INCH-POUND
15 Sep 2015

TECHNICAL STATEMENT OF NEED
ADVANCED BOMB SUIT, GENERATION II

This performance specification is approved for use by Departments and Agencies of the Department of Defense. (DoD).

1.0 SCOPE.

1.1 Scope. This Technical Statement of Need (TSN) document describes the requirements for an Explosive Ordnance Disposal armor system ensemble. This is a personal protective equipment system that provides whole body blast effects protection to Explosive Ordnance Disposal (EOD) personnel. (See Section 6.1) The bomb suit ensemble is used in situations where the EOD Soldier will attempt a Render Safe Procedure (RSP) or Disposal Procedure (DP) against Unexploded Ordnance (UXO) or Improvised Explosive Devices (IED) that cannot be attacked remotely. The Explosive Ordnance Disposal Armor System is a Critical Safety Item (CSI).

1.2 Classification. The Suit, Explosive Ordnance Disposal is a whole body blast effects protective ensemble consisting of the following primary protective components: head protection (helmet and visor), torso and arms protection (jacket), legs and feet protection (trousers). The ensemble includes carrying cases/bags for the suit and the helmet system. This purchase description delineates the performance requirements of the suit and helmet system.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be used in improving this document should be addressed to: Product Manager-Soldier Protective Equipment, Program Executive Office-Soldier, US Army, 10170 Beach Road, Building 328T, Fort Belvoir, Virginia 22060.

1.3 Sizing.

1.3.1 Helmet. Threshold (T) The helmet (head protection system) will be available as a one size helmet system to fit the 5th percentile female to 95th percentile male Soldier via fit adjustment system. Objective (O) Multiple helmet sizes will be available to fit the 5th percentile female to 95th percentile male Soldier. Sizes shall be determined in accordance with the Technical Report, Natick/TR-15/0072012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

1.3.2 Suit. (T) The suit (thoracic and extremity protection system) will be available in four sizes to fit the 5th percentile female to 95th percentile male Soldier. (O) The suit will fit the 5th percentile female to 95th percentile male Soldier with a minimum of six sizes. Sizes shall be determined in accordance with the Technical Report, Natick/TR-15/0072012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

2.0 APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they shall meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications standards and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-191: Textile Test Methods
FED-STD-595: Colors used in Government Procurement

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-43511 - Detail Specification Visors, Flyer's Helmet, Polycarbonate

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-662 - V50 Ballistic Test for Armor

MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-464 - Department of Defense Interface Standard Electromagnetic Environmental Effects Requirements for Systems
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests
(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF TRANSPORTATION FEDERAL MOTOR VEHICLE SAFETY

DOT FMVSS 218 - Department of Transportation Federal Motor Vehicle Safety Standard No.218 Motorcycle Helmets

(Copies of documents are available on line at http://www.nhtsa.dot.gov/cars/rules/standards/ safstan2.htm. The complete text of all Federal Motor Vehicle Safety Standards and other NHTSA regulations can be found in Title 49 of the Code of Federal Regulations (CFR). Title 49 of the CFR is published in seven volumes; the fifth volume (Parts 400-999) is where these regulations can be found. Copies of this volume can be obtained for a cost from the U. S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328)

Technical Report, Natick/TR-15/0072012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

(Copies of this report are available from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161, (704) 487-4650, http://www.ntis.gov or Defense Technical Information Center, 8725 John J. Kingman Road, Suite 0944, Fort Belvoir, VA 22060-6218, http://www.dtic.dla.mil.)

ITOP 04-2-805, FR/GE/UK/US Projectile Velocity and Time-Of-Flight Measurement

(Copies of documents are available by sending to Commander, US Army Test and Evaluation Command, ATTN: AMSTE-TM-T, Aberdeen Proving Ground, MD 21105-5055)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC Test Method 16 - Colorfastness to Light
AATCC Test Method 22 - Water Repellency: Spray Test
AATCC Test Method 135 - Dimensional Change after Laundering
AATCC Procedure 9 -Visual Assessment of color Difference of Textiles
(Copies of are available on line at www.aatcc.org or from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z87.1-2003 American National Standard- Occupational and Educational Personal Eye and Face Protection Devices

(Copies are available online at http://webstore.ansi.org/ansidocstore or from American National Standards Institute, 25 West 43rd Street, 4th floor, New York, NY 10036.)

AMERICAN SOCIETY FOR QUALITY

ANSI/ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Copies are available online at http://www.asq.org or from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM D 751 - Standard Test Methods for Coated Fabrics
ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
ASTM D 1424 - Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
ASTM D 1777 - Standard Test Method for Thickness of Textile Materials
ASTM D 2261 - Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)
ASTM D 3512 - Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble Pilling Tester
ASTM D 3776 - Standard Test Method for Mass Per Unit Area (Weight) of Fabric
ASTM D 3884 - Standard Guide for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)
ASTM D 5034 - Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D 5035 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 5587 - Standard Test Method for Tearing Strength of Fabrics by Trapezoid Procedure

ASTM D 6413 - Standard Test Method for Flame Resistance of Textiles (Vertical Test)
ASTM D 5276 - Standard Test Method for Simulated Drop of Loaded Containers by Shock Machines

(Copies of documents are available online at www.astm.org or from the ASTM INTERNATIONAL, 100 Barr Harbor Drive, P.O. BOX C700 West Conshohocken, PA 19428-2959.)

CANADIAN STANDARDS ASSOCIATION (CSA)

CAN/CSA Z617 - Personal Protective Equipment (PPE) for Blunt Trauma

(Copies of Standards are available online at www.csa.ca or from Canadian Standards Association (CSA), 5060 Spectrum Way, Mississauga, Ontario, L4W 5N6, Canada.)

INTERNATIONAL COMMISSION ON ILLUMINATION (CIE)

CIE (1924) - Standard for Luminous Efficiency Functions: Photopic *V(λ)*

(Copies of these documents are available from www.cie-usnc.org or CIE/USA Publications Office, c/o TLA-Lighting Consultants, Inc., 7 Pond St., Salem, MA 01970.)

NATIONAL INSTITUTE OF JUSTICE (NIJ)

NIJ Standard 0117.01 dated Sept 2014 – Public Safety Bomb Suit Standard

(Copies of this document are available from www.nij.gov)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 Requirements. The bomb suit shall meet the following requirements.

3.2 Minimum V_{50} Ballistic Protection Limits. The bomb suit system shall be capable of providing the minimum V_{50} ballistic limits at 0 degrees obliquity when tested with the specified projectiles in accordance with (IAW) section 4.2. Protection shall be contiguous between the regions called out below. For regions that include overlapping areas with differing material stacking, the least protective stacking format shall represent the protective region. Front and rear sections of the body are separated by the frontal or coronal plane illustrated in Figure 3 in the Appendix. Human body directions are also shown in Figure 3.

3.2.1 Frontal Thorax, Abdomen/Groin, and Neck. The front medial thorax, front medial abdomen/pelvis, and front medial neck shall be provided protection as follows.

Fragment mass/velocity

64 grain Right Circular Cylinder (RCC), no less than 4020 fps

This minimum protection level shall cover between bust points (medial/lateral) and between sternal and crotch level. Protection shall be centered and be contiguous across the chest, abdomen and groin. Maximum areal density of the chest region shall be 7.3 lbs/ft^2. Maximum areal density of the abdominal/groin region shall be 6.2 lbs/ft^2. This areal density includes the soft armor ballistic carrier pouching materials, rigid armor plates, and any rigid armor cover materials needed to secure components together, but excludes the outer shell and inner shell of the suit.

The frontal thoracic protection shall be no less than 8 inches wide for size designed to fit the 5th percentile Soldier, no less than 9 inches wide for size(s) designed to fit the 50th percentile Soldier, and no less than 10 inches wide for size designed to fit the 95th percentile Soldier.

3.2.2 Front Center Neck. The front medial neck shall be provided protection as follows

Fragment mass/velocity

2 grain RCC, no less than 5000 fps
4 grain RCC, no less than 3840 fps
16 grain RCC, no less than 2735 fps
64 grain RCC, no less than 2030 fps
17 grain FSP, no less than 2700 fps

This minimum protection level shall cover the front of the neck. This protection level shall be at least 7 inches wide (laterally) for all sizes.

Maximum areal density of this armor region shall be 3.7 lbs/ft^2. This areal density includes the soft armor ballistic carrier pouching materials and any rigid armor cover materials needed to secure components together within the ballistic package, but excludes the outer shell and inner shell of the suit.

3.2.3 Front of head, face, eyes (visor)

Fragment mass/velocity

Transparent armor shall provide the following minimum protection
17 grain FSP, no less than 2500 fps

Transparent Armor areal density shall not exceed 5.4 lbs/ft^2 (threshold), 5.2 lbs/ft^2 (objective)

Areas peripheral to the transparent armor (between the helmet shell and the transparent armor) shall provide the following minimum protection exclusive of any soft armor overlaps present on the suit:

17 grain FSP, no less than 2560 fps

3.2.4 Helmet shell shall cover the sides, back, forehead, and top of head.

Fragment mass/velocity

2 grain RCC, no less than 3575 fps
4 grain RCC, no less than 2990 fps
16 grain RCC, no less than 2190 fps
64 grain RCC, no less than 1715 fps
17 grain FSP, no less than 1970 fps

3.2.5 Front Arms, Front Sides Torso, Front Sides Abdomen/Pelvis, Front Sides Neck: The frontal arms from radial styloid to acromion and anterior scye; the front lateral torso to bust points, the front abdomen/pelvis lateral to bust points; and the front neck lateral to bust points shall be provided with protection as follows.

Fragment mass/velocity

2 grain RCC, no less than 2515 fps
4 grain RCC, no less than 2215 fps
16 grain RCC, no less than 1920 fps
64 grain RCC, no less than 1580 fps
17 grain FSP, no less than 1720 fps

Maximum areal density of this armor region shall be 0.86 lbs/ft^2. This areal density includes the soft armor ballistic carrier pouching materials, but excludes the outer shell and inner shell of the suit.

3.2.6 Back Arms, Back Torso, Back of Neck, and Top of Feet: The back of arms from Stylion to acromion and posterior scye; the back of torso and back of neck from nuchale to top of buttocks at Posterior-Superior Iliac Spine (PSIS); and frontal top of feet from ankle crease to toes shall be provided the following protection.

Fragment mass/velocity
2 grain RCC, no less than 1930 fps
4 grain RCC, no less than 1720 fps
16 grain RCC, no less than 1585 fps
64 grain RCC, no less than 1245 fps
17 grain FSP, no less than 1320 fps

Maximum areal density of this armor region shall be 0.50 lbs/ft^2. This areal density includes the soft armor ballistic carrier pouching materials, but excludes the outer shell and inner shell of the suit.

3.2.7 Front Upper Legs: protection extends from the crotch level to middle of patella. Protection shall cover the front half of the upper leg. Protection shall be provided as follows.

Fragment mass/velocity
2 grain RCC, no less than 3420 fps
4 grain RCC, no less than 2865 fps
16 grain RCC, no less than 2490 fps
64 grain RCC, no less than 1995 fps
17 grain FSP, no less than 2340 fps

3.2.8 Front Lower Leg: Front of lower leg protection shall extend from top of patella to ankle crease and cover the front half of the lower leg.

Fragment mass/velocity

2 grain RCC, no less than 2965 fps
4 grain RCC, no less than 2450 fps
16 grain RCC, no less than 2205 fps
64 grain RCC, no less than 1830 fps
17 grain FSP, no less than 2090 fps

3.2.9 Rear upper legs, rear lower legs, and buttocks: Rear lower leg, rear upper leg, and buttocks protection shall extend from rear ankle to top of buttocks at Posterior-Superior Iliac Spine (PSIS). Protection level stated applies to integral components of the bomb suit system and does not include fit adjustment components that are applied directly to the back of the leg to permit fitment to larger wearers.

Fragment mass/velocity

17 grain FSP, no less than 820 fps

Maximum areal density of this armor region shall be 0.20 lbs/ft^2. This areal density includes the soft armor ballistic carrier pouching materials, but excludes the outer shell and inner shell of the suit.

