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SYSTEM PERFORMANCE SPECIFICATION (SPS)

FOR
JOINT URBAN TEST CAPABILITY, LIVE URBAN AREA
INCREMENT 1

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System Performance Specification (SPS) For
Joint Urban Test Capability (JUTC)
Live Urban Area (LUA)
Increment 1

1. SCOPE.

This System Performance Specification (SPS) establishes the performance requirements for the design, development, test and installation of the Joint Urban Test Capability (JUTC) Live Urban Area (LUA), Increment 1. Increment 1 provides the initial capability for JUTC. The JUTC LUA will be located at the White Sands Missile Range (WSMR), New Mexico.

1.1 Identification.

The JUTC LUA will provide a reconfigurable live test facility representative of urban areas throughout the world. The primary use of the JUTC LUA will be to provide Developmental and Operational Testing for Department of Defense systems and systems of systems.

2. APPLICABLE DOCUMENTS.

The following documents form a part of this SPS to the extent specified herein. This SPS is designated as a first tier document. The documents referenced directly in this SPS are designated as second tier documents and are considered part of this SPS to the extent specified herein. Documents referenced in successive tiers are not part of this SPS and are to be used for guidance only.

2.1 Order of precedence.

In the event of a conflict between the text of this SPS and the references cited herein, the text of this SPS takes precedence. Nothing in this SPS, however, supersedes applicable laws and regulations, unless a specific exemption has been obtained.

2.2 Government documents.

Military Standards

MIL-STD-130N	-	Identification Marking of U.S. Military Property

Army Research Laboratory (ARL)

ARL-TR-439	-	Urban Terrain Building Types, 2nd Edition

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.302-308	-	Design Safety Standards for Electrical Systems

WSMR

156-A092-ENGSS	-	Real-Time Advanced Graphics Engine (RAGE) Operations Manual

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2.3 Non-Government documents.

American National Standards Institute (ANSI)

ANSI Z35.1-72	-	Specification for Accident Prevention Signs
ANSI Z35.4-73	-	Specification for Informational Signs Complementary to ANSI Z35.1, Accident Prevention Signs
ANSI Z53.1-79	-	Marking Physical Hazards Safety Color Code
ANSI Z535.3-2011	-	Criteria for Safety Symbols
ANSI Z535.4-2011	-	Product Safety Signs and Labels

National Fire Protection Association (NFPA)

NFPA 70	-	National Electric Code
NFPA 780	-	Standard for the Installation of Lightning Protection Systems

3. REQUIREMENTS.

Section 3 of this SPS defines the requirements that the JUTC LUA must meet to be acceptable. Each requirement is cross-referenced to the associated verification requirement in section 4.

3.1 LUA functional and performance requirements.

The LUA shall be located at WSMR on a government furnished area, which is approximately 200 meters (m) by 240m. The LUA equipment shall consist of Urban Building Replicas (UBRs), Sidewalks, Obstacles, and Utility Poles, as defined in this SPS.

3.1.1 Urban Building Replicas (UBRs).

The Live Urban Area shall include UBRs. The UBRs shall be modular, reconfigurable, and transportable. The UBRs shall represent the Dc5 (Commercial Buildings) and Do2 (Apartment Buildings) Urban Terrain Zones (UTZs), as defined in this SPS. UTZs are further described in the Army Research Laboratory Study, ARL-TR-439, Urban Terrain Building Types. The UBRs shall meet the specific UTZ required parameters defined in the following SPS paragraphs.

3.1.1.1 Technical Feasibility Test (TFT).

Two samples of the UBRs shall be subjected to a TFT in accordance with 4.1.

3.1.1.2 Initial UBR configuration.

Note: Due to the inherent modularity and reconfigurability of the UBRs, they can be configured and reconfigured into multiple arrangements. However, this initial configuration is the minimum defined capability for UBR arrangement. This allows for a configuration which can be

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used for deriving minimum quantities of UBR components and allows for an initial test configuration. The Contractor shall identify and provide all necessary support equipment. No support equipment is available at WSMR for this reconfiguration, i.e., cranes, forklifts, man lifts, etc.

The UBRs shall be configured initially to meet the requirements as defined in Figure 3-1, Initial LUA Configuration; Table 3-1, Initial UBR Configuration; and Table 3-2, UBR Material Types. Table 3-1 defines the UTZ type, minimum dimensions of the UBRs, the number of stories of the UBRs, the requirement for UBR interiors, and the requirement for electrical power distribution within each of the UBRs. Low fidelity UBRs are UBRs with limited interior features. High fidelity UBRs are UBRs with significant interior features, such as many interior rooms, stairs, and interior doors. High fidelity UBRs are defined in section 3.1.1.5. Table 3-2 defines the material types which initial UBRs shall be capable of representing.

