CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY THE DESIGN ACTIVITY.

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| MATL MGMT |  |  |
| MFG |  |  |
| CONFIG MGMT |  |  |
| DRAFTING |  |  |
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INTERPRET THIS DRAWING IAW ASME Y14.100

REQUIREMENTS SPECIFICATION

FIT CAPROCK PROGRAM

SEARCH & RESCUE ROBOT (FIT/CSRR)

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| REVISION HISTORY | | | |
| REV | DESCRIPTION | DATE | APPROVED |
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| APPLICATION | |  | | |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |

**FOR OFFICIAL USE ONLY**

REVISION RECORD

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| Date | Revision | Description | Approval |
|  | - | Initial Release | C000XXXXX |

**TABLE OF CONTENTS**

Paragraph Title Page

[1.0 SCOPE 6](#_Toc418668354)

[2.0 APPLICABLE DOCUMENTS 6](#_Toc418668355)

[3.0 REQUIREMENTS 7](#_Toc418668356)

[3.1 Item Definition 7](#_Toc418668357)

[3.1.1 Functional Description 7](#_Toc418668358)

[3.1.1.1 *Control and Piloting* 8](#_Toc418668359)

[3.1.1.2 *Speed & Maneuverability* 8](#_Toc418668360)

[3.1.1.3 *Optical Camera* 8](#_Toc418668361)

[3.1.1.4 *Audio/Acoustics* 8](#_Toc418668362)

[3.1.1.5 *Illumination* 8](#_Toc418668363)

[3.1.1.6 Operational Endurance 8](#_Toc418668364)

[3.1.1.7 Operational Availability 9](#_Toc418668365)

[3.1.2 External Interfaces 9](#_Toc418668366)

[3.1.2.1 Debris Field Characterization 9](#_Toc418668367)

[3.1.2.1.1 Distance 9](#_Toc418668368)

[3.1.2.1.2 Inclination 9](#_Toc418668369)

[3.1.2.1.3 Pass-through Opening 9](#_Toc418668370)

[3.1.2.1.4 Standing Water 10](#_Toc418668371)

[3.1.2.1.5 Climbing / “Curb” Height 10](#_Toc418668372)

[3.1.2.1.6 Trench Width 11](#_Toc418668373)

[3.1.2.2 *RF Link* 11](#_Toc418668374)

[3.1.2.2.1 Transmit EMI 11](#_Toc418668375)

[3.1.2.2.2 Receive EMI 11](#_Toc418668376)

[3.1.2.3 *External Power Interface* 11](#_Toc418668377)

[3.1.2.4 *Control, Status, Data Interface* 11](#_Toc418668378)

[3.1.2.5 *Transport* 11](#_Toc418668379)

[3.1.2.6 *Maintainer/Installer Interface* 11](#_Toc418668380)

[3.1.2.7 *Electromagnetic Interference (EMI) Environment* 11](#_Toc418668381)

[3.1.3 Physical Characteristics 11](#_Toc418668382)

[3.1.3.1 Size 11](#_Toc418668383)

[3.1.3.2 Weight 12](#_Toc418668384)

[3.1.4 Environmental 12](#_Toc418668385)

[3.1.4.1 Temperature 12](#_Toc418668386)

[3.1.4.2 Sealing 12](#_Toc418668387)

[3.1.4.2.1 Operational 12](#_Toc418668388)

[3.1.4.2.2 Non Operational Cleaning 12](#_Toc418668389)

[3.1.5 Nameplates and Product Marking(s) 12](#_Toc418668390)

[3.1.6 Customer Furnished Equipment 12](#_Toc418668391)

[4.0 QUALITY ASSURANCE PROVISIONS 12](#_Toc418668392)

[4.1 Responsibility for Performance Verification 12](#_Toc418668393)

[4.2 Requirements Verification and Traceability Matrix (RVTM) 12](#_Toc418668394)