3.3 Blast Protection. The bomb suit system shall demonstrate significant improvement in survivability and injury reduction in terms of blast overpressure and head and neck injury as compared to the unprotected case. Face on peak pressure shall be attenuated by at least 80% over the frontal thorax vs the unprotected case when tested IAW paragraph 4.3. The bomb suit shall provide protection from blast-induced head acceleration and neck injury. Head Injury Criteria (HIC) values shall be attenuated by 80% and Neck Injury Criteria values

shall remain below 1.0 per National Highway Traffic Safety Administration (NHTSA) Injury Criteria. Blast overpressure testing shall be conducted in accordance with section 4.3.

When exposed to the conditions in paragraph 4.3, protective integrity of the system shall be maintained. Protective components of the suit and helmet shall remain in proper position to maintain protection throughout the blast event. Ejection of protective components as a result of blast event that would lead to total loss of protection after the blast event to that particular area is considered a failure.

3.4 Non-ballistic Impact Protection. The bomb suit system shall provide non-ballistic impact protection to the head and spine to protect against impact with ground or other stationary objects when tested IAW section 4.4.

3.4.1 Impact Protection, head. The finished helmet assembly shall provide non-ballistic impact protection by reducing acceleration of the head during low velocity blunt impact events at various temperatures.

(T) The maximum average acceleration of the head form for all tests (including the various impact sites, temperatures specified, and first and second impacts, however, each size will be averaged separately) shall be no greater than 300g at an impact velocity of 22 feet/second. The peak head form acceleration for any individual impact test shall not exceed 350g when tested IAW section 4.4.1. for the ambient case on the flat surface. The helmet shell shall not fracture as a result of impact testing.

(O) No individual acceleration for any drop condition or striking surface will exceed 300g and will not remain above 200g for more than 2.0 ms or 150g for 4.0 ms.

3.4.2 Impact Protection, spine/back. The bomb suit system shall provide the back torso with impact protection. The back protector shall be at least 8.0 inches wide for all sizes with length scaled to size. The back protection system shall remain centered across the torso sagittal plane during use.

The average force transmitted to the portion of the bomb suit covering the back of the wearer shall not exceed the maximum force values listed in Table I for the condition described when tested IAW section 4.4.2.

TABLE I. Spine/Back Impact Protection

Threat	Threat Energy	Maximum Force	Condition
Sphere	75J (55.32 ft-lb)	8 kN (1798 lbf)	Ambient

3.5 Flame/Heat Protection. Testing shall be conducted IAW section 4.5.

(T) The outer shell shall be flame resistant except for high wear areas (knee pads, elbows/forearm, foot covers, thoracic plate, and groin plate areas), ties, hook and loop fasteners and other small findings.

(O) All outer shell exposed components, including high wear areas, be flame resistant.

3.5.1 Suit Flame Resistance (Outer Shell). The primary outer shell material shall be flame resistant, self-extinguishing, and not exhibit melting behavior. These requirements apply when the fabric is new and after 10 launderings as specified in AATCC 135, machine cycle (1), washing temperature (II), and drying procedure (B).

(T) Outer shell material shall have the following characteristics for vertical flame test: maximum after-flame shall be 2.0 seconds in the warp and fill directions, average maximum afterglow shall be 25 seconds in the warp and fill directions, and maximum char length shall be 3.5 inches in the warp and fill directions

(O) Outer shell materials shall have the following characteristics for vertical flame test: maximum after-flame shall be 1.0 seconds in the warp and fill directions, average maximum afterglow shall be 25 seconds in the warp and fill directions, and maximum char length shall be 1.0 inches in the warp and fill directions.

3.5.2 Helmet Flame Resistance.

(T) The finished shell shall be self-extinguishing with after-flame less than 15 seconds upon removal of the burner flame. Flaming before the withdrawal of the flame source is permitted. There shall be no flaming melt drip after removal of the burner flame.

(O) The shell shall be ignition resistant.

3.6 Weight. Maximum system weight for each size system will be as follows. Weight will include all components required for the suit to be functional and meet the requirements stated in this performance specification. This weight includes the suit and largest available helmet system if the helmet is available in more than one size. Maximum system weight does not include the cooling system, carry bags, batteries, and additional protective accessories not called out in this specification.

Suit size for 5th percentile female: (T) 57.0 lbs. (O) 39.0 lbs.
Suit size for 50th percentile male: (T) 64.0 lbs. (O) 44.0 lbs.
Suit size for 95th percentile male: (T) 72.0 lbs. (O) 50.0 lbs.
*Additional sizes shall be scaled accordingly

3.7 Maneuverability/Flexibility and Operational Suitability. The bomb suit system shall not significantly impede efficient and safe accomplishment of mission due to design, material selection or bulk of the system. EOD personnel shall be able to maneuver through corridors, closely spaced furniture, climb stairs and ladders; look under, around or into a vehicle/aircraft/ship, desk, closet, or other confined spaces. EOD personnel shall be capable of quickly and safely positioning specialized render-safe tools, diagnostic tools, and explosive counter charges during counter Improvised Explosive Device Defeat Operations

when wearing the bomb suit system. Maneuverability/Flexibility shall be verified by soldier trials.

3.8 Vision/Optics. The bomb suit system shall not impede vision with respect to efficient accomplishment of the mission. Unless otherwise specified, the visor shall have three areas of vision which are identified as: outside the area of vision (no optical requirement), non-critical area of vision, and critical area of vision. The critical area is a 40 degree radius field of view from the primary line of sight intercept point on the visor for the designed right and left eye locations up to within 0.5 inch from the edge of non-optical portions of the helmet and visor. The center point for the right and left optics shall be identified as point "1R" and "1L", respectively. The "1R" and "1L" center points will be located 1.30 inches below the designed right and left eye vertical position. The designed right and left eye vertical position shall be identified by the vendor with respect to the visor. The designed right and left eye vertical position correspond to the "4R" and "4L" positions noted in Figure 1 of Mil-DTL-43511D. The bomb suit system visor shall meet the following requirements:

3.8.1 Visor clarity and workmanship. The visor shall be clear. The visor shall be free from visually detectable striae, waviness, cloudiness, and imperfections such as pits, lint, bubbles, scratches, and foreign particle imperfections which are gross in size and quantity within the critical viewing area up to within 0.5 inch of the edge of the visor. Visor clarity shall be tested IAW section 4.8.1.

3.8.2 Luminous Transmittance. Visor shall have a luminous transmittance of not less than 65% in the critical viewing areas when tested IAW 4.8.2.

3.8.3 Prismatic Deviation.

3.8.3.1 The vertical prismatic deviation for either right or left eye shall be no more than 0.25 prism diopters for each location specified in Mil-DTL-43511D. The vertical prismatic imbalance shall not exceed 0.15 prism diopters for each location specified in Mil-DTL-43511D when tested IAW 4.8.3.

3.8.3.2 The horizontal prismatic imbalance shall not exceed 3.0 prism diopters base out or 0.1 prism diopters base in for each location specified.

3.8.4 Refractive Power. The refractive power shall not exceed ±0.5 diopters for each eye at the as worn eye location (locations 4R and 4L) when tested IAW section 4.8.4.

3.8.5 Haze. The haze shall not exceed 4% (threshold), 2% (desired) when tested IAW 4.8.5.

3.8.6 Fogging. Fogging (condensation of moisture) in the critical viewing area of the inside of the visor shall be dispelled within 60 seconds of completing the exercise when tested in accordance with paragraph 4.8.6. The use of anti-fog treatments that require regular reapplication to prevent fogging on the inside of the visor are not permitted. Fogging

of the outside of the visor is acceptable. It is desired that the outside surface of the visor be fog resistant.

3.8.7 Field of View. The effective field of view provided by the bomb suit system shall be measured statically and dynamically. The bomb suit system shall be constructed such that required field of view is obtained through the visor directly and through head freedom of motion. Field of view available to the wearer through the visor's optical areas with the wearer erect and with head facing forward and looking horizontally (straight ahead) provides the Static Field of View. The ability to see maximally downward through the visor towards the feet using downward rotation of the head provides Dynamic Downward Field of View.

3.8.7.1 Static Field of View. Minimum field of view when tested IAW section 4.8.7.1 for the directions indicated shall be as shown in Table II.

TABLE II. Static FOV requirements

Measurement	Angle (degrees)
Superior	≥ 21
Super-Nasal	≥ 26
Nasal	≥ 44
Infero-Nasal	≥ 41
Inferior	≥ 40
Infero-Temporal	≥ 48
Temporal	≥ 49
Super-Temporal	≥ 29

3.8.7.2 Dynamic Downward Field of View (Head Rotation Only). The maximum average occluded angle shall be 22.5º when tested IAW section 4.8.7.2.

3.9 Hearing.

3.9.1 Hearing Capability. The bomb suit wearer shall be capable of hearing ambient sounds and voice communications to maintain situational awareness and enhance communication.

3.9.2 Hearing Protection: The bomb suit shall enable standard issue Combat Ear Plugs to be used in either the linear or non-linear protective configuration when tested IAW section 4.9.

3.10 Breathing. Adequate ventilation shall be provided to the wearer to allow normal respiration, provide fresh air flow during use, and prevent fogging of the visor. Ventilation system shall provide a minimum of 1.5 cubic feet per minute (CFM) of airflow to the facial region of the helmet. Ventilation system shall be adjustable to allow air flow rate to be varied between 0 CFM and 3 CFM with at least seven intermediate air flow rates available between the minimum and maximum. The minimum ventilation capability of 1.5 CFM shall be provided for a minimum of 180 minutes on a single set of fresh standard commercial size batteries. Ventilation system shall be quiet and unobtrusive during operation to minimize discomfort and distraction to the user during usage.

3.11 Talking. The bomb suit and helmet/visor assembly shall not impede normal speaking capability. The design shall allow the wearer to both raise or lower the visor within 10 seconds. The visor shall positively lock in both the raised and lowered position.

3.12 Sizing.

3.12.1 Helmet. (T) The helmet (head protection system) will be available as a one size helmet system to fit the 5th percentile female to 95th percentile male Soldier via fit adjustment system. Objective (O) Multiple helmet sizes will be available to fit the 5th percentile female to 95th percentile male Soldier. Sizes shall be determined in accordance with the Technical Report, Natick/TR-15/0072012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

3.12.2 Suit. (T) The suit (thoracic and extremity protection system) will be available in four sizes to fit the 5th percentile female to 95th percentile male Soldier. (O) The suit will fit the 5th percentile female to 95th percentile male Soldier with a minimum of six sizes. Sizes shall be determined in accordance with the Technical Report, Natick/TR-15/0072012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

3.13 Donning/Normal Doffing/Emergency Doffing/Incapacitated Doffing. The following capabilities are to be met using the complete bomb suit system without cooling system. All closures and methods of adjustment shall be durable and easy to operate.

3.13.1 Donning. The complete bomb suit system shall be donned within 5 minutes (threshold), 2 minutes (desired) with the help of one assistant. Donning shall be verified by soldier trials.

3.13.2 Normal Doffing. The complete bomb suit shall be normal doffed within 2 minutes without the help of an assistant. Doffing shall be verified by soldier trials.

3.13.3 Emergency Doffing (unaided). Emergency Doffing shall be accomplished unaided for emergency removal of the suit. The complete bomb suit system shall be removed by the wearer within 1 minute. This capability shall be demonstrated by the wearer with gloved and ungloved hands. Emergency doffing shall be verified by soldier trials.

3.13.4 Incapacitated Doffing. The bomb suit system shall have the ability to be doffed from injured (incapacitated) wearer in both the prone or supine position without excessively moving the wearer. Excessive movement of the wearer is defined as needing to lift or rotate the subject in the torso region. Medical responders are permitted to reach under the wearer's torso. Incapacitated doffing shall be verified by soldier trials.