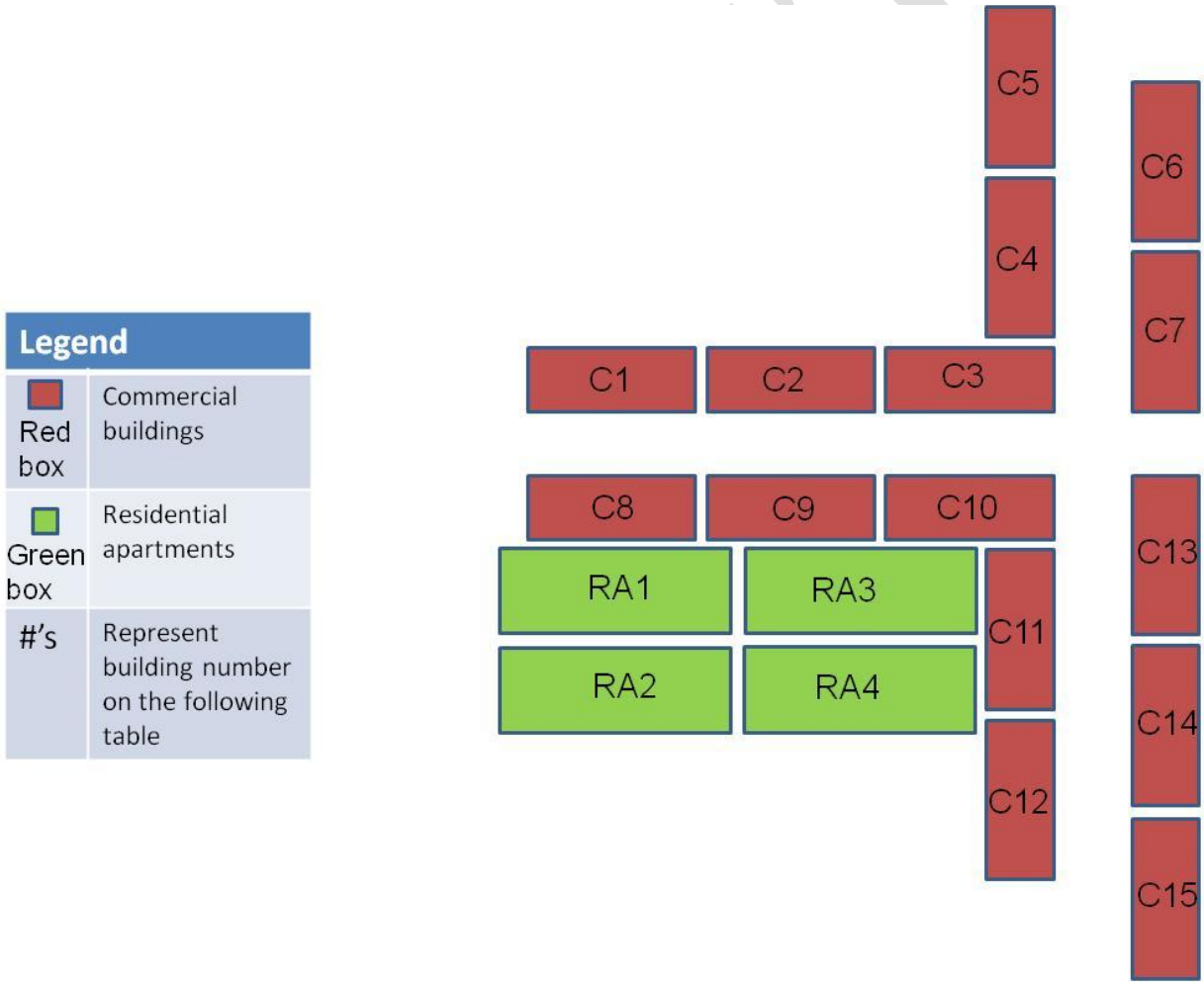

Figure 3-1 Initial LUA Configuration

Table 3-1 Initial UBR Configuration

UBR Number Per Figure 3-1	UTZ	Footprint (meters)	Stories	Low or High Fidelity Interiors	Electrical Power
C1	Dc5	25X10	4	Low Fidelity	Yes
C2	Dc5	25X10	5	Low Fidelity	Yes
C3	Dc5	25X10	5	High Fidelity	Yes
C4	Dc5	25X10	3	Low Fidelity	No
C5	Dc5	25X10	3	Low Fidelity	No
C6	Dc5	25X10	3	High Fidelity	Yes
C7	Dc5	25X10	4	Low Fidelity	No
C8	Dc5	25X10	5	Low Fidelity	No
C9	Dc5	25X10	4	High Fidelity	Yes
C10	Dc5	25X10	5	Low Fidelity	No
C11	Dc5	25X10	2	Low Fidelity	Yes
C12	Dc5	25X10	2	Low Fidelity	No
C13	Dc5	25X10	4	Low Fidelity	No
C14	Dc5	25X10	2	High Fidelity	Yes
C15	Dc5	25X10	2	Low Fidelity	No
RA1	Do2	25X16	5	Low Fidelity	No
RA2	Do2	25X16	5	High Fidelity	Yes
RA3	Do2	25X16	5	High Fidelity	Yes
RA4	Do2	25X16	5	Low Fidelity	Yes

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Table 3-2 Initial UBR Material Types

UBR Number Per Figure 3-1	Material Representation	Frame or mass type	Type of infill or cladding (material to be represented)
C1	reinforced concrete w/infill walls	frame	Terra Cotta
C2	reinforced concrete w/infill walls	frame	Terra Cotta
C3	reinforced concrete w/infill walls	frame	Terra Cotta
C4	reinforced concrete w/infill walls	frame	Terra Cotta
C5	reinforced concrete w/infill walls	frame	Terra Cotta
C6	reinforced concrete w/infill walls	frame	CMU
C7	reinforced concrete w/infill walls	frame	CMU
C8	steel-framed light cladding	frame	Steel
C9	steel-framed light cladding	frame	Brick Veneer
C10	steel-framed light cladding	frame	Concrete Aggregate
C11	reinforced concrete w/infill walls	frame	CMU
C12	reinforced concrete w/infill walls	frame	CMU
C13	reinforced concrete w/infill walls	frame	Brick
C14	concrete masonry unit (CMU)	mass	CMU
C15	kiln-fired brick	mass	Brick
RA1	reinforced concrete w/infill walls	frame	CMU
RA2	steel-framed w/light cladding	frame	Concrete Aggregate
RA3	reinforced concrete w/infill walls	frame	Terra Cotta
RA4	mass concrete - box wall	mass	Reinforced Concrete

3.1.1.3 Secondary UBR configuration.

Note: This secondary UBR configuration allows for demonstration of the reconfigurability of the UBRs.

The UBRs shall be reconfigured from the initial configuration to the secondary configuration to meet the requirements as defined in Figure 3-2, Secondary LUA Configuration; Table 3-3, Secondary UBR Configuration; and Table 3-4, Secondary UBR Material Types. Table 3-3 defines the UTZ type, minimum dimensions of the UBRs, the number of stories of the UBRs, the requirement for UBR interiors, and the requirement for electrical power distribution within each of the UBRs. Table 3-4 defines the material types which secondary UBRs shall be capable of representing.