**LIST OF TABLES**

Table Title Page

[Table 1.0 Document Status 5](#_Toc418668395)

[Table 2.0 Referenced Documents 6](#_Toc418668396)

[Table 3.0 Requirements Verification and Traceability Matrix (RVTM) 13](#_Toc418668397)

[Table 4.0 Signal Entry Panel Connector Definition 14](#_Toc418668398)

[Table 5.0 Optical Camera Interface Connector Pin Out 14](#_Toc418668399)

[Table 6.0 Infrared (IR) Camera Interface Connector Pin-Out 15](#_Toc418668400)

[Table 7.0 Prime Power Interface Connector Pin-Out 15](#_Toc418668401)

**LIST OF FIGURES**

Figure Title Page

[Figure 3.1-1 Urban Debris Field Example 7](#_Toc418668402)

[Figure 3.1.1-1 FIT/CSRR System Functional Diagram 7](#_Toc418668403)

[Figure 3.1.2.1.1-1 Debris Field Maximum Ingress/Egress Distance 9](#_Toc418668404)

[Figure 3.1.2.1.2-1 Debris Field Maximum Inclination 9](#_Toc418668405)

[Figure 3.1.2.1.3-1 Debris Field Minimum “Pass-Through” Opening 10](#_Toc418668406)

[Figure 3.1.2.1.4-1Standing Water Maximum Depth 10](#_Toc418668407)

DOCUMENT STATUS

Table 1, identifies the document sections that require additional information or additional details in later versions. List all issues that are TBD or are unresolved issues and remove from this section as the issues become resolved.

Table 1.0 Document Status

|  |  |  |  |
| --- | --- | --- | --- |
| ID | SECTION | DESCRIPTION | Close By |
| FIT/CSRR-XX |  |  |  |
| FIT/CSRR-XX |  |  |  |

| **Object Identifier** | The FIT/CSRR |
| --- | --- |
| FIT/CSRR-1 | SCOPE |
| FIT/CSRR-2 | This specification establishes the functional, performance, interface and verification requirements for the FIT CAPSTONE PROGRAM, SEARCH & RESCUE ROBOT (FIT/CSRR). |
| FIT/CSRR-3 | The FIT/CSRR is a mobile search and rescue vehicle, capable of being wirelessly controlled by human operators, located on the perimeter of a debris field that has been created as the result of some natural or manmade disaster. The FIT/CSRR will have the capability of traversing the interior of the debris field, having a highly varied terrain, littered with obstacles of all sizes, shapes, textures, etc. The FIT/CSRR will have the capability of providing an optical camera feed, back to the operators, in both the human visual, and IR frequency spectrums, to be used for both vehicle navigation and search operations. The FIT/CSRR will have the capability of two way audio communication between the FIT/CSRR operators and any human survivors that have been located. The FIT/CSRR will have the capability of providing positional information back to the operators to aid in excavation and recovery activities. |
| FIT/CSRR-XX | FIT/CSRR interfaces are specified in Section 3. |
| FIT/CSRR | Quality Assurance provisions in section 4 identify the methods by which the requirements in this document are verified. |
| FIT/CSRR | FIT/CSRR cable interface requirements are provided in Appendix A. |
| FIT/CSRR | An Acronym List is provided in Appendix B. |
| FIT/CSRR | APPLICABLE DOCUMENTS |
| FIT/CSRR | The following documents form a part of this specification to the extent specified herein. Where conflict occurs between these documents and this specification, the contents of this specification should take precedence. |
| FIT/CSRR | Table 2.0 lists the documents referenced in this specification. |
| FIT/CSRR | Table 2.0 Referenced Documents |
| FIT/CSRR | |  |  | | --- | --- | | **Document Number** | **Title** | |  |  | |  |  | |  |  | |