3.14 Electrostatic Discharge Resistance. ESD Resistance shall be tested IAW section 4.14. (T) The bomb suit shall offer a grounding means to enable a contiguous ground path from the person wearing the bomb suit to the walking surface. The resistance of the grounding between the wearer and the ground shall be less than $1x10^{10}$ Ohms. This feature shall be included with the bomb suit, to be installed or removed from the bomb suit at the wearer's discretion. (O) The bomb suit shall have a passive grounding system.

3.15 Shell Materials. The bomb suit's flame resistant outward facing shell shall have minimum break strength of 260 lbs. in the warp direction and 220 lbs. in the fill direction. Minimum break strength after 10 home launderings per AATCC 135-1995 machine cycle (1), washing temperature (II), and drying procedure (B) shall be 200 lbs warp and 160 lbs fill.

The outer shell of the suit shall have minimum tear strength of 35 lbs in the warp direction and 30 lbs. in the fill direction. The outer shell (outward facing material that is subject to rainwater) shall be tested for water repellency. Water repellency spray rating shall meet or exceed 90,90,80 in the new condition. After 10 home launderings per AATCC 135-1995, machine cycle (1), washing temperature (II), and drying procedure (B), spray rating shall meet or exceed (T) 50,50,50 or (O) 70,70,70.

The bomb suit flame resistant inner shell surface shall have minimum break strength of 150 lbs in the warp direction and 100 lbs in the fill direction. No more than 20% loss of break strength shall be incurred after 10 home launderings per AATCC 135-1995 machine cycle (1), washing temperature (II), and drying procedure (B). Flame resistant inner shell material shall have minimum tear strength of 10 lbs in warp direction and 6 lbs in fill direction. Shell materials shall be tested IAW section 4.15.

3.16 High Wear Areas. (T) Rubberized foot cover and rubberized knee pad shall provide abrasion resistance and durability. Materials used in these regions shall provide minimum of 5000 cycles durability. Foot cover high wear areas include the sole of the foot cover and areas on top of the foot cover that are subject to abrasion when kneeling. (O) The bomb suit shall be designed for easy replacement of reinforced high wear areas. High wear areas shall be tested IAW 4.16.

3.17 Health Hazard Prevention. The bomb suit system shall show no toxicity nor create a health hazard to the user as a result of normal usage when evaluated IAW section 4.17. These hazards include; allergies to materials used in the suit, musculoskeletal injury due to poor weight distribution of components, and sharp objects, such as exposed fasteners in the helmet.

3.18 Color. Overall color of bomb suit trousers, jacket, and helmet shall be a subdued green color or as specified in the contract. Reinforced high wear areas may be either green or black or as specified in the contract. Color shall be tested IAW section 4.18.

Examples of acceptable green colors shall approximate Pantone 190323 TP, 180420 TP, 180622 TP, 175912 TP, 186114 TP, FED-STD 595B color chips 34094 (CG483), 34095, 34102, 34087 (OG 106), or 34127.

Examples of acceptable black colors shall approximate Pantone colors 190000 TP, 190608 TP, 194305 TP, or FED-STD 595B 37030, 37031, 37038.

3.19 Pockets/Stowing. The bomb suit shall provide pockets or other means of stowing and transporting hand tools and ancillary equipment used in the mission, in a safe and secure manner. The following tools and equipment shall be accommodated: Commercial multi-tool (examples: Leatherman, Gerber, Schrade), and a fixed blade knife of 4 to 6 inches in length. Pockets or other stowing and transporting means shall be positioned to minimize snagging, optimize safety and ease of reach, and securely hold the tools and equipment. A tape loop shall be secured to the front center of the suit at omphalion level to secure roll of tape. A pair of 1 inch non-metallic D-rings shall be attached vertically and 6 inches to left and right of the saggital plane at the omphalion level.

3.20 Helmet Retention. The bomb suit helmet shall provide an easily adjustable, comfortable helmet retention system that provides maximum stability and retention while providing easy helmet removal during doffing. A washable, comfortable, flame resistant head cover such as a balaclava shall be provided. Comfort liner materials, earpads, and other components subject to direct contact with the scalp, face, ears, and neck shall be shall be removable and replaceable from the helmet, as well as hand washable.

3.21 Lighting. The bomb suit system shall provide a hands free lighting accessory to permit operation under dim or no light conditions. Lighting control (on/off switch) shall be easily accessible. The light shall provide improved vision during low light conditions when performing Render Safe, Disruption, and Reconnaissance missions. Minimum acceptable illumination shall be 20 lux at a distance of 72.0 inches from the light source. This minimum illumination shall be available over a circular area no less than 18.0 inches in diameter at a distance of 72.0 inches from the light source. Lighting shall be tested IAW 4.21.

3.22 Compatibility/Interfaces. The bomb suit shall be compatible with all functional equipment required for the EOD mission including cooling system, eyeglasses, and Nuclear, Biological, Chemical protective (NBC) equipment. The bomb suit system shall provide the option to allow wear of an M40A1 mask and Joint Service General Purpose mask (XM53) via use of an optional visor. Testing shall be performed IAW section 4.22.

3.22.1 Eyeglasses/Corrective Eyewear. EOD Soldier shall be capable of wearing standard military issue vision correcting eyeglasses field kit frame of choice item NSN: 6540-01-522-8094 with the ABS.

3.22.2 NBC Equipment. Helmet must be compatible with the M50 Joint Service General Purpose Mask.

3.22.3 Power supply. (T) Power supply(s) shall be compatible with standard size commercial off-the-shelf Alkaline batteries and commercial off-the-shelf rechargeable batteries (Nickel Metal Hydride type). Examples of standard sizes include AA, AAA, C, D. No tool shall be required for replacement of batteries. (O) Connection for optional secondary power source using existing DoD rechargeable power source.

3.22.4 CREW (Counter Radio Controlled Explosives Warfare) Systems. Bomb Suit Shall be interoperable with the CREW system.

3.23 Environmental. The bomb suit shall operate in and withstand all environmental conditions expected to be encountered in Hot and Basic climatic categories with minimal detrimental effects to operation.

The bomb suit shall provide ballistic protection that does not degrade due to aging of materials, normal usage, perspiration, UV exposure, or exposure to the environment when tested IAW section 4.2 and 4.23.

3.23.1 Fungus resistance. All components and parts of the bomb suit, including interior components, shall be resistant to fungal growth. The visual grading shall be less than or equal to 2. All components shall show only trace or no susceptibility to fungal growth nor experience damage due to the presence of fungus spores or adjacent fungus growth when tested as specified in 4.23.1

3.24 Shelf Life. The ABS shall be rot, mildew, petroleum, oil, and lubricant resistant. It shall be water/saltwater, ultraviolet (UV) light resistant and have a shelf life of not less than ten years.

3.25 Launderability/Washability. The shell of the trousers, jacket, and other large components with areas making contact with the body during wear of the bomb suit, shall be machine washable per AATCC 135-1995 machine cycle (1), washing temperature (II) and drying procedure (B). The laundered bomb suit shall retain integrity and proper function following 10 launderings. Each laundering cycle of the bomb suit includes disassembly, laundering, drying, and reassembly. The helmet shall be cleanable with a damp cloth. The helmet liner components, such as helmet ear pads, fit pads, comfort liners, and balaclavas that are subject to skin contact shall be washable by hand. The helmet liner components shall retain integrity and full function following 10 hand washings. Each hand washing cycle includes disassembly, laundering, drying, and reassembly. Washable helmet liners shall be removable and replaceable. Manufacturer's disassembly, cleaning, drying, and reassembly instructions will be consulted for specific procedures as needed. Launderability shall be tested IAW section 4.24.1.

3.26 Ballistic Panels. The bomb suit shall have removable and replaceable ballistic panels to permit laundering and facilitate repair. The ballistic panels shall be securely

fastened to prevent shifting from proper position during storage, transportation, and operational use. Ballistic panels shall be marked, indicating location and orientation in the bomb suit. Ballistic panels shall be constructed so that during use within the suit and while ballistic panels are removed from the suit, the ballistic properties are not compromised due to potential exposure to water, UV/sunlight/other light damage, detergents, or other environmental conditions likely to be encountered. Ballistic materials are not required to be removable from the helmet, boot covers, or leg expansion sizing panels. Ballistic panels that house materials that could be degraded by liquids shall be covered and sealed in a polyurethane coated 70 x70 denier nylon fabric that is edge sealed. Edge seal shall be no less than 3/16 inch wide along perimeter of soft armor ballistic panel. The polyurethane coated material shall have the following physical characteristics: Weight shall be 3-4 oz/yd^2; Tear Strength shall be no less than 1.0 lb Warp and 1.0 lb Fill when tested per ASTM D2261; Break Strength shall be no less than 125.0 lb Warp and 100.0 lb Fill when tested per ASTM 5034; Hydrostatic Resistance shall be no less than 126 lb/in^2 when tested per ASTM D751 Procedure A. Ballistic panels shall be tested IAW section 4.26.

3.27 Labeling. Suit Components. Every major suit component (jacket, trouser, and other individual components) shall have a full descriptive label. The label shall be permanently attached to interior of the major component in a location that is readily visible during equipment preparation for usage. Information on the label shall be indelible and be readable after 10 machine launderings per paragraph 3.4.2. Type on the label shall be no smaller than 10 point. The label shall contain the following information. Labeling shall be evaluated IAW section 3.4.4.

- Item nomenclature
- Contractor Name
- Model Number
- Contract Number
- Date manufactured
- Size (if applicable)
- Serial Number
- Lot Number
- Care and Laundering instructions
- National Stock Number

Ballistic Panels. Removable ballistic panel labeling shall be labeled with the following information:

- Item nomenclature
- Contractor Name
- Model Number
- Contract Number
- Date manufactured
- Size (if applicable)
- Serial Number

- Lot Number

The removable ballistic panels shall have, as needed, orientation and positioning indicators if the ballistic panel can be reinstalled incorrectly into the wrong side of the suit, upside down, or in any other incorrect position that will compromise protection. If components need to be labeled “RIGHT” or “LEFT”, then “RIGHT” and “LEFT” labeling shall correspond to the right side of the person wearing the suit and the left side of the person wearing the suit, respectively.

The helmet shall be either stamped or labeled (such as a pressure sensitive label) in a location that is not visible from the outside of the helmet during normal use, but is easily accessible when the helmet is not being worn. The label shall provide the following information:

- Item nomenclature
- Contractor Name
- Model Number
- Contract Number
- Date manufactured
- Size (if applicable)
- Serial Number
- National Stock Number

3.28 Storage and Transport Containers. The bomb suit system shall have a storage system as follows:

3.28.1 Storage and transport case for helmet, visor, and small accessories storage. This storage case shall have a carry handle to permit transport of the item under typical field usage. Each container, with its intended contents, shall maintain integrity and protect its contents from drops and handling likely to be incurred during field use. The helmet storage and transport case shall be rigid. The helmet visor shall have a protective cover to prevent damage during storage and preparation for use.

3.28.2 Short term storage and transport case for jacket and trousers (non-helmet components). The short term storage and transport case shall be made of flexible material and have a carry handle to enable easy movement between vehicles and ground. It shall have a comfortable means to carry as a backpack to enable easy movement of item from storage and transport areas over distance to other areas under typical field usage. It shall have an internal storage pocket capable of holding user instruction cards and any add-on components and accessories required to permit proper functioning of the system.

3.28.3 Long term storage container for jacket and trousers (non-helmet components). The storage case shall be rigid with a hinged lid that has a mechanical closure.

3.28.4 Each respective storage case and its contents shall be capable of being stacked 3 high (6 high for helmets) without incurring damage to contents. Soft cases shall be designed with adequate padding to prevent damage to the enclosed items during transport and handling. Handles or other handling/transportation features on the storage containers shall

be durable with design consideration for ease of repair/replacement. Closures on the storage containers shall be easy to operate and shall be durable. The storage system shall be tested IAW section 4.28.

4.0 VERIFICATION. Unless otherwise stated, the following requirements apply to a finished bomb suit consisting of a helmet, jacket, trousers, and other components required to provide required protection and usability.