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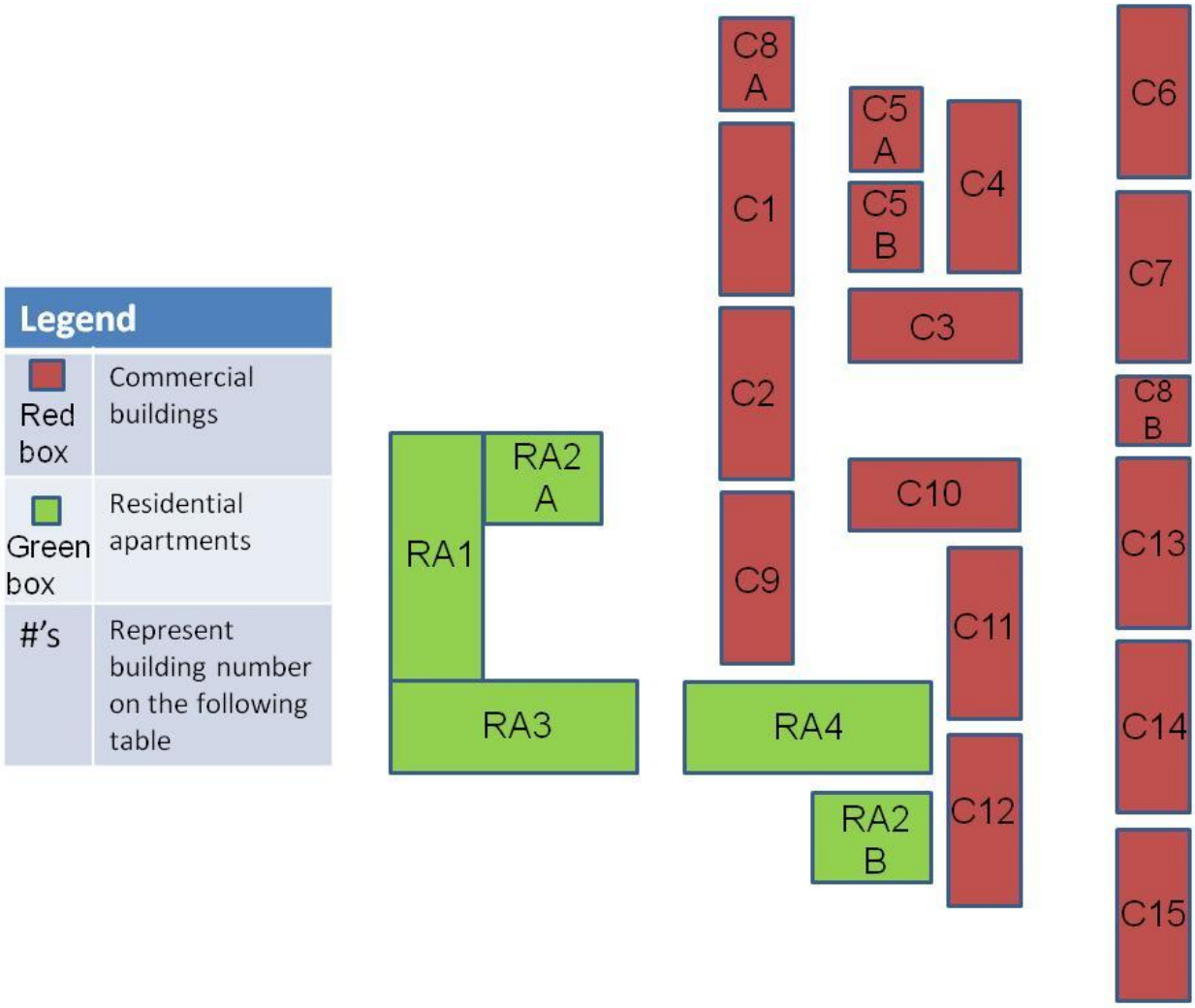

Figure 3-2 Secondary LUA Configuration

Table 3-3 Secondary UBR Configuration

UBR Number Per Figure 3-2	UTZ	Footprint (meters)	Stories	Low or High Fidelity interiors	Electrical Power
C1	Dc5	25X10	4	Low Fidelity	Yes
C2	Dc5	25X10	5	Low Fidelity	Yes
C3	Dc5	25X10	5	High Fidelity	Yes
C4	Dc5	25X10	3	Low Fidelity	No
C5 A	Dc5	13X10	2	Low Fidelity	No
C5 B	Dc5	12X10	4	Low Fidelity	No

C6	Dc5	25X10	3	High Fidelity	Yes
C7	Dc5	25X10	4	Low Fidelity	No
C8 A	Dc5	15X10	5	Low Fidelity	No
C8 B	Dc5	10X10	5	Low Fidelity	No
C9	Dc5	25X10	4	High Fidelity	Yes
C10	Dc5	25X10	5	Low Fidelity	No
C11	Dc5	25X10	2	Low Fidelity	Yes
C12	Dc5	25X10	2	Low Fidelity	No
C13	Dc5	25X10	4	Low Fidelity	No
C14	Dc5	25X10	2	High Fidelity	Yes
C15	Dc5	25X10	2	Low Fidelity	No
RA1	Do2	25X16	5	Low Fidelity	No
RA2 A	Do2	10X16	5	High Fidelity	Yes
RA2 B	Do2	15X16	5	High Fidelity	Yes
RA3	Do2	25X16	5	High Fidelity	Yes
RA4	Do2	25X16	5	Low Fidelity	Yes

Table 3-4 Secondary UBR Material Types

UBR Number Per Figure 3-2	**Material Representation**	**Frame or mass type**	**Type of infill or cladding (material to be represented)**
C1	reinforced concrete w/infill walls	frame	Terra Cotta
C2	reinforced concrete w/infill walls	frame	Terra Cotta
C3	reinforced concrete w/infill walls	frame	Terra Cotta
C4	reinforced concrete w/infill walls	frame	Terra Cotta
C5 A	reinforced concrete w/infill walls	frame	Terra Cotta
C5 B	reinforced concrete w/infill walls	frame	Terra Cotta
C6	reinforced concrete w/infill walls	frame	CMU
C7	reinforced concrete w/infill walls	frame	CMU
C8 A	steel-framed light cladding	frame	Steel

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C8 A	steel-framed light cladding	frame	Steel
C9	steel-framed light cladding	frame	Brick Veneer
C10	steel-framed light cladding	frame	Concrete Aggregate
C11	reinforced concrete w/infill walls	frame	CMU
C12	reinforced concrete w/infill walls	frame	CMU
C13	reinforced concrete w/infill walls	frame	Brick
C14	concrete masonry unit (CMU)	mass	CMU
C15	kiln-fired brick	mass	Brick
RA1	reinforced concrete w/infill walls	frame	CMU
RA2 A	steel-framed w/light cladding	frame	Concrete Aggregate
RA2 B	steel-framed w/light cladding	frame	Concrete Aggregate
RA3	reinforced concrete w/infill walls	frame	Terra Cotta
RA4	mass concrete - box wall	mass	Reinforced Concrete

3.1.1.3.1 Secondary UBR configuration timeframe.

The reconfiguration time from the Initial LUA Configuration to the Secondary LUA Configuration shall not exceed 60 calendar days. A maximum of 2500 man hours over the 60 calendar day period shall be utilized for total reconfiguration. The contractor shall identify all the necessary support equipment to accomplish this reconfiguration.

Note: The Contractor shall provide all necessary support equipment. No support equipment is available at WSMR for this reconfiguration, i.e., cranes, forklifts, man lifts, etc.

3.1.1.4 UBR reconfigurability.

The UBRs shall be reconfigurable with regards to the characteristics and parameters as follows:

i. Physical Size (width and depth of UBRs).

ii. Height (number of stories, maximum five stories). A story shall be 3m in height.

iii. Density (spacing between UBRs).

iv. Roof Configuration (reconfigurable from flat roof to and from pitched roof).

v. Roof Parapet (flat roofs shall have the capability to be configured with parapets).

vi. Exterior Windows and Doors (size and location). Windows and door shall be functional for use.

vii. Interiors of the UBRs, for high fidelity, (reconfigurable with regards to interior walls, stairs, and doors).

Note: The Government will provide additional reconfigurability metrics in the final SPS.

