.

I. All the above shall be separately identified and logged. The system shall automatically update the customer/client through the same media with the information mentioned in Section 2 of this document.

J. The web-based customer shall have the privilege of viewing the status of work requests

previously launched by him.

K. The asset tracking and management system to record and track item movement shall be integral part of the CFMMS. The tracking and recording of item movement from/to shall be through user-friendly straightforward operations.

L. Tracking of equipment/system shall be possible both facility wise and system wise.

M. General access in the system shall be restricted to the user based on his job responsibility and shall therefore be configurable at sub module level.

N. Any data available will be provided to the successful bidder in the 'as is' condition. It shall therefore be his responsibility to convert it to suitable format and import in to the system.

O. The system software shall be capable of generating customized reports using renowned 3rd party software. The package shall include such software to generate standard reports, advanced reports, standard graphs, unlimited user defined selection filters, ability to customize reports via third party software interface. The types of report under each category that shall be initially programmed and supported shall be discussed and agreed.

P. The Computerized Facility Maintenance Management System (CFMMS) shall operate in a Microsoft Windows platform.

Q. From the main menu of the maintenance manager, it shall be possible to penetrate through the individual functionality described below, through the selection of any of the unique icons. Icons that clearly communicate the function desired shall be provided for the following functions:

1. Automatically Generated Work Orders.
2. Preventive Maintenance Scheduling (PM).
3. Demand Maintenance (DM).
4. 100% Web Based.
5. PM/DM routing.
6. Asset and Equipment Tracking.
7. Maintenance Histories.
8. Inventory & purchasing.
9. Multiple stock rooms.
10. Budgeting.
11. Purchasing and Receiving History.
12. Employee Tracking.
13. Labor Tracking with Multiple Wage Rates.
14. Failure Codes.
15. Task Listing.
16. Batch Print and Close Work Orders.
17. Down Time Analysis.
18. Cost History.
19. Mean Time between Failure Analysis.
20. Mean Time to Repair Analysis.
21. SLA Management.
22. Project Management.
23. Data Import/Export.
24. User Definable Specifications.
25. Advanced Filter, Sort, and Find features.

26. Job Plans.
27. Calendars.
28. Resources

R. When an item of equipment reaches a run-time limit or when an item of equipment fails, a work order shall be automatically generated by the CFMMS. This shall apply to all equipment monitored by the ELV Building Services Systems detailed in Part 1 of these documents.

S. The ELV Building Services Systems Contractors shall issue a list of maintenance requirements for the equipment they furnish and the I2BS Contractor shall enter the information into the CFMMS database.

T. The CFMMS database shall reside on a separate PC, which shall be a node on the Converged IP network. Provide a keyboard, mouse and monitor meeting the specifications detailed in these documents.

2.27 PARKING FACILITY MANAGEMENT SYSTEM

A. The Parking Facility Management System Contractor shall provide a BACnet, LonWorks or Modbus interface to the I2BS. The interface shall be set up so as to provide, at minimum, the following monitoring points:
1. Status (healthy/fault) of Parking Facility Management System components.
2. Number of spaces available in each car park.
3. Alarms associated with the car park access control system.

B. It shall be possible to implement the following functions from the I2BS control rooms:
1. Reset the number of spaces in each car park.
2. Switch the display signs on and off.

C. The Parking Facility Management System Contractor shall prepare a list of all items of information that are available at the Parking Facility Management System and shall present the information to the Owner for review. The Owner shall determine whether information in addition to that specified herein shall be transferred from/to the Parking Facility Management System. The Employer shall be able to amend, add and delete information that is to be transferred from the Parking Facility Management System to another ELVBS at any time up to substantial completion.

D. The Parking Facility Management System Contractor shall provide all BACnet object IDs or Lon SNVT IDs or Modbus IDs to the I2BS Contractor. Provide all necessary documentation regarding the data Objects that are to be communicated to the Parking Facility Management System. The documentation shall be of such a standard that the Employer's staff who have received training on the operation of the I2BS shall be able to add, delete and amend information that is to be exchanged between the Parking Facility Management System and the I2BS without a requirement for additional information or assistance from the Parking Facility Management System Contractor.