4.1 Classification of inspections. The inspection requirements specified herein are classified as outlined below. Unless otherwise specified, the contractor is responsible for the performance of all inspection requirements specified herein. The Government reserves the right to perform any of the inspections set forth where such inspections are deemed necessary to ensure the supplies conform to prescribed requirements.

a) First Article Test (FAT) (see 4.2)

b) Lot acceptance/Conformance Inspection test (see 4.3)

4.1.1 First article test. When a first article test is required, it shall be examined for requirements shown in table III.

4.1.1.1 Pre-First Article Testing. Prior to FAT, the contractor must submit their technical data package to the Government for approval in order to gain approval to conduct FAT. The technical data package shall include, but not limited to the following:

- Two (2) suits sized for the 50% percentile male soldier. One (1) each for DCMA and PM Standard Samples.
- Two (2) dry lay-ups for each unique ballistic package. One (1) each for DCMA and PM Standard Samples.
- The dry lay-up shall not be sewn together or compressed and shall be placed inside the cloth ballistic cover that shall be heat sealed on only three sides allowing for the ballistics to be taken out/put in.
- Bomb Suit technical documentation shall contain the following information:
- Build Sheet
- Design Nomenclature
- Material Types, Model/Part Numbers, Nomenclatures, etc
- Number of plies, Orientation, Weave, Denier, Weight, etc
- Areal Density
- Stitch Pattern
- Component Dimensions

Any priority data or intellectual property provided by Contractors, to include dry-layups, technical information, and sample inserts, will be properly protected and will not be disclosed outside of the Government, in accordance with DFARS clause 252.227-7013.

4.1.2 Material qualification. At any point after a first article test has been approved, any material change shall be tested in accordance with the appropriate paragraph of this Purchase Description and approved by the Government.

4.1.3 Protective package qualification. At any point after a first article test has been approved, any material or process change to the protective package will be required to pass all first article test requirements as specified.

4.1.4 Conformance inspection. Conformance inspection shall be performed in accordance with Section 3 and 4. The Government's acceptance of the contractor's end item product will be determined by the protective requirements validation.

4.1.5 Certificate of Compliance (COC). When COCs are required, the Government reserves the right to inspect such items to determine the validity of the certification. COCs shall include substantiating data.

4.1.6 Demonstration verification. The performance requirement is verified by observation and operation that the properties, characteristics and parameters of the item meet the functional requirements specified in applicable paragraphs of Section 3. Pass or fail criteria are simple accept or reject indications of functional performance since no quantitative values exist or are difficult to measure.

4.1.7 Requirements and verifications. Table III delineates performance requirements verified during FAT and LAT. Table IV delineates component quantities required for FAT and LAT.

TABLE III. Requirements and Verifications

Characteristic	Requirement Paragraph	Verification Paragraph	FAT Initial Production (FAT)	Conformance Lot Inspection
Ballistic Protection (Suit System)	3.2	4.2	X	x
Ballistic Protection (Helmet System)	3.2	4.2	X	x
Blast Protection Levels	3.3	4.3	X	NT
Non-ballistic Impact Protection, Head	3.4.1	4.4.1	X	x
Non-ballistic Impact Protection, spine/back	3.4.2	4.4.2	X	NT
Flame/Heat Protection, Suit Shell Materials	3.5.1	4.5.1	X	CoC
Flame/Heat Protection, Helmet	3.5.2	4.5.2	X	CoC
Weight	3.6	4.6	X	x
Vision/Optics	3.8	4.8	X	CoC
Electrostatic Discharge Resistance (Wearer to ground)	3.14	4.14	X	CoC
Suit Outer Shell (outer facing/exposed)	3.15	4.15	X	CoC
Suit Outer Shell (body facing)	3.15	4.15	X	CoC
High Wear Area materials	3.16	4.16	X	CoC
Colors	3.18	4.18	X	CoC
Helmet Retention	3.20	4.20	X	CoC
Lighting	3.21	4.21	X	CoC
Interface and Interoperability	3.22	4.22	X	CoC
Environmental	3.23	4.23	X	CoC
Launderability	3.25	4.25	X	CoC
Ballistic Panels	3.26	4.26	X	CoC
Labeling	3.27	4.27	X	CoC
Storage and Transport	3.28	4.28	X	CoC

NT = Not Tested in LAT. However, the government reserves the right to conduct any test in this specification at any time and refuse acceptance due to a failure.

Table IV. Testing Quantities

		FAT		LAT	
		Quantity	Type	Quantity	Type
V50 Ballistic Testing	Chest	16	shootpack + blast shield	3	end item
	Groin	46	shootpack + blast shield	10	end item
	Neck	48	neck shaped shootpack	8	end item
	Face Shield (Transparent)	16	end item	2	end item
	Area between transparent armor and helmet shell if applicable	23	end item	3	end item
	Helmet shell	24	end item	4	end item
	Front Arms, Front Sides Torso, Front Sides Abdomen/Pelvis, Front Sides Neck	24	15"x15" shootpack	6	end item
	Back of Arms, Back Torso, Back of Neck, Top of feet	24	15"x15" shootpack	4	end item
	Front Upper Legs	24	15"x15" shootpack	6	end item
	Front Lower Leg	24	15"x15" shootpack	4	end item
	Rear Legs	16	15"x15" shootpack	4	end item
Destructive testing	Blast	5	complete suit and helmet (50th percentile male)	0	
	Non-ballistic Impact Protection, Head	9	complete helmets	9	Complete helmets
	Non-ballistic Impact Protection, spine/back	6	3 each of smallest size and largest size spines	0	
	Flame/Heat Protection, Suit Shell Materials	1	sq yd of material	0	
	Flame/Heat Protection, Helmet	1	Helmet shell with outer cover if applicable	0	
	High Wear Area materials	3	1 each knee, sole of foot, top of foot	0	
Non-destructive testing	Weight	1	complete suit and helmet (50th percentile male)	0	
	Vision/Optics			0	
	Electrostatic Discharge Resistance (Wearer to ground)			0	
	Suit Outer Shell (outer facing/exposed)			0	
	Colors			0	
	Hearing Protection			0	
	Helmet Retention			0	
	Lighting			0	
	Interface and Interoperability			0	

4.2 Ballistic Performance. Verify that required protection is provided to all portions of the bomb suit wearer's body as described in Paragraph 3.2. Testing will be conducted on end items, and/or 15 x 15 inch shoot packs (for soft armor areas), and/or a combination of end item rigid components integrated onto 15 x 15 inch shoot packs or larger shoot packs as needed to represent the end item component. In cases where the rigid end item component is to be attached to a representative soft armor shoot pack, the soft armor shoot pack shall be rectangular and extend at least 3.0 inches beyond the largest dimension of the rigid component to enable uniform clamping. The rigid component shall be attached to the soft armor shoot pack backing using the same attachment means used in actual suit construction. The items to be provided for Ballistic Performance testing will be called out in the contract.

TABLE V. Ballistic Requirements

Location	17 gr FSP ambient	17 gr FSP conditioned	2 gr RCC ambient	4 gr RCC ambient	16 gr RCC ambient	64 gr RCC ambient	64 gr RCC conditioned	# of V50 tests required per threat
Chest/Groin						4020 (L)	4020	2
Neck	2700 (L)	2700	5000	3840	2735	2030		2
Face Shield (Transparent)	2500 (L)	2500						1
Area between transparent armor and helmet shell if applicable	2560 (L)	2560						1
Helmet	1970 (L)	1970	3575	2990	2190	1715		2
Front Arms, Front Sides Torso, Front Sides Abdomen/Pelvis, Front Sides Neck	1720 (L)	1720	2515	2215	1920	1580		2
Back of Arms, Back Torso, Back of Neck, Top of feet	1320 (L)	1320	1930	1720	1585	1245		2
Front Upper Legs	2340 (L)	2340	3420	2865	2490	1995		2
Front Lower Leg	2090 (L)	2090	2965	2450	2205	1830		2
Rear Legs	820 (L)	820						2

Notes:
1. If the same ballistic package is used in multiple regions, shoot packs may be used to represent multiple regions.
2. All tests are required for FAT. Tests labeled with (L) are required to be verified during LAT as well as FAT.
3. Conditioning includes all conditions outlined in sections 4.6.1. and is tested for government reference only.

4.2.1 Conditions. Dry specimens and specimens after; water submersion (sea water), hot temperature, cold temperature, accelerated aging and POL conditioning will be ballistically tested after being conditioned for government reference only. Prior to conditioning, the heat sealed ballistic cover and the outer carrier will be carefully cut 4-inches along the top and bottom edges without cutting into the ballistic filler allowing the ballistic filler to be completely exposed to the environmental conditions.

4.2.1.1 Sea Water (Wet Conditioning). Sea water shall be utilized for wet test conditions. Prior to conditioning, the heat sealed ballistic cover and outer carrier will be

carefully cut 4-inches along the top and bottom edges without cutting into the ballistic filler allowing the ballistic filler to be completely exposed. Sea water formulation is 3% sodium chloride / 0.5% magnesium chloride. The armor submersion equipment shall consist of a water bath that allows for at least one armor panel of the largest size lay horizontally, without any folds or bends. The specimens are submerged such that the fluid is in contact with all exterior surfaces to allow maximum fluid penetration. A ten pound weight shall be placed on a 15" x 15" plate to distribute load to allow for maximum fluid penetration for a minimum of 24 hours but should not exceed 24.5 hours. The water temperature shall be 70 degrees F ± 10 degrees F. For armors that are buoyant, additional weights shall be used to ensure that the entire sample is submerged. After removing the specimen from the water, it shall be hung vertically and 1allowed to dry for 10 min (+5 min/-0 min) and tested within 5 minutes with tests completed within 60 minutes.

4.2.1.2 Temperature Extreme Conditions. Prior to conditioning, the heat sealed ballistic cover and outer carrier will be carefully cut 4-inches along the top and bottom edges without cutting into the ballistic filler allowing the ballistic filler to be completely exposed. For hot temperature extreme, the armor sample shall be heated in an oven operating at 155 + 10 degrees Fahrenheit for 6 +/- ¼ hours continuously. The test specimen shall be removed from the oven, mounted and ballistically tested within 10 minutes with tests completed within 60 minutes. For cold temperature extreme, the armor sample shall be cold temperature exposed to -60 +/-10 degree F for 6 +/- ¼ hours continuously. The test specimen shall be removed from refrigeration, mounted and ballistically tested within 10 minutes with tests completed within 60 minutes. If either test is not completed within 60 minutes the specimen shall be reconditioned for at least 1 hour at the temperature specified above.

4.2.1.3 Accelerated Aging. Prior to conditioning, the heat sealed ballistic cover and outer carrier will be carefully cut 4-inch along the top and bottom edges without cutting into the ballistic filler allowing the ballistic filler to be completely exposed. Accelerated aging for the armor sample will be performed in general accordance with ASTM D1149, with the following modifications. The entire armor sample under test will be subjected to treatment. All tested components will be conditioned for 72 hours at 40ºC while maintaining a minimum of 50 parts per hundred million of ozone. The armor sample do not require any additional tensile strain during accelerated aging conditioning. After accelerated aging conditioning, the armor sample under test must remain at ambient (70 ± 5°F) atmospheric conditions for a minimum of 24 hours prior to ballistic testing, not to exceed 36 hours from completion of conditioning.

4.2.1.4 POL Contamination. Prior to conditioning, the heat sealed ballistic cover and outer carrier will be carefully cut 4-inch along the top and bottom edges without cutting into the ballistic filler allowing the ballistic filler to be completely exposed. POL conditioning should be done on each of the following; motor oil (motor oil shall conform to ASTM D-4485, Grade CD-II) and F-24. The specimens shall be placed flat in an adequately sized pan for the largest size vest to lay flat with enough POL fluid in the bin to cover the test item. A ten-pound weight shall be placed on a 15" by 15" plate to

distribute load to allow maximum fluid penetration. The loaded specimen shall remain immersed for 4 hours -0/+15 mins at room condition. After removing the specimen from the POL fluid, it shall be hung vertically and allowed to dry for 15 minutes. Excess POL fluid shall be wiped from the surface to facilitate handling of the specimen. Before mounting in the test fixture, the sample may be contained in a resealable plastic bag and mounted to the test fixture to limit exposure to contaminants and fumes. The specimen then shall be ballistically tested within 30 minutes from removal in the POL fluid, with testing completed within 60 minutes. If the testing is not completed within 60 minutes another specimen shall be conditioned as specified above and the testing shall continue with the second panel.