|  |  |
| --- | --- |
|  | REQUIREMENTS |
|  | Item Definition |
|  | The FIT/CSRR is a remotely piloted vehicle, capable of search and rescue missions within the interior of an urban debris field, created as a result of a natural or man-made disaster event. |
|  | Rescue worker and dog at building Stock Photo |
|  | Figure 3.1-1 Urban Debris Field Example |
|  | The FIT/CSRR **Shall** be comprised of a vehicle, transit case, and other support equipment required for the staging and execution of urban search and rescue missions. |
|  | Functional Description |
|  | A system functional diagram of the FIT/CSRR is shown in Figure 3.1.1-1. |
|  |  |
|  | Figure 3.1.1-1 FIT/CSRR System Functional Diagram |
|  | *Control and Piloting* |
|  | The FIT/CSRR **Shall** be controlled wirelessly (un-tethered) |
|  | The FIT/CSRR **Shall** be self powered (un-tethered) |
|  | *Speed & Maneuverability* |
|  | The FIT/CSRR **Shall** be capable of traveling at speeds up to 1 ft/s (TBR) over a flat, unobstructed surface. |
|  | The FIT/CSRR **Shall** be capable of executing a 360° turn within a 18” diameter circle |
|  | The FIT/CSRR **Shall** be laterally stable at an inclination up to +/- 30°. |
|  | The FIT/CSRR **Shall** be capable of self righting, inverted drive, or some other anti-tip-over strategy, to mitigate the risk of becoming immobile due to its orientation with respect to gravity. |
|  | *Optical Camera* |
|  | The FIT/CSRR **Shall** have an optical camera feed, for vehicle navigation and search operations, displayed to the FIT/CSRR vehicle operator, in the range of human visual acuity (390 to 700 nm), at a 1280 x 960 minimum resolution, and a 120 Hz minimum refresh rate. |
|  | The FIT/CSRR **Shall** provide a optical camera feed, in the infrared frequency spectrum range, displayed to the FIT/CSRR operator, at a 1280 x 960 minimum resolution, and a 120 Hz minimum refresh rate |
|  | The FIT/CSRR optical cameras **Shall** be capable of omni-directional vision (+90°/-90° elevation, 360° azimuth). |
|  | *Audio/Acoustics* |
|  | The FIT/CSRR **Shall** provide two-way audio capability between the vehicle and operator. |
|  | The vehicle **Shall** have a microphone, with an acoustic response of 5db minimum, over a frequency range of 20 to 20Hz. |
|  | The FIT/CSRR vehicle **Shall** have a speaker, capable of projecting sound at an acoustic pressure of 80 db (TBR), measured 1 meter (39.4 ft) away, and over a frequency range of 20 to 20Hz. |
|  | The FIT/CSRR operator **Shall** be provided with audio that is received from the vehicle microphone. The operator **Shall** have the ability adjust the volume from 0 to 80 db, as measured a distance of 1 meter (39.4 ft) away. |
|  | *Illumination* |
|  | The FIT/CSRR vehicle **Shall** have external omni-directional lighting capability of 5000 lumens minimum, to support piloting, navigation, and search operations. |
|  | The FIT/CSRR operator OCU **Shall** have a display that that is easily readable in bright daylight. |
|  | Operational Endurance |
|  | The FIT/CSRR **Shall** have a minimum operational endurance time of 1 hour, at maximum (100%) duty cycle. |
|  | Operational Availability |
|  | The FIT/CSRR **Shall** be capable of full mission deployment in less than 5 minutes from its fully stowed transit case configuration. |
|  | The FIT/CSRR **Shall** be capable of being fully charged, from a completely depleted condition, in less than one hour (1 hr). |
|  | External Interfaces |
|  | Debris Field Characterization |
|  | Distance |
|  | The FIT/CSRR **Shall** be capable of traversing a debris field for a distance of up to 50m. |
|  |  |
|  | Figure 3.1.2.1.1-1 Debris Field Maximum Ingress/Egress Distance |
|  | Inclination |
|  | The FIT/CSRR **Shall** be capable of traversing a debris field with an average inclination of 30 degree, measured of a distance of one meter (30°/m). |
|  |  |
|  |  |
|  | Figure 3.1.2.1.2-1 Debris Field Maximum Inclination |
|  | Pass-through Opening |
|  | The FIT/CSRR **Shall** be capable of traversing a minimum opening in the debris field of 12” high x 12” wide. |
|  |  |
|  |  |
|  | Figure 3.1.2.1.3-1 Debris Field Minimum “Pass-Through” Opening |
|  | Standing Water |
|  | The FIT/CSRR **Shall** be capable of fording standing water with a depth up to 1 inch (1”) maximum. |
|  |  |
|  |  |
|  | Figure 3.1.2.1.4-1Standing Water Maximum Depth |
|  | Climbing / “Curb” Height |
|  | The FIT/CSRR vehicle **Shall** be capable of traversing curb heights up to 10 cm (4 in). |
|  | Trench Width |
|  | The FIT/CSRR vehicle **shall** be capable of traversing trench widths up to 15.4 cm (6 in) |
|  | *RF Link* |
|  | The FIT/CSRR **Shall** provide a wireless communication link with an operator/pilot located on the perimeter of the debris field. |
|  | Transmit EMI |
|  | The FIT/CSRR **Shall** have the ability to transmit and receive data, at (TBD) frequency, through a debris field having (TBD) dbm of RF attenuation. |
|  | The FIT/CSRR **Shall** be capable of transmitting no less than (TBD) dBm EIRP peak across the EM spectrum of (TBD) to (TBD) Hz. |