2.28 PUBLIC ADDRESS SYSTEM (PAS)

A. The PAS Contractor shall provide a BACnet, LonWorks or Modbus interface to the I2BS. The interface shall be set up so as to provide, at minimum, the following monitoring points:

1. Status (healthy/fault) of PAS components.

B. The I2BS shall forward the following information to the PAS:
1. Flight related information to enable the PAS to assemble the associated message segments for broadcasting.
2. Details of UPS failures so that PAS operators are informed of potential problems if the mains power is lost.

B. The PAS Contractor shall prepare a list of all items of information that are available at the PAS and shall present the information to the Employer for the Employer's review. The Employer shall determine whether information in addition to that specified herein shall be transferred from/to the PAS. The Employer shall be able to amend, add and delete information that is to be transferred from the PAS to another ELVBS at any time up to substantial completion.

D. The PAS Contractor shall provide all BACnet object IDs or Lon SNVT IDs or Modbus IDs to the I2BS Contractor. Provide all necessary documentation regarding the data Objects that are to be communicated to the PAS. The documentation shall be of such a standard that the Employer's staffs who have received training on the operation of the I2BS shall be able to add, delete and amend information that is to be exchanged between the PAS and the I2BS without a requirement for additional information or assistance from the PAS Contractor.

2.29 UTILITIES AND INFRASTRUCTURE PLC SCADA SYSTEM

A. The PLC SCADA Specialist shall provide an OPC interface to the I2BS. The interface shall be set up so as to provide, at minimum, the following monitoring points:
1. Status (healthy/fault) of utilities and infrastructure components.
2. Maintenance related information to be used by the CFMMS

B. The PLC SCADA Specialist shall prepare a list of all items of information that are available at the PLC SCADA System and shall present the information to the Owner for review. The Owner shall determine whether information in addition to that specified herein shall be transferred to the I2BS. The Owner shall be able to amend, add and delete information that is to be transferred from the PLC SCADA System to another ELVBS at any time up to substantial completion.

2.30 LV/MV POWER DISTRIBUTION SCADA SYSTEM

A. The LV/MV Power Distribution SCADA System Specialist shall provide an OPC interface to the I2BS. The interface shall be set up so as to provide, at minimum, the following monitoring points:
1. Status (healthy/fault) of the LV/MV electrical distribution systems.
2. Maintenance related information to be used by the CFMMS

B. The LV/MV Power Distribution SCADA System shall prepare a list of all items of information that are available at the LV/MV Power Distribution SCADA System and shall present the information to the Owner for review. The Owner shall determine whether information in addition to that specified herein shall be transferred to the I2BS. The Owner shall be able to amend, add and delete information that is to be transferred from the LV/MV Power Distribution SCADA System to another ELVBS at any time up to substantial completion.

2.31 METERING SYSTEM

A. The readings of the Power Meters, Thermal Energy Meters, LPG Meters, and Potable Water Meters shall be transferred to the I2BS over a metering bus (M-bus) or Modbus.

2.29 SUBMITTALS

A. Submit documentation and samples in accordance with the requirements of Division 1.

B. Shop Drawings: Indicate system configuration; interconnection wiring diagrams; location, data characteristics, programming and operating reference for server operating system; programming and operating reference for each application and programming language provided.

C. Product Data: Provide for each component, including plug-in circuit boards. Include cabinet dimensions, weights, and support point locations for each item of enclosed equipment.

D. Manufacturer's Installation Instructions: Indicate installation instructions.

E. Manufacturer's Certificate: Certify electrical components meet or exceed listing requirements of Underwriters Laboratories, Inc.

F. Submit software provider's license agreement stating limits on use, copying, and transferring software.

G. Field Reports: Indicate acceptance of component and equipment installation, interconnecting wiring, and weekly progress on installation and start-up of system software.

H. Where installation procedures, or any part thereof, are required to be in accord with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to MOI/SFMC prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

I. Prior to procurement of equipment submit for approval the following drawings and documents:
   1. Equipment specifications and completed technical data sheets.
   2. Control logic diagrams and logic descriptions.
   3. Statement of specification compliance.
   4. Interoperability documentation.
   5. All other certifications as detailed in these specifications.

J. Prior to start of system installation and construction submit for approval the following drawings and documents:
   1. Shop drawings for the I2BS Application Servers, consoles and peripheral I/O devices.
   2. Point to point wiring diagrams.
   3. Other pertinent data.

K. Prior to commencing start-up activities the documents to be submitted for approval:
   1. System construction inspection procedures.

2. Operator and maintenance personnel-training curriculum.

L. Prior to final acceptance testing and turnover and as a condition of system acceptance, the following documents are to be submitted in four copies in accordance with requirements of Division 1:
   1. System Operator manual.
   2. Systems maintenance manual including specifications/technical data on each piece of equipment, trouble-shooting charts and preventive maintenance instructions.
   3. As-built drawings including equipment dimension drawings, equipment wiring and connection drawings.
   4. Complete supplementary information about the software and hardware of the system supplied. This to include at minimum:
      a. System block diagram (hardware).
      b. Software "functional" flow diagram.
      c. Memory map of all units.
      d. Source and object lists of software program.
      e. Complete point list
      f. Point mapping schedule and description
      g. Point mapping techniques
   5. All passwords.
   6. Comprehensive and complete interoperability documentation. The I2BS Contractor shall provide separate interoperability documentation at the end of execution of the project, which shall detail the method of integration for future ELV Building Services Systems. This document shall also include the ID for all data sent and received by the I2BS together with all pertinent details such as the address of the sending and receiving ELV Building Services Systems, the protocol and all other relevant data necessary for MOI/SFMC's staff to:
      a. Amend, add and/or delete data transfer between the Extra Low Voltage Building Systems that will communicate with one another as a result of this contract.
      b. Provide data transfer between Extra Low Voltage Building that do not communicate with one another as a result of this contract but which may be added in the future.
      c. Configure protocols handled by the I2BS in addition to those provided under this contract.
   7. All other documentation as detailed in these specifications.
   8. Backups of all software and databases.

M. The I2BS Contractor shall handover all programmes, database, configuration and network data to MOI/SFMC.

N. The I2BS Contractor shall provide interoperability documentation for all ELV Building Services Systems. All the data related to the components shall be presented along with their respective ID created in the system.

PART 3 - EXECUTION

3.01 TRAINING

A. Submit an outline of the training courses to be given. The purpose of I2BSDevelopment and Operation training shall be to provide comprehensive operational and development training & technology transfer to MOI/SFMC personnel such that they will be substantially independent of the I2BS Contractor for future additions, deletions and

changes to the I2BS systems. The training shall provide enough technical information and understanding to MOI/SFMC personnel, so that they shall be able to perform ELV systems integration, data exchange and management for the total operation in the future. Training shall be held at the I2BS Contractor's facility and at MOI/SFMC site. This training shall be based on real time system simulation and on the actual system at the site. The training programme shall be approved by MOI/SFMC prior to commencement of training sessions. The training outline shall include a schedule of the training sessions in at least one-half day increments, indication of the topics to be covered in each session and any prerequisite requirements that should be met prior to attendance. The training outline shall be submitted with the initial shop drawing and submittals packages. The training shall be the responsibility of the I2BS Contractor. Training shall be coordinated with MOI/SFMC designated training coordinator. If required by MOI/SFMC the I2BSContractor shall provide Certification Training at the I2BS Contractor's facility. The I2BSContractor shall make all necessary arrangement for boarding, lodging and travel arrangements of MOI/SFMC personnel at the I2BS Contractor location if the location is outside Riyadh.

B. Training sessions shall include classroom type instruction and "hands on" instruction and shall be given by the Contractor at the I2BS Contractor's facilities, at the I2BS Test Facility and on-site as detailed below. The trainers shall be factory trained, shall be experienced with the hardware and software and shall be experienced trainers. The resumes of the trainers shall be submitted to MOI/SFMC for approval. The resumes shall indicate clearly the experience and expertise of the proposed training staff with regard to both their technical and training capabilities. The I2BS Contractor shall certify the proposed training staff as Contractor trainers. The I2BS Contractor shall advise MOI/SFMC of the recommended qualifications for the potential trainees.