4.2.2 Ballistic Test Criteria. For all Ballistic Performance tests the following minimum information is required by the government to validate performance:

- Armor specimen description including exact materials description by layers, thickness, sizes, weights of all components and areal density of armor system
- Conditioning of armor specimen
- Test projectile with exact nomenclature
- Test date, temperature and humidity measurements
- Yaw angle
- Angles of target obliquity
- Velocity measurements of each test shot used to test the armor
- Velocity loss and/or corrected striking/residual velocity for fragment simulating projectiles
- PP (Partial Penetration) designation or CP (Complete Penetration) designation next to each shot velocity as determined.
- Angle of spall/debris ejection if applicable
- Name of company performing tests
- Type of gun barrel, caliber, and propellant used
- Range measurements including distances from gun barrel to velocity measurement devices and target

4.2.3 Projectile Velocity Determination. Projectile velocity measurement methods shall employ either high velocity lumiline screens or electrical contact screens which either open or close an electric circuit by passage of the projectile through the detector. Contact screens may consist of metallic foils separated by a thin insulating layer, or may consist of a circuit printed on paper with the circuit spacing such that the projectile passing through the screen will break the circuit. An electric counter type chronograph measuring to the nearest microsecond or as a minimum to the nearest 10 microseconds will be used with these measuring devices. As an alternative, radiographic equipment calibrated to capture the projectile at various time intervals of flight can be used. For fragment simulating projectiles, velocity correction methodology shall be used to calculate the actual striking velocity and, where appropriate, actual residual velocity.

4.2.4 Weapon Mounting Configuration. The spacing from the weapon muzzle to the first pair of triggering devices shall be sufficient to prevent damage from muzzle blast and obstruction from smoke in case optical devices are used. Recommended distances can be found in USATECOM ITOP 04-2-805. Spacing between triggering devices is a function of the expected velocity of the projectile being fired. In many instances, physical restriction, such as short overall distance from muzzle to test sample dictates the spacing of the triggering devices. The last pair of triggering devices shall be placed at least four (4) feet (122 cm) in front of the test sample and should be protected from possible damage resulting from fragments.

4.2.5 Environmental Test Conditions. All ballistic tests shall be performed at standard atmosphere of 68 (+/- 10) degree Fahrenheit and 50 (+/- 20) % relatively humidity. Temperature and humidity measurements shall be recorded before the beginning of day's test firings and every two hours thereafter.

4.2.6 Projectile Yaw Determination. Projectile yaw shall be measured for each firing by yaw cards, flash radiograph or photography. Any round for which yaw is determined to be greater than 5 degrees shall be disregarded in the calculation of the ballistic limit. The measurement system employed should be capable of measuring yaw within an accuracy of 0.5 degree.

4.2.7 V50 BL Calculation. For non-helmet armor systems, which includes the face shield, and components three (3) Partial Penetrations (PP) and three (3) Complete Penetrations (CP) within a 125 ft/sec velocity spread or five (5) Partial Penetrations (PP) and five (5) Complete Penetrations (CP) within a 150 ft/sec velocity spread yield the V50 BL determination that will be accepted. If neither the 6 shot or 10 shot conditions for determination of V50 can be satisfied, and if there are at least five partial penetrations at velocities in excess of the minimum required V50 velocity, and there are no complete penetrations at or below the minimum required V50 velocity, and at least 10 fair shots have been made into the test items, the test items will be determined to have satisfied that specific threat condition requirement. For all bomb suit components, more shots may be required to calculate a more accurate V50 with standard logistic regression statistical method for First Article Testing or/and production lot testing as specified in FAT/QA protocol document.

For helmets the V50 BL for each helmet shell shall be determined from the average of five (5) Partial Penetrations (PP) and five (5) Complete Penetrations (CP) within a 125 ft/sec velocity spread. In cases where the velocity spread is greater than 125 ft/sec, seven (7) Partial Penetrations (PP) and seven (7) Complete Penetrations (CP) within a 150 ft/sec velocity spread yield the V50 BL. If neither the ten or the fourteen shot conditions can be satisfied, and at least seven partial penetrations at velocities in excess of the required minimum V50 have been achieved, and there are no complete penetrations at or below the minimum required V50 velocity, and at least 14 fair shots have been made in the helmet(s), then the requirement will be deemed satisfied. Should none of these three conditions apply, the test shall be declared inconclusive.

4.2.8 PP and CP Determination for V50. Complete and partial penetrations (see 6.6) will be determined based on the impressions left on an aluminum witness sheet. A 0.020 in. (0.51 mm thick 2024 T3 sheet of aluminum) will be placed 6 (+0.5/-0.0) inches(152 + 12.7 mm/-0.0 mm) behind and parallel to the target (3 inches for helmet and face shield). The aluminum witness sheet will be at least 15 x 15 in. size (smaller size allowed for helmet and visor testing) and be of sufficient size to capture all fragments resulting from the ballistic event, mounted rigidly around its perimeter and placed so that the target impact location is approximately at the center of the aluminum sheet. Perimeter restraint is required for shoot packs during testing so that the material is not pulled through the ballistic test window frame. Unrestrained or improperly restrained shoot pack materials will tend to be pulled down the projectile line of flight. Uniform application of perimeter restraint provides more accurate and reproducible data.

4.2.9 Helmet Shell

Helmet test samples shall be divided into 5 sections (Crown, Front, Left, Rear, and Right) with markings made on the outside surface of the shell. The Crown shall be a 5.0 inch diameter circle centered at the peak of the helmet. The remaining four sections shall be marked by dividing lower edge of the Crown into four sections. The zero degree mark is placed in the front center of the helmet and the angular orientation proceeds in a counterclockwise progression as viewed from the top of the helmet. The Front, Left, Rear, and Right sections shall be formed by drawing lines from lower edge of the shell to the location of the Crown center. Helmet sectioning schematic is depicted in section 6.

- Helmet shall be rigidly mounted.
- Ensure that any penetrating projectiles do not strike the opposite side of the helmet.
- A minimum of two fair shots shall be randomly fired in each section.
- All shots for each section shall be located within the marked dividing lines.
- Shots shall be placed at least 2.0 inches from previous shots.
- Shots shall be placed at least 1.0 inch from edge of shell or drilled holes
- If two fair shots cannot be placed in a section, the second shot shall be placed on another helmet in the same section, but not in the same location as the first shot. If a shot, considered unfair because of location, results in a partial penetration, it may be considered a fair shot.
- Inspect inside surface of helmet and avoid shooting any areas delaminated from previous shots.
- Holes or other passages in the helmet shell are permitted to allow proper functioning of the helmet as long these areas provide the required protection. Testing will be conducted as needed to measure protection for these conditions.

4.2.10 Visors

- Visors shall be rigidly mounted.
- Shots shall be placed at least 1.0 inch from edge.
- Shots shall be place at least 2.0 inches from previous shots.

- Visors designed with variable construction (i.e. transparent and opaque) will have each differentiated area tested separately. If the helmet is required to enable designed protection to be achieved, then visor and helmet will be tested as a system. A new helmet will be used for the visor test.

4.2.11 Suit Shoot pack Panels or Actual Suit Component Testing

Soft armor shoot packs should be 15.0 x 15.0 inch square size panels and configured in the proposed final armor material system for the First Article Testing Only (see 6.3). Test samples configured with end item rigid armor panels should be rectangular with minimum dimensions of 15.0 x 15.0 inches and have 3.0 inches or greater soft armor backing extending beyond the largest dimension of the rigid component. If a rigid armor panel is curved, the minimum dimension of the panel shall be 15.0 x 15.0 inches as measured along the curved surface. If full suit systems are required for First Article Test, the actual suit will be appropriately disassembled and fixtured.

For all size shoot pack test panels a metallic frame (approx. 0.20 inch thick aluminum or steel) with minimum 1.4 inch webbing shall be employed to restrain the test material during ballistic impact.

The shoot pack test panel will be sandwiched between 2 frames and restrained with mechanical or pneumatic clamping devices at each of the four corners of the frame.

The restraining frames for soft armor shoot packs will be cut so that a ballistic window of minimum 12.0 x 12.0 inch square is available for testing. For shoot packs containing end item rigid armor panels, the available ballistic testing window shall be no less than 12.0 x 12.0 inches and provide ballistic testing window no less than 1.5 inches from edge of shoot pack.

Soft armor samples: All shots shall be at least 3.0 inch from any edge of shoot pack or actual suit component. Test shots shall be sufficiently spaced so that sequential shots are not influenced by previous impact areas. A minimum shot spacing of 2.5 inch is required but 3.0 inch is recommended.

Shoot packs or actual suit components containing rigid armor only: All shots shall be placed at least 1.0 inch from edge of rigid panel for fragment simulating projectiles up to and including 64 grain nominal mass. Test shots shall be sufficiently spaced so that sequential shots are not influenced by previous impact areas. A minimum shot spacing of 2.5 inch is required for fragmentation simulators up to 64 grain nominal mass, but 3.0 inch is recommended. 207 grain fragment simulating projectiles require a minimum shot placement of 3.0 inch from edge and a minimum shot spacing of 3.5 inch (4.0 inch is recommended).

Shoot packs or actual suit components containing rigid armor and soft armor: All shots shall be placed at least 1.0 inch from edge of rigid panel and at least 3.0 inch from edge of soft armor for fragment simulating projectiles up to and including 64 grain nominal mass. Test shots shall be sufficiently spaced so that sequential shots are not influenced by previous impact areas. A minimum shot spacing of 2.5 inch is required for

fragmentation simulators up to and including 64 grain nominal mass, but 3.0 inch is recommended. 207 grain fragment simulating projectiles require a minimum shot placement of 3.0 inch from edge of rigid panel and at least 3.0 inch from edge of soft panel with a minimum shot spacing of 3.5 inch (4.0 inch is recommended).

Depending on the test panel size it may be necessary to use 2-3 panels for the V50 determination.

Test specimens shall be reconditioned to initial shape after every shot.

4.3 Blast Overpressure Protection. Verify that blast integrity is provided per Paragraph 3.3. Bomb suits and helmet systems designed to fit the 50th percentile male will be blast tested under full scale blast conditions using an Anthropomorphic Test Device (ATD). Protection will be measured using free field detonation of 1.25 lbs of C-4 explosive at a nominal range of 2 feet. Face-on peak pressure shall be attenuated by at least 80% over the frontal thorax vs the unprotected case. Three tests shall be conducted, each with a protected mannequin and an unprotected mannequin. The average peak pressure will be calculated and compared to determine percent reduction. In addition, a pressure sensor will be placed in the ear of both the protected and unprotected mannequin with data taken for government reference only.

4.3.1 Head and Neck Blast Injury Protection. The bomb suit shall provide protection from blast-induced head acceleration and neck injury. Head Injury Criteria (HIC) values shall be attenuated by 80% vs. unprotected and Neck Injury Criteria shall remain below 1.0, as per NHTSA Injury Criteria, for tests conducted using 1.25 lbs C4 placed at 24 inches from the center of the explosive charge to the sternum of the mannequin. Three tests shall be conducted, each with a protected mannequin and an unprotected mannequin. The average peak pressure will be calculated and compared to determine percent reduction.

4.3.2 Blast Coverage. Verify that a rigid thoracic plate system contiguously covers the frontal thoracic and abdomen areas of the wearer. Plate system shall overlap across the chest and abdomen.

4.4 Impact Protection. Impact attenuation shall be in accordance with the requirements in Paragraph 3.4 and tested as follows:

4.4.1 Helmet Impact Protection. The non-ballistic impact protection shall be tested IAW NIJ 0117.01 with the following modifications:

Ambient drops onto a flat surface shall be done at 22 ft/sec.
Pass/fail criteria shall be as stated in section 3.4.1.
Full helmet assemblies with face shields shall be used.