3.1.1.5 High fidelity UBRs.

The following features shall be required for all High Fidelity UBRs:

i. Shall include roof access to personnel. Roof access shall be provided with existing infrastructure in the UBR.

ii. Shall include ceilings that are representative of Dc5 and Do2 UTZs.

iii. Shall include floors that are representative of Dc5 and Do2 UTZs.

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iv. Shall include stairs representative of Dc5 and Do2 UTZs.

v. Shall include interior rooms representative of Dc5 and Do2 UTZs.

vi. Shall include access doors representative of Dc5 and Do2 UTZs to all interior rooms.

Note: The Government will provide additional Dc5 and Do2 representative UTZ metrics in the final SPS.

3.1.1.6 UBR placement on compacted earth.

UBRs shall meet all requirement of this SPS when placed on 95% compacted earth with a grade ranging between a minimum of 1 percent to a maximum of 3 percent. The UBRs shall not exceed the bearing capacity of the compacted earth.

Note: Bearing capacity values will be provided by the Government in the final SPS.

3.1.1.6.1 Compacted earth area.

UBRs shall meet all requirement of this SPS when placed in an area approximately 200m by 240m. This area shall include the space required for all support equipment, i.e., cranes, forklifts, man lifts, etc.

Note: Exact area dimensions will be provided by the Government in a scaled figure for the final SPS.

3.1.1.7 UBR material realism.

The UBRs shall realistically represent building types listed in Table 3-2, Initial UBR Material Types with regards to the following physical properties:

i. Radio Frequency (1 MHz to 8 GHz).

ii. Infrared (short wave, medium wave, and long wave).

iii. Laser Reflectance (1.06 μm laser wavelength).

iv. Acoustics (20 Hz to 20,000 Hz).

v. Visible Light (visually representative).

Note: Acceptance criteria for material realism are currently being developed by the Government and will be included in final SPS.

3.1.1.8 UBR cable distribution.

The UBRs shall accommodate the installation of communication cabling after the configuration of UBRs has been accomplished. UBR cable distribution shall accommodate cabling from every room inside the UBR to a central location within the UBR.

3.1.1.9 UBR electrical power distribution.

The UBRs shall include the distribution of electrical power both in the interior and exterior of UBRs. All UBRs shall have electrical power distribution capability; however, electrical distribution shall be initially required for the UBRs listed in Tables 3-2 and 3-4 with electrical power defined as “yes”.

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3.1.1.9.1 UBR electrical power interface.

The electrical interface to each UBR shall be 80 amps, 208 volts, 3 phase, 60 Hz. This electrical interface shall be provided for each floor of the UBR. The electrical interface shall be convertible to support 50 Hz.

3.1.1.9.2 UBR electrical power generator.

UBRs shall have the capability to be powered through a diesel electrical generator placed inside the UBR. The generators shall have provisions to minimize acoustic noise. Generator exhaust shall be adequately vented to meet safety regulations.

Note: Government will provide additional detail to include power output, acoustic noise levels, safety requirements, and operating time.

3.1.1.9.2.1 UBR electrical power generator quantity.

A minimum of 9 generators shall be provided to power the UBRs, as shown in Table 3-1 and Table 3-3. A minimum of 1 generator shall have 50 Hz power output capability.

3.1.1.9.3 UBR electrical power and lighting.

UBRs shall include an electrical light for every interior room, in every high fidelity interior UBRs. Lights shall be controllable within each room. Lights shall consist of a combination of fluorescent and incandescent. An outdoor light shall be provided near every door of a UBR that has electrical power. In the low fidelity powered UBRs, lighting shall be provided per floor.

3.1.1.9.4 UBR electrical power receptacles.

UBRs shall include quad AC power outlets in all high fidelity interior rooms. In addition, external outlets shall be provided near every door of a UBR that has electrical power. In the low fidelity powered UBRs, quad AC power outlets shall be provided per floor.

3.1.1.9.5 Electrical power master switch.

Each UBR shall have a master switch that can turn off all electrical power to that UBR. In addition, there shall be a power switch at each floor for each powered UBR.

3.1.1.10 UBR mounting apparatus.

3.1.1.10.1 UBR instrumentation mounting.

The UBRs shall provide mounting for various instrumentation equipment (cameras, speakers, microphones, etc). Mounts shall be reconfigurable with regards to location, both on the exterior and interior of the UBRs. Mounting apparatus for instrumentation shall be standardized so that any instrumentation device can be mounted on any mount.

3.1.1.10.2 UBR equipment mounting.

The UBRs shall provide mounting for other equipment, such as lighting, signage, antennas, and air conditioning units (both roof mounted and window mounted).

3.1.1.11 UBR weatherproofing.

The UBRs shall be weather tight, sealed against wind-driven sand, and sealed against intrusion of rodents and other animals.

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3.1.1.12 Flooring gridlines.

Gridlines shall be provided on all floors in high fidelity UBRs. Gridlines shall have a minimum spacing of 0.5m. Each gridline shall be labeled.

3.1.2 Urban area sidewalks.

The LUA shall include Urban Area Sidewalks.

3.1.2.1 Sidewalk dimensions.

The sidewalks shall be 100m in length and be 1.2m wide. The sidewalks shall be provided in 2m lengths.

3.1.2.2 Sidewalk reconfiguration.

Sidewalks shall be reconfigurable and transportable and placed within the JUTC LUA.

3.1.2.3 Sidewalk representation.

Sidewalks shall not contain metal and shall have reinforcement (such as fiberglass) to prevent cracking.

3.1.3 Urban area obstacles.

The LUA shall include Urban Area Obstacles (i.e., curbs).

3.1.3.1 Obstacle dimensions.

The Obstacles shall be 52m in length and be 0.15m and 0.30m in height. The Obstacles shall be provided in 2m lengths. 26m shall be 0.15m in height and the other 26m shall be 0.30m in height.

3.1.3.2 Obstacle reconfiguration.

Obstacles shall be reconfigurable and transportable and placed within the JUTC LUA.

3.1.3.3 Obstacle representation.

Obstacles shall not contain metal and shall have reinforcement (such as fiberglass) to prevent cracking.

3.1.4 Utility poles.

The LUA shall include Utility Poles.

3.1.4.1 Utility pole placement.

All UBRs shall have the capability to mount utility poles to each corner of the UBR. In addition, mounting points shall be provided at a minimum distance of 38m apart.

3.1.4.2 Utility pole quantity.

20 Utility Poles shall be provided in the LUA. The 20 utility poles shall be mounted as part of the initial configuration and secondary configuration.

3.1.4.3 Utility pole material.

10 utility poles shall be made of wood and the other 10 shall be made of metal.

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3.1.4.4 Utility pole cable mounting.

Appropriate hardware shall be provided for mounting communication and power cabling.

3.1.5 Durability.

The LUA equipment shall be designed for a lifespan of 20 years and a minimum of three reconfigurations per year.

3.1.6 Environmental conditions.

The LUA equipment shall withstand the following environmental conditions without deterioration:

i. Ambient Temperature:

-20°F to + 120°F

ii. Wind Loading:

120 miles per hour

3.1.7 Transportability.

All LUA equipment shall be transportable within the WSMR LUA.

3.1.8 Materials and processes.

Materials and processes shall be in accordance with the following requirements. Commercial and Non-Developmental Items (CaNDI) and GFE are exempt from these requirements, unless otherwise specified in this section. CaNDI must comply with the Government's definitions in order to be exempt.

3.1.8.1 Parts.

The LUA hardware shall be comprised of CaNDI to the maximum extent practicable. LUA Peculiar Equipment shall be kept to a minimum.

3.1.8.2 Materials.

Materials selected for the LUA hardware shall meet the following additional performance requirements:

i. Except in the case of consumable items, materials used shall preclude deterioration in performance and appearance over the 20 year service life of the equipment.

ii. When it is commercially practicable, materials selected shall allow LUA-peculiar parts to be repairable by commonly applied commercial processes.

iii. Materials selected shall withstand, without deterioration, the effects of the environment in which the equipment will be operated, stored, and transported.

iv. Materials selected shall preclude exposure of personnel, facilities, and the environment to toxic, explosive, and fire hazards throughout the life cycle of the equipment and thereafter.

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3.1.8.2.1 Flammable materials.

Materials shall be noncombustible or fire retardant in the most hazardous conditions of atmosphere, pressure, and temperature to be expected in their application. Nonpermanent fire retardant additives shall not be used to achieve fire retardation.

3.1.8.2.2 Fungus-inert materials.

When the specified environment is conducive to fungus growth, the equipment shall be fabricated using fungus-inert materials.

3.1.8.2.3 Hazardous materials.

The LUA shall not expose personnel or the environment to excessive levels of toxic, carcinogenic, teratogenic, and otherwise hazardous materials as defined by OSHA and the Environmental Protection Agency (EPA). If hazardous materials must be used in order to meet the performance requirements of this SPS, only Government-authorized materials shall be used, the hazardous items shall be suitably marked, and all due precautions shall be taken to prevent whatever harm the hazardous material may cause.

3.1.8.2.4 Metals.

Metals shall be corrosion-resistant, or shall be coated or metallurgically processed to resist corrosion. The environmental conditions to which the equipment will be exposed shall not cause corrosion and shall not cause deterioration of metal parts.

3.1.8.2.5 Ozone-Depleting Substances (ODS).

The use of substances classified as Class I ODS, shall be avoided unless there is no suitable non-ODS alternative available.

3.1.8.2.6 Wood products.

Wood products shall be treated for preservation, fire-retardation, and termite protection, and shall conform to commercial Grade B or better.

3.1.8.2.7 Radioactive material.

Radioactive materials shall not be utilized unless specifically authorized in writing by the Government.

3.1.8.3 Processes.

Processes shall be in accordance with established industry standards (e.g., American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), Institute of Electrical and Electronic Engineers (IEEE), etc.). The following additional requirements shall apply to the fabrication of LUA equipment, unless otherwise specified.

3.1.8.3.1 Protective finishes and coatings.

Class I ODS-based primers, coatings, and solvents shall be avoided.

3.1.8.3.1.1 Painting, and preparation for.

Surfaces to be painted shall be prepared and painted in accordance with the paint manufacturer's recommendations. Class I Ozone-Depleting Substances based solvents shall be avoided in the surface preparation process.

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3.1.8.3.2 Corrosion prevention.

The LUA equipment shall not be subject to corrosion and shall not be subject to other forms of physical deterioration in its intended use. The following is a list of characteristics, not all inclusive, that may contribute to such corrosion and deterioration and shall be avoided:

i. Crevices susceptible to moisture collection.

ii. Galvanic metal couples over 100 mV potential difference.

iii. Moisture-tight designs without proper seals.

iv. Unprotected bearings.

v. Untested adhesively bonded designs (stress and humidity tests).

vi. Metallic material where nonmetallic is suitable.

vii. Hardware requiring field maintenance for corrosion control.

3.1.9 Nameplates or product markings.

LUA equipment and cables shall be identified and marked in accordance with the following requirements. Markings shall be permanent, securely fastened, and shall withstand the operational and storage environment, environmental testing, and cleaning procedures. Legibility shall be as required for ready readability. Markings shall be of a color which is in contrast to the color of the background surface. Markings of items shall not adversely affect the life and utility of the item. Letters shall be without serifs (sans-serifs) such as Gothic or Futura capitals, and the numerals shall be Arabic, except when Roman numerals are used for type designations.

3.1.9.1 Unique identification.

Each hardware article or a repairable unit formed by a grouping of subassemblies, components or constituent parts shall have a Department of Defense human and machine readable unique identification (UID) with bar code label marking (or equivalent Radio Frequency Identification) per MIL-STD-130N, Figure 2.c (construct #2). The UID shall be derived by concatenating data identifier 17V, Cage Code 57039, followed by the item part number, followed by the serial number. LUA components shall be identifiable both when deployed in the LUA and when in storage.

3.1.9.2 Cable and wire markings.

Disconnectable cables and wires shall be permanently and legibly marked in accordance with the following requirements, which shall apply to all equipment categories (i.e., LUA equipment, CaNDI, GFE, and CAOE). Types of disconnectables include plugs, jacks, lugged terminals, push-on captivated wires. Jumpers or links located on terminal boards, jacks or plugs are exempt from such marking. Soldered or wire wrap connections are also exempt from such marking. Markings shall not damage the wires or cables attached to and shall be located within approximately 8 cm from the connector, terminal or plug, oriented in such a manner as to be readable without removal of the wire or cable or support clamps.

3.1.9.2.1 Cable marking method.

The following methods shall be used to mark cables and wires:

i. Molded on the cable.

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ii. Stamped on the cable.

iii. Securely attached, appropriately marked plastic bands (no less than .25 mm thickness).

iv. Bands of appropriately marked heat shrinkable tubing.

3.1.9.2.2 Cable marking information.

The following information shall be marked on all disconnectable cables.

3.1.9.2.2.1 "W" and "P" cable designations.

A "W" designation (W1, W2, etc.) shall be assigned to uniquely identify cables and wires. The numerical portion of the "W" designations shall be consecutive throughout the LUA. In addition, each connector within the same cable shall be identified with a "P" designation (P1, P2, etc). The numerical portion of the "P" designations shall be consecutive for a given cable. The "W" and "P" designations shall be marked on cables in accordance with Figure 3-3.

3.1.9.2.2.2 To-from designators.

In addition to the "W" and "P" designations, cable and wire markings shall also include "to-from" reference designators to identify the locations where they are connected. Cables and wires internal to subassemblies are not required to be marked with the "from" designator. The "to-from" designators shall be marked on cables in accordance with Figure 3-3.