C. There shall be a minimum of twelve (12) 4-hour sessions at the I2BS Test Facility that is to be established by the I2BS Contractor. Training shall be provided to a minimum of 6 of MOI/SFMC 's staff. These training sessions shall be tailored to the construction schedule and they shall be presented in accordance with a flexible schedule that shall be acceptable to MOI/SFMC. Follow up training shall consist of twelve (12) 4-hour sessions on-site using the installed components during the period immediately prior to the acceptance testing. Further follow up training shall consist of twelve (12) 4-hour sessions on-site during the warranty period. These training sessions during the warranty period shall be scheduled with MOI/SFMC and shall take place on-site or at the I2BS Test Facility as agreed by MOI/SFMC. The above numbers of training sessions are a minimum. If necessary the training detailed above shall be extended to ensure that MOI/SFMC personnel have a comprehensive understanding of the operation and development of the system. Where it is noted in these documents that the MOI/SFMC staff shall work with the I2BS Contractor's staff as part of the training, this shall be in addition to the above.

D. Provide all training materials (training manual, hand-outs, textbooks, workbooks etc.) and any audiovisual equipment required to execute the training. The training manual shall be submitted to MOI/SFMC for approval and any changes requested by MOI/SFMC shall be made at no additional cost to MOI/SFMC. The training manual shall include all of the topics included in the training sessions and shall be customized for this installation. Provide 3 hardcopies and 3 electronic copies of the final version of the training manual to MOI/SFMC at least 2 weeks prior to the commencement of the training. The final version of the training manuals shall be available to the training course participants at the time the training commences.

E. Training sessions shall be formatted to maximize the usage of time of the attendees and

prevent redundant coverage of materials for advanced students. Training sessions shall be designed on the basis of experience and knowledge of the attendees scheduled to participate and shall differentiate between the requirements of supervisory, operations and maintenance personnel. The training programme shall be designed to cover:

1. The management, administration and expansion of the I2BS Platform, NIU, Server Hardware and Software.
2. Operations training for the I2BS components and the associated interfaces to the ELV systems components.
3. Maintenance of the I2BS Components
4. Alarm, report, trends, graphics and other Management Level functions.

F. The training shall be specific to this project and shall cover, at minimum, the following:

1. Data base features.
2. Operating sequence programming.
3. Operator interface features.
4. Information access.
5. The addition, deletion and amending of data to be transferred from one system to another.
6. Operator definable values.
7. Interfaces between the Extra Low Voltage Building Systems.
8. Other subjects necessary to ensure that the Operators, maintenance and supervisory staffs will be able to operate the I2BS without any on-going assistance from any outside party.
9. Performing real time control and monitoring functions.
10. Configuration of various subsystems including controllers and field level devices.
11. The uploading and downloading of controller configurations and field level devices.
12. The addition, deletion and reconfiguration of controllers and field level devices.
13. Logical programming of calculated points.
14. Graphics development and scripting and the inclusion of dynamic data.
15. Accessing images from the network video management system.
16. Addition, deletion and amending of reports.
17. Export of data to third party software such as Microsoft Excel.
18. Disaster recovery including the back up and restoration of I2BS software and databases.
19. Integration of a new building and the associated ELV Building Services Systems controllers.
20. The addition, deletion and amendment of data to be transferred from an ELV Building Services System to the I2BS.

G. Provide sufficient training to MOI/SFMC's staff such that they shall be able to:

1. Operate the I2BS systems without a requirement to refer to manuals or to contact the I2BS Contractor for assistance.
2. Amend, add and delete data in the databases.
3. Add and delete ELV systems that communicate with the I2BS systems.
4. Amend, add and/or delete data transfer between the Extra Low Voltage Building Systems that will communicate with one another as a result of this contract.
5. Provide data transfer between Extra Low Voltage Building Systems that do not communicate with one another as a result of this contract but which may be added in the future.
6. Configure protocols handled by the I2BS in addition to those provided under this contract.
7. Create backups of the database.

8. Restore database from backup.

H. In addition to the training detailed in 3.01.C above the I2BS Contractor shall provide on-going training at the I2BS Test Facility. MOI/SFMC's staff shall be involved in all aspects of the I2BS Test Facility operation during interoperability compliance testing and during the set up and testing of the Test Facility.

3.02 BORING AND PATCHING

A. The I2BS Contractor shall undertake boring and patching where necessary for the installation of I2BS components. Boring and patching shall meet, at minimum, the following requirements:
   1. Before undertaking any boring or patching obtain MOI/SFMC approval.
   2. Make boring with clean, square and smooth edges. Patches shall be inconspicuous in covered areas and visually undetectable in areas normally accessible to the tenants.
   3. Restore fire ratings if boring has violated the fire rated assemblies.

3.03 FIRE STOPPING

A. The MEP trade shall provide fire stopping for I2BS components. All conduit, cable, or cable tray penetrations of fire rated assemblies shall be sealed with code-approved fire stopping material. Seal or fire-stop shall meet, at minimum, the following requirements:
   1. Comply with all applicable codes, regulations and statutory requirements.
   2. Approved by the authority having jurisdiction.
   3. Firesafing system or device used shall not derate the ampacity of electrical cables passing through it.

3.04 HANGING AND SUPPORTING

A. Install all equipment, devices, materials and components in compliance with the manufacturer's recommendations. Supports shall be suitable for the environment within which the component is to be installed. Coordinate all hanging and supporting of components with all trades.

B. Boring and cutting shall be kept to a minimum and conducted in a neat and workmanlike manner. Provide reinforcing and fastening materials as necessary.

3.05 TESTING AND INSPECTIONS

A. Testing shall be undertaken at several stages during the project. A contract shall not be awarded to the I2BS Contractor until it has been demonstrated that the I2BS can meet all of the requirements of these Contract documents. Similarly an ELV Building Services System Contractor shall not receive a Contract until it has been determined that the interface between the I2BS Network Integration Unit and the ELV Building Services System controllers meets all of the requirements of these specifications. Once the Pre-Approval testing has determined that the I2BS and ELV Building Services System controllers can meet the requirements of their respective specifications and award of

contract has been confirmed, the following tests shall be undertaken:

1. Factory Tests – Software and hardware shall be thoroughly tested before it is shipped to the site.
2. Inspection/testing during installation.
3. Components shall be tested on site and shall be individually accepted by MOI/SFMC prior to the commencement of the acceptance testing of the integrated I2BS and ELV Building Services Systems.
4. Acceptance Testing of the installed integrated components.

B. Costs associated with the required inspections and testing shall be included in this scope of work. Additional charges will not be accepted. The I2BS Contractor shall make available all equipment as necessary to satisfactorily demonstrate the acceptability of the components and systems.

C. Any component furnished under this sub-contract shall be made available for inspections or tests, as deemed necessary by MOI/SFMC. Use of any component by MOI/SFMC and MOI/SFMC shall not imply acceptance of the system or acceptability of any component. Availability and demonstration of the systems shall not be withheld and the use of components shall not imply the start of the Defects Liability Period.

D. Installation, hardware, software and system personnel shall be available at all tests. These personnel shall be familiar with the installation and shall undertake all tests as requested by MOI/SFMC in order to verify that the I2BS components individually and in total meet the specifications.

E. Pre-Approval Testing of the I2BS:

1. The I2BS shall demonstrate within 30 days of receiving a letter of intent to award a Contract that the proposed I2BS can meet all of the requirements detailed in these Contract Documents.
2. Within 30 days of successfully completing the I2BS Pre-Approval Test the I2BS Contractor shall provide an ELV Building Services System test facility at a location to be assigned by MOI/SFMC.

F. Pre-Approval Testing of the ELV Building Service Systems Controllers:

1. The data transfer between the various Extra Low Voltage Building Services Systems controllers and the I2BS shall be demonstrated at a test facility established by the I2BS Contractor prior to the award of contract to the ELV Building Services System Contractors. The tests shall be fully coordinated by the I2BS Contractor. The I2BS Contractor shall liaise with each party concerned and shall ensure that the necessary test facilities, including a data port to a 10-gigabit per second Ethernet network, are available and operational. The IT & T/SCN Contractor shall provide the 10Gbps Data Network. The I2BS Contractor shall provide an I2BS Applications Server, Operator Workstation and a NIU. It shall be conclusively demonstrated that the Extra Low Voltage Building Services Systems can communicate via the NIU with the Applications Server and vice versa. If the test is successful a time shall be established that is acceptable to MOI/SFMC when the interface can be demonstrated. This test must be completed within 60 days of the issue of the letter of intent to award a contract for the Extra Low Voltage Building Services System. Each party involved in the test shall provide the applicable components necessary to perform the demonstration. Ensure the presence of suitably skilled personnel at the tests. The components provided for and the functions performed at the tests by each party shall be those that they are required to provide for the actual installation. The testing of the interface between the Extra Low Voltage

Building Services Systems controllers and the I2BS Management Level shall verify, at minimum, that:

a. All points mapped from the Extra Low Voltage Building Services System controllers to the I2BS Management Level are reported correctly at the I2BS workstation.
b. All mapped points are identical with regard to value, the engineering units and significant digits at both the sending Extra Low Voltage Building Services System controllers and the I2BS Management Level.
c. The communications watchdog is functioning correctly.
d. Communications speed between the systems is satisfactory.
e. Systems restart and communications between the systems resume following a power failure without operator intervention.
f. All response times with respect to the annunciation of changes of state and equipment alarms shall be shown to comply with the requirements detailed in these specifications and in the associated ELV Building Services System specifications.

2. Subsequent to the Pre-Approval testing detailed above at the I2BS Test Facility, the I2BS Contractor shall submit a report to MOI/SFMC detailing the results of the tests. An ELV Building Services System Contractor who cannot successfully demonstrate compliance with the requirements of the I2BS specification and the ELV Building Services System specifications with respect to the interoperability shall not be awarded a contract.
3. The I2BS Test Facility shall be the property of MOI/SFMC and shall be maintained operational under the maintenance and warranty requirements in the same way as any other item of equipment furnished under this contract.
4. The I2BS Test Facility shall be a major tool for the training of MOI/SFMC personnel. In addition to the training detailed in Part 3.01 above the I2BS Contractor shall provide on-going training at the I2BS Test Facility. MOI/SFMC staff shall be involved in all aspects of the I2BS Test Facility operation during interoperability compliance testing and during the set up and testing of the Test Facility.
5. The I2BS Contractor shall submit method statements outlining the procedures for Pre-approval tests to MOI/SFMC for approval.

G. Factory Tests/Software Tests:

1. All components shall be tested by the I2BS Contractor to ensure compliance with the specifications before they leave the I2BS Contractor's premises and shall be tested again on-site by the I2BS Contractor before the commencement of acceptance testing. The I2BS Contractor shall not ship components to the project site until they have been found to be fully compliant with the specifications.
2. Subsequent to the factory testing detailed above at the I2BS Contractors Facility, the I2BS Contractor shall submit a report to MOI/SFMC detailing the results of the tests.
3. If MOI/SFMC decides to witness the tests, MOI/SFMC, the I2BS Contractor and ELV Building Services System Contractors shall establish a mutually agreed time for the testing to take place.
4. The I2BS Contractor shall not commence installation on site until the approval of MOI/SFMC has been received and such approval shall not be given until such time as all interfaces/data exchanges have been successfully demonstrated off site. The I2BS Contractor shall have responsibility for the coordination of the tests and the reporting of the test results.
5. The I2BS Contractor shall develop and fully test all software required for the interface between the I2BS and equipment furnished by others prior to the

delivery of the associated hardware and software components to the project site. There shall be no software development on site except that associated with the entry of database items such as setpoints, alarm limits, control constants and schedules.

6. The interfaces between the NIU and the ELV Building Services Systems controllers shall be fully demonstrated to MOI/SFMC at the I2BS Contractor's facilities prior to the installation of any I2BS microprocessor based components at the project site. The demonstration shall include all hardware and software components associated with the interfaces.

H. Inspection During Installation:

1. Prior to commissioning tests, the I2BS shall be available for use by MOI/SFMC . Use by MOI/SFMC shall not imply acceptance of any component of the I2BS or the commencement of the Defects Liability Period.
2. Provide staff to assist MOI/SFMC in the inspections made during the installation period to review the progress and quality of the ongoing work. MOI/SFMC will generate Field Observation Reports on the findings of the inspection. MOI/SFMC shall advise the I2BS Contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The I2BS Contractor shall take corrective action to meet the requirement of the specifications.
3. Failure of MOI/SFMC to identify any error or omission during inspections shall not relieve the I2BS Contractor of any of the specification requirements and shall not imply that a deviation from the specification has been accepted.

I. Component Testing:

1. Prior to the scheduling of the final acceptance tests, the I2BS Contractor shall perform a complete and detailed operational check of each I2BS component.
2. The I2BS Contractor shall submit a report detailing the results of the component tests. MOI/SFMC shall determine from the reports whether or not the system is ready for final acceptance testing. If it is determined that the system is ready for final acceptance testing, the I2BS Contractor shall repeat the testing which shall be witnessed by MOI/SFMC.
3. MOI/SFMC shall prepare a deficiency list. Following the rectification of the deficiencies the testing shall be resumed on the defective components
4. All components testing involving the exchange of information between the I2BS and another system shall involve the Contractor of the other system.

J. Final Acceptance Testing:

1. Final Acceptance testing shall not commence until all components have been satisfactorily tested by the I2BS Contractor and the test results approved by MOI/SFMC.
2. The I2BS Contractor shall schedule a repeat of the system testing at a time convenient to MOI/SFMC. These tests for the verification by MOI/SFMC shall not be scheduled until the I2BS Contractor has verified that all systems are operating in accordance with the specifications.
3. Final acceptance testing of the I2BS shall comprise a demonstration to MOI/SFMC that all components meet specification. The demonstration shall be performed by the I2BS Contractor and shall be witnessed by MOI/SFMC. The I2BS Contractor shall remedy any deficiencies that are observed during the final acceptance testing and retesting shall be scheduled at a time suitable to MOI/SFMC. If there are deficiencies remaining after the follow-up final

acceptance testing that require further testing by MOI/SFMC , then the expenses of MOI/SFMC incurred in providing the additional follow-up tests to verify compliance with the specifications, including travel, subsistence, accommodation and normal consulting fees, shall be paid by the I2BS Contractor at no additional cost to MOI/SFMC .

4. The following shall be demonstrated as a minimum:
   a. Each and every software and hardware component of the I2BS meets specification.
   b. All data transfer between systems is undertaken as specified.
   c. All system alarms comply with the specification.
5. Testing of the I2BS during the systems and integrated testing shall be coordinated with all other trades associated with the system being tested. The system shall be tested as a complete entity during these tests. The I2BS portion of the systems shall not be tested in isolation.
6. Test Documentation:
   a. Test results shall be documented using test sheets. The test sheets shall be prepared in an appropriate format for the various tests. The final format of the proposed test forms shall be submitted by the I2BS Contractor for approval at the shop drawing stage. The I2BS Contractor shall make any changes requested by MOI/SFMC at no cost to MOI/SFMC.
   b. Completed test sheets indicating the test results for each I2BS test shall be submitted to MOI/SFMC at least 2 weeks prior to the proposed final acceptance tests. MOI/SFMC shall determine on the basis of the I2BS Contractor's system testing, whether or not it is appropriate to commence final acceptance tests. It shall be MOI/SFMC ’s decision as to whether the final acceptance tests can proceed as proposed by the I2BS Contractor or whether deficiencies have to be remedied and additional testing undertaken by the I2BS Contractor before the final acceptance tests can proceed.
   c. At minimum, component test sheets will be prepared to cover each of the following items:
      i. I2BS hardware including redundant server failover tests.
      ii. Information exchange between each system.
      iii. I2BS watchdog functions.
      iv. Other tests as considered necessary by MOI/SFMC.
   d. All test documentation shall be maintained in electronic format and in hard copy.
7. A method statement for the test procedure shall be submitted to MOI/SFMC for approval.

END OF SECTION 15925