4.4.2 Spine Impact Protection. Testing shall be conducted IAW NIJ standard 0117.01 except that a 75 J threat energy shall be used.

4.5 Flame/Heat Protection. Flame/Heat Protection shall be in accordance with the requirements in Paragraph 3.5 and tested as follows:

4.5.1 Outer Shell. The suit's outer shell material shall be tested per ASTM D6413.

4.5.2 Helmet Flame Resistance. The helmet shell shall be tested per ASTM D6413 except that the helmet will be suspended such that the burner flame hits the outside surface of the helmet at the crown at a 90 degree angle to the flame. The distance between the helmet shell surface and the top of the burner shall be 1.5 inch. The flame shall be adjusted so that the tip of the inner cone of the flame impinges on the helmet surface (total flame height is approximately 3 inches). The helmet shell shall be exposed to the flame for 12 seconds and then the flame shall be removed.

4.6 Weight. Verify that the weight of the bomb suit does not exceed the requirements of 3.6 utilizing a scale with resolution to 0.1 lb.

4.7 Maneuverability/Flexibility and Operational Suitability. Verify that the basic mission profiles as described in 3.1.1.6 can be performed in a safe and timely manner. The Government will conduct standard representative mission performance scenario techniques, tactics, and procedures using experienced EOD Soldiers.

4.8 Vision/Optics. Verify through observation, operation and testing that the Visor/Helmet configuration does not impede vision per requirements of 3.8.

4.8.1 Visor Clarity and Workmanship. The visor shall meet the requirements of 3.3.1. The viewing area shall be visually inspected under illumination with the unaided eye for surface defects. The visor shall be positioned in the "as worn" position from the examiner. Visually scan the viewing area for imperfections while viewing a straight edge (e.g. the edge of a bare, straight fluorescent lamp against a dark background), move the visor slowly while looking for waves, ripples, image jump, and other defects.

4.8.2 Luminous Transmittance. The visor shall meet the requirements of 3.8.2 when tested per ASTM D 1003, Standard Test Method for Haze and Luminous Transmittance of plastics. The measurement shall be for CIE Illuminant A or C.

4.8.3 Prismatic Deviation. The visor shall meet the requirements when tested per method described in MIL-DTL-43511D paragraph 4.4.1. Aperture plate shall be positioned nominally 1.0 inch in front of test item. A nominal interpupilary distance of 2.60 inches shall be used. The visor will be measured in five locations: 1L-1R, 3-2R, 2L-3, 4L-4R, 5L-5R. For locations 3-2R and 2L-3, the visor shall be rotated about the vertical axis maintaining the front surface vertical so that the horizontal tangent of the apex is perpendicular to the laser light path.

4.8.4 Refractive Power. The visor shall meet the requirements when tested per ANSI Z87.1. Measurements will be taken at locations 1L and 1R.

4.8.5 Haze. The visor shall meet the requirements of 3.8.5 when tested per Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics, ASTM D1003. The measurement shall be for CIE Illuminant A or C.

4.8.6 Fogging. Fogging resistance shall meet the requirements of 3.8.6. The helmet and visor shall be conditioned to a temperature of 40 (+/- 2) °F for 8 hours. The suit system shall then be donned by a test subject (with the help of an assistant) in accordance with the manufacturer's instructions. The suit is to be donned and worn under controlled conditions 70 (+/- 2) °F, 65 (+/- 2) percent relative humidity during this test. When it is time to don the helmet system and visor, the helmet and visor shall be removed from the conditioning environment and donned to the wearer within 30 seconds of being removed from the conditioning environment. Should the design include a separate helmet and visor system with a visor that shall be installed separately, the helmet and visor will be installed no more than 60 seconds apart. Final donning preparations and adjustments to the suit system shall be made within the next 90 seconds. No more than 120 seconds shall pass from removal of the helmet/visor from the conditioning chamber to the point where the complete suit system is donned and adjusted for correct fit. Within the next 30 seconds, the test subject shall walk 30 feet forward to a point and return 30 feet to starting point. When walking exercise is complete, the test subject shall stand and breathe normally until those 30 seconds are complete. In the next 30 seconds, the test subject shall conduct 30 "slow" jumping jacks. When jumping jacks are complete, the test subject shall stand and breathe normally until those 30 seconds are complete. The wearer can make system adjustments as needed to counter any fogging that occurs (i.e. increase helmet ventilation, or activate any other anti-fogging features) in the next 30 seconds. If fogging in the critical viewing area does not clear within the next 30 seconds, the system fails. Each available bomb suit size will be tested using two test subjects.

4.8.7 Field of View. Two test subjects are required to test each suit size. These tests shall be conducted using a properly fitted bomb suit and helmet.

4.8.7.1 Static Field of View. Static field of view shall be IAW paragraph 3.8.7.1 when tested IAW NIJ standard 117.01 Static FOV test procedure.

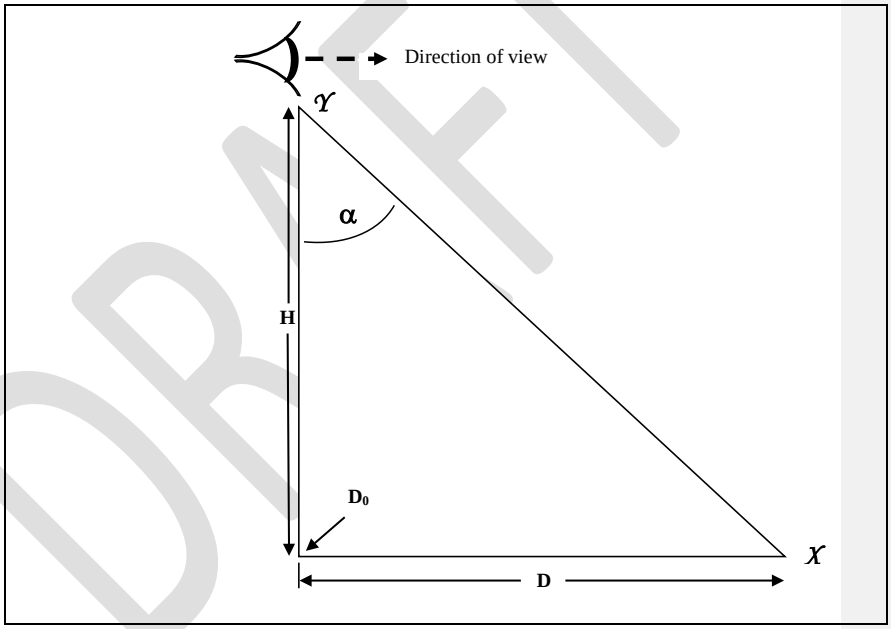
4.8.7.2 Dynamic Downward Field of View (Head Rotation Only).

A tape measure is to be laid on the floor, and is to be used as the viewing line. The test subject is to don the complete Bomb Suit under evaluation and stand upright, centered over the viewing line facing parallel with the tape measure, such that the majority of the tape measure extends to the front of the subject. A portion of the tape measure (approximately 60 cm (24 in)) is required to extend behind the subject. Use a plumb bob or other suitable means to establish the vertical plane located at the surface of the subject's eyes. Mark this point on the viewing line using tape or other suitable marking device D_0 (as shown in the figure below). Measure and record the height of the subject's eyes (H). Using a laser pointer, move the dot along the tape measure viewing line towards the subject. An assistant is to ensure that the subject only moves their head and neck to see the dot. No torso movement is permitted. The test subject's

arms/hands shall remain at his sides. No adjustment of the suit or helmet is allowed when conducting each trial. The nearest point at which the subject can no longer see the laser dot is the limit of the subject's downward field of view and is marked X. Record this value. The distance **D** is determined by noting the value of the marked line at point **X** and subtracting the value at point $\mathbf{D_0}$. Repeat the view limit test three times. The result is the average of the three trials (D). The ***occluded angle***, or **α**, is calculated by

$$\alpha = \tan^{-1}\left(\frac{D}{H}\right)$$

FIGURE 1. Method to Determine Dynamic Downward FOV (Head Rotation Only)



4.9 Hearing.

4.9.1 Verify through observation and operation that normal hearing capability is provided in accordance with the requirements of 3.8. This shall be verified during qualification using experienced EOD Soldiers.

4.9.2 Ability to wear Combat Ear Plug will be verified during qualification using experienced EOD Soldiers.

4.10 Breathing. Verify through observation and operation that adequate ventilation is provided in accordance with 3.10. The required air flow rate shall be directed in the facial region of the wearer. A volumetric airflow measuring system shall be used to measure ventilation capability at standard laboratory conditions.

4.11 Talking. Verify through observation and operation that the wearer can speak freely with the visor in the up or down position in accordance with 3.11.

4.12 Sizing. Verify that the bomb suit ensemble sizes proposed will fit the 5th percentile female to the 95th percentile male in accordance with 3.12.

4.13 Donning/Doffing/Emergency Doffing/Incapacitated Doffing. The performance requirement is verified by observation and operation that the donning and doffing performance meets the functional requirements specified. This performance, per 3.13 requirement is to be verified by test personnel trained per manufacturer's donning and doffing instructions. Two subjects are required to test each size of suit. The size of suit being tested shall be the appropriate size for the wearer based upon the manufacturer's sizing chart. The test subjects, including assistants (for donning and normal doffing) and medical responders (for Incapacitated Doffing) shall be properly trained and shall have practiced the donning, doffing, emergency doffing, and incapacitated doffing procedures a minimum of five times prior to conducting the tests.

4.14 Static Electricity/Electrostatic Discharge (ESD) Resistance. Ground strap resistance shall be measured with a calibrated ohm meter between the points that contact the body and the ground.

4.15 Shell Materials. Bomb suit outer shell shall be tested per the requirements of 3.15. Break strength shall be tested per ASTM D 5034 Breaking Strength and Elongation of Textile Fabrics. Tear strength shall be tested per ASTM D 5587. Water repellency of the outer shell shall be tested per AATCC 22. Bomb suit inner shell shall be tested per the requirements of 3.15. Break strength shall be tested per ASTM D 5034 Breaking Strength and Elongation of Textile Fabrics. Tear strength shall be tested per ASTM D 1424.

4.16 High Wear Areas. Verify by observation and operation that wear resistant materials and designs have been provided in high wear areas in accordance with 3.16. Materials used in the high wear areas (foot soles, front top of feet and knee areas) shall be tested per ASTM 3884 using H-18 wheels with 1000g weight.

4.17 Health Hazards.

4.17.1 Skin Toxicity. The finished bomb suit components shall be shown to be non-toxic. The contractor may provide information which certifies that the chemicals and/or materials have been safely used commercially where prolonged contact has occurred. This information would include Material Safety Data Sheets for materials, finishes, adhesives, or treatments used the suit.

4.17.2 Other Health Hazards. Verify through observation, operation and analysis that the bomb suit does not pose a health safety hazard to the wearer in accordance with 3.17.

4.18 Color. The color of the finished cloth as specified in 3.18 shall be visually matched by AATCC Evaluation Procedure 9, Option A, using sources simulating artificial daylight D75 illuminant with a color temperature of 7500 (+ 200)°K illumination of 100 + 20 foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2856 (+ 200)°K.

4.19 Stowage. Verify by observation and operation that the stowage capabilities meets the functional requirements specified in 3.19.

4.20 Helmet Retention. Verify by observation and operation that the helmet meets the functional requirements specified in 3.20.

4.21 Lighting(Hands Free Light). Verify by observation and operation that the hands-free lighting system meets the requirements specified in Paragraph 3.21. Illumination pattern and intensity will be verified using a light meter. The light meter sensor shall be positioned on planar surface 72.0 inches from the center of the light source. The planar surface shall be perpendicular to within ±5 degrees to the central axis of the light source.

4.22 Compatibility/Interfaces. Verify by observation and operation that the following systems are compatible with the bomb suit in accordance with paragraph 3.22.

4.22.1 Eye Glasses/Corrective Eyewear. Verify that corrective eyewear is compatible with the bomb suit as described in 3.22.1.

4.22.2 NBC Equipment. Compatibility with M50 Joint Service General Purpose Mask shall be demonstrated.

4.22.3 Power Supply. Verify by observation and operation that the power supply(s) meets the requirements specified in Paragraph 3.22.3.

4.22.4 CREW (Counter Radio Controlled Explosives Warfare) Systems. Verify by observation and operation that the bomb suit operates normally and does not interfere with the CREW systems outlined in contract.

4.23 Environmental. An analysis of subcomponent materials shall be conducted to assess the stability of their composition and assess ability to maintain functional integrity after exposure to the various environmental conditions specified in 3.23. Testing conducted in 4.6.1 will be considered in this analysis.

4.23.1 Fungus test. Verification of compliance with the fungus requirement will be performed through the use of certified materials and coupon sampling. A fungus test will be performed on all non-certified materials. Tests will be performed in accordance with Method 508 of MIL-STD-810. A sample of each non-certified material will be placed in the fungus test chamber for 28 days.

4.24 Shelf Life. Manufacture shall certify shelf life IAW paragraph 3.24.

4.25 Launderability. Verify capability to disassemble, hand wash or launder, dry, and reassemble bomb suit and helmet in accordance with 3.25. Washed items will be inspected and analyzed for damage and changes in integrity following each disassembly, laundering/washing, drying, and reassembly step. The ability to properly re-insert and secure the ballistic panels into the suit will be verified as part of each laundering cycle.

4.26 Ballistic Panel Removal and Replacement Capability. Verify through removal and replacement procedures that ballistic panels are removable, replaceable, and can be properly fastened into position for operational use in accordance with 3.26. Repeat the removal and replacement cycle ten (10) times for all removable panels after the outer shell has been exposed to ten (10) laundering cycles per 3.25. Verify that the ballistic panels maintain proper position within the suit during and after field operations.

4.27 Labeling. Visual verification of labeling shall be conducted in accordance with 3.27 after operational field testing. Verify that ballistic panels are marked in accordance with 3.27.

4.28 Storage Containers. Verify by visual inspection and operation that storage containers meet the requirements specified in 3.28. Each container with contents will be dropped vertically by the handles/handling feature onto a surface per ASTM TM 5276. Each container shall undergo 5 drops from a height of two feet. The entire bomb suit ensemble and accessories shall be fully functional and undamaged. The soft case containers shall not rupture or inadvertently open.

TABLE VI. End item visual and operational defects.

		(1-99)	(101-199)	(201-299)
Examine	Defect	Classification		
		Critical	Major	Minor
Helmet shell	Any fabric fibers visibly cut or raised on the shell body.			201
	Any outer surface dent, depression, or area not smooth.			202
	Any delamination or blister.		101	
	Any evidence of cracking.	1		

Examine	Defect	Classification		
		Critical	Major	Minor
	Any evidence of dry spot, any area of nonresin flow or other molding deficiency.		102	
	Any fabric gap, any pit except those specified		103	
	Any raised pleat or wrinkle, or any raised crease (groove) 1 inch or longer.			203
	Any permissible gap or pit not resin filled as specified (exterior only).			204
	Any unauthorized patching, repair or reworking.		104	
	Any attaching hole exhibiting delamination, or other damage of the shell material.		105	
	Any attaching hole exhibiting fraying (uncut material attached at the edge of the hole).		106	
	Note: Criteria apply to exterior of finished helmet except as noted.			
Helmet Shell Edging	Not completely covering bottom periphery and sides as specified except for gap at rear of helmet if piece cut to length.			205
	Any cut, tear, or hole.			206
	Any area not adhered to shell. Note: An area shall be considered not adhered if it can be pulled away from shell with fingernail.			207
	If piece cut to length:			
	- ends overlapped			208
	- gap between ends in excess of 0.100 inch			209
	Butt joint not in rear of helmet.			210
Finish (coating) on exterior	Any scuffed area or scratch.			211
	Finish wet or tacky to the touch.		107	
	Coating furrows, flakes, or peels when scratched with fingernail.		108	
	Blemish, such as peeling, blistering, or flaking.		109	
	Not a smooth, uniform coating (i.e., run or sag affecting an area more than one square inch).			212
	Not completely and uniformly cover the shell surface and the outside of the edging.			213

Examine	Defect	Classification		
		Critical	Major	Minor
	Foreign matter embedded in or appearing on the finish, such as dirt, stain, oil, or grease.			214
	Color of exterior finish not as specified.		110	
	Not uniformly applied to the outside surface of the helmet shell			215
	Evidence of cut blisters		111	
	Ballistic material showing signs of being visibly cut, gouged or raised		112	
	Any unauthorized repair.		113	
Inner Helmet Liner System (impact liner and comfort liner and fit pads)	Impact liner damaged, gouged, cracked or otherwise compromised	2		
	Any required component omitted.	3		
	Any component misplaced or not assembled.	4		
	Color of any component not as specified.		114	
	Any hole, cut, tear, or smash.		115	
	Any material not firmly or tightly woven, edges frayed or scalloped.			216
	Any material with abrasion mark, broken or missing yarns, slub, or broken end or pick, or multiple floats (if applicable).			217
	Any mend, yarn, or patch.			218
	Any raw edge (note that raw edge not securely caught in stitching shall be classified as open seams).			219
	Any open seam (note that a seam shall be classified as an open seam when one or more stitches joining a seam are broken or when two or more consecutive or runoff stitches occur).			220
	Stitch tension loose, resulting in loose bobbin or top thread.			221
	Stitch tension excessively tight, resulting in puckering material.			222
	Stitching ends not secured.			223
	Thread breaks, skipped stitches, or run-offs not overstitched.			224
	Note: Sewing defects apply only if item has sewing.			
Retention System	Any component incorrectly installed on helmet (e.g., wrong side or backwards).	5		
	Any required component omitted.	6		

Examine	Defect	Classification		
		Critical	Major	Minor
	Any sharp edge or burr. 2/		116	
	Any hardware not secured in the orientation specified.		117	
	Any hardware component not finished as specified.		118	
	Any hole, cut, tear, or smash in webbing.		119	
	Webbing not firmly or tightly woven, edges frayed or scalloped.		120	
	Webbing possessing multiple floats.		121	
	Webbing possessing abrasion mark, broken or missing yarns, slub, or broken end or pick. Any hole, cut, tear, or smash.		122	
	Any mend, darn, or patch.		123	
	Any raw edge (note that raw edge not securely caught in stitching shall be classified as open seams).			225
	Any open seam (note that a seam shall be classified as an open seam when one or more stitches joining a seam are broken or when two or more consecutive or runoff stitches occur).			226
	Stitch tension loose, resulting in loose bobbin or top thread.			227
	Stitch tension excessively tight, resulting in puckering material.			228
	Stitching ends not secured.		124	
	Thread breaks, skipped stitches, or run-offs not overstitched.		125	
	Bartack or box-x, if any, omitted.		126	
	Bartack or box-x, if any, not as specified or not in specified location		127	
Marking	Shell: omitted, incorrect, illegible, or not as specified.		128	
Manual	Omitted		129	
Hands Free Lighting System	Lighting system inoperable	7		
Helmet Ventilation System	Ventilation system inoperable	8		
	Fans binding, noisy, unbalanced	9		

Examine	Defect	Classification		
		Critical	Major	Minor
Visor	Visor attachment system incorrectly installed	10		
Visor	Components missing	11		
	Visor misaligned		130	
	Scratch, abrasion, marring of optical surface in critical area of vision	12		
	Scratch, abrasion, marring of optical surface in non-critical area of vision		131	
	Chip, deep scratch, crack in optical surface	13		
	Pit, bubble, scratch, foreign matter, void, inclusions, or blister in critical area of vision	14		
	Pit, bubble, scratch, foreign matter, void, inclusions, or blister in non-critical area of vision		132	
	Embedded dust specks, bubbles in coatings and laminations in critical area of vision	15		
	Embedded dust specks, bubbles in coatings and laminations in non-critical area of vision		133	
	Severe warping, distortion, haze, flow lines, sinks, or depressions	16		
	Coating problems, runs, drips, flow lines		134	
	Visor locking mechanism does not lock in down position	17		
	Visor locking mechanism does not lock in up position	18		
	Visor binds, sticks, or rubs during raising or lowering operation		135	
1/ The helmet shall be examined from a distance of approximately 2 feet. 2/ A sharp edge is defined as something likely to severely abrade or cut skin if contacted.				

Suit Components

Examine	Defect	Classification		
		Critical	Major	Minor
Cloth	Any hole, cut, or tear			229

Examine	Defect	Classification		
		Critical	Major	Minor
	Any abrasion marks, broken or missing yarns or multiple floats			230
	Any mend, darn, or patch		136	
	Needle chews			231
Webbing or Tape	Any hole, cuts, tears, or smash		137	
	Not firmly and tightly woven, edges frayed or scalloped		138	
	Multiple floats		139	
	Abrasion mark, slub, or broken end or pick		140	
Snap Fasteners	Inability to fasten/connect snap fastener	19		
	Loose snap action	20		
	Missing Snap Fastener	21		
Labels	Missing	22		
	Illegible Printing	23		
	Smudged or damaged		141	
	Not firmly attached		142	
Sealed Ballistic Panels	Exposed ballistic fibers	24		
	Rip/Tear in cover	25		
	Excess material around sealed edges			
	Puckers, stretching, or other evidence of material damage		143	
	Dimensions not meeting requirements	26		
	Bunching or evidence of ballistic filler not meeting requirements	27		
Use & Care Pamphlet	Missing, incorrect, illegible, or not as specified		144	

5.0 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Department or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6.0 NOTES. This section contains information of a general or explanatory nature, which may be helpful, but is not mandatory

6.1 Intended Use. The Explosive Ordnance Disposal Suit Ensemble is an integrated, whole body protective outfit, able to be rapidly donned and doffed. It is used intermittently for Improvised Explosive Device defeat operations. This equipment provides protection from fragmentation, blast overpressure, tertiary impact, heat, and flame generated by UXOs (grenades, projectiles, submunitions), and IEDs (including letter, pipe, briefcase bombs, and modified munitions). The EOD PPE shall be user friendly. It will be easy to unpack, don, doff, and pack. The system shall allow maximum flexibility, range of motion, sight, hearing, and speaking to permit efficient accomplishment of the EOD mission. Weight of the equipment will be evenly distributed to subject the wearer to minimal imbalance during use.

6.2 Acquisition requirements. Acquisition documents shall specify the following:

- Title and date of this documents
- When First Article Test and pre-production items are required
- Color Required
- Size Tariff

6.3 First Article. When requiring a first article inspection, the contracting officer should provide specific guidance to the contractor as to whether the first is a first article sample, a first production item, or a number of items to be tested. The contracting officer should also include specific instructions in the acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Pre-solicitation documents should provide Government waiver rights for samples of first article inspection to bidders offering a previously acquired or tested product. Bidders offering such products, who wish to rely on such production or test, shall furnish evidence with the bid, that prior Government approval is appropriate for the pending contract.

6.4 Conformance Inspection. An affordable conformance inspection with confidence varies depending upon a number of procurement risk factors. Some of these factors include contractor past performance, Government schedules and budget, product material and design maturity, manufacturing capital equipment and processes applied, the controlled uniformity of those processes, labor skill and training, and the uniformity of measuring

processes and techniques. During the solicitation, contracting documents should indicate those tests desired and their designated frequency based on a risk assessment for the procurement.

6.5 Ballistic Testing Definitions. The following definitions are provided to assist in understanding the test procedures:

Fair Impact. All impacts will be at 0 degrees obliquity. A projectile that impacts the armor at an angle of incidence no greater than + 5 degrees from the intended angle of incidence will be considered a fair impact.

Partial Penetration PP(P). Any fair impact that is not a complete penetration shall be considered a partial penetration.

Complete Penetration (CP) for V50 Testing. A complete penetration occurs when the impacting projectile or any fragment thereof, or any fragment of the test specimen perforates the witness plate resulting in a crack or hole which permits light passage when a 60-watt, 110-volt bulb is placed behind the witness plate.

Residual Velocity. The velocity at which a projectile exits the rear surface of an armor sample. Used only for Vs/Vr testing.

Areal Density (AD). A measure of the weight of the armor per unit area, usually expressed in pounds per square foot (lb. /ft^2) or kilograms per square meter (kg/m^2) of surface area.

Obliquity. A measure, normally in degrees, of the extent to which the impact of a projectile on an armor material deviates from a line normal to the target. Thus, a projectile fired perpendicular to an armor surface at 0 degrees obliquity.

Spall. The detachment or delamination of a layer of material or the ejection of projectile/armor material in the area surrounding the location of impact, which occurs on the front of the armor surface. Spalling may be a threat mechanism even when penetration of the armor itself is not complete.

Yaw. Projectile yaw is the angular deviation of the longitudinal axis of the projectile from the line of flight at a point as close to the impact point on the target as is practical to measure.

V50 Ballistic Limit (BL). In general, the velocity at which the probability of penetration of an armor material is 50 percent.

Subject Term (key word) listing.

- Blast protective
- Bomb
- Bomb disposal
- CBRNE
- CREW
- Ballistics
- EOD

- IED
- Improvised Explosive Device
- Helmet
- Render safe

Appendix

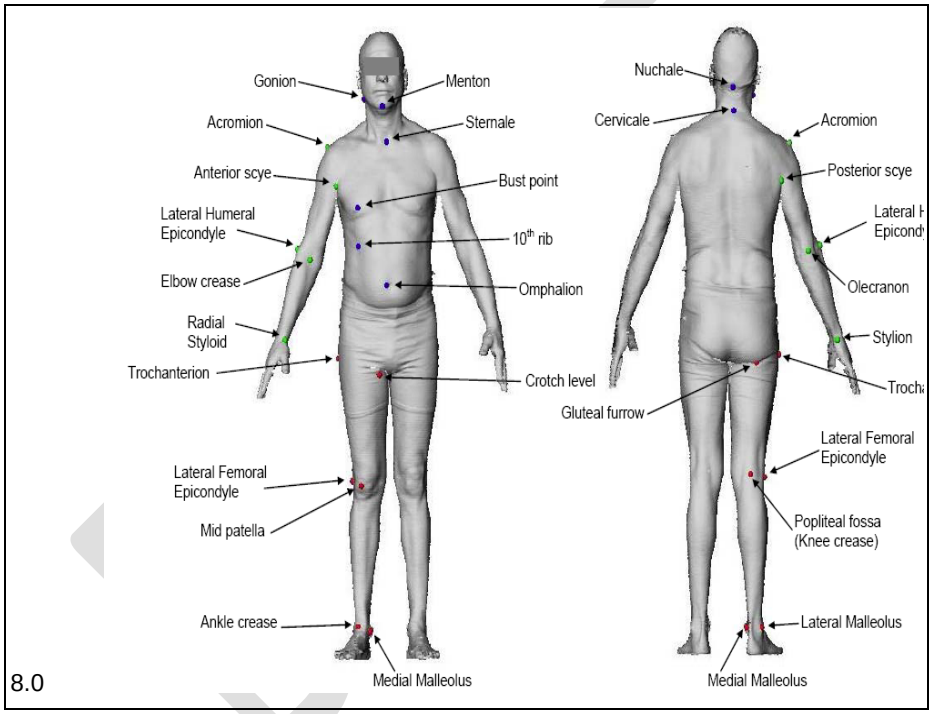
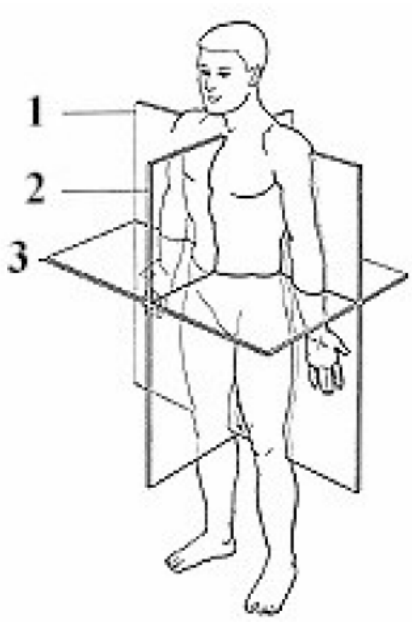
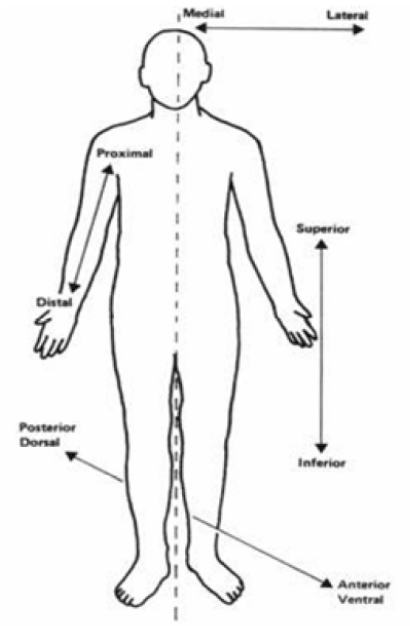


FIGURE 2. Body landmarks

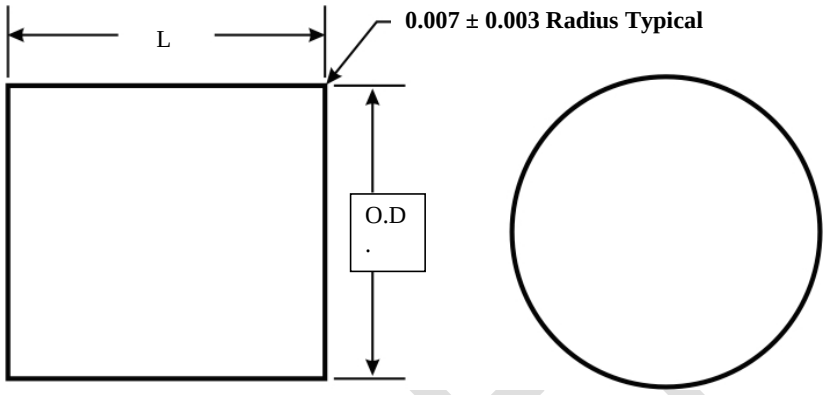


Human body plane 1) frontal or coronal, 2) sagittal, 3) transverse



Human body directions.

FIGURE 3. Human body plane and directions



Weight (Grains)	Outside Diameter (OD) (inches)	Length (L) (inches)
2 (± 0.10)	0.111 (± 0.001)	0.111
4 (± 0.15)	0.134 (± 0.001)	0.147
16 (± 0.5)	0.219 (± 0.001)	0.221
64 (± 1.0)	0.344 (± 0.001)	0.355

Notes:
O.D. is nominal diameter of drill rod as furnished.
Adjust length (L) to meet the indicated weight (grains).
3. Material is AISAI 4340 heat treated to Rockwell “C” hardness of 29 (± 2).

FIGURE 4. Right circular cylinder

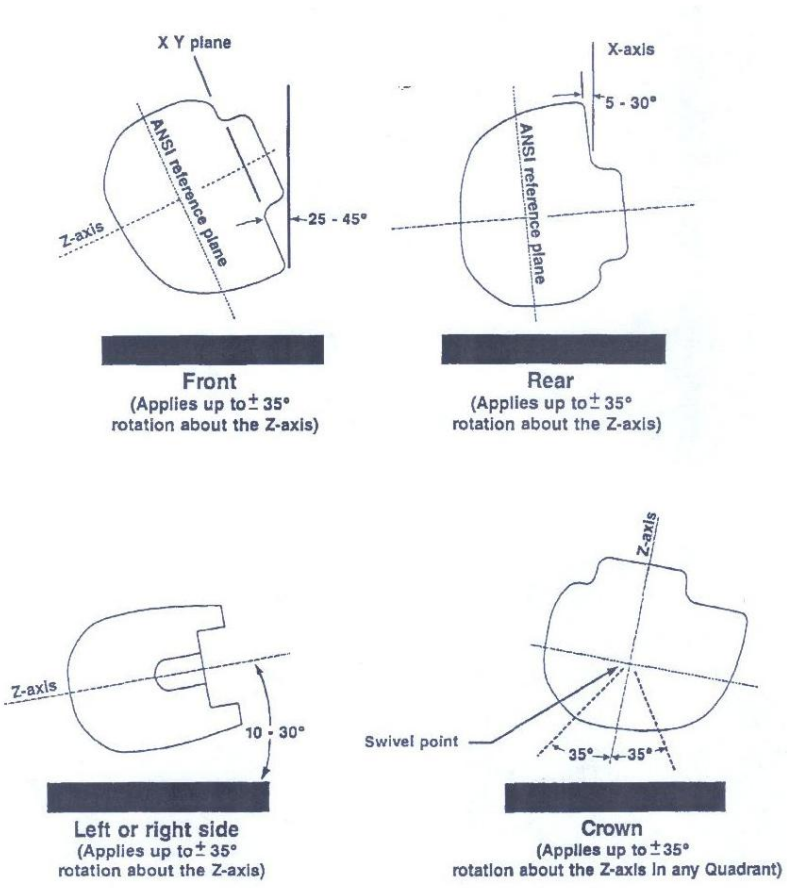


FIGURE 5. Impact testing headform angles

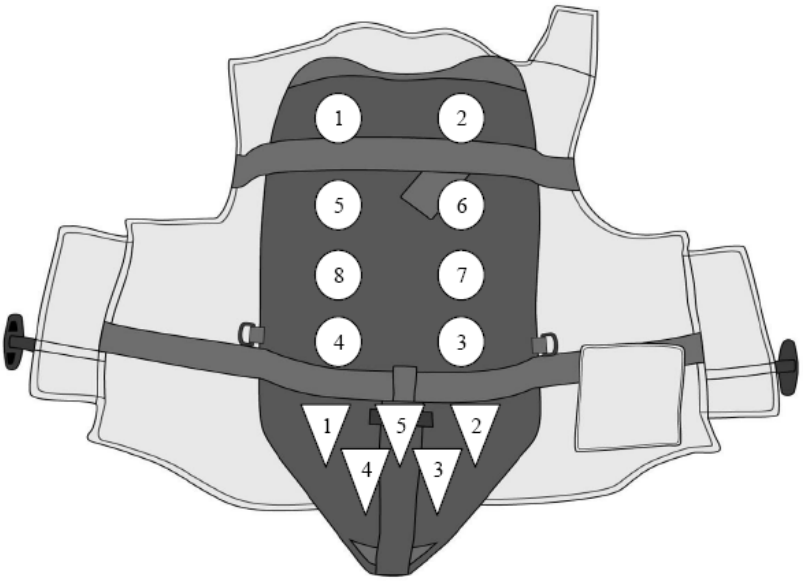


FIGURE 6. Recommended Shot Pattern for 64gr RCC on Thoracic Components (actual shot pattern may vary by size due to shot spacing requirements)

Helmet Sectioning	
Helmet Section	Section Measurements
Top	5 inch diameter circle about crown
Front	315° to 45°
Right side	45° to 135°
Back	135° to 225°
Left side	225° to 315°

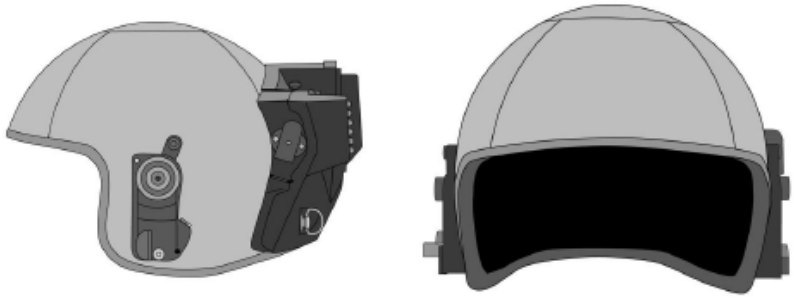


FIGURE 6. Helmet sectioning for ballistics testing

Custodian
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Preparing Activity
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