|  | Receive EMI |
|  | The FIT/CSRR **Shall** accept continuous fields with combined potentials of (TBD) V/m across the band of (TBD) to (TBD) Hz. |
|  | *External Power Interface* |
|  | The FIT/CSRR **Shall** be capable of connecting to an external power source for charging, and to operate without depleting the onboard battery during staging, prior to mission ingress. Connector and pin-out as specified in Appendix B, SEP Connectors and Pin-Outs. |
|  | *Control, Status, Data Interface* |
|  | The FIT/CSRR **Shall** provide physical space on the SEP for a control, status and data interface connections, as required to diagnose and troubleshoot failures in the field. |
|  | *Transport* |
|  | The FIT/CSRR, in its shipping container, **Shall** be capable of withstanding a 45 deg drop, on any corner, from a height of 12 inches (0.3 m). |
|  | The FIT/CSRR, in its shipping container, **Shall** be capable of withstanding a drop, on any flat side, from a height of 12 inches (0.3 m). |
|  | *Maintainer/Installer Interface* |
|  | The FIT/CSRR **Shall** include at least one environmentally sealed access panel to facilitate connecting to an external power source, service, diagnostics/troubleshooting, and repair in the field. |
|  | Captive fasteners **Shall** be used on all field service panels to facilitate access in the field. |
|  | *Electromagnetic Interference (EMI) Environment* |
|  | The FIT/CSRR **Shall** comply with all FCC and VDE regulations for radiated RF emissions. |
|  | Physical Characteristics |
|  | Size |
|  | The FIT/CSRR, in its stowed configuration, **Shall** not exceed a total size envelope of 12” high x 12” wide x 12” long. |
|  | Weight |
|  | The FIT/CSRR vehicle weight **Shall** not exceed 12 pounds (TBR). |
|  | The FIT/CSRR total weight, which includes the vehicle, transit case, and all other support equipment required for the staging and execution of urban search and rescue operations, **Shall** not exceed 42 pounds (TBR). |
|  | Environmental |
|  | Temperature |
|  | The FIT/CSRR **Shall** be capable of operating in temperatures ranging from -20 C (-4 F) to +60 C (140 F). |
|  | Sealing |
|  | Operational |
|  | The FIT/CSRR **Shall** be IP-65 (dust tight, resistant to water spray) compliant while operating. |
|  | Non Operational Cleaning |
|  | The FIT/CSRR vehicle **shall** be able to withstand cleaning with common household surfactants and a fresh water spray. |
|  | Nameplates and Product Marking(s) |
|  | The FIT/CSRR nameplate **Shall** be marked with the manufacturer's name, symbol, lot or date code, part number and serial number, as a minimum. |
|  | Customer Furnished Equipment |
|  | None (TBR) |
|  | QUALITY ASSURANCE PROVISIONS |
|  | Responsibility for Performance Verification |
|  | Unless otherwise specified in writing, the supplier is responsible for the performance of all inspection, examination, and test requirements specified herein. |
|  | The Supplier will implement a Quality Assurance program to insure that the delivered system meets all applicable requirements during manufacture and test. |
|  | Requirements Verification and Traceability Matrix (RVTM) |
|  | Table 4.3 provides a list of each requirement and the verification method to be used. The parent requirement is also identified in the far right column. The following abbreviations are used in the table to indicate the verification method and are defined as follows. |
|  | **Inspection (I).** Verification of the physical characteristics by examination of the equipment and associated documentation. Comparison of pertinent characteristics against a predetermined qualitative or quantitative standard. May require moving or partial disassembling of the item to accomplish the verification. |
|  | **Analysis (A).** Verification through technical evaluations of calculations, computations, models and analytical solutions, reduced data and representative data to determine if the item conforms to the specified requirements of the specifications. |
|  | Analysis will contain justification as to how the data verifies that the requirement will be met. |
|  | **Test (T).** Verification that a specified requirement is met by exercising the applicable item under specified conditions using appropriate instrumentation in accordance with test procedures. Actual measured values are recorded, operated on according to the test procedure, and acceptance is determined by comparing the value with the specified limit or range value(s). |
|  | **Demonstration (D).** Demonstration is a method of verification whereby the properties, characteristics, and parameters of the item are determined by observation alone and without the use of instrumentation for quantitative measurements. This method is used when a specification requirement does not contain a specific numerical parameter that must be measured. Demonstrations may occur during verification of a unit under test at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified. |

Table 3.0 Requirements Verification and Traceability Matrix (RVTM)

| **Object ID** | **Para. No.** | **Description of Requirements** | **Analysis** | **Demo** | **Inspect** | **Test** |
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| **Object Identifier** | FIT/CSRR |
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|  | **Appendix A. FIT/CSRR Signal Entry Panel Connector and Pin-Out** |
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**APPENDIX A**

Table 4.0 Signal Entry Panel Connector Definition

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| **Interface** | **Connector Designator** | **Connector Part No.** | **Mating Connector** | **Description** |
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Table 5.0 Optical Camera Interface Connector Pin Out

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| **Pin** | **I/O** | **Cond. Type** | **Signal Name** | **Spec.** | **Notes** |
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Table 6.0 Infrared (IR) Camera Interface Connector Pin-Out

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| **Pin** | **I/O** | **Cond. Type** | **Signal Name** | **Spec.** | **Notes** |
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Table 7.0 Prime Power Interface Connector Pin-Out

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|  | **I/O** | **Cond. Type** | **Signal Name** | **Spec.** | **Notes** | |
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| --- | --- |
| Acronym | Definition |
| CFE | Customer Furnished Equipment |
| COTS | Commercial Off The shelf |
| dBm | Decibel-Milliwatt |
| EDM | Engineering Development Model |
| EMI | Electromagnetic Interference |
| IAW | In Accordance With |
| ICD | Interface Control Document |
| IR | Infrared |
| LOS | Line of Sight |
| MHz | Mega Hertz |
| MIL-STD | Military Standard |
| PN | Part Number |
| RVTM | Requirements Verification and Traceability Matrix |
| SEP | Signal Entry Panel |
| SWaP | Size, Weight & Power |
| TBD | To Be Determined |
| TBR | To Be Resolved |
| VDC | Volts, Direct Current |
| V/m | Volts per meter |
| WAN | Wide Area Network |