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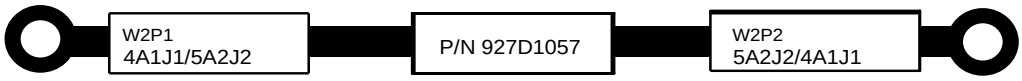
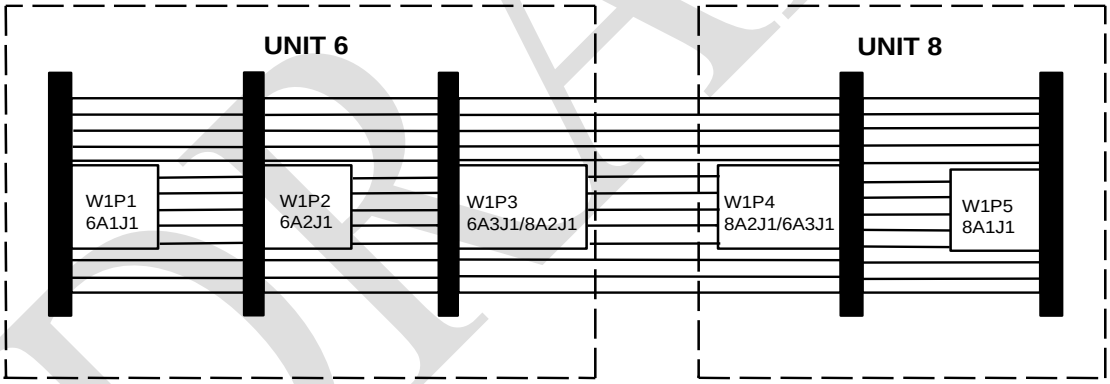
Basic inter-cabinet cable:



Multiple destination cable:

Terminal wire marking:

Daisy chain, continuous ribbon cable with clamp on connectors:



NOTE (1) PREFIX MAY BE OMITTED FOR WIRES OR CABLES LOCATED ENTIRELY WITHIN THE SAME CABINET.

NOTE (2) FOR PURPOSES OF THESE MARKING REQUIREMENTS, UNITS COMPRISED OF MULTIPLE CABINETS OR BAYS PERMANENTLY WELDED OR BOLTED TOGETHER SHALL BE CONSIDERED AS HAVING SEPARATE CABINETS.

NOTE (3) THE UNDERLYING CRITERIA FOR WIRE AND CABLE MARKING SHALL BE EASE OF MAINTENANCE AND REDUCTION OF CHANCES FOR MISCONNECTION.

Figure 3-3 Examples of Cable Markings

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3.1.9.3 Safety markings.

Danger, caution, and warning signs, labels, and markings shall be used to warn of specific hazards such as voltage, current, thermal, or physical. Guards, barriers, and access doors, covers, or plates shall be marked to indicate the hazard which may be present upon removal of such devices. When possible, marking shall be located such that it is not removed when the barrier or access door is removed. Additionally, hazards internal to units shall be marked adjacent to hazards if they are significantly different from those surrounding items. Physical hazards shall be marked in accordance with ANSI Z53.1-79. Voltage hazards shall be marked in accordance with ANSI Z35.1-72, and ANSI Z35.4-73.

3.1.10 System safety.

3.1.10.1 Environmental safety.

LUA equipment shall be safe to operate and maintain and shall not present uncontrolled safety, health, or environmental hazards to operators and maintainers throughout the life cycle of LUA equipment. LUA equipment shall comply with 29 CFR 1910.302-308, and NFPA 70. LUA equipment shall provide fail safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal. Commercial off the Shelf (COTS) equipment shall be certified as meeting the requirements of a nationally accredited safety-testing laboratory for its intended use (i.e., UL).

3.1.10.2 Hazardous materials.

LUA equipment shall not incorporate hazardous material, such as asbestos; glass fiber materials (as the outer surface or covering on cables, wire, or other items where they may cause skin irritation to operating personnel); Halon or other Ozone-depleting substances. When maintenance procedures require access to glass fibers, such as insulation, a caution note alerting maintenance personnel shall be visible. LUA equipment shall preclude exposure of personnel or the environment to excessive levels of toxic, carcinogenic, or otherwise hazardous materials as defined by the Occupational Health and Safety Administration (OSHA), Environmental Protection Agency (EPA), and the Department of Transportation (DOT).

3.1.10.3 Personnel safety.

LUA equipment shall provide maximum safety to personnel when installing, operating, adjusting and maintaining the equipment. Cables shall be minimized and located to preclude tripping hazards or damage to cables. The equipment shall conform to 8-hour time weighted average sound level of 85 dBA for steady-state and 140 dBP for impulse noise. The design of the equipment shall provide user personnel maximum access and safety while operating and maintaining the equipment. Equipment and transit cases housing equipment shall be designed, installed, and labeled so that it can be removed, handled, and lifted safely. Single person lift limits for equipment are as follows:

Handling Function	1-person (male/female) Lbs	2-Person Lbs	4-Persons Lbs
Equipment lifted less than five feet above the floor	37	74	128

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Equipment lifted less than three feet above the floor	44	88	154
Equipment designed to be carried 33 feet or less	42	84	147

3.1.10.4 Mechanical safety.

Moving parts shall be guarded or provided with safety devices to prevent mechanical injury to operator and maintenance personnel. Edges and corners shall be rounded and free from burrs. Center of gravity shall be such that equipment is stable and easy to handle.

3.1.10.5 RF safety.

Antennas and other devices that carry sufficient RF voltage to burn or injure personnel shall be protected from accidental contact in the same manner as for AC voltages. Microwave or RF radiation signs shall be permanently affixed to warn personnel of danger zones.

Antenna tips or other sharp rods shall have tip caps or other suitable design fixture to prevent puncture hazards to eyes, etc., where personnel are likely to be exposed to such hazards. Where design considerations permit, antennas shall be coated with a dielectric material to insulate against at least 10,000 volts Root Mean Squared (RMS). To assure adequate lightning protection, the following design features are required for all fixed, semi-permanent, and mobile facilities that incorporate antenna tower/masts:

i. Antenna masts must incorporate a ground stud with the necessary hardware to permit secure attachment of a ground strap/rod.

ii. Lead-in wires require discharge units (lightning arrestors) on each conductor or enclosure in a continuous metallic shield that is effectively grounded; coaxial cable lead-in may be used as is if the outer shields are grounded at both ends.

iii. Ground resistance shall be less than 10 Ohms.

3.1.10.6 Electrical safety.

LUA equipment shall have the following basic capabilities:

i. All installed electrical infrastructure shall be in compliance with the latest version of NFPA 70 unless otherwise directed.

ii. All installed electrical infrastructure shall be grounded IAW the requirements defined in NFPA 70.

iv. All installed electrical infrastructure shall be protected from lightning IAW the requirements defined in NFPA 780.

v. All conduit, raceway, boxes, cabinets, cabling and components shall be in accordance with NFPA 70 unless otherwise directed.

vi. Applicable danger, caution, and warning signs shall be designed and installed in accordance with ANSI Z535.3-2011 and ANSI Z535.4-2011 to warn user personnel of specific hazards such as voltage, current, and thermal.

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3.1.10.7 Equipment energized from multiple power sources.

A warning label in accordance with Figure 3-4 shall be securely affixed to electrical and electronic units which have more than one source of electrical power. The warning label shall be located in such a manner as to allow operation and maintenance personnel to identify all of the circuits providing electrical power, and the location and designation of the de-energizing switches. Method of applying, permanency, legibility, and lettering shall be as specified in 3.1.99.

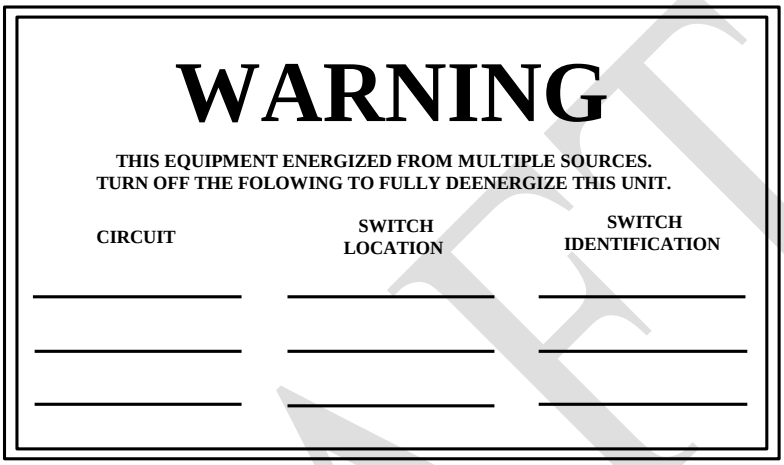

Figure 3-4 Multiple Power Source Label

3.1.11 Quantitative maintainability requirements.

Quantitative maintainability requirements for the entire LUA shall be a Mean-Time-To-Repair (MTTR) of ___ minutes, a Maximum-repair-time (MMAX) of ___ minutes to the 90th percentile for Unscheduled On-site Maintenance and a Mean-Preventive-Maintenance-Time (MPT) of __ minutes per day for Scheduled Maintenance.

Note: The Government will provide maintainability requirements in the final version of this SPS.

3.2 LUA configuration software.

The LUA configuration software shall be compatible and able to run on all current Microsoft Windows platforms.

3.2.1 3-Dimensional (3-D) model.

The LUA configuration software shall provide an accurate 3-D model of the physical LUA configuration. This model will provide a dynamic, interactive module that allows customization and reconfiguration based on the live urban area configuration.

3.2.2 Configuration.

The LUA configuration software shall facilitate the initial configuration and reconfiguration of the JUTC LUA equipment. The LUA configuration software shall identify components required to build each UBR and other LUA equipment.

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3.2.3 Real-Time Advanced Graphics Engine (RAGE) interface.

Data generated from the LUA configuration software shall interface to the Real-Time Advanced Graphics Engine (RAGE) software suite at WSMR. RAGE interface is defined by the RAGE Operations Manual, 156-A092-ENGSS.

4. VERIFICATION.

This section includes all verifications to be performed to determine that LUA equipment offered for acceptance conforms to all requirements in Section 3 of this SPS.

4.1 Technical Feasibility Test.

The TFT shall consist of two UBRs. These two UBRs shall conform to the specifications of UBRs C5 and RA2 as identified in Table 3-1. Additionally, in order to verify the reconfigurability of the UBRs, UBR C5 shall be reconfigured to conform to the specification of UBR C5 A and UBR C5 B, as identified in table 3-3. Furthermore, UBR RA2 shall be reconfigured to conform to the specification of UBR RA2 A and UBR RA2 B, as identified in Table 3-3. The TFT UBRs shall be required to meet specification requirements prior to producing additional UBRs. The TFT shall be conducted in accordance with the verification requirements as defined in the following sections.

4.2 Inspection conditions.

Unless otherwise specified, all inspections shall be performed in prevailing environmental conditions that define normal range operations.

4.3 Methods of verification.

Methods utilized to accomplish verification include:

i. Analysis. An element of verification that utilizes established technical or mathematical models or simulations, algorithms, charts, graphs, circuit diagrams, or other specific scientific principles and procedures to provide evidence that state requirements were met.

ii. Demonstration. An element of verification that generally denoted the actual operation, adjustment, or re-configuration of items to provide evidence that the designed functions were accomplished under specific scenarios. The items may be instrumented and quantitative limits of performance monitored.

iii. Test. An element of verification and inspection that generally denoted the determination, by technical means, of the properties or elements of items, including functional operation, and involves the application of established scientific principles and procedures.

iv. Examination. An element of verification and inspection consisting of investigation, without the use of special laboratory appliances or procedures, of items to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally nondestructive and typically includes the use of sight, hearing, smell, touch, and taste; simple physical manipulation; mechanical and electrical gauging and measurement; and other forms of investigation.

v. Certification. An element of verification that that generally denotes or documents the prior conduct of formal test verification, and relies on documented test results, performance

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data, analytical data, or vendor documentation. The items require that the contractor certify that the requirements have been met.

4.4 Classification of inspections.

The inspection requirements specified herein are classified as follows:

i. Qualification Inspection. Typically associated with the verification activities of test, analysis, and demonstration. These efforts align with verification of measurable attributes of the LUA equipment.

ii. Conformance Inspection. Typically associated with the verification activities of examination and demonstration. These efforts align with verification of non-measurable or non-quantifiable attributes of the LUA equipment.

4.5 Requirements.

The requirements shall be verified through conformance inspection of the fielded LUA equipment, as defined in Table 4-1.

Table 4-1 Requirement/Verification Cross-Reference Matrix

Section 3 Requirement	A	D	T	E	C
3.1 LUA functional and performance requirements.		√			
3.1.1 Urban Building Replicas (UBRs).		√		√	
3.1.1.1 Technical Feasibility Test (TFT).	√	√	√	√	√
3.1.1.2 Initial UBR configuration.		√		√	
3.1.1.3 Secondary UBR configuration.		√		√	
3.1.1.3.1 Secondary UBR configuration timeframe.		√		√	
3.1.1.4 UBR reconfigurability.		√		√	
3.1.1.5 High fidelity UBRs		√		√	
3.1.1.6 UBR placement on compacted earth.	√	√	√	√	√
3.1.1.7 UBR material realism			√	√	
3.1.1.8 UBR cable distribution		√		√	
3.1.1.9 UBR electrical power distribution		√		√	
3.1.1.9.1 UBR electrical power interface		√	√	√	
3.1.1.9.2 UBR electrical power generator		√	√	√	

3.1.1.9.3 UBR electrical power and lighting		√	√	√	
3.1.1.9.4 UBR electrical power receptacles		√	√	√	
3.1.1.9.5 Electrical power master switch		√		√	
3.1.1.10 UBR mounting apparatus	√	√		√	
3.1.1.10.1 UBR instrumentation mounting		√		√	
3.1.1.10.2 UBR equipment mounting		√		√	
3.1.1.11 UBR weatherproofing		√		√	
3.1.1.12 Flooring gridlines				√	
3.1.2 Urban area sidewalks.				√	
3.1.2.1 Sidewalk dimensions.				√	
3.1.2.2 Sidewalk reconfiguration.		√			
3.1.2.3 Sidewalk representation.				√	
3.1.3 Urban area obstacles.				√	
3.1.3.1 Obstacle dimensions.				√	
3.1.3.2 Obstacle reconfiguration.		√			
3.1.3.3 Obstacle representation.				√	
3.1.4 Utility poles.				√	
3.1.4.1 Utility pole placement.				√	
3.1.4.2 Utility pole quantity.				√	
3.1.4.3 Utility pole material.				√	
3.1.4.4 Utility pole cable mounting.	√	√		√	
3.1.5 Durability	√				
3.1.6 Environmental conditions.	√		√		
3.1.7 Transportability.	√	√		√	

3.1.8 Materials and processes.	√	√	√	√	√
3.1.8.1 Parts.				√	
3.1.8.2 Materials.	√			√	
3.1.8.2.1 Flammable materials.	√			√	
3.1.8.2.2 Fungus-inert materials.	√			√	
3.1.8.2.3 Hazardous materials.	√			√	
3.1.8.2.4 Metals.	√			√	
3.1.8.2.5 Ozone-Depleting Substances (ODS).	√			√	
3.1.8.2.6 Wood products.	√			√	
3.1.8.2.7 Radioactive material.	√			√	
3.1.8.3 Processes.				√	
3.1.8.3.1 Protective finishes and coatings.	√			√	
3.1.8.3.1.1 Painting, and preparation for.	√			√	
3.1.8.3.2 Corrosion prevention.	√			√	
3.1.9 Nameplates or product markings.				√	
3.1.9.1 Unique identification				√	
3.1.9.2 Cable and wire markings.				√	
3.1.9.2.1 Cable marking method.				√	
3.1.9.2.2 Cable marking information.				√	
3.1.9.2.2.1 “W” and “P” cable designations.				√	
3.1.9.2.2.2 To-from designators.				√	
3.1.9.3 Safety markings.				√	
3.1.10 System safety.	√			√	√
3.1.10.1 Environmental safety.	√				

3.1.10.2 Hazardous materials.	√				
3.1.10.3 Personnel safety.	√			√	
3.1.10.4 Mechanical safety.	√			√	
3.1.10.5 RF safety.	√			√	√
3.1.10.6 Electrical safety.	√			√	√
3.1.10.7 Equipment energized from multiple power sources.	√	√		√	
3.1.11 Quantitative maintainability requirements.	√				
3.2 LUA configuration software.		√		√	
3.2.1 3-Dimensional (3-D) model.		√		√	
3.2.2 Configuration.		√		√	
3.2.3 Real-Time Advanced Graphics Engine (RAGE) interface.		√		√	

4.5.1 Reliability assessment.

The system-level reliability assessment shall demonstrate compliance with the specified quantitative reliability requirements. As a minimum, data to be collected and tracked during the assessment period shall include Live Urban Area operating hours, failure occurrences, and the achieved MTBF. The following detailed testing requirements shall also apply.

i. Failure criteria. All failures occurring during the reliability assessment shall be classified as Relevant (see 6.1.4) or Non-relevant (see 6.1.3). Relevant failures shall be further classified as Chargeable (see 6.1.1) and Non-chargeable (see 6.1.2). Only those failures classified as chargeable shall be used for determining the achieved MTBF. The Government will make the final determination of failure classifications.

ii. Reliability test conditions. During the reliability assessment, the Live Urban Area shall be exercised at frequencies and durations typical of those occurring in normally scheduled testing operations. Electrical stresses shall include ON-OFF cycling and operation under the specified operating modes and duty cycles. The specific test conditions shall be in accordance with the Government-accepted Test Procedures.

4.5.2 Maintainability assessment.

Concurrently with the reliability assessment period specified above, all Live Urban Area maintenance actions shall be monitored, recorded, and evaluated to demonstrate compliance with the specified MTTR requirement. MTTR elements subject to tracking during maintenance actions include failure isolation, disassembly, removal and replacement, reassembly, and checkout times.

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5. PACKAGING.

For acquisition purposes, the packaging requirements shall be as specified in the contract.

6. NOTES.

6.1 Definitions.

The following definitions are applicable to this SPS.

6.1.1 Chargeable failures.

Chargeable failures include:

i. Intermittent failures

ii. Unverified or verified failures

iii. Independent failures

iv. Parts and equipment design (cause of failure can be traced back to a defect in the design of the part or equipment)

v. Parts and equipment manufacturing (cause of failure can be traced back to poor workmanship or inadequate manufacturing process control during the part or equipment fabrication, testing, or repair prior to the start of the reliability assessment)

vi. Contractor-furnished equipment (failure cause can be traced back to operating, maintenance, or repair procedures)

vii. Relevant failures

6.1.2 Non-chargeable failures.

Nonchargeable failures include:

i. Nonrelevant failures.

ii. Failures induced by GFE operating, maintenance, or repair procedures.

iii. Failures of items having specified life expectancy which have been operated beyond the specified replacement time.

6.1.3 Non-relevant failures.

Non-relevant failures are Live Urban Area equipment failures which cannot be expected to occur during field service. Non-relevant failures include:

i. Installation damage.

ii. Accident or mishandling.

iii. Failures of the test facility or test equipment.

iv. Failures caused by an externally applied overstress condition, in excess of the approved test requirements.

v. Normal operating adjustments (non-failures) specified in the approved equipment operating instructions.

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vi. Secondary failures within the equipment, which are proven to be caused by nonrelevant or relevant primary failures.

vii. Failures caused by human error.

6.1.4 Relevant failures.

Relevant failures are Live Urban Area equipment failures which can be expected to occur during field service. Relevant failures include:

i. Intermittent failures.

ii. Unverified failures (failures which cannot be duplicated, which are still under investigation, or for which no cause could be determined).

iii. Verified failures not otherwise excluded under the other failure categories.

iv. Pattern failures (two or more failures of the same part in identical or equivalent applications when the failure are caused by the same basic failure mechanisms).

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