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8 June 1983
SUPERSEDING
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13 October 1978

MILITARY SPECIFICATION

SYSTEM, AIRCREW AUTOMATED ESCAPE, EJECTION SEAT TYPE: GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Air Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements for the design, installation, demonstration, performance, and testing of an open type ejection seat aircrew automated escape systems. The escape system includes the ejection seat assembly, the aircraft canopy and escape path clearance subsystem the sequencing subsystem aircraft interface and the aircrewmember interface.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

QQ-C-320	Chromium Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)
PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-C-795	Cushioning Materials, Flexible, Cellular, Plastic Film For Packaging Applications

SPECIFICATIONS

MILITARY

MIL-P-116	Preservation, Methods Of
MIL-P-514	Plate, Identification, Instruction And Marking, Blank
DOD-D-1000	Drawings, Engineering And Associated Lists
MIL-S-5002	Surface Treatments And Inorganic Coatings For Metal Surfaces Of Weapons Systems
MIL-B-5087	Bonding, Electrical, And Lighting Protection, For Aerospace Systems
MIL-E-5400	Electronic Equipment, Airborne, General Specification For
MIL-C-5541	Chemical Conversion Coatings On Aluminum And Aluminum Alloys
MIL-C-6021	Casting, Classification And Inspection Of
MIL-E-6051	Electromagnetic Compatibility Requirements, Systems
MIL-H-6088	Heat Treatment Of Aluminum Alloys
MIL-T-6117	Terminal, Cable Assemblies, Swaged Type
MIL-H-6875	Heat Treatment Of Steels (Aircraft Practice), Process For
MIL-I-6903	Ink, Marking (For Parachutes And Other Textile Items}
MIL-F-7179	Finishes and Coatings, Protection Of Aerospace Weapons Systems, Structures And Parts, General Specification For
MIL-F-7190	Forqing, Steel, For Aircraft And Special Ordinance Applications
MIL-C-7905	Cylinder, Compressed Gas, Non-scatterable
MIL-C-7958	Control, Push Pull, Flexible And Rigid
MIL-A-8064	Actuator And Actuating Systems, Aircraft, Electro-mechanical, General Requirements For
MIL-I-8500	Interchangeability And Replaceability Of Component Parts For Aircraft And Missiles
MIL-S-8516	Sealing Compound, Polysulfide Rubber, Electric Con-nectors And Electric Systems, Chemically Cured
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys
MIL-M-8650	Mockup, Aircraft, Construction Of
MIL-D-8708	Demonstration Requirements For Airplanes
MIL-M-18012	Markings For Aircrew Station Displays Design And Configuration Of
MIL-F-18264	Finishes, Organic, Weapons System, Application And Control Of
MIL-I-18464	Insignia And Markings For Naval Weapons Systems
MIL-P-l9834	Plate, Identification, Metal Foil, Adhesive Backed
MIL-A-21180	Aluminum-alloy Castings, High Strength
MIL-D-21625	Design And Evaluation Of Cartridges For Cartridge Actuated Devices
MIL-P-23460	Pin, Quick-release, Self-retaining, Positive-locking
MIL-S-23586	Sealing Compound, Electrical, Silicone Rubber, Accelerator Required
MIL-D-23615	Design And Evaluation Of Cartridge Actuated Devices

MIL-I-23659	Initiator, Electric, General Design Specification
MIL-M-24041	Molding And Potting Compound, Chemically Cured, Polyurethane (Polyether-based)
MIL-A-25165	Aircraft Emergency Escape System, Identification Of
MIL-M-43719	Marking Materials and Markers, Adhesive, Elastomeric, Pigmented, General Specification For
MIL-S-81018	Survival Kit Container, Aircraft Seat, With Oxygen, General Specification For
MIL-S-81040	Survival Kit Container, Aircraft Seat, Without Oxygen, General Specification For
MIL-H-81200	Heat Treatment Of Titanium And Titanium Alloys
MIL-M-81203	Manual, Technical, In-Process Reviews, Validation, And Verification Support Of
MIL-L-81352	Lacquer, Acrylic (For Naval Weapons Systems)
MIL-D-81514	Device, Restraint Harness Take-up, Inertia-Locking, Powered-Retracting, General Specification For
MIL-D-81980	Design And Evaluation Of Signal Transmission Subsystems, General Specification For
MIL-P-83126	Propulsion Systems, Aircrew Escape, Design Specification For
MIL-C-83488	Coating, Aluminum, ION Vapor Deposited
MIL-A-85041	Aircrew Escape Propulsion Systems, General Specification For

STANDARDS

FEDERAL

FED-STD-595	Color (Requirements For Individual Color Chips)

MILITARY

DOD-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of U.S. Military Property
MIL-STD-210	Climatic Extremes For Military Equipment
MIL-STD-411	Aircrew Station Signals
MIL-STD-461	Electromagnetic Emission And Susceptibility Requirements For The Control Of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement Of
DOD-STD-480	Configuration Control-Engineering Changes, Deviations And Waivers
MIL-STD-481	Configuration Control-Engineering Changes, Deviations And Waivers (Short Form)
MIL-STD-482	Configuration Status Accounting Data Elements and Related Features
MIL-STD-680	Contractor Standardization Program Requirements

MIL-STD-794	Part and Equipment, Procedures For Packaging And Packing Of
MIL-STD-810	Environmental Test Methods
MIL-STD-831	Test Reports, Preparation Of
MIL-STD-838	Lubrication Of Military Equipment
MIL-STD-850	Aircrew Station Vision Requirements For Military Aircraft
MIL-STD-882	System Safety Program Requirements
MIL-STD-889	Dissimilar Metals
MIL-STD-961	Military Specification And Associated Documents Preparation Of
MIL-STD-962	Outline Of Forms And Instructions For The Preparation Of Military Standards And Military Handbooks
MIL-STD-965	Parts Control Program
MIL-STD-1167	Ammunition Data Card
MIL-STD-1333	Aircrew Station Geometry For Military Aircraft
MIL-STD-1385	Preclusion Of Ordnance Hazards In Electromagnetic Fields, General Requirements For
MIL-STD-1472	Human Engineering Design Criteria For Military Systems, Equipment And Facilities
MIL-STD-1474	Noise Limits For Army Materiel
MIL-STD-1515	Fastener Systems For Aerospace Application
MIL-STD-1521	Technical Reviews And Audits For Systems Equipment, And Computer Programs
MIL-STD-2067	Aircrew Automated Escape Systems Reliability And Maintainability (R/M) Program Requirements For,

HANDBOOKS

MILITARY

MIL-HDBK-5	Metallic Materials And Elements For Aerospace Vehicle Structures
MSL-HDBK-132	Protective Finishes
MIL-HDBK-694	Aluminum And Aluminum Alloys

BULLETINS

MILITARY

MIL-BUL-147	Specifications And Standards Of Non-Government Organizations Released For Flight Vehicle Construction
MIL-BUL-544B-2	List Of Federal, Military, & Industrial Specifications & Standards, & NAVAIR Series Documents Approved By The Naval Air Systems Command - Numerical Listing

2.1.2 Other Government documents, drawings, and publications. The following other Government documents and publications form a part of this specification to the extent specified herein.

NATIONAL AEROSPACE STANDARD

NAS 1091	Streamer Assembly, Warning

(Application for copies of National Aerospace Standards should be directed to: National Standards Association, Inc., 1321 Fourteenth Street, Northwest, Washington, DC, 20005.)

DEPARTMENT OF LABOR

29CFR-1910	General Industry Safety and Health Standard

(Application for copies should be addressed to the Superintendent of Documents Government Printing Office, Washington, DC, 20402. Orders for the publications should cite "the latest issue and supplements thereto".)

DEPARTMENT OF COMMERCE

49CFR-171 thru -179	Transportation, Interstate Commerce, Explosives and Other Dangerous Articles

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC, 20402. Orders for the publications should cite "the latest issue and supplements thereto".)

DEPARTMENT OF DEFENSE

OPNAVINST 4790.2	The Naval Aviation Maintenance Programs (NAMP)

NAVAL AIR SYSTEMS COMMAND

AD 1350	Engineering Drawings And Associated Data
SD-24	General Specification for Design and Construction of Aircraft Weapon Systems, Volume I, Fixed Wing Aircraft

REPORTS

NAVAIR 01-1A-20	Aviation Hose And Tube Manual
NAVAIR 01-1A-32	Reliability Engineering Handbook
NAVAIR 11-100-1	Cartridges And Cartridge Actuated Devices For Aircraft and Associated Equipment
NAVAIR Report NO. 7836	Power Cartridge Handbook
NATC Report SY-121R-81 (AD B061511L)	Aviation Anthropometric Survey, The 1981 Naval And Marine Corps, Final Report
NATC Report SY-126R-78 (AD B033411L}	Field Of View Evaluation Apparatus (FOVEA), Design, Development, And Validation
NWC-1027	Assembly, Parachute, Personnel, Sealed

(Copies of specifications, standards, handbooks drawings, and publication required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. The issues of the document which is indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

NATIONAL FIRE PREVENTION ASSOCIATION

NFPA Code 56-A 1973

(Application for copies should be addressed to the National Fire Prevention Association, publication Sales Department, Batterymarch Park, Quincy, MA, 02269.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence, except for SD-24.

3. REQUIREMENTS

3.1 General design requirements.

3.1.1 Selection of materials and standard parts. The selection of materials, standard parts, processes corrosion protective coatings, and design features to prevent corrosion shall be in accordance with SD-24 or the aircraft detail specification. Parts shall be selected and processed in accordance with Procedure I of MIL-STD-965 (see 6.2.2). Standard parts are those parts specified by the applicable detail specification or those listed in MIL-BUL-147, MIL-STD-1515, and MIL-E-5400, appendix A. MIL-BUL-544 shall be considered as a secondary specification for parts selection (with the exception of electronic and electrical parts).

3.1.1.1 Materials. Materials and their applicable specification shall appear on all detail drawings. Use of materials which are not controlled by Government specifications nor specifically described herein, shall be approved in writing by the Government procurinq activity; hereinafter it shall be referred to as the procuring activity. Particular care shall be given to close fitting parts in the choice of both materials and corrosion control practices. The contractor shall prepare specifications or standards for materials or processes inadequately defined by Government or acceptable non-government organization specifications and standards (see 6.2.2.).

3.1.1.1.1 Metal parts. All metal parts shall be of the corrosion-resistant type or treated to render them resistant to corrosion. Unless protected against galvanic corrosion, dissimilar metals (as specified in MIL-STD-889) shall not be used in contact with each other. General design information governing usage of metals shall be in accordance with MIL-HDBK-5. General design information for aluminum and aluminum alloys shall be in accordance with MIL-HDBK-694.

3.1.1.1.1.1 Heat treatment. Heat treatment of aluminum parts shall be in accordance with MIL-H-6088. Heat treatment of steel parts shall be in accordance with MIL-H-6875. Heat treatment of titanium and titanium alloy parts shall be in accordance with MIL-H-81200.

3.1.1.1.1.2 Castings. Aluminum alloy castinqs shall be in accordance with MIL-A-21180. All castings shall be classified in accordance with MIL-C-6021.

3.1.1.1.1.3 Steel forqings. Steel forqings used in the escape system shall be in accordance with MIL-F-7190, Grade A.

3.1.1.1.1.4 Maqnesium and maqnesium alloys. Magnesium parts shall not be used in the escape system.

3.1.1.1.1.5 Wire rope and cable assemblies. Wire rope and cable assembly terminal ends and intermediate fittings shall be in accordance with MIL-T-6117.

3.1.1.1.2 Non-metallic parts. Non-metallic components shall be designed to minimize deterioration caused by abrasion, exposure to environmental conditions listed in 3.1.9, and petroleum oil, lubricants, ozone, or hydraulic fluids. Protection shall be provided for non-metallic components, particularly nylon lines, for which strength degradation associated with abrasion or exposure-induced deterioration can endanger the system user. All upholstery, cushions, cover materials, and fabrics, excluding the recovery parachute and those materials used as load application devices, shall be flame resistant and shall not produce toxic gases when subjected to high temperature or flame. Additionally, the materials and finishes used in the escape system shall not be nutrients for micro-organisms.

3.1.1.1.3 Lubrication. Lubricants and lubrication practices shall be in accordance with MIL-STD-838. Lubricants shall perform as required throughout the temperature range from -65°F to +200°F. Lubricants shall:

a. Not degrade the performance of components with which they come in contact.

b. Eliminate the need for relubrication by field maintenance activities, except during other scheduled aircraft maintenance.

3.1.1.1.4 Hydraulic fluids. Hydraulic fluids used in the escape system or escape system components shall perform as required throughout the temperature range from -65°F to +200°F, and shall be fire-resistant, non-corrosive, of the lowest possible toxicity to preclude exceeding threshold limits specified in OSHA Code 29CFR-1910 for normal handlinq.

3.1.1.1.5 Potting compounds. Potting compounds employed in the aircrew-member escape system shall be selected from those listed on the qualified products lists of MIL-S-8516, MIL-S-23586, and MIL-M-24041.

3.1.1.2 Corrosion protection. The contractor shall develop and implement a corrosion control program in which the elements of the escape system shall be treated as external components (see 6.2.2). Corrosion protection practices employed in manufacturing the aircrew escape system and its components shall be in accordance with MIL-STD-889 for dissimilar metals and with MIL-F-7179, Type I, for parts and surfaces of assemblies.

3.1.1.2.1 Finishes, Protective coatings and finishes shall not crack, chip, or scale during normal service life or when subjected to the general service environmental conditions specified in 3.1.9. Surface treatments and inorganic coatings for metal surfaces shall be applied in accordance with MIL-S-5002. Application and control of organic finishes shall be in accordance with MIL-F-18264 and MIL-HDBK-132.

3.1.l.2.2 Anodizing, chemical surface treatment, and chromium plating. All aluminum and aluminum alloy parts that are not subject to wear, abrasion, or erosion shall either be anodized in accordance with MIL-A-8625, Type II anodic coating, or receive a chemical conversion treatment in accordance with MIL-C-5541. Parts subject to wear, abrasion, erosion, or severe corrosion conditions shall be anodized in accordance with MIL-A-8625, Type II anodic coating. Anodic coatings for all aluminum and aluminum alloy parts subject to severe wear shall be in accordance with MIL-A-8625, Type III, except for parts that would normally be reworked during overhaul. For these parts, chromium plating shall be used in accordance with QQ-C-320, Class II.

3.1.1.2.3 Plating. Steel parts in contact with aluminum or aluminum alloys shall be cadmium plated in accordance with QQ-P-416, Type II, Class I, or coated with aluminum by ion vapor deposition in accordance with MIL-C-83488, Type II, Class I.

3.1.2 Drawings. Drawing requirements will be specified in the contract in accordance with AD 1350 (see 6.2.1). Levels and types of drawings shall be in accordance with DOD-D-1000 and DOD-STD-100. The drawings shall depict significant geometrical design parameters (see 3.2) such as the location of the seat intersect point, the back tangent, the seated surface tangent, and the back tangent and ejection angles (see 6.2.2).

3.1.3 Access ports. Access ports complying with MIL-STD-1472 shall be incorporated in the escape system to permit inspection of any escape system mechanism or component which requires periodic maintenance and is not readily accessible. Access ports shall be designed to permit the performance of necessary adjustments while the system is safetied without requiring removal of the ejection seat assembly from the aircraft. All access port edges shall be rounded or covered to protect maintenance personnel from injury. Access port covers shall use quick release, self-retained fasteners. Where necessary, inspection ports shall be incorporated to permit maintenance personnel to ascertain that shipping safety pins are removed and that all critical components are ready for flight. The contractor shall develop a maintenance interface document which describes the characteristics, layout, and installation of all equipment having a maintenance interface (see 6.2.2).

3.1.4 Dimensions. The outline dimensions of the ejection seat assembly shall be compatible with the crew station dimensions as shown on the applicable aircraft drawing.

3.1.5 Weight. The weight of the escape system shall be kept to a minimum and be consistent with the escape system design and performance requirements contained in this specification. Throughout the development program, careful control shall be exercised over the system weight to achieve the lightest weight consistent with system performance and structural strength. Periodic detailed weight records shall be maintained by the contractor.

3.1.6 Color. The color of the ejection seat assembly shall be nonsecular black in accordance with MIL-L-81352. Escape system components, except the parachute canopy or those parts for which a color scheme is specified herein, which do or might leave the aircraft during an escape, shall be non-reflecting and unobtrusive in color to reduce the likelihood that such components would assist in the apprehension of any of the aircrewmembers during the enemy evasion phase of their escape.

3.1.7 Projections. The ejection seat assembly shall preclude:

a. Snagging, jamming, and damage of clothing and equipment.
b. Injury to personnel during normal operational use, ejection, or maintenance.
c. Damage, snagging, and tearing of the ejection seat assembly components or subassemblies during ejection and recovery, operational use, or maintenance.

3.1.8 Ballistics. Cartridges, cartridge actuated devices (CADs), electric initiators, and gas-operated devices (GODs) shall be capable of operating in water to a depth of 100 feet after an immersion time of five minutes. Where feasible, active redundancy in the form of duplicate cartridges or dual initiation subsystems for each cartridge and separate transmission paths for each CAD, electric initiator, and GOD shall be provided. Preference shall be given to components previously qualified and released for service prior to developing and qualifying new components. Qualified components are specified in NAVAIR Report No. 7836 and NAVAIR 11-100-1. All cartidges, CADs, electric initiators, and GODS shall be acceptable to the procuring activity prior to the installation or use of these components in automated aircrew escape systems. Each ballistic component shall be accompanied by an Ammunition Data Card prepared in accordance with MIL-STD-1167 (see 6.2.2).

3.1.8.1 Cartridges. All cartridges shall be designed in accordance with the requirements of MIL-D-21625.

3.1.8.2 Cartridge actuated devices. All CADS shall be designed in accordance with the requirements of MIL-D-23615.

3.1.8.3 Electric initiators. All electric initiators shall be designed in accordance with the requirements of MIL-I-23659.

3.1.8.4 Gas operated devices. All GODs shall be designed in accordance with the requirements of MIL-D-23615.

3.1.8.5 Explosive devices hazard classification data and disposal procedures. The contractor shall develop explosive devices hazard classification data and disposal procedures to be utilized by personnel to implement damage control and recovery actions in the event of an accident or incident involving these devices during the development, testing, or operational use of the escape system (see 6.2.2). These procedures shall be acceptable to the procuring activity prior to initial utilization or incorporation of live explosive devices in the escape system or subsystems.

3.1.9 Environmental requirements. The escape system shall be designed to operate during and following exposure to the environmental conditions specified below:

a. Temperature: -65°F to +165°F.
b. Solar radiation: in accordance with MIL-STD-210 for the naval surface environment (unsheltered).
c. Altitude: in accordance with the aircraft detail specification.
d. Rain: in accordance with MIL-STD-210 for the naval surface environment, one hour averaging time.
e. Relative humidity: zero percent to 100 percent.
f. Fungus: as encountered in tropical climates.
g. Salt fog and flue gases: as encountered in the naval unsheltered environment.
h. Sand and dust: in accordance with MIL-STD-210 for the ground environment.
i. Acceleration, shock, and vibration: as derived from the aircraft detail specification and the aircraft environmental analysis for specific locations within the aircraft.

3.1.10 Electromagnetic interference and electromagnetic compatibility (EMI/EMC). The escape system shall be designed to be compatible with the aircraft EMI/EMC environment in accordance with MIL-E-6051, MIL-STD-461, and MIL-STD-462.

3.1.11 Government-furnished equipment (GFE). The contractor shall be responsible for the integration of GFE into the escape system and for interfacing with GFE external to the escape system. Changes to GFE to meet needs peculiar to a specific escape system may be proposed by the contractor but shall not be implemented until acceptable to the procuring activity (see 6.2.2).

3.1.11.1 GFE specification conformance. In the event of a conflict or inconsistency between the performance or other critical parameter requirements of the contract GFE specification(s) and the delivered GFE component(s), the contractor shall inform the procuring activity of the nature and impact of the discrepancy.

3.1.12 Interchangeability and replaceability. Parts and assemblies shall be interchangeable or replaceable in accordance with MIL-I-8500.

3.1.12.1 Reparable assemblies. The contractor shall comply with the requirements of MIL-STD-680 and appendix B thereto when selecting reparable equipments, assemblies, and subassemblies for incorporation into the system design.

3.1.13 Support equipment. The escape system shall be designed to be maintained at the organizational and intermediate maintenance levels with common support equipment.

3.1.14 Marking and decals. Labeling shall be in accordance with MIL-STD-1472 and the following requirements.

3.1.14.1 operating instructions and warnings. All escape system controls shall be identified and marked in accordance with MIL-M-18012 and MIL-M-43719 and, except for the lower firing control, shall indicate-the direction of movement for proper operation. Escape system marking decals located on the exterior surfaces of the aircraft shall be in accordance with MIL-A-25165. Rescue arrows shall be incorporated on the exterior of the aircraft in accordance with MIL-I-18464. Warning decals shall be prominently displayed adjacent to ballistic components and devices to warn rescue crews of the potential hazard or injury to the aircrewmember or rescue crew if the component or device should be damaged or actuated during rescue attempts.

3.1.14.2 Ejection seat preflight check-off list decals. Decals or metal foil identification plates shall be prepared in accordance with MIL-P-19834. They shall depict the ejection seat assembly and each of the critical escape system components which can be visually checked to ascertain its readiness for use. The decals shall provide a list identifying each keyed component and, in terse statements, describe the component condition required for flight status (i.e., "Safety pin -- Removed.", "Connector link ˙Connected.”). The checklist shall be located where it can be easily read by the aircrewmember when performing a preflight check.

3.1.14.3 Maintenance and preflight inspection aids. Where feasible, decals shall be utilized to denote the location of critical escape system components, particularly those which are small or hidden and likely to be overlooked during system maintenance quality inspection and preflight inspection.

3.1.14.4 Age life markings. Date of manufacture of age life limited components, except textiles and explosives, shall be etched, engraved, or embossed on the body of the component in a location which shall not deqrade the performance characteristics of the components. Marking of explosive components shall be in accordance with MIL-D-21625, MIL-D-23615, or MIL-A-85041, as applicable. Textiles shall be marked in contrasting colors in accordance with the applicable drawing using marking ink in accordance with MIL-I-6903.

3.1.14.5 Identification, instruction, and marking plates. Identification, instruction, and marking plates shall be in accordance with MIL-P-514, Composition A, Class 2; Composition C, or Composition D, as applicable. Unless otherwise specified in the contract, the color of the plates shall be predominately black, FED-STD-595 color number 17038, with white lettering. Attachment of the plates shall be in accordance with MIL-P-514. The colors, finish, and locations of the plates shall be selected to preclude reflections which interfere with the external field of view or which may distract the aircrewmember(s).

3.1.14.5.1 Identification of product. Identification marking shall be in accordance with MIL-STD-130. Nameplates shall be in accordance with MIL-P-514 requirements for Composition A, Class 2 or Composition C identification plates and shall contain the following information:

EJECTION SEAT ASSEMBLY, AIRCRAFT
Specification MIL-S-18471G(AS)
National Stock No.____________________
Manufacturer's Part No.____________________
Manufacturer's Serial No.____________________
Contract or Order No.____________________
Manufacturer's Name or Trade Mark __________

3.1.15 Manufacturing plan. The contractor shall develop, implement, and maintain a plan for producing the test and demonstration articles required herein (see 6.2.2). The plan shall assure dherence to the approved escape system configuration and the production of escape system test articles of requisite quality.

3.1.16 Foolproofness. Components and subsystems shall be as foolproof as possible to avoid incorrect assembly which could result in damage, malfunction, or degraded safety of flight. Turnbuckle and cable ends, cable or actuator-arm lengths, joints, etc. shall be arranged so that incorrect assembly will be difficult, if not impossible. Brackets, levers, links, bearings, control rods, torque arms, and similar parts that can be installed backwards or upside down shall, whenever practicable, be symmetrical about each of the three axes or it shall be impossible to install unsymmetrical parts upside down or backwards. All electrical, fluid, or mechanical connections such as connections for controls, instrument lines, hydraulic lines, etc., shall be incapable of being reinstalled incorrectly where such incorrect reinstallation would involve damage, malfunction, or safety of flight. New parts (originating front a modification of a common part in the same or other type, model, or series aircraft) which differ from the original part (in performance specifications affectinq safety of fliqht or possible injury to personnel) shall be configured to be non-interchangeable with aircraft other than types, models, or series which require the same specified performance.

3.1.17 Lifting provisions. The ejection seat assembly shall contain lifting provisions if hoisting is required during any phase of maintenance.

3.2 Detail design requirements.

3.2.1 System design. The escape system includes: the ejection seat assembly, aircraft canopy and escape path clearance subsystem, sequencing subsystem, aircraft interface, and the aircrewember interface. The ejection seat assembly shall include ejection seat mounted components and subsystems. As part of the design effort, tradeoff analyses shall be conducted among the possible design alternatives that are available within the range and limits of the detail specification or contract (see 6.2.2). The contractor shall ensure that all ejection seat assembly to aircraft interface connections disconnect automatically upon ejection of the ejection seat from the aircraft and do not cause injury to the aircrewmember or damage to personal equipment. The desiqn of the assembly shall prevent leg abduction during the escape sequence under the conditions specified in 3.3.2. All interface connections shall be easily and securely connected upon ejection seat assembly installation and easily disconnected upon ejection seat assembly removal. The escape system shall be electrically grounded to the aircraft structure in accordance with MIL-B-5087, Class S.

3.2.1.1 Aircrewmember accommodation. The ejection seat assembly shall accommodate the aircrewmember anthropometric population range specified in the contract or aircraft detailed specification with the aircrewmember wearing full personal flight gear (see appendix). The ejection seat assembly shall provide comfortable and adequate support arid retention of the aircrewmember's body under all conditions of flight throughout the aircraft performance envelope, including takeoff and landing. All antropometric data for aircrewmembers shall be in accordance with SY-121R-81.

3.2.1.2 Cockpit compatibility. The aircrewmember station geometry shall be in accordance with MIL-STD-1333. The ejection seat assembly shall be compatible with the aircrewmember station in which the ejection seat assembly is to be installed. Fully-equipped aircrewmembers within the specified anthropometric population range shall be able to reach and fully actuate all emergency aircraft controls throughout the full range of ejection seat assembly adjustments while fully restrained in the full-back position by the restraint subsystem. Each aircrewmember shall be able to reach and actuate all normal aircraft and equipment controls assigned to or located in the crew station with the ejection seat assembly adjusted to place the occupant's eye level at the design eye position. Bivariate anthropometric data for verifying the compatibility of the aircrewmember while seated in the ejection seat assembly shall be in accordance with SY-121R-81. The location of the ejection seat assembly, in relation to other aircraft equipment, shall permit the aircrewmember to ingress to and egress front the ejection seat assembly in a safe, rapid, and uncomplicated manner. This location shall not hinder emergency manual escape from the aircraft by fully equipped aircrewmembers.

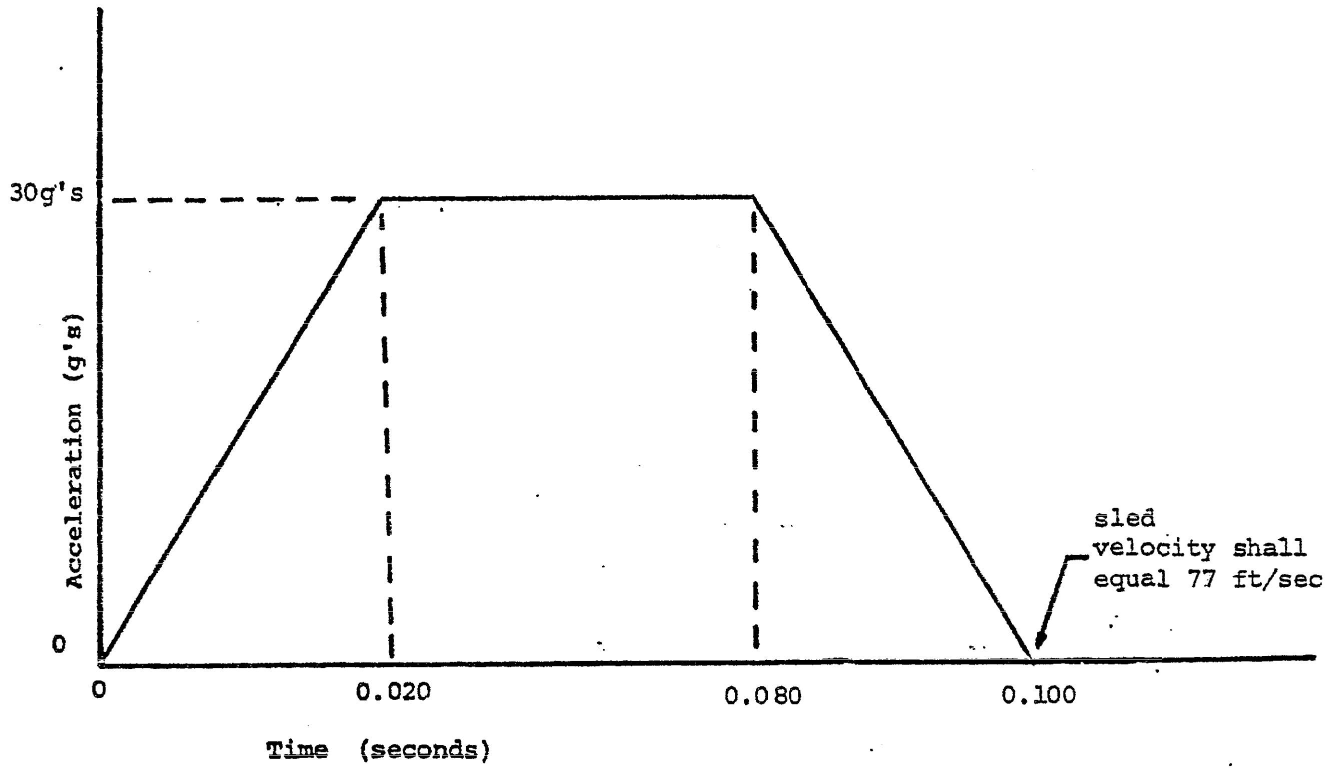
3.2.1.3 Escape system controls. Design and placement of escape system controls shall be in accordance with MIL-STD-1472 and shall not jeopardize the safety of the aircrewmember actuating those escape system controls. The design or placement of escape system controls shall not hinder the fully-equipped aircrewmember's emergency manual escape from the aircraft throughout the entire range of vertical and fore-and-aft ejection seat assembly adjustment. Aircrewmembers within the specified population range shall be able to reach and fully actuate their escape system controls while restrained in the full back position by the restraint system.

3.2.1.4 Field of vision. The escape system shall minimize degradation of the aircrewmember's field of vision. The ejection seat headrest shall be designed to be the minimum width possible, but not less than that specified in 3.2.2.1 .1.3 in order to maximize the aft vision of all aircrewmembers and forward vision of the rear-most aircrewmembers in tandem seat aircraft.

3.2.1.5 Impulse noise levels. As a result of the operation of the escape system, impulse noise levels measured at the design eye position in each aircrewmember station shall not exceed the damage risk criterion of MIL-STD-1474 for beta-duration impulse noise. Since the probable maximum exposure of any aircrewmember to repeated-impulse noise is limited to the minimal number of impulses occurring during the operation of the escape system, the damage risk criterion shall be corrected to permit an additional 10dB. Since all aircrewmembers are equipped with approved helmet assemblies with integral ear protection, an additional correction shall be made to the damage risk criterion to permit an additional increase of 20dB.

3.2.1.6 Design strength. The ejection seat assembly, the ejection seat attachment fitting, and the ejection seat supporting structure shall be capable of withstanding the following types of loads without failure and without degrading or compromising escape system performance:

a. Acceleration loads resulting from the aircraft flight loading as specified in the aircraft detail specifications
b. Windblast loads resulting from the escape system performing as specified in 3.3.2.
c. Ejection loads resulting from simultaneous upward accelerations of 27g's along the ejection guide rails and dynamic pressures sustained during sea level escape at maximum aircraft equivalent airspeed or 600 KEAS, whichever is less.
d. Loads resulting from deployment and operation of the deceleration and stabilization subsystem.
e. Loads resulting from deployment and operation of the recovery subsystem.
f. Impact loads as a result of ejection seat assembly contact with aircraft structure during the escape path clearing sequence.
g. Crash loads applied at the ejection seat assembly interface and having the acceleration profile shown in figure 1. Crash loads are further specified to have a resultant vector lying in the plane formed by the roll and yaw axes of the aircraft and directed at any angle from forward along the roll axis to downward along the yaw axis. The escape system and its components shall be designed to preclude premature or inadvertent actuation during, or resulting from, the application of the crash loads.



Note: The velocity change represented by the area under the curve is equivalent to 77 feet per second (ft/sec).

FIGURE 1. Crash load acceleration profile.

3.2.1.7 Reliability.

3.2.1.7.1 Probability of success. As a minimum, the escape system shall achieve the reliability levels specified for the following operational modes:

a. Aircrew automated escape reliability, expressed as the probability that the escape system shall perform as required in 3.3.2, shall be at least 0.98.
b. Non-emergency reliability, expressed as the probability that the escape system shall successfully perform the requirements of this specification and the aircraft mission requirements specified in the aircraft detail specification, shall be at least that specified in the applicable subsystem allocation for the aircraft in which the escape system will be installed.

3.2.1.7.2 Design redundancy. System components, whose proper functioning is critical to the successful operation of the escape system or to the safety of the aircrewmember(s), shall be redundant or shall be provided with redundant actuation means.

3.2.1.7.3 Fail-safe operation. Critical functional components or subsystems which have two or more modes of operation shall be designed to ensure that any failure of the sensing, command, or control means to properly select the intended mode of operation shall result in the system functioning in the least hazardous mode. The selection of the least hazardous mode shall be acceptable to the procuring activity (see 6.2.2).

3.2.1.8 Maintainability. If more stringent maintainability requirements are specified by the aircraft detail specification subsystem allocations, they shall be achieved. As a minimum, the escape system shall achieve the following maintainability levels:

a. Based upon a flying hour rate of 35 hours/month, the direct maintenance man hour/flight hour (DMMH/FH) at the organizational and intermediate maintenance levels for corrective and preventive maintenance including the preparation of items to be installed in the escape system, shall be not greater than 0.05 for a single seat escape system. (A different value of the DMMH/FH may be designated in the contract for application to a multiple seat system. In addition, the procuring activity may also adjust the DMMH/FH for different flying rates to assure that the total DMMH/month/aircraft does not exceed 1.75 hours.)
b. The mean time to repair (MTTR) shall be not greater than 0.40 hours.
c. The maximum corrective maintenance time (M_{max}) for the 95th percentile individual maintenance action, ranked on the basis of corrective times, shall be not greater than 2.5 hours including time for parachute packing, and time for system removal and reinstallation in the crew station, if required.

d. At least 95 percent of the total maintenance actions can be performed by maintenance personnel within the Navy Aviation Structural Mechanic, Safety Equipment (AME) rating at pay grade E-4 or below (or civilian equivalent).

3.2.1.9 Design for maintenance. The non-explosive mechanical subsystems or components of the escape system shall be designed to permit functional testing during maintenance. The ejection seat shall be designed so that its structural portions require no inspections other than for corrosion and external damage. Explosive operated systems shall be capable of being visually checked for proper installation, corrosion, and external damage. The ejection seat shall be capable of being fully safetied while performing any maintenance action, including the replacement of cartridges. There shall be no rigging or adjustment requirements for replacement parts. Once an escape system is fired, none of the components shall be reused, even if repaired. Maintenance functions to be performed at the organizational (0) and intermediate (I) level shall be capable of being performed both ashore and afloat. The ejection seat assembly shall be designed to be maintained and supported without the use of a support stand. The escape system shall be designed to permit performance of the following selected maintenance functions at the specified levels:

a. The escape system, excluding parachutes and the survival kit, shall be designed to be maintained at the O and depot (D) levels of maintenance. The functions to be performed at these levels shall include, but not be limited to the following:

(1) O level: Operational check, test and inspect; replacement of subassemblies, assemblies, and components including explosive elements.
(2) D level: Repair of repairable components and beyond the capability of maintenance (BCM) of O level maintenance; refurbishment of major assemblies, usually during aircraft standard depot level maintenance (SDLM).

b. Personnel parachutes, survival kits (including the emergency oxygen systems and contents), and drogue parachutes shall be designed to be maintained at the O and I levels of maintenance except for hydrostatic testing of the emergency oxygen bottle* The functions to be performed at these levels shall include, but not be limited to, the following:

(1) O level: Turnaround, daily, and special periodic inspection; removal and installation of equipment, servicing of the emergency oxygen bottle off the aircraft.
(2) I level: Inspect, test and repair the equipment, repack personnel parachutes; repack drogue parachutes that are packed in a container that is removable from the seat; replacement of explosive elements and pyrotechnics.
(3) D level: Hydrostatic test of the emergency oxygen bottle.

3.2.2 Subsystem/component design. The following escape system subsystems and components shall be utilized, as applicable.

a. Ejection seat assembly.

(1) Ejection seat structure and guide rail assembly (see 3.2.2.1).
(2) Ejection seat positioning subsystem (see 3.2.2.2).
(3) Positioning and restraint subsystem (see 3.2.2.3).
(4) Propulsion subsystem (see 3.2.2.4).
(5) Deceleration and stabilization subsystem (see 3.2.2.5).
(6) Recovery subsystem (see 3.2.2.6).
(7) Survival equipment container (see 3.2.2.7).
(8) Personal services connections (see 3.2.2.8).
(9) Intraseat sequencing subsystems (see 3.2.2.9).
(10) Initiation subsystems (see 3.2.2.10).
(11) Signal transmission subsystem (STS) (see 3.2.2.13).
(12) personnel location subsystems (see 3.2.2.14).
(13) Ground safety subsystem (see 3.2.2.16).

b. Interseat sequencing/spatial separation subsystem (see 3.2.2.11).

c. Aircraft canopy and escape path clearance subsystem (see 3.2.2.12).

d. Classified equipment destruct system initiator (see 3.2.2.15).

3.2.2.1 Ejection seat structure and guide rail assembly. The general ejection seat assembly geometry shall be as shown in figures 2 and 3. The ejection seat shall provide comfortable and adequate support during flight operations and during ejection. The ejection seat shall be contoured (support surfaces, cushioning, or combinations thereof) to provide support for the aircrewmember's body. The ejection seat shall be designed so that, in the normal in-flight position, the aircrewmember’s body is positioned to be coincident with the back tangent at the thoracic region and buttocks and coincident with the seated surface tangent at the buttocks.

3.2.2.1.1 Ejection seat structures. The ejection seat structure shall provide:

a. Space for a survival equipment container.
b. No cause for jamming or snagging of survival equipment or the survival equipment container.
c. Positive retention of the survival container so that it does not rock or slide and, under aircraft acceleration loads, does not separate from the ejection seat.
d. Drain holes to prevent moisture collection.
e. Positioning and restraint subsystem attachment points.
f. Accommodation for the maximum specified population sitting hip width and support of the maximum and minimum specified population thigh length.

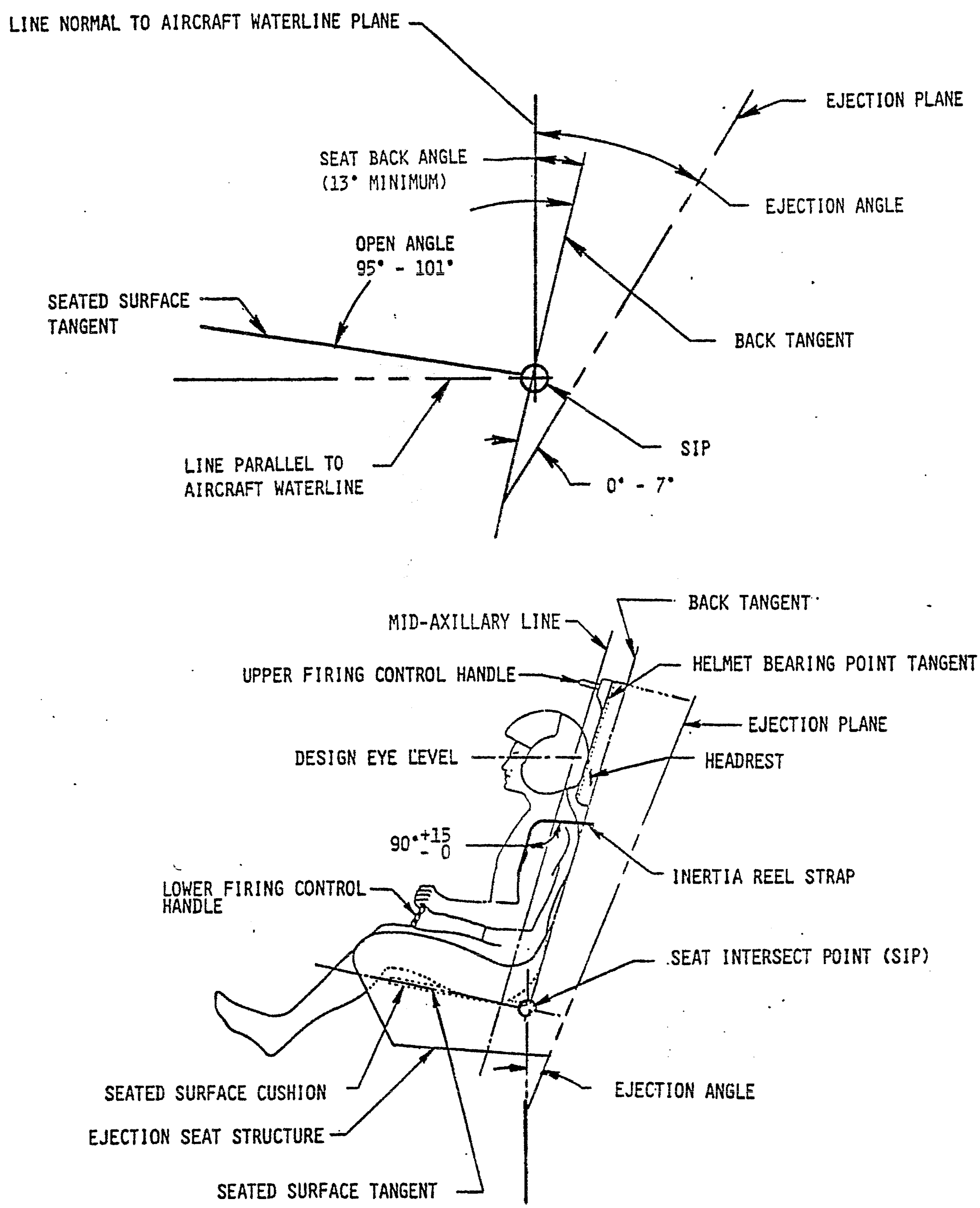
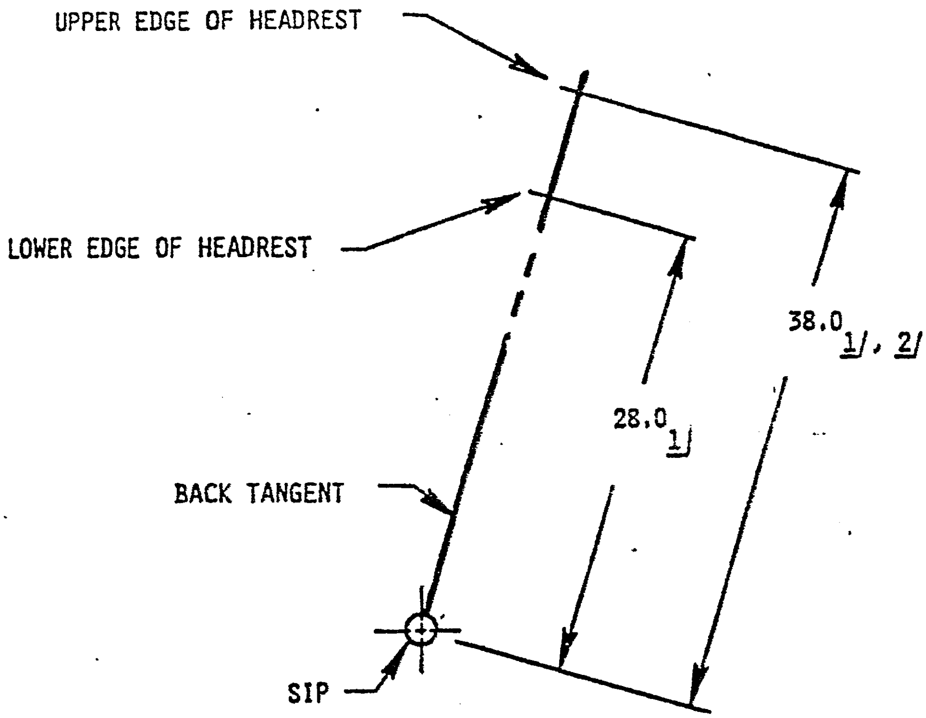


FIGURE 2. Ejection seat assembly geometry schematic.



1/ DIMENSIONS ARE IN INCHES FOR A FULLY EQUIPPED AIRCREWMEMBER AND WITH THE SIP FULL DOWN.

2/ FOR A MOVABLE SEATED SURFACE RELATIVE TO THE HEADREST. UPPER EDGE OF HEADREST DIMENSION IS INCREASED BY THE MAXIMUM APPLICABLE SEAT HEIGHT ADJUSTMENT.

FIGURE 3. Headrest height dimensions.

3.2.2.1.1.1 Ejection seat back. The open angle between the ejection seat back tangent and the seated surface tangent shall be in accordance with figure 2. The ejection seat back shall be rigid and contoured to support the scapula over its entire area at the top and sacro-coccyx region at the bottom, during power retraction and initial boost or catapult phase for the entire specified aircrewmember population. Lumbar and kidney support shall be provided by cushioning (see 3.2.2.1.4) and be non-intrusive.

3.2.2.1.1.2 Ejection seat sides. The ejection seat sides shall provide space for the aircrewmember manual release handle on the right-hand side in accordance with 3.2.2.3.4. If the ejection seat structure sides protrude above the compressed sitting surface of the ejection seat, the ejection seat , structure sides shall accommodate the sitting hip breadth range of the specified aircrewmember population wearing full personal gear.

3.2.2.1.1.3 Headrest. A headrest shall be provided to support the helmeted head of the aircrewmember. It shall be contoured to minimze head rotation and instability during flight operations and ejected escape. The cushion provided for the headrest shall comply with 3.2.2.1.4. The locus of the helmet bearinq point throughout the range of ejection seat assembly height adjustment shall he a line parallel to and not greater than 2.0 inches forward of the back tangent. The width of the headrest shall be not less than 6.75 inches. Headrest height shall be determined in accordance with figure 3.

3.2.2.1.2 Ejection seat structural connection to aircraft. An accessible visible, manual means shall be provided for easily connecting and disconnecting ejection seat assembly-aircraft connections to enable organizational maintenance personnel to readily and safely install or remove the ejection seat assembly in the aircraft. The connection shall be capable of supporting loads imposed on it during all flight maneuvers, ejection, and crash conditions as specified in 3.2.1.6. Provision shall be made for easy aircrewmember preflight inspection and determination of the flight status of the structural connections of the ejection seat assembly.

3.2.2.1.3 Seat guides. A means shall be provided to guide the ejection seat in a fixed path during its ejection from the aircraft. The design shall prevent jamming or chattering due to loads imposed upon the ejection seat-aircrewmember combination during ejection and flight. The design shall also prevent jamming due to foreign objects.

3.2.2.1.4 Cushions. Cushions shall be incorporated into the seated surface, the back, and the headrest of the ejection seat assembly for aircrewmember support and comfort. Cushion design and location shall accomodate the specified aircrewmember population while fully restrained in the optimum ejection position. Upholstery shall meet the static electricity discharqe requirements of NFPA Code 56-A 1973. Cushions shall be upholstered and shall remain secured under all maneuver, ejection, and crash conditions Cushions shall be easily removable for maintenance purposes. Cushion covers shall be removable and washable. When compressed by the weight of the maximum specified population aircrewmember, the seated surface cushion thickness shall be not greater than 0.5 inches below the occupant’s ischial tuberosities to prevent dynamic overshoot of the aircrewmember. In addition to meeting the requirements of 3.1.1.1.2, cushion and upholstery materials shall be selected considering the following characteristics:

a. Moderate elastic compression in all directions over the specified temperature range consistent with distributing aircrewmember loads to reduce or eliminate concentrated loads.
b. Low thermal conductivity.
c. Adequate porosity or permeability for heat dissipation via natural ventilation (convection).
d. Low absorption of liquids.
e. Minimize occupant sliding.

3.2.2.2 Ejection seat positioning subsystem. The ejection seat positioning subsystem shall perform as required for an installed life in accordance with 3.4.2.1 and predicated upon at least 20 cycles per flight (of which one of every five cycles shall be full-stroke cycles and the remaining four cycles shall be short-stroke cycles of one inch length).

3.2.2.2.1 Ejection seat height adjustment. The ejection seat height adjustment shall accommodate the range of aircrewmembers specified by the aircraft detail specification. Such adjustment shall be designed to permit all aircrewmembers within the specified population sitting height range to adjust their eye level to the design eye position.

3.2.2.2.1.1 Ejection seat adjustment control. A three-position switch (momentary ON-OFF-momentary ON type) shall be used. The ejection seat adjustment control shall be located on the forward right-hand side of the ejection seat and positioned to preclude injury to the occupant as the ejection seat position is adjusted.

3.2.2.2.1.2 Ejection seat adjustment actuator. The ejection seat electromechanical actuator shall be in accordance with MIL-A-8064 except that lubrication practices shall be in accordance with 3.1.1.1.3. The electrical power requirements for the ejection seat adjustment actuator shall be compatible with available aircraft electrical power supply capability. The location and design of the electrical power supply connection between the ejection seat and the aircraft shall be in accordance with 3.1.10.

3.2.2.2.2 Pre-ejection ejection seat positioner. An automatic ejection seat positioner to relocate the ejection seat front an operational position to an ejection position, shall be incorporated in ejection seats in those aircrewmember stations in which the clearances are inadequate to ensure that the aircrewmember will not strike aircraft structure or fixed equipment during the escape. The ejection seat positioner shall be capable of positioning the ejection seat and aircrewmember (wearing full personal flight gear) to the safe ejection position while subjected to an acceleration of 6.0g's in any direction. No combination of pre-ejection accelerations and ejection accelerations shall be injurious to the aircrewmember. The ejection seat shall be retracted and locked in the ejection position prior to the start of ejection seat boost. This function shall be performed using a redundant primary means and an automatic backup means. Devices that preclude ejection such as interlocks shall not be used.

3.2.2.2.3 Ejection seat fore and aft adjustment. Fore and aft adjustment of the ejection seat within the cockpit shall be provided, if necessary, to ensure efficient aircrewmember performance of flight operations

3.2.2.3 Positioning and restraint subsystem. The positioning and restraint subsystem shall be integral with the ejection seat assembly and shall, as a minimum, include a torso restraint subsystem, shoulder restraint take-up mechanism limb restraint subsystem, and restraint system manual release. The positioning and restraint subsystem shall:

a. Meet applicable human factors requirements specified herein.
b. Incorporate restraint attachment fittings which are located and oriented to permit positive connection and simple and rapid release. Release shall be able to be accomplished by either gloved hand of the unassisted aircrewmember. No more than seven attachment fittings shall be required for normal egress. For emergency egress (with the survival kit), no more than three devices shall be required to be manually activated, including the manual release handle specified in 3.2.2.3.4. Single point restraint subsystem release means are permitted.
c. Provide adequate restraint during in-flight accelerations, when commanded by the aircrewmember, under any combination of the dynamic, loadings ranging throughout the flight envelope as defined by the aircraft detailed specifications. While restrained, the aircrewmember shall be able to control torso movements to the degree necessary to reach and operate emergency and flight controls. The means employed to provide the restraint shall permit the aircrewmember to control the degree of restraint achieved and of the subsequent restraint relaxation.
d. Ensure that the combination of release and restraint controls also provide positive, simple, and rapid connection in multi-crew aircraft in which aircrewmembers may be required to leave their stations during flight.
e. Automatically and in a programmed sequence, position and restrain the aircrewmember during the period from initiation of the escape sequence until separation from the ejection seat.
f. Prevent submarining of the lower torso during ejection.
g. Incorporate a positioning and restraint subsystem automatic release which will, as part of the programmed ejection sequence, separate the aircrewmember from the ejection seat during the recovery subsystem phase and prior to touch down.

3.2.2.3.1 Torso restraint subsystem. The torso restraint subsystem shall be compatible with all combinations of specified personnel clothing and equipment. If necessary to ensure adequacy of lower torso restraint during ejection, powered lower torso restraint mechanisms shall be used.

3.2.2.3.2 Shoulder restraint take-up mechanism. The inertia-lacking shoulder harness take-up device shall have a powered retraction feature to automatically place the ejection seat occupant in the best position for withstanding the loads specified in 3.2.1.6. The device shall be in accordance with MIL-D-81514. Powered retraction shall be commenced immediately upon ejection initiation in a manner that shall ensure effective restraint. The shoulder harness bearing point on the ejection seat assembly shall be located so that the angle between the aircrewmember's mid-axillary line and the line the shoulder harness makes to the shoulder harness bearing surface on the aircrewmember's shoulder shall be as shown in figure 2. In those ejection seat assemblies in which the ejection seat adjustment is accomplished by means of independent movement of the ejection seat structure, the location of the ejection seat shoulder harness bearing point shall be determined by the sitting shoulder height and sitting eye height of the minimum specified population aircrewmember with the aircrewmember's eyes at the design eye position. In those ejection seats in which the ejection seat adjustment is accomplished by means of movement of the entire ejection seats, the location of the ejection seat shoulder harness bearing point shall be determined by the sitting shoulder height and sitting eye height of the maximum specified population aircrewmember with the aircrewmember's eyes at the desiqn eye level. In addition, the shoulder restraint system shall provide lateral restraint of the ejection seat occupant. A manual lock and unlock control in accordance with MIL-D-81514 for the take-up mechanism shall be provided on the left side of the ejection seat and shall move forward to lock and aft to unlock. It shall be protected from being stepped upon or shall be capable of being stepped upon by a maximum specified anthropometric aircrewmember wearing full personal flight gear without sustaining damage that would degrade its subsequent operation or cause subsequent injury to the ejection seat occupant or damage to the aircrewmember's personal protective garments or survival equipment. The desiqn and placement of the control shall ensure positive, simple, and rapid operation of the control by the aircrewmember.

3.2.2.3.3 Limb restraint subsystem. The limb restraint subsystem shall automatically restrain the aircrewmember's arms and legs prior to the ejection seat-aircrewmember combination entering the airstream. The limb restraint subsystem shall prevent flailing of the limbs for all dynamic pressures resulting from ejection within the escape envelope specified in 3.3.2. The forces exerted upon the aircrewmember for limb restraint shall not be injurious to the aircrewmember. The limb restraint shall be automatically released during the seat and aircrewmember separation phase of the ejection sequence. In addition, the limb retention system shall also be released by the manual release handle.

3.2.2.3.4 Manual release handle. A manual release handle shall be provided on the right-hand side of the ejection seat. The manual release handle shall perform dual functions. On a non-ejected seat, it shall release the restraint system and safety the ejection seat assembly to preclude inadvertent actuation of the propulsion subsystem or pre-ejection functions. For this function, it shall be capable of being recycled (by the sequential application of two motions) so that the restraint system can be reset readily by maintenance personnel. On an ejected seat, the manual release handle shall function to enable manual override actuation of the recovery subsystem in accordance with 3.2.2.6. The manual release handle shall:

a. Be capable of being reached and actuated by an aircrewmember in the fully retracted position and in any position of ejection seat adjustment
b. Be capable of releasing the aircrewmember (wearing a full complement of flight and survival equipment) and the survival kit from the ejection seat when the aircraft is in a crash or static emergency condition requiring emergency manual egress.
c. Require the sequential application of two motions: a lock or unlock motion requiring the application of 10 ±5 pounds and an actuation motion requiring the application of 40 pounds maxixmum.
d. Lock when actuated in the personnel restraint release position at the same point that harness release occurs, unless the handle pulls free of the ejection seat or is attached by a flexible cable. The manual release handle may continue to travel past the lock point in the direction of actuation, but shall not return through the lock point.
e. Be capable of locking and then supporting a maximum specified population, fully-equipped aircrewmember using the manual release as a handhold or support in manually egressing from the cockpit, unless the handle pulls free of the ejection seat when actuated or is attached to the seat only by a flexible cable.
f. Have a cycle service life of at least 5,000-cycles as a complete subsystem. A cycle shall consist of the movement of the control from one position to the other and back to its initial position and shall be calculated in accordance with 3.4.2.1.
g. Be capable of beinq stepped upon by a fully-equipped, maximum specified population aircrewmember without sustaining damaqe that would degrade its subsequent operation or cause the subsequent injury of an ejection seat occupant or damage to personal protective garments or survival equipment.

The restraint harness manual release handle shall be of such size that a gloved hand of a maximum specified population aircrewmember (pressurized pressure suit glove, if applicable) may be readily inserted. Two-motion, squeeze-and-pull type, handles shall have a cross section sufficiently large to reduce interference with the squeezing action caused by contact between the fingers and the paint or heel of the hand. Push-pull controls shall be in accordance with MIL-C-7958.

3.2.2.4 Propulsion subsystem. A propulsion subsystem shall be used to eject the ejection seat assembly and occupant from the aircraft. Rocket motors and integral rocket catapults shall be in accordance with MIL-P-83126. Ballistic catapults that are not an integral part of a rocket catapult shall be designed in accordance with MIL-D-21625 and MIL-D-23615. Where feasible, propulsion subsystems previously qualified and released for service use shall be used in preference to developing and qualifying new propulsion subsystems. Ignition of the propulsion subsystem shall not cause burn damage to any aircrewmember or the aircrewmember's flight equipment or cause the malfunctioning of other escape system components in a multi-seat aircraft.

3.2.2.4.1 Rocket thrust centerline and ejection seat-aircrewmember center of gravity. The ejection seat-aircrewmember center of gravity (c.g.) extremes shall be determined for the specified aircrewmember population (see 3.2.1.1) with full personal flight gear and for the range of ejection seat adjustments. The rocket system centerline of thrust shall be located using the dynamic c.g. to prevent excessive rocket induced pitching of the ejection seat-aircrewmember combination. Neither the ejection seat occupant nor ground crew personnel shall be required to effect any adjustment of the escape system or any of its components to ensure achievement of the optimal relationship between the ejection seat-aircrewmember combination c.g. and the rocket thrustline.

3.2.2.5. Deceleration and stabilization subsystem. The deceleration and stabilization subsystem shall be integral with the ejection seat assembly and shall control the motion of the aircrewmember and ejection seat combination during ejection in accordance with requirements specified herein. Compliance with these requirements shall be demonstrated during the system tests of 4.4.2, 4.4.3, and 4.6.1. The deceleration and stabilization subsystem shall be capable of meeting the requirements listed below:

a. Remain securely stowed within the ejection seat assembly envelope in a dormant condition during normal aircraft operating modes until such time as it is needed during the ejection sequence.
b. Throughout the escape envelope specified in 3.3.2, commence to perform at the required point in the ejection sequence and continue to control the motion of the aircrewmember and ejection seat combination without interruption until recovery parachute canopy opening. It shall prevent periods of random attitude free flight and eliminate instabilities which could cause limb injuries, system malfunctions, and performance degradation.
c. Control pitch, roll, and yaw rates (at parachute canopy container opening speeds in excess of 150 KEAS) in a manner which will maintain the angular displacement of the ejection seat back plane relative to the centerline of the deploying parachute within:

    (1) The limits depicted in figure 4 for pitch.
    (2) 45° in roll.
    (3) 45° in yaw.

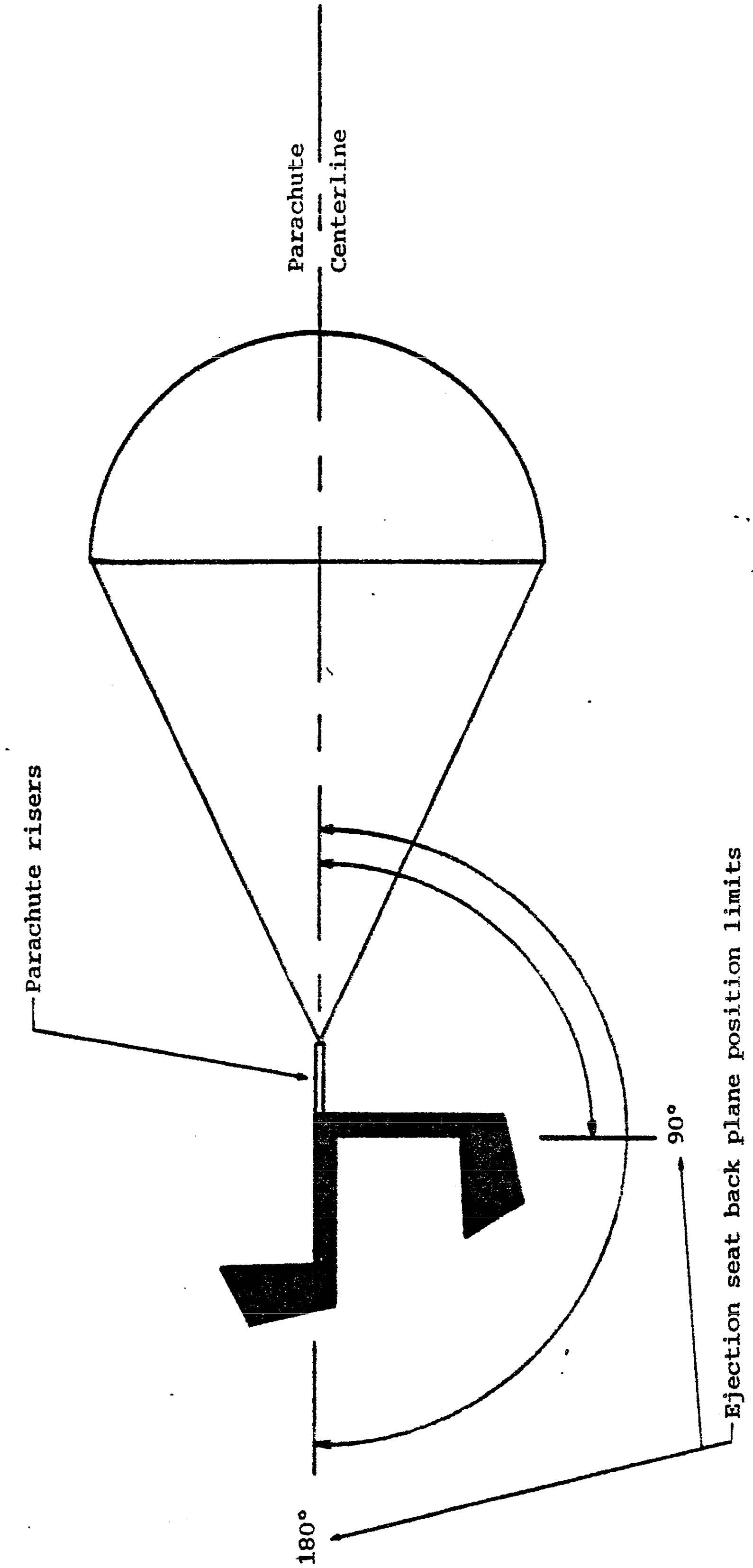


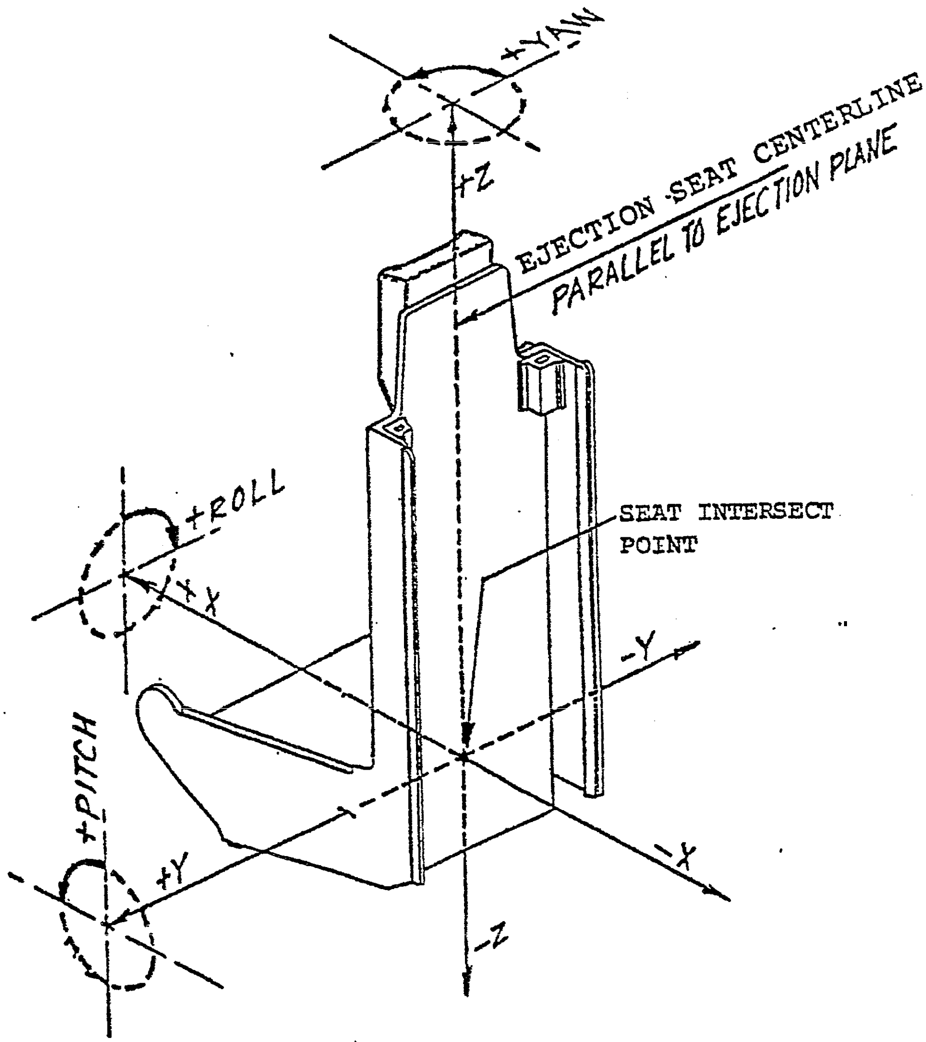
FIGURE 4. Limits of allowable angular displacement of ejection seat back plane relative to parachute risers in pitch during interval between recovery parachute line stretch and first full open.

The angular limits specified above shall be maintained throughout the time interval from recovery parachute canopy line stretch to recovery parachute canopy first full open. The measurement and interpretation of these angles shall comply with data and instrumentation requirements of the appendix.

d. Decelerate the aircrewmember and ejection seat assembly combination to the speed required for safe parachute canopy deployment. Deceleration and transition loading shall be applied in a uniform and continuous manner.
e. Limit control and deceleration loads imposed on the aircrew-member to ensure that the vector sum of such loadings (when measured along each of the three axes in figure 5) does not exceed the maximum allowable loads of table I.
f. Throughout its sequence of operations, deploy its elements in a free and clear trajectory path. Insure that the deployed elements clear the rocket exhaust plumes and that load carrying members are not subject to interference or damage by other escape system components to the maximum extent practicable
g. Prevent entanglement of risers and parachute canopy suspension lines.

3.2.2.6 Recovery subsystem. The recovery subsystem shall be integral with the ejection seat assembly and shall control the descent of the aircrewmember after ejection from the aircraft in accordance with the requirements specified herein. As a minimum, the recovery subsystem shall include a container, parachute canopy, parachute canopy release fittings, risers, cross connector straps, and a positive deployment device. The recovery subsystem shall:

a. Remain securely stowed within the ejection seat assembly in a dormant condition during aircraft operation, including flight with the aircraft canopy removed, until such time as it is required to function during the escape sequence.
b. Prevent subsystem initiation and operation prior to the ejection seat assembly and aircrewmember clearing the aircraft cockpit.
c. Perform its operation in an automatic and programmed sequence following initiation.
d. Delay the deployment of the recovery parachute until a nominal altitude of 18,000 feet has been achieved when ejection from the aircraft occurs at a higher ICAO standard altitude.
e. Function within the escape envelope specified in 3.3.2.
f. Provide redundancy for performing all subsystem functions, subject to written approval by the procuring activity, except as limited by the use of a single parachute canopy.
g. Utilize the manual release handle to actuate the recovery subsystem in the event of a failure of the automatic sequencing system in accordance with 3.2.2.3.4.
h. Incorporate a positive extraction device or means to deploy the parachute canopy.



1/ The Y axis is defined as being normal to the seated surface tangent and the back tangent at their point of intersection (the ejection seat intersect point of figure 2).

2/ The XZ plane is the plane of symmetry bisecting the ejection seat assembly.

3/ The origin of the resulting orthogonal coordinate system is defined as the ejection seat intersect point.

FIGURE 5. Ejection seat assembly orthagonal coordinate set.

TABLE I. Maximum deceleration, stabilization, and recovery opening loads allowable on aircrewmember.

	ICAO Standard Altitude Range				
	8,000 feet and below		Over 8,000 feet to 18,000 feet		Over 18,000 feet
	450 KEAS and below	Greater than 450 KEAS	450 KEAS and below	Greater than 450 KEAS	
Maximum resultant allowable loading 1/ & 2/	25g	35g	20g	30g	No recovery subsystem deployment permitted in this range.

1/ Resultant loads shall be obtained as the vector sum of time-variant loads measured along each of the three axes defined in figure 5. Maximum resultant loadings shall be calculated as specified in the appendix.

2/ Maximum allowable loading applies to the aircrewmember population range specified in 3.2.1.1 and wearing full personal flight gear.

i. Limit parachute canopy opening loads imposed on the aircrewmember (whether prior to, during, or subsequent to separation from the ejection seat) in accordance with the requirements of 3.2.2.5.d and 3.2.2.5.e.
j. Achieve the total velocity and vertical descent velocity specified in 3.2.2.6.1.d while meeting the load requirement of 3.2.2.5.d and table I and while meeting the performance requirements of 3.3.2.
k. Provide a free and clear trajectory path for each deployed element and ensure that load carrying members are not subject to interference or damage by other escape system components, to the maximum extent practicable, throughout its sequence of operations.
l. Dampen oscillatory or rotational motions and prevent entanglement of risers and suspension lines and distribute deployment loads to the ejection seat or to the aircrewmember in a dynamically stable manner in accordance with 3.2.2.5.

3.2.2.6.1 Parachute canopy. The parachute canopy shall support the maximum specified population aircrewmember with full personal flight gear in accordance with 3.2.1.1 and shall:

a. Exhibit uniform, reliable, and repeatable openinq characteristics, be deployed parallel with the relative wind, achieve full line stretch prior to initial inflation of canopy, and minimize post inflation collapse.
b. Incorporate both canopy water deflation pockets and parachute canopy release devices which release automatically upon contact with sea water.
c. Be spread aerodynamically or forcibly to ensure rapid, consistent, and safe operation in accordance with the maximum allowable load envelope specified in table I.
d. Limit total velocity (V_T) to a maximum of 30 feet per second and vertical descent velocity (V_v) to a maximum of 24 feet per second ICAO standard conditions with a suspended weight of 291 pounds.
e. Limit angular displacements of the aircrewmember during descent to a vertical cone with the center of the parachute canopy as the apex having a half angle of 15° maximum, under no wind conditions.
f. Provide a gliding or steerable mode capability that is selectable and initiated only as an aircrewmember option. The requirements of 3.2.2.6.1.d are applicable to both the non-steerable mode and to the steerable mode after application of a flare or brake maneuver.

3.2.2.6.2 Parachute container. The parachute container shall be in accordance with NWC-1027. The container shall provide sotroage for the parachute canopy and protect the parachute canopy against degradation caused by sunlight, ozone, flue gases, rain, salt spray, and dust. The container shall be mounted directly upon or shall be integral with the ejection seat assembly and shall be capable of easy removal. Back type containers shall not be used.

3.2.2.6.3 Recovery subsystem positive deployment device. The positive deployment device shall not interfere with the parachute canopy function during or after its action. The positive deployment device shall be capable of extracting and deploying the parachute canopy under a zero wind condition. Loading contributed by the device shall not cause the loads specified in table I to be exceeded.

3.2.2.6.4 Parachute risers. The length of the parachute risers shall be approved in writing by the procuring activity and shall connect the aircrewmember to the parachute canopy (see 6.2.2). The risers shall incorporate cross connector straps, located and attached as approved in writing by the procuring activity (see 6.2.2).

3.2.2.6.5 Parachute canopy release. A means shall be provided for the aircrewmember to quickly release the parachute canopy after touchdown.

3.2.2.6.6 Recovery subsystem manual backup control. The recovery subsystem shall contain a manual backup control in accordance with 3.2.2.3.4.

3.2.2.6.7 Other recovery subsystem components. Requirements for the parachute canopy container, the positive deployment device, the risers, and cross connector straps, specified in 3.2.2.6.1. through 3.2.2.6.4 inclusive, shall not be construed as prohibiting the use of multiple parachutes, staged parachute configurations, brakes, energy or shock absorbers, rockets, or other devices as components for fulfilling the requirements for the recovery subsystem.

3.2.2.7 Survival equipment container. The survival equipment container shall be comprised of the escape oxygen supply and a suitable protective container for the Government-furnished survival equipment. If used, rigid seat survival kits shall be designed in accordance with MIL-S-81018 or MIL-S-81040 as applicable. Otherwise, the contractor shall prepare a specification in accordance with 3.2.2.17. Survival equipment components shall be approved types, consistent with requirements of the aircraft detail specification. Containers shall be either entirely rigid or semi-rigid (i.e., comprised of a rigid lid and non-rigid container). The survival equipment container shall:

a. Provide 1100 cubic inches of useable storage for Government-furnished survival equipment, plus additional volume as required for the escape oxygen supply.
b. Protect the survival equipment and aircraft interconnections from damage during normal aircraft usage and maintenance.
c. Not interfere with the aircraft's control stick travel when the container is installed with its full complement of survival equipment.
d. Be secured in a manner which prevents movement relative to the ejection seat, any time prior to the separation of the aircrewmember and the ejection seat.
Incorporate provisions to permit the proper functioning, deployment and actuation of survival equipment during the escape sequence.

f. Automatically separate from the ejection seat and remain secured to the aircrewmember during and after the separation of the aircrewmember and the ejection seat. Separation shall be in a repeatable, controlled positive manner through an unobstructed path.
g. Be compatible with the positioning and restraint subsystem as specified in 3.2.2.3.
h. Be easily detachable at the aircrewmember's option during ground emergency egress.
i. Provide an actuation handle(s) that is(are) useable by the specified population of aircrewmembers using a single gloved hand while suspended in the parachute harness.
j. Be of the lightest practical weight.

3.2.2.7,1 Escape oxygen supply. The escape oxygen supply shall provide not less than 7.0 cubic feet of free oxygen at 14.7 pounds-force per square inch absolute (psia) and 60°F (100 cubic inches at 1800 pounds-force per square inch gage (psig)). Oxygen cylinders at 1800 psig, if used, shall be in accordance with MIL-C-7905. The escape oxygen supply shall contain a manual actuation provision that shall be designed and located to be accessible to the aircrewmember for manual actuation while seated in the ejection seat assembly in the aircrewmember station and in any position of ejection seat adjustments The escape oxyqen supply shall be actuated automatically in accordance with MIL-S-81018 during ejection for both rigid and non-rigid survival equipment containers. The oxygen and communication services, for either rigid or non-rigid containers, shall be as specified in MIL-S-81018 or the applicable detail specifications

3.2.2.8 Personal services connections. Personal services connections shall be provided and be standard according to the service provided. All connections shall be positive so that proper attachment is assured. All disconnections shall be automatic during ejection. The disconnection of the personal services leads shall not result in injury to the aircrewmember or damage to flight garments or survival equipment. Upon emergency egress with the survival kit, the personal services connections shall readily disengage and shall not impede the escape of the aircrewmember.

3.2.2.9 Intraseat sequencing subsystems. The operating sequence of the ejection seat assembly and its components and subsystems shall be controlled by the intraseat sequencing subsystem approved by the procuring activity (see 6.2.2). The subsystem shall function following initiation by either the initiation subsystem or the interseat sequencing/spatial separation subsystem as applicable. Any method of signal transmission across the ejection seat assembly-aircraft interfaces shall be automatically connected when the ejection seat assembly is installed and automatically disconnected when the ejection seat assembly is removed. Any method of signal transmission across the ejection seat-aircraft interface shall be redundant and shall be protected against damage, foreign objects, and dirt at all times. The intraseat sequencing subsystem and its sensors shall be protected from, or shall be designed to function properly after contamination by, metal chips and filings, moisture, sand, dust, oil, grease, hydraulic fluids, and other debris potentially present in aircrewmember stations. Failure of the intraseat sequencing subsystem or its sensors shall not result in failure of the affected component(s) or subsystem(s) to function in a preselected mode.

3.2.2.9.1 Sensors. Sensors utilized in the escape system shall be approved by the procuring activity and shall meet the following requirements (see 6.2.2):

a. Sensors shall be incorporated as redundant pairs with separate and independent signal transmission lines routed to minimize the likelihood that localized aircraft damage would disable both lines.
b. Probes and static pressure ports which route free airstream samples to altitude, airspeed, and other similar sensors shall be located, oriented, and secured in a manner which ensures repeatable and accurate performance over the full range of the parameter(s) being sensed. The repeatability and accuracy of the installed sensor and control subsystems shall be demonstrated during the tests of 4.4.2, 4.4.3, and 4.6.1.
c. Tubing and hoses used to interconnect the various probes, ports, vents, sensors, and control elements shall incorporate water traps or the equivalent to ensure that accumulated moisture will not interfere with proper functioning
d. Sensor design and placement shall not hinder or endanger a fully equipped aircrewmember and the escape system during normal ingress and egress, normal aircraft operations emergency manual escape from the aircraft, or ejection.
e. Sensors and probes shall be located and suitably protected to ensure that jettisoned material and fragments resulting from the escape sequence do not prevent proper functioning.

3.2.2.10 Initiation subsystems. The initiation subsystem shall:

a. Include, as a minimum, a firing control mechanism and a lower firing control assembly comprised of a lower firing control handle and redundant lower firing control linkages. If an aircrewmember, tightly restrained and representing worst case anthropometry and attire, cannot actuate the lower firing control handle under one negative "g" condition, then an upper firing control assembly comprised of a face curtain, upper firing control handle and redundant upper firing control linkages shall also be required.
b. Initiate the complete escape sequence required for safe ejection of the aircrewmember and associated ejection seat, when actuated.
c. Be integrated, as required, with the interseat sequencing/spatial separation subsystem in escape systems containing two or more crew stations.
d. Transmit all signals redundantly (i.e., via at least two independent functionally parallel, and physically separated paths).

e. Perform throughout an installed life, as required in accordance with 3.4.2.1, based upon 0.05 complete cycles per flight.

Compliance with initiation subsystem requirements shall be demonstrated during the review of 4.3.2 and during the tests of 4.4, 4.5, and 4.6 as applicable.

3.2.2.10.1 Lower firing control assembly. The lower firing control assembly shall be capable of:

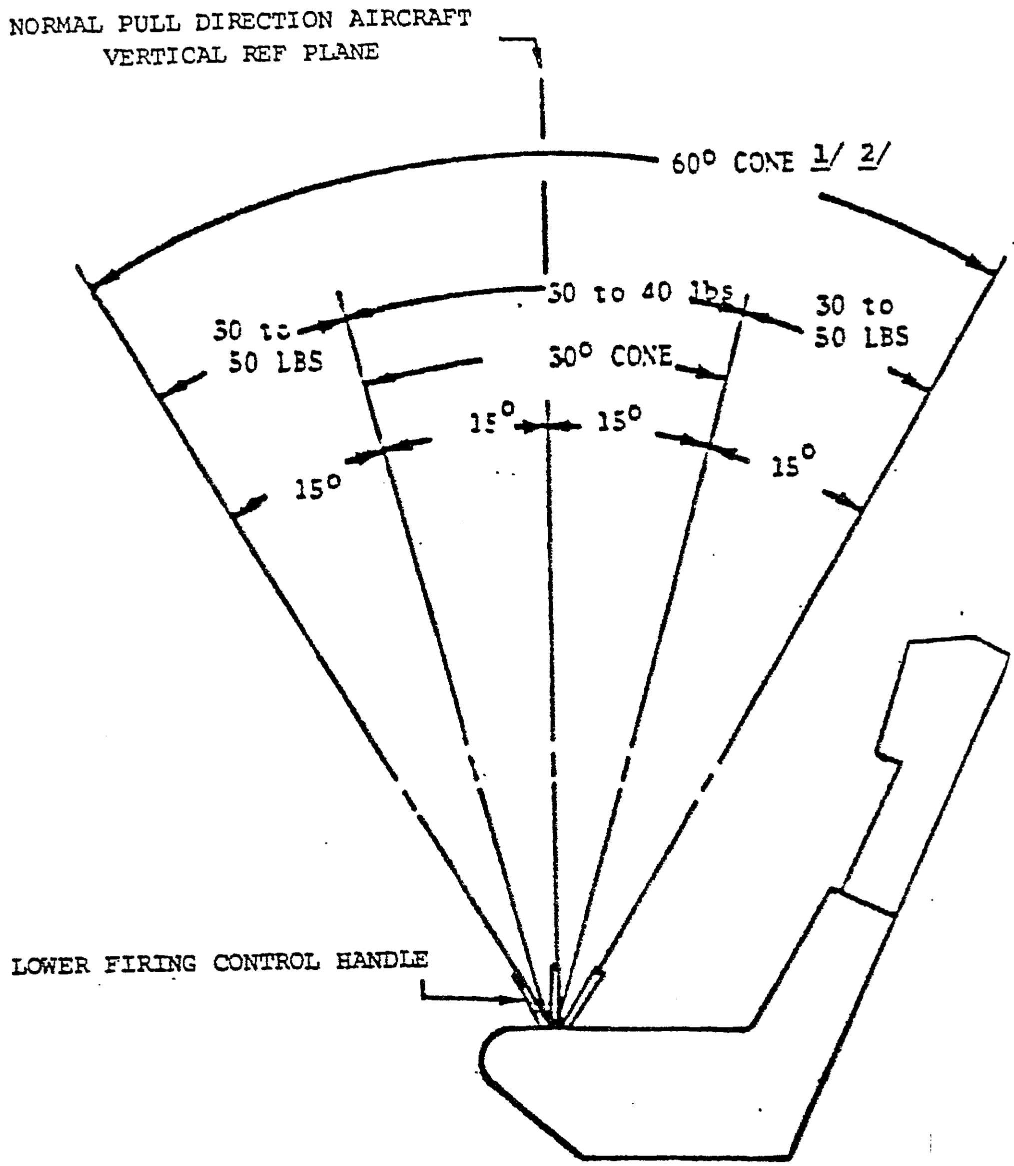
a. Being stepped upon by a fully equipped maximum specified population aircrewmember without sustaining damage that would degrade its subsequent operation, cause subsequent injury to an ejection seat occupant, or cause damage to the aircrewmember's personal protective garments or survival equipment.
b. Withstanding an actuation force of 400 pounds limit load and 600 pounds ultimate load.

3.2.2.10.1.1 Lower firing control handle. The lower firing control handle shall:

a. Be located on the centerline of the forward edge of the ejection seat structure
b. Be capable of being reached and moved to full extension by an aircrewmember having maximum specified population sitting height and minimum specified population functional reach while in the seated and fully restrained position.
c. Be oriented and configured so as to be readily grasped by the maximum specified population gloved hand(s) with palm(s) facing aft.
d. Actuate the initiation subsystem when moved once by the aircrewmember from the normal, dormant position to the fully extended (actuation) position.
Have an overall travel of not less than two inches nor more than four inches from the normal position to the actuation position.
f. Achieve its travel from the normal position to the actuated position in response to forces applied by the aircrewmember in accordance with figure 6.
g. Remain clear of the space envelope defining the full operational range of the aircraft control stick throughout its travel at any selected ejection seat height.
h. Not interfere with or be obscured by the personal flight equipment of a seated aircrewmember.

3.2.2.10.2 Upper firing control assembly. If required (see 3.2.2.10), the upper firing control assembly shall:

a. Preclude inadvertent face curtain extraction due to windblast following aircraft canopy loss during normal aircraft operation.



1/ Requirements apply with the ejection seat unoccupied.

2/ The pull force required to extract the firing control handle from the housing shall be between 15-25 pounds in any direction within the 600 cone.

FIGURE 6. Ejection-seat assembly lower firing control initiation pull force loads vs angles.

b. Preclude interference with or obstruction of the safe functioning of the escape system in the event an ejectee should release the face curtain following its actuation and prior to the separation of the aircrewmember and the ejection seat.
c. Withstand an actuation force of 600 pounds limit load 800 pounds ultimate load.
d. Preclude snagging by either the aircrewmember or maintenance personnel working in the cockpit or on the ejection seat.
Incorporate face curtain redundancy in the form of metallic cable connections between the upper firing control handle and the redundant upper firing control linkages.

Use of an upper firing control assembly which is not of the face curtain type shall require the prior written approval of the procuring activity.

3.2.2.10.2.1 Upper firing control handle. The upper firing control handle shall:

a. Be located and centered above the aircrewmember's helmet and attached to the face curtain.
b. Be capable of being reached and moved to full extension by an aircrewmember having minimum specified population sitting height and functional reach while fully restrained with the ejection seat adjusted to a full-don position.
c. Be oriented and configured so as to be capable of being readily grasped by the maximum specified population gloved hand(s) with palm(s) facing down.
d. Clear the aircraft canopy or radiation shields sufficiently to allow grasping by a maximum specified population aircrewmember wearing all applicable flight equipment with the ejection seat in its highest position.
e. Actuate the initiation subsystem when moved once by the aircrewmember from the normal, dormant position and achieving the fully extended (actuation) position.
f. Reach below the aircrewmember's oxygen mask at full extension
g. Achieve its travel from the normal position to the actuated position in response to forces applied by the aircrewmember: 20 to 40 pounds for extraction from its housing and 30 to 40 pounds to full extension. The design shall ensure that, when fully extended, the aircrewmember's arms from the shoulders to the elbows are pressed tightly against the sides of the chest with the forearms pointing upward.
h. Remain clear of the aircrewmember's oxygen mask, protective helmet and visor while on the ground, airborne and throughout its full travel at any selected ejection seat height.

i. Be automatically released from the ejection seat during the aircrewmember and ejection seat separation phase.

3.2.2.10.2.2 Face curtain. The face curtain shall be:

a. Sufficiently flexible, shaped (full) in center, long and wide to extend over the aircrewmember's helmet and fully cover the entire open face area of the helmet, oxygen mask and helmet visor.
b. Secured to and move with the upper firing control handle.
c. Strong enough to withstand the windblast loads specified in 3.3.2.
d. Adequately protected from, if not impervious to, the environmental conditions of 3.1.9.
e. Extended, during actuation of the upper firing control handle, in a manner which causes the aircrewmember's head to be positioned on and supported by the headrest.
f. Secured to the redundant upper firing control linkages without reliance upon the helmet surface as a bearing point for any part of the linkages.

3.2.2.10.3 Firing control mechanism protections. The firing control mechanisms shall be designed, located, and protected to preclude inadvertent escape system actuation resultinq from foreign object interference or damage from inadvertent or improper operation or maintenance of aircraft systems and equipment.

3.2.2.10.4 Firing control linkages. Design of the lower and upper firing control linkages shall be independent to ensure the jammed or disconnected condition of one does not prevent operation of the other. In addition, redundancy shall be incorporated into all firing control linkages.

3.2.2.11 Interseat sequencing/spatial separation subsystem. Each escape system containing two or more ejection seat assemblies shall be provided with an interseat sequencing/spatial separation subsystem. The subsystem shall:

a. Upon command, automatically sequence individual ejection seats of the escape system in a manner which ensures that ejection seat-aircrewmember combinations will not collide with each other nor with jettisoned equipment, such as aircraft canopies.
b. Protect aircrewmembers from heat and blast effects resulting from the other ejection seats being ejected during escape system operation.
c. Accomplish the spatial separation sequence in Minimal time.
d. Transmit all signals redundantly (i.e, via at least two independent, functionally parallel, and physically separated paths).
e. Not eliminate the ability of aircrewmembers to effect individual escape prior to subsystem initiation and subsequent to any subsystem failure.

f. Automatically bypass the initiation of vacant ejection seats and previously ejected seats. Time delays of vacant and previously ejected seats which are not required for proper spatial sequencing of remaining occupied ejection seats shall also be automatically eliminated from the subsystem sequence.

3.2.2.11.1 Subsystem controls. Subsystem controls shall include:

a. A provision for the automatic initiation of the subsystem upon actuation at any time of any ejection seat firing control handle at the pilot's station.
b. A manual command sequence control which shall provide the pilot with the option of sharing subsystem initiation capability with one additional aircrewmember station. The additional aircrewmember station designation shall be as provided by the aircraft detail specification or, in the case of training aircraft, as provided in 3.2.2.11.1e.
c. A provision for automatic subsystem initiation upon actuation of any ejection seat firing control handle at the pilot or designated aircrewmember station during any period of shared control.
d. Visual advisory signals, in accordance with MIL-STD-411, at the pilot's station and at the designated aircrewmember's station while command sequence control is being shared by the two aircrewmember stations.
e. Controls which permit reversal of pilot and designated aircrewmember stations so that the instructor pilot may select either station as the pilot station in training aircraft. The pilot-selected configuration shall comply with subsystem retirements for pilot and designated aircrewmember stations as specified in 3.2.2.11.
f. Ejection warning controls which are capable of activating an ejection signal upon manual command at pilot and designated aircrewmember stations. An ejection signal shall be provided in accordance with MIL-STD-411.
g. A device or devices mounted either on the aircraft or the ejection seat to meet the requirements of 3.2.2.11f for bypassing vacant ejection seats and vacant ejection seat time delays. If mounted on the aircraft, the device(s) shall be integral with the manual command sequence control. If mounted on the ejection seat, the device(s) shall be integral with the ejection seat safety device of 3.2.2.16.

Each control shall perform throughout an installed life as required in accordance with 3.4.2.1, based upon 12 complete cycles per flight.

3.2.2.12 Aircraft canopy and escape path clearance subsystem. The aircraft canopy and escape path clearance subsystem shall ensure a suitably cleared escape path for an ejecting aircrewmember and ejection seat combination. The subsystem shall have a redundant primary mode, an automatic backup mode, and a manual control mode. Any combination of methods, including but not limited to ballistic jettisoning, camming, ballistic fragmenting, mechanical fracturing, or other methods, shall be used to perform the clearing functions within the three modes, provided that subsystem and mode requirements specified herein are complied with. Designs which result in implosion during ejection shall not be used. The aircraft canopy and escape path clearance subsystem capabilities shall be demonstrated during the tests of 4.4.1, 4.4.2, and 4.6 and shall be capable of meeting the following requirements:

a. Remain securely stowed in a dormant status during normal aircraft operating conditions.
b. Upon actuation of any ejection seat firing control, immediately actuate the redundant primary mode and the automatic backup mode in a programmed sequence as required to clear the escape path of all aircraft structure and equipment such as the aircraft canopy, canopy glass, consoles, controls, etc. Partial or toal failure of the redundant primary mode shall not prevent completion of the escape path clearing function by the backup mode.
c. Incorporate a manual control handle for initiating escape path clearance without initiating seat ejection.
d. Perform the escape path clearing function in a manner which delays the ejection seat's first motion to no more than 0.3 seconds following escape system initiation. Partial or total failure of the redundant primary mode shall not result in extending the time delay limit to more than 0.3 seconds.
e. Limit impulse noise levels resulting from subsystem operation in accordance with requirements of 3.2.1.5.
f. Function without degrading escape system performance throughout the escape envelope defined in 3.3.2.

3.2.2.12.1 Redundant primary mode. The aircraft canopy and escape path clearance subsystem redundant primary mode shall be capable of meeting the requirements specified in 3.2.2.12 and the following:

a. Upon actuation of any ejection seat firing control handle, utilize redundant elements to automatically clear the escape path of all aircraft structure and equipment.
b. Perform the escape path clearing function in a manner which ensures that fixed obstructions (e.g., unbroken aircraft canopy glass which is attached to the aircraft canopy frame, consoles, and instrument panels) at each point are removed prior to passage of the aircrewmember through that point. Contact with fragmented or broken materials shall be minimized.
c. During the redundant primary mode, limit the catapult pressure dynamic loading contribution imposed upon the ejection seat by the canopy or other structure to a retarding pulse of peak amplitude not greater than 3.0g's and base duration not greater than 20 milliseconds as

measured from the catapult pressure baseline (see 6.4.6) as shown in figure 7. The catapult pressure baseline shall be calculated in accordance with the appendix.

d. Minimize spattering of expended explosive material on the aircrewmember.

3.2.2.12.2 Automatic backup mode. The escape path automatic backup mode shall be capable of meeting the requirements listed below, in addition to those listed in 3.2.2.12:

a. In the event of partial or total failure of the redundant primary mode, automatically clear the escape path of all aircraft structure and equipment.
b. During the automatic backup mode, limit the catapult pressure dynamic loading contribution imposed upon the ejection seat by the canopy or other structure to a retarding pulse of peak amplitude not greater than 8.0g's and base duration not greater than 20 milliseconds, as measured from the catapult pressure baseline (see 6.4.6) and as shown in figure 7.

3.2.2.12.3 Escape path obstructions.

3.2.2.12.3.1 Aircraft canopy. The aircraft canopy shall be cleared by jettisoning ballistic fracturing, mechanical penetration, or other means.

3.2.2.12.3.2 Consoles, controls, and other obstructions. Any consoles, controls, structures and other obstructions protruding into the escape path shall be cleared from the escape path in accordance with the requirements of 3.2.2.12.6.

3.2.2.12.4 Escape path controls.

3.2.2.12.4.1 Automatic control. The automatic control shall insure that initiation of the escape sequence shall cause both the redundant primary mode and the automatic backup mode to automatically perform in a programmed sequence which will clear the escape path. Any combination of partial failures or total failure of the redundant primary mode shall not adversely affect the operation of the automatic backup mode. In addition, the automatic control shall insure the shortest possible timing and shall at least equal the time specified in 3.2.2.12.d between system initiation and ejection seat first motion. For example, in a system utilizing aircraft canopy jettisoning as a primary mode, the automatic control shall signal the ejection seat to commence first motion at the preset time delay or upon clearance of the aircraft canopy from the ejection path, whichever occurs first. Any combination of failures of the devices utilized to signal the completion of pre-ejection events shall not prevent catapult firing at the end of the preset time delay limit. The preset time delay limit shall be not greater than 0.3 seconds.

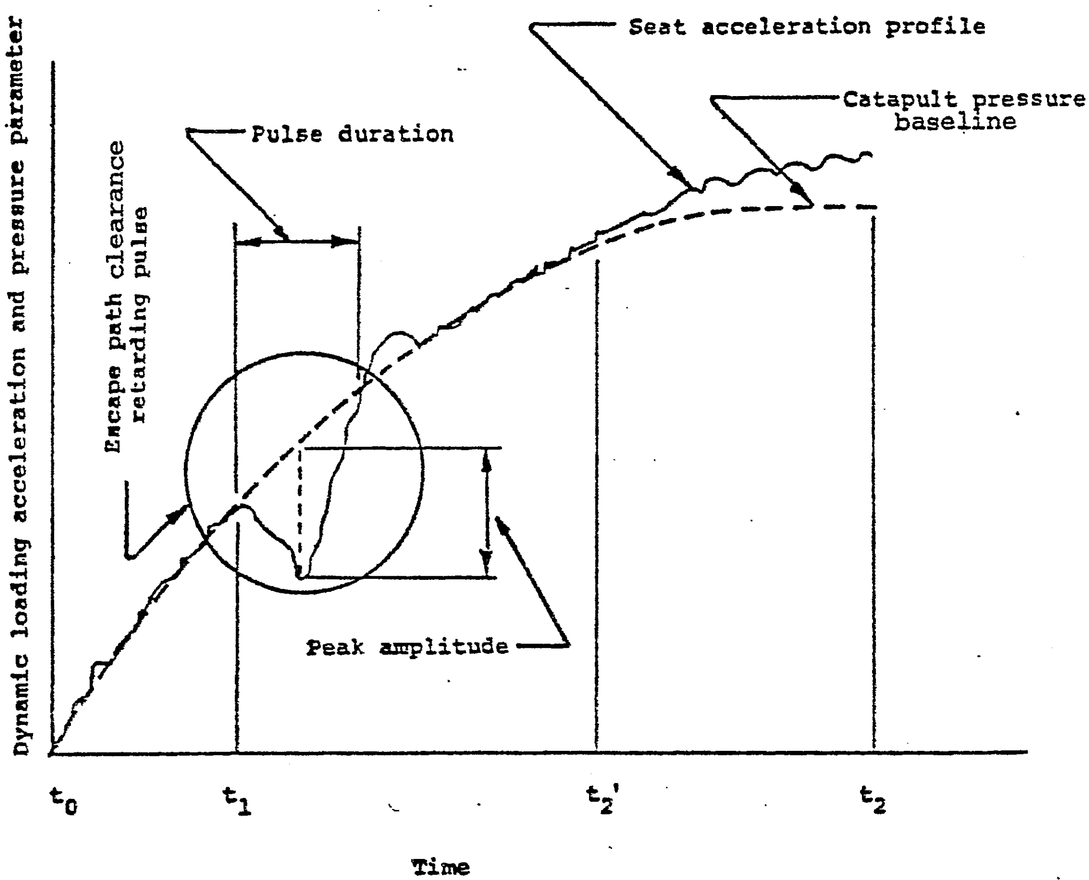


FIGURE 7. Escape path clearing effects on dynamic loading.

3.2.2.12.4.2 Manual control. Manual control of the escape path clearing function shall be provided by the manual control handle which shall be designed for use under emergency egress conditions as specified in 3.3.3. The manual control handle for the manual control mode shall be located on the left side of the aircraft, at the height of the headrest, in a position accessible to the aircrewmember (while restrained in the full back position). The handle shall be large enough for the gloved hand of a maximum specified population aircrew-member to grasp and operate. The handle design and location shall not interfere with ingress to or egress from the ejection seat assembly. Particular attention shall be given to the manual mode capability to provide positive aircraft canopy clearance when the aircraft is submerged.

3.2.2.12.4.3 Interlocks. To eliminate the possibility that failure of control or signal elements will prevent backup mode operation and catapult firing, interlocks shall not be used in the escape path clearance subsystem. If a time delay (up to 0.3 seconds) is used, then the automatic control of 3.2.2.12.4.1 shall be used in lieu of interlocks to enable catapult firing upon completion of pre-ejection events but prior to the expiration of the time delay.

3.2.2.12.5 Escape path interface. All equipment adjacent to the periphery of the escape path shall be free of sharp edges and corners, projecting bolts, and other potentially injurious features.

3.2.2.12.6 Ejection clearances. Ejection clearances shall be provided in accordance with MIL-STD-1333 and shall be mocked-up in accordance with MIL-M-8650 for demonstration as specified in 4.5.1.

3.2.2.13 Signal transmission subsystem (STS). The STS shall comply with the requirements of MIL-D-81980. All STS component designs shall be acceptable to the procuring activity prior to installation or use in an automated aircrew escape system (see 6.2.2.). Where feasible, components previously qualified and released for service use shall be used in preference to developing and qualifying new components. Procuring activity approval shall be obtained for the development and qualification of new components (see 6.2.2).

3.2.2.13.1 Ballistics. Ballistic components designed as part of a signal transmission system designed in accordance with 3.1.8.

3.2.2.13.2 Transmission lines. Transmission lines (hoses or tubing, detonating cord, electric wiring, and deflagration cord) shall be used to provide the means for routing signal(s) between STS components. Detonating cord, deflagration cord, and linear shaped charges shall be designed in accordance with the requirements of MIL-D-21625 and 3.1.8.5.

3.2.2.13.2.1 Ballistic hoses and fittings. Ballistic hoses and fittings shall be selected and designed in accordance with NAVAIR 01-1A-20 to ensure reliable, consistent transmission (without loss of subsystem or component integrity) at normal operating pressures and temperature. Ballistic hoses, fittings, and components shall be located and routed or shielded to:

a. Protect aircrewmembers from injury and equipment and escape system components from damage resulting from ballistic hose or fitting failure during operation.

b. Protect the ballistic hoses and fittings from mechanical damage during normal ejection seat use, ejection, installation, removal, or stowage.

Ballistic hose bends (elbows) in excess of 45° shall not be used.

3.2.2.13.3 Precautions for electrical ignition subsystems. Electrical ignition subsystems shall be protected from hazards of electromagnetic radiation in accordance with MIL-STD-1385 and shall have independently shielded circuits secured against vibration and protected against short circuits or grounds resulting from chafing. The subsystem shall be protected forom the environmental conditions specified in 3.1.9. Junctions shall be designed to eliminate current leakage to or from other aircraft circuits and to minimize hazards of electro-magnetic radiation. The ignition subsystem electrical power supply shall be used solely to supply power to the ignition system and shall be adequate to ensure ignition under all service environmental conditions specified in 3.1.9. Verification of electrical ignition subsystem non-susceptiblity to hazards of electromagnetic radiation shall be conducted in accordance with MIL-STD-1385.

3.2.2.13.4 Installation and routing of STS and components. The STS components shall be selected, designed, routed, and mounted as required to provide foolproofness, to withstand system operational loads, and to withstand relative motion between STS components and other subsystem(s) interfaces without degradation of the STS during operation. The STS component location, routing, and shielding shall also be selected to provide:

a. Protection against heat that is capable of damaging or degrading components.
b. Protection to prevent damage during normal use.
c. Accessibility to maintenance personnel for periodic replacement of age limited components.
d. Assurance of maintenance personnel safety during removal or installation operations.

3.2.2.14 Personnel location subsystems.

3.2.2.14.1 Personnel locator device(s). A method for automatically activating personnel locator device(s) upon ejection of the ejection seat shall be incorporated. Personnel locator device(s) to be used shall be specified by the detail specification. The means for actuating the device(s) shall be designed and located to permit using activities to arm or safety the locator device actuation subsystem as necessary without requiring removal of the survival container or the ejection seat assembly from the aircraft. Arming or safetying the subsystem shall be a task readily accomplished in flight. A visible indication shall be provided to indicate the status of the subsystem

3.2.2.14.2 Aircraft emergency IFF actuation. The escape system shall provide for automatic actuation of the emergency IFF system upon ejection. The IFF actuation system design shall preclude inadvertent actuation caused by ejection seat assembly or aircraft maintenance actions such as movement, removal, or installation of ejection seat assemblies or equipment regardless of whether or not the aircraft electrical system is energized.

3.2.2.15 Classified equipment destruct system initiator. If a classified equipment destruct system is initiated by the escape system, the actuation system shall be designed to prevent inadvertent activation caused by ejection seat assembly or aircraft maintenance actions (such as movement, removal, or installation of ejection seat assemblies or equipment), regardless of whether or not the aircraft electrical system is energized.

3.2.2.16 Ground safety subsystem. An escape system deactiviating device shall be provided which, when operated, shall:

a. Safety the ejection seat propulsion unit arid any pre-election functions which could injure maintenance personnel working in the cockpit or an aircrewmember in the process of ingressing or egressing the ejection seat.
b. Readily indicate by visual means that the ejection seat is safetied and is not ready for flight.
c. Preclude the aircrewmember from flying in the aircraft without being aware that the ejection seat is safetied.

The safety device shall be designed so that it will remain in either the safety-on or safety-off position. When in the safety-off position, the device shall not interfere with a seated aircrewmember's comfort. The safety device shall perform as required throughout an installed cycle life predicated upon five cycles per flight and calculated in accordance with 3.4.2.1. In multi-place aircraft, any vacant seat bypass control may utilize this device to perform the dual functions of providing ground safety and vacant seat bypass.

3.2.2.16.1 Removable ground safety pins. Removable ground safety pins shall be a single-acting, quick-release type pin designed in accordance with MIL-P-23460. Safety pins, when installed, shall be highly visible and readily accessible. Safety pins shall be securely fastened to a red fabric streamer designed in accordance with NAS 1091. The streamer shall be marked in large white letters: “REMOVE BEFORE FLIGHT”. Safety pins shall not lock in place unless the devices in which the pins are inserted are safetied.

3.2.2.16.1.1 Safety pin and streamer flight stowage. Provisions shall be made for the stowage of escape system safety pins and streamers to prevent their loss or interference with aircraft controls and to ensure their availability to ground crews. Stowage positions shall be located in a position accessible to a seated aircrewmember and shall permit stowage of safety pins and streamers and the securing of the stowage device with one hand. The stowage provisions shall be accessible to maintenance personnel or rescue personnel reaching into the cockpit.

3.2.2.17 Escape system component and subsystem specifications. The contractor shall prepare for procuring activity approval, specifications for components and subsystems covering the design, test, manufacture, or quality assurance procedures not adequately defined by military or federal specifications or standards or acceptable non-government organization specifications or standards (see 6.2.2). Specifications shall be prepared in accordance with MIL-STD-961.

3.3 System performance. The escape system shall provide immediate initiation and the subsequent complete automatic functioning of all components and subsystems in proper sequence, after a single non-interrupted actuation of any appropriate escape system firing control handle.

3.3.1 Aircrewmember maximum loads. Loading during the ejection sequence shall be controlled to minimize adverse physiological consequences on the aircrewmember while meeting the performance criteria of 3.3.2. Maximum loads imparted to the aircrewmember during the ejection sequence shall:

a. Be not greater than 25g's in the Z-axis at a 70°F temperature condition during the initial boost or catapult phase as measured by seat-mounted instrumentation and calculated in accordance with 30.3.8c (see 4.4.2 and 4.6.1).
b. Be in accordance with the requirements of 3.2.2.12.1.c and 3.2.2.12.2.b for aircraft canopy and escape path clearance (see 4.4.1).
c. Be in compliance with table I for all other phases leading up to and including parachute opening (see 4.4.2 and 4.6.1).
d. Not be evaluated after recovery parachute opening.

3.3.2 Escape envelope. Upon actuation of the escape system, the aircrewmember shall be provided with the escape capabilities throughout the performance envelope represented in table II for all conditions of ejection seat-aircrewmember center of gravity locations as specified in 3.2.2.4.1, regardless of the position of the ejection seat height adjustment or position of the ejection seat assembly within the aircraft (see 4.4.2, 4.4.3, and 4.6.1).

3.3.3 Emergency egress. The aircrewmember shall be provided with the capability of egressing from the aircraft in an emergency without ejecting (see 4.6.2.1.1). During emergency egress, the aircrewmember shall have the option to either retain or detach the survival equipment container. The aircrewmember shall have the capability of clearing the escape path for rapid egress either on land or in the water to a depth of thirty feet, measured from the surface of the water to the top of the aircraft canopy. The time required for emergency egress, exclusive of aircraft canopy clearance but including all aircrewmember actuations, shall be not greater than 10 seconds.

3.4 System effectiveness.

3.4.1 Reliability. The contractor shall establish, implement, and document a system reliability program in accordance with and embodying the program elements defined in MIL-STD-2067 (see 6.2.2).

TABLE II. Escape system ground clearance requirements envelope cross section for single seat aircraft. 1/ , 2/

Aircraft velocity conditions 3/			Worst case vertical clearance above ground level (in feet) at aircraft bank angles of: 3/, 6/			
Airspeed KEAS 4/	Dive angle degrees	Sink rate fpm	0°	45°	90°	180°
0	0	0	0 9/	0	20	170
		2,000	0	0	70	200
		6,000	80	90	160	260
		10,000	170	175	220	300
130	0	0	0 9/	0	10	120
		2,000	0	0	30	160
		6,000	30	40	110	210
		10,000	110	120	180	270
225	0	0	0 9/	0	10	90
		2,000	0	0	20	110
		6,000	10	20	100	180
		10,000	90	110	160	230
600 5/	0	0	0 9/	0	40	140
		2,000	0	0	90	190
		6,000	30	50	180	280
		10,000	130	150	240	370
50	20	7/	0 8/	0	70	190
0	30	7/	0	0	50	170
	60		0	20	70	130
	90		80	80	80	80
130	30	7/	80	90	150	230
	60		210	220	250	290
	90		280	280	280	280
225	30	7/	130	150	200	270
	60		300	310	330	380
	90		390	390	390	390
450	30	7/	500	520	590	670
600 5/	30	7/	560	570	660	750
	60		1050	1060	1110	1150
	90		1270	1270	1270	1270

1/ Recovery parachute shall achieve an average descent velocity as specified in 3.2.2.6.1e, except as permitted in 9/ .

2/ Proposed conditions for escape involving sequencing ejection of two or more aircrewmembers shall be prepared in similar format and made available to the procuring activity for written approval.

3/ Aircraft velocity and bank angle conditions at escape system initiation.

4/ Airspeeds measured along the aircraft X axis as positioned by the corresponding dive angle.

5/ Substitute maximum aircraft airspeed if aircraft maximum airspeed is less than 600 KEAS.

6/ Ground level encompasses a range of altitudes from -1,000 feet to +6,000 feet above mean sea level.

7/ Aircraft sink rate as defined by the specified airspeed and dive angle.

8/ This condition shall be met with an aircraft deceleration of 5.0g's measured parallel to the qround.

9/ The parachute canopy shall open fully at least one time while the lowest point of the aircrewmember is at least twenty feet above the ground. Achievement of average descent velocity of 3.2.2.6.1e shall not be required.

3.4.1.1 Critical components analyses. The contractors shall conduct a worst case type stress analysis, a worst case type tolerance analysis, and an environmental study of those critical parts, the failure of which will significantly affect the ability of the escape system to perform its overall function or adversely impact safety considerations (see 6.2.2). Critical parts shall include those parts identified as such through experience, reliability analysis, failure mode and effects analysis, or through a single point failure analysis.

3.4.1.1.1 Stress analysis. The critical components stress analysis shall be conducted in accordance with NAVAIR 01-1A-32 (see 6.2.2).

3.4.1.1.2 Tolerance analysis. As a minimum, the critical components tolerance analysis shall include thorough evaluations of the following, as applicable (see 6.2.2):

a. Tolerance buildup.
b. Shaft and bore eccentricities (i.e. run-out).
c. Concentricity deviations.
d. Centrality deviations.
e. Straightness (taper) deviations
f. Perpendicularity deviations.

3.4.1.1.3 Environmental study. The environmental study of the critical components shall be conducted in accordance with MIL-STD-2067 (see 6.2.2).

3.4.2 Maintainability. The contractor shall establish, implement, and '--' document a system maintainability program in accordance with and embodying the program elements defined in MIL-STD-2067 (see 6.2.2). The general guidelines specified in MIL-STD-1472 shall be used for designing for maintainability ease.

3.4.2.1 Cycle life. The number of cycles required for achieving one installed cycle life shall be calculated as follows:

a. Gross cycles - (cycles/flight) x (20 flights/month) x (months/installed life of the component) x (1.25 safety factor).
b. Cycle life - gross cycles rounded upward- to next full 1000 cycles.

Cycles per flight include allowances for cycling during preflight preparation, all phases of flight, post-flight operations, and periodic maintenance and inspections performed within the aircrewmember station.

3.4.3 System safety. The contractor shall conduct a system safety program in accordance with MIL-STD-882 (see 6.2.2). The hazard severity classification shall define any hazard identified as degrading the escape system performance envelope (see 3.3.2) as a Category I hazard.

3.4.4 Configuration management. The contractor shall establish, implement, and document a program for managing the escape system configuration in accordance with DOD-STD-480 and MIL-STD-481 (see 6.2.2). The program shall apply during all stages of development and production. The program shall establish means for controlling and tracing all changes in escape system configuration whether the changes are physical in nature or are changes in processes or conditions imposed during development, manufacture, assembly, or inspection. The program plan shall also describe how the contractor intends to assure proper configuration identification.

3.4.4.1 Configuration identification. The configuration management program shall include procedures for selecting and identifying configuration items, the preparing and identifying of engineering drawings, and the preparing and processing of design specifications. It shall also include the procedures for establishing the functional baseline (see 4.3.2.1), the testing baseline (see 4.3.2.4), and the product or final baseline (see 4.6.2) including modifications thereto.

3.4.4.2 Configuration status accounting. Configuration status accounting shall be in accordance with MIL-STD-482 (see 6.2.2).

3.4.4.3 Changes history. The contractor shall maintain a changes history of all changes affecting the escape system design or system manufacturing processes or procedures. The history shall include at least the following information:

a. Date of change occurrence.
b. Description of the change.
c. Explanation of why the change was made.
d. List of any alternative actions considered.
e. Basis for selection or rejection of alternatives: cost, schedule, technical, contractual, or similar factors.

3.5 Workmanship. Workmanship shall be of the highest quality to assure optimum performance, reliability and service life. Particular attention shall be given to ensure freedom from defects, burrs, and sharp edges; accuracy of dimensions, radii, fillets, and markings of parts and assemblies; thoroughness of welding, brazing, painting, and riveting; alignment of parts and tightness of assembly screws and bolts.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Development testing (DT), reviews, and audits. Development testing (DT), reviews, and audits for the escape system shall include, but shall not be limited to, the test and inspection regimen described below. All tests specified shall be successfully completed in accordance with 4.7.6. For all ejection testing, the contractor shall also comply with the additional test conditions and data requirements specified in the appendix. Design reviews, audits, and similar events shall be conducted as specified in the following paragraphs or, where designated, by the contractor with procuring activity representatives in attendance. The objective of these events is to ensure, in an orderly manner, that the escape system design is compatible with the fully-equipped aircrewmember and the aircraft, and is in accordance with the specification requirements. The events shall be conducted and approved in the sequence herein specified. The test and inspection program for the development of the escape system shall consist of the demonstration and validation phase, DT-I, and the full scale development phase, DT-II. Each phase shall be further subdivided as follows:

a. Initial engineering demonstration and validation, DT-IA. Initial engineering demonstration and validation shall include the tests specified in 4.3 and such other tests as required to generate sufficient data to satisfy the initial functional configuration audit requirements of 4.3.2.1 for all components and subsystems not already qualified in accordance with the requirements of this specification (see 4.3.1.1). The reviews and audits to be conducted during DT-IA shall include the following:

  (1) Engineering proofing article I (EPA-I) review (see 4.3.1).

    (a) Initial qualification status review (IQSR) (see 4.3.1.1).

  (2) Engineering proofing article II (EPA-II) review (see 4.3.2).

    (a) Initial functional configuration audit (IFCA) (see 4.3.2.1).
    (b) Field maintainability article I (FMA-I) (see 4.3.2.3).
    (c) Testing baseline configuration audit (TBCA) (see 4.3.2.4).

(d) Materials and processes review (see 4.3.2.5}.
(e) Critical components analyses review (see 4.3.2.6).

(3) Pre DT-IB design review (see 4.3.3).

b. Final engineering demonstration and validation, DT-IB. Final engineering and validation shall consist of the track tests, in-flight ejection tests, and aircraft canopy and escape path clearance tests specified in 4.4. The configuratin of the test articles shall be in accordance with the testing baseline established in 4.3.2.4.

c. Component and subsystem full scale development, DT-IIA. Component and subsystem full scale development shall include the component and subsystem tests specified in 4.5.1 and the system design compliance tests specified in 4.5.2. The configuration of the test articles shall be in accordance with the testing baseline established in 4.3.2.4. DT-IIA shall also include:

(1) Pre DT-IIB design review (see 4.5.3).

(a) Final functional configuration audit (FFCA) (see 4.5.3.1).

d. System full scale development tests, DT-IIB. The system full scale development tests shall consist of the system track tests specified in 4.6.1. Test article configureation shall be in accordance with the final baseline established by 4.6.2. The reviews and audits to be conducted during DT-IIB shall include the following:

(1) Physical configuration audit (PCA) (see 4.6.2).

(a) Production proofing article (PPA) review (see 4.6.2.1).
(b) Field maintainability article II (FMA-II) review (see 4.6.2.2).

The approximate time phase relationships of the test phases and other escape system milestones and events specified herein are shown in figure 8.

4.3 Initial engineering demonstration and validation, DT-IA. The DT-IA tests and inspections shall include, but not be limited to, the following:

a. Ballistic component tests. Cartridge and cartridge actuated device (CAD) tests shall be accomplished in accordance with the design verification testing (DVT) requirements of MIL-D-23615 and MIL-D-21625. Rocket component testing shall be accomplished in accordance with the DVT requirements of MIL-A-85041.

b. Static load tests. Design strength shall be validated by static load tests which simulate the load conditions of 3.2.1.6. Loading shall be applied incrementally to demonstrate structural integrity under operational loading conditions as analytically determined

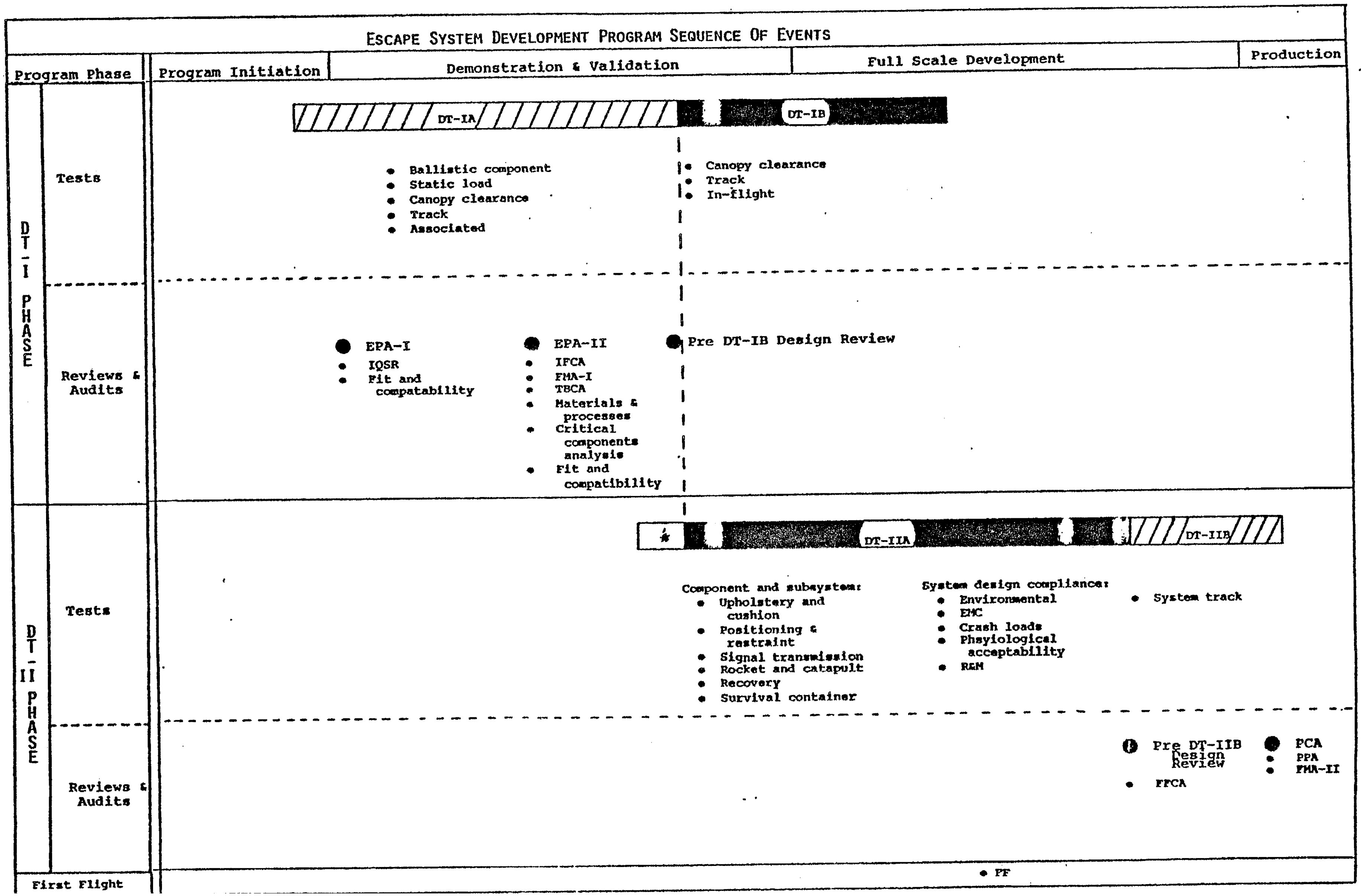


FIGURE 8. Escape system development program sequence of events.

by the contractor and which are acceptable to the procuring activity. Subsequently, loading shall be incrementally increased to establish safety margins at failure. Loads carried by all critical load carrying members shall be measured and recorded. Test set-up, loadings, and failures shall be documented photographically. Post-test design changes shall necessitate rerunning static load tests.

c. Aircraft canopy and escape path clearance subsystem tests. Four ground level, zero airspeed tests shall be conducted, two utilizing the redundant primary mode and two utilizing the automatic backup mode. Tests shall be designed to represent worst case conditions. Test data requirements and instrumentation shall comply with the appendix.
d. Track tests. A series of six escape system track tests shall be conducted with ejection speeds varied from zero to maximum and including all applicable crossover speed modes. Test data requirements and instrumentation shall comply with the appendix. DT-IA track tests shall be conducted using available test vehicles acceptable to the procuring activity.
e. Other types of tests, commensurate with the development risk involved, shall be required for those components and subsystems not already qualified in accordance with the requirements of this specification and as determined by the initial qualification status review (see 4.3.1.2).
f. The reviews and audits specified from 4.3.1 through 4.3.3.

4.3.1 Engineering proofing article I (EPA-I) review. The EPA-I review, which includes the initial qualification status review (see 4.3.1.1) and the escape system fit and compatibility evaluation (see 4.3.1.2), is a preliminary evaluation of the escape system design and shall be completed prior to commencement of DT-IA testing specified in 4.3.

4.3.1.1 Initial qualification status review (IQSR}. An IQSR shall be conducted by the contractor with procuring activity participation ninety days or less prior to the completion of the escape system fit and compatibility evaluation, (see 4.3.1.2). The objective of this review shall be to establish the acceptability of all components and subsystems for use in escape systems. For this specification the term qualification refers to a component or subsystem that meets the quality assurance requirements of this specification or has been previously accepted for escape system service use in accordance with its own military specification or standard. The IQSR shall:

a. Identify those components or subsystems which shall be subjected to qualification tests in accordance with other military specifications or standards.
b. Identify those components and subsystems requiring qualification and which are not covered by existing military specifications and are considered critical in accordance with 3.4.1.1.

c. Determine the acceptability of those components or subsystems previously qualified for escape system service use.
d. Determine the acceptability of qualifying any component or subsystem which may be recommended by the contractor for qualification by similarity to items previously qualified for escape system service use.
e. Review the DT-IIA test program plan to ensure that it provides for qualification of all components and subsystems which are not considered satisfactorily qualified for escape system service use.

4.3.1.2 Escape system fit and compatibility evaluation. The escape system fit and compatibility evaluation shall provide a preliminary evaluation of escape system fit and compatibility with the aircraft and a preliminary evaluation of aircrewmember accommodation and mission task performance at each aircrewmember station. The contractor shall prepare and install an escape system engineering proofing article(s) in the aircraft (or an aircraft cockpit or aircrewmember station simulation acceptable to the procuring activity) for a preliminary evaluation of the escape system design for each aircrewmember station. Each proofing article shall be representative of the planned final design and shall be constructed in accordance with MIL-M-8650. Each article shall accurately depict the location and routing of all ballistic devices and signal transmission lines, electrical wiring, and ejection seat assembly or component connections interfacing with the aircraft mounted escape system elements. If applicable, the recovery subsystem and survival container shall be simulated in a manner permitting bench-type manual demonstration of operation. All ejection seat assembly controls shall be simulated in a manner permitting operation of the control handles. However, the controls need not be connected to operating linkages or components. The back tangent (see 6.4.3) and the seated surface tangent (see 6.4.4) shall be defined for visual reference, The contractor shall comply with appendix 2 of MIL-M-8650. Complex components, subsystems, and operations shall be illustrated and described in detail so that the participants reviewing the system can quickly and accurately verify the design, assembly, and operation of each element of the escape system. Until the final baseline configuration has been approved in accordance with 4.6.2, the contractor shall maintain the proofing article in the delivered, or the corrected configuration to permit its use as a configuration reference tool by both contractor and procuring activity personnel. No changes shall be made in the configuration of the article during its retention as a configuration reference tool.

4.3.1.2.1 Emergency egress tests. The contractor, using subjects representative of the anthropometric specified population and wearing full winter personal flight gear (see appendix), shall demonstrate emergency egress on land. The egress shall be considered complete when the aircrewmember, with survival equipment, has cleared the cockpit. The contractor shall prepare a descriptive analysis of the capability of the escape system to satisfy the submerged egress requirements in accordance with 3.3.3 (see 6.2.2).

4.3.1.2.2 Demonstration of aircrewmember population range accommodation. For each aircrewmember station, the contractor shall demonstrate compliance with the requirements of 3.2.1.1.

4.3.1.2.3 Demonstration of aircrewmember capability to reach and actuate aircraft controls. For each aircrewmember station, the contractor shall demonstrate compliance with the requirements of 3.2.1.2.

4.3.1.2.4 Demonstration of aircrewmember capability to reach and actuate escape system controls. For each aircrewmember station, the contractor shall demonstrate compliance with the applicable requirements of 3.2.1.3. The reach requirements of 3.2.2.10.1 and 3.2.2.10.2.1 shall be demonstrated.

4.3.1.2.5 Field of vision. Field of vision plots for each aircrewmember station shall be made available as part of the compatibility demonstrations. The effect of each occupied ejection seat assembly and other system components upon the field of vision for each aircrewmember station shall be depicted upon field of vision plots in accordance with the procedures specified in MIL-STD-850. Plots shall be made quantitatively with the Field of View Evaluation Apparatus (FOVEA) in accordance with NATC report SY-126R-78. In a multi-seat aircraft, the FOVEA shall be positioned at the design eye position for the ejection seat assembly being evaluated. The other ejection seat assemblies within the aircraft at the time of plotting shall be occupied and in the full-up position.

4.3.2 Engineering proofing article II (EPA-II) review. The EPA-II review, which includes the escape system fit and compatibility evaluation (see 4.3.2.2) and the audits and reviews specified in 4.3.2.1, 4.3.2.3, 4.3.2.4, 4.3.2.5, and 4.3.2.6, is a detailed evaluation of the proposed design and configuration. Limited DT-IIA testing may be authorized by the procuring activity prior to final acceptance of the EPA-II review. At least 60 days shall be allowed after the completion of DT-IA testing (see 4.3) to provide sufficient time to gather data for and to complete the IFCA (see 4.3.2.1) prior to the commencement of other EPA-II events.

4.3.2.1 Initial functional configuration audit (IFCA). An IFCA of the escape system shall be conducted by the contractor in accordance with MIL-STD-1521 prior to the commencement of other EPA-II events. A summary of the results of the DT-IA tests, as documented by the individual development test reports, shall be made available to the procuring activity (see 4.7.3.4). The objective of the IFCA will be to verify that sufficient data has been generated and that compliance with functional and performance requirements have been demonstrated by DT-IA testing before preceding to DT-IIA and DT-IIB. Concurrent with the conduct of the IFCA, a qualification status review shall be conducted by the contractor as a follow-up to the IQSR of 4.3.1.1.

4.3.2.2 Escape system fit and compatibility evaluation. A proofing article(s) shall be installed in the aircraft or an aircraft cockpit mock-up acceptable to the procuring activity for evaluation of escape system fit and compatibility with the aircraft and for evaluation of aircrewmember accommodation and task performance. The contractor shall prepare and install in each appropriate aircrewmember station an engineering proofing article representing the proposed testing baseline configuration (see 4.3.2.4). Parts need not be manufactured by production processes. In a program involving retrofit of the ejection seat assembly and associated elements into a specified aircraft, installation of each proofing article shall be conducted in accordance with formalized installation instructions prepared by the contractor and will be observed by representatives of the-procuring activity. The ejection seat back tangent (see 6.4.3) and the seated surface tangent (see 6.4.4) shall be depicted on the ejection seat. The ejection seat intersect point (SIP) (see 6.4.1) location and the projected tangents shall be defined for visual reference. If practical, side panel identification marks or pilot holes shall be used for location of the SIP. If impractical to identify the SIP by structural points, a durable and rigid template shall be provided to determine the physical location of the SIP. The contractor shall comply with appendix 2 to MIL-M-8650. Complex components, subsystems, and operations shall be illustrated and described in detail so that the participants reviewing the system can verify quickly and accurately the design, assembly, and operation of each element of the escape system. The same tests and demonstrations as required by 4.3.1.2.1 throuqh 4.3.1.2.5 shall be performed. At the completion of these tests, the contractor shall maintain the proofing articles in accordance with 4.3.1.2.

4.3.2.3 Field maintainability article I (FMA-I) review. The contractor shall prepare a maintainability article(s) for review within thirty days prior to and thirty days following the completion of the EPA-II review. parts need not be manufactured by production processes. The FMA-I maintainability article shall be the same configuration as the EPA-II proofing article. The function of the FMA-I review is to determine whether the escape system design meets all specified maintainability requirements. Adequate maintenance instructions and peculiar support equipment evaluation articles needed to accomplish and evaluate all maintenance requirements and actions at each maintenance level shall be provided with the maintainability article, The peculiar support equipment evaluation articles shall be the proposed final design, but need not be manufactured by planned production processes; however, the equipment shall be capable of safely performing the specified tasks. The escape system shall be subjected to a field maintainability review conducted by the procuring activity in accordance with MIL-STD-2067. The objective of this review shall be to:

a. Ensure system and component maintainability.
b. Develop information for evaluating contractor recommended maintenance procedures and practices.
c. Determine the support equipment and peculiar support equipment suitability for performing the required maintenance tasks in a fleet maintenance environment.
d. Evaluate susceptibility of escape system components to damage during cockpit aircraft maintenance.

All ballistic components of the prototype escape system shall be inert; however, all mechanical firing mechanisms shall be in working order.

4.3.2.4 Testing baseline configuration audit (TBCA). A testing baseline configuration audit (TBCA) shall be conducted by the contractor, with a procuring activity representative in attendance. The audit shall be conducted in accordance with MIL-STD-1521, within forty-five days of the completion of the EPA-II review. The objective of the TBCA shall be to formally examine the EPA-II ejection seat assembly against its technical documentation in order to establish a testing baseline for DT-IB and DT-II testing. This documentation package, as a minimum, shall include a complete set of level 2 drawings prepared in accordance with DOD-D-1000 (see 6.2.2). The approved documentation package, as a result of the TBCA, shall constitute the approved testing baseline configuration.

4.3.2.5 Materials and processes review. The procuring activity will conduct an in-depth review of the planned materials and processes to determine compliance with 3.1.1. In preparation for the review, the contractor shall ensure that each drawing has complete materials and process call-outs. In addition, the contractor shall prepare a parts list or parts tree by subassembly and assembly breakdown and listing thereon, for each part, all applicable drawing numbers.

4.3.2.6 Critical components analyses review. The contractor shall document the results of the critical component stress analysis, tolerance analysis, and environmental study (see 3.4.1.1.). The results of these analyses shall be made available to the procuring activity at the critical components analyses review in a manner which will permit the determination of the adequacy of the design of the critical components to meet worst case stresses, acceptable limits for worst case tolerances, and the ability to effectively withstand and operate under the effects of extreme environmental conditions. In addition, evidence shall be made available by the contractor during the review to clearly show how the results of these analyses affect or will affect the design, test, and production of the escape system to ensure that it meets the requirements of this specification

4.3.3 Pre DT-IB design review. The procuring activity will conduct a pre DT-IB design review to ensure that components and subsystems of the escape system design are compatible with the aircraft and the fully-equipped aircrewmember, and are in accordance with the specification requirements herein. Successful completion and approval of this review and establishment of the testing baseline are prerequisites for the commencement of the final engineering demonstration and validation, DT-IB tests (see 4.4), and the component and subsystem full scale development, DT-IIA tests (see 4.5). At the pre DT-IB design review, the contractor shall present a summary of all significant findings and results of the following:

a. Tests and inspections of 4.3.
b. Engineering proofing article I (EPA-X) review (see 4.3.1).
c. Engineering proofing article II (EPA-II) review (see 4.3.2).

Additionally, the contractor shall summarize the remedial actions planned for all outstanding design conformance inspection deficiency reports from previous events. The procuring activity will determine, from the information presented, the suitability of the escape system design for commencement of the DT-IB tests (see 4.4) and the DT-IIA tests (see 4.5).

4.4 Final engineering demonstration and validation, DT-IB. The final engineering demonstration and validation tests shall not commence prior to completion and approval of the pre DT-IB design review (see 4.3.3). The objective of the tests shall be to demonstrate the capability of the escape system to meet the performance requirements of 3.3 and table II. Not all table II conditions shall be demonstrated by testing; however, the specific tests to be conducted shall be stipulated in the test plan (see 4.7.2). Data from these tests shall be utilized to evaluate specification performance requirement compliance at the pre DT-IIB design review (see 4.5.3). Test article configuration shall be in compliance with the testing baseline (see 4.3.2.4).

4.4.1 Aircraft canopy and escape path clearance subsystem. DT-IB testing of the aircraft canopy and escape path clearance subsystem shall be completed as required prior to the start of DT-IB track tests. Test results shall be used to demonstrate compliance with 3.2.2.12. Tests shall be conducted at worst case temperature conditions, acceptable to the procuring activity, DT-IB testing of the aircraft canopy and escape path clearance subsystem shall include a minimum of four tests in the redundant primary mode, a minimum of four tests in the automatic backup mode, and two tests for contingency purposes. Test quantities may be adjusted downward depending on the technical, complexity of the system. Data requirements applicable to demonstrating escape path clearance shall be in accordance with the appendix.

4.4.2 Track tests. The DT-IB track tests shall consist of eight ground level escape system tests throughout the speed range as specified by the procuring activity. The tests shall be conducted with fully instrumented test articles and shall use both the maximum and minimum specified aircrew-member test dummies or other population parameters if data indicates a particular problem. Detailed test requirements shall be in accordance with the appendix. Test resulsts shall also be used to determine compliance with the detailed design requirements not specifically tested elsewhere in this section, including but not limited to 3.2.1.5, 3.2.2.5, 3.2.2.9, and 3.2.2.10. Compliance with the-requirements specified in 3.2.1.5 shall be demonstrated as part of of zero track tests. Test data requirements and acquisition and analysis techniques shall be in accordance with the appendix. All test hardware shall be furnished by the contractor.

4.4.3 Inflight ejection tests. The design verification inflight ejection tests shall consist of a minimum of six ejection seat tests as specified in the test plan (see 4.7.2). They shall demonstrate the ability of the ejection seat to function at the highest practical test altitude condition and at the highest practical test airspeed at the parachute opening altitude. They shall demonstrate required sensor and timing control functioning under actual airspeed and altitude conditions. Detailed test requirements shall be in accordance with the appendix.

4.5 Component and subsystem full-scale development, DT-IIA. The component and subsystem full scale development tests and inspections shall consist of the component and subsystem tests of 4.5.1, the system design compliance tests of 4.5.2, and the reviews and audits of 4.5.3. Data from the tests of 4.5.1 and 4.5.2 shall be used at the pre DT-IIB design review to evaluate compliance with specification requirements.

4.5.1 Component and subsystem tests. Component and subsystem DT-IIA tests shall be conducted as described below on equipment that is in accordance with the testing baseline (see 4.3.2.4) to demonstrate compliance with the requirements of this specification as modified by the initial qualification status review (IQSR) (see 4.3.1.1).

4.5.1.1 Upholstery, covers, and cushions. Samples of all upholstery paddings and textiles shall be self-extinguishing when tested by applying a 1550°F flame to the lower edge of a test specimen for 12 seconds. Average burn length shall be not greater than eight inches; average flame time after removal of the test flame shall not exceed 15 seconds. Drippings shall not continue to flame more than an average of five seconds.

4.5.1.2 Positioning and restraint subsystem. The positioning and restraint subsystem will be tested by the procuring activity to demonstrate compliance with the requirements of 3.2.2.3. Simulated dynamic flight load testing to demonstrate table II and 3.2.2.3c requirements will be performed. Loads will be applied parallel to the X, Y, and Z axes of figure 5 in positive and negative directions. The number of load applications in each direction will be representative of the-aircraft mission profile and shall be specified in the test plan. Manual adjustments of the positioning and restraint subsystems will not be permitted between load applications.

4.5.1.3 Signal transmission subsystem (STS). The STS shall complete all tests required by MIL-D-81980 to demonstrate performance as required in accordance with 3.2.2.13.

4.5.1.3.7 Cartridges. Cartridges shall complete all tests required by MIL-D-21625 to demonstrate performance as required in accordance with 3.1.8.1.

4.5.1.3.2 Cartridge actuated devices (CADS). CADs shall complete all tests required by MIL-D-23615 to demonstrate performance as required in accordance with 3.1.8.2.

4.5.1.3.3 Electric initiators. Electric initiators shall complete all tests required by MIL-I-23659 to demonstrate performance as required in accordance with 3.1.8.3.

4.5.1.3.4 Gas operated devices (GODS). GODS shall complete all tests required by MIL-D-23615 to demonstrate performance as required in accordance with 3.1.8.4.

4.5.1.3.5 Transmission lines. Detonating and deflagration cord and linear shaped charges shall complete all tests required by MIL-D-21625 to demonstrate performance as required in accordance with 3.2.2.13.2.

4.5.1.4 Rocket motors and rocket catapults. Rocket motors and rocket catapults shall complete all tests required by MIL-A-85041 in accordance with 3.2.2.4.

4.5.1.5 Recovery subsystem. The recovery subsystem shall be tested to demonstrate compliance with 3.2.2.6.

4.5.1 .5.1 Parachute assembly. The parachute assembly shall be tested to demonstrate compliance with 3.2.2.6.1, as part of the tests specified in 4.4.3 and 4.5.1.5, where parachute canopy opening occurs a minimum of 1,000 feet above ground level. Total velocity (V_T) and vertictal descent velocity (V_V) shall be determined by averaging a minimum descent of 200 feet, excluding the final 40 feet above the local terrain of the lowest extremity of the aircrew-member. Prior to averaging, all data shall be corrected to ICAO standard sea level, no wind conditions. Data from track tests shall not be used to establish V_T or V_V.

4.5.1.6 Survival container. Rigid seat survival kits shall complete all tests required by MIL-S-81018 or MIL-S-81040, as applicable, to demonstrate compliance in accordance with 3.2.2.7. For survival containers not conforming to the requirements of MIL-S-81018 or MIL-S-81040, the contractor shall prepare a test plan in accordance with 4.7.2 and demonstrate the acceptability of the proposed configuration for use in aircrew escape systems.

4.5.2 System design compliance tests. The escape system test articles shall be in accordance with the testing baseline (see 4.3.2.4). Modifications necessitated by test conditions shall be approved in writing by the procuring activity and incorporated into the applicable test plan prior to the start of the test.

4.5.2.1 Environmental conditioning. Compliance with the requirements of 3.1.9 shall consist of environmental conditioning followed by an ejection seat performance test as defined below.

4.5.2.1.1 Test articles and procedures. Two test articles shall be subjected to MIL-STD-810 environmental tests as defined in table III. Test article A shall consist of an inert ejection seat assembly with ballasting used to replace pyrotechnic devices. Test article B shall include one lot of active pyrotechnic devices as defined by the escape system configuration. Performance testing of test article A shall consist of demonstrating proper operation of all manually controlled devices. Test article B devices shall not be performance tested before, during, or after environmental conditioning except as specified in 4.5.2.1.2. Environmental conditions shall be imposed on both test articles in compliance with table III, in the order listed.

4.5.2.1.2 Performance test. Upon completion of environmental conditioning test articles A and B shall be combined into an ejection seat assembly and test fired at ground level, zero airspeed, occupied ejection seat conditions Results shall demonstrate performance as required of all escape events and functions. Instrumentation and camera coverage shall be defined in the test plain

TABLE III. Escape system environmental test requirements.

Environment	MIL-STD-810		Notes
	Method	Procedure	
High temperature	501	II	1/
Low temperature	502	I	2/
Solar radiation	505	I	
Temperature-altitude	504	I	3/
Rain	506	I	
Humidity	507	I	
Fungus	508	I	
Salt fog	509	I	4/
Dust (fine sand)	510	I	
Acceleration	513	I	5/
Shock	516	I	5/
Vibration	514	IA	5/

1/ Highest operating temperature shall be 165°F.

2/ Lowest operating temperature shall be -65°F.

3/ The escape system shall be tested as category 6 equipment.

4/ During salt fog testing, sulphur dioxide gas shall be injected into the test chamber at six hour intervals for a time duration of 60 minutes and a flow rate of 50 cubic centimeters per hour per cubic foot of test chamber volume.

5/ The ejection seat shall be occupied with a specified population maximum size test dummy in a full compliment of personal flight gear.

4.5.2.2 Electromagnetic compatibility. Electromagnetic compatibility tests shall be conducted in accordance with MIL-STD-461, MIL-STD-462, and MIL-STD-1385 to verify escape system compatibility with the aircraft electromagnetic and radiation interference environment and requirements of 3.1.10. At least one sample of each electrically different ejection seat assembly shall be tested. If all ejection seat assemblies are electrically identical, only the pilot's ejection seat assembly shall be tested.

4.5.2.3 Crash loads. The ejection seat assembly crash load tests will be conducted by the procuring activity to demonstrate the requirements of 3.2.1.6.g. The test input profile will comply with figure 1 using a trapezoidal pulse shape having the nominal rise, dwell, and total times as indicated in figure 1 and a maximum acceleration of 30±2g's and a velocity change of 77 ±3 ft/sec. Two tests will be conducted. The first test will simulate crash loading in the -X direction (eyeballs out). The second test will simulate crash loading in the +Z direction (eyeballs down). For these tests, the ejection seat assembly will be occupied by a maximum specified anthropomorphic dummy wearing the heaviest combination of personal flight gear defined in the appendix. The ejection seat assembly interface will be mounted to a rigid test fixture through which the crash loads will be applied. Test fixture design shall be detailed in the test plan (see 4.7.2).

4.5.2.4 Physiological acceptability demonstrations. Physiological acceptability tests will be conducted by the procuring activity to demonstrate that the escape system meets the physiological acceptability requirements of 3.2 and 3.3. Human subjects and anthropomorphic dummies required for these tests will be provided by the procuring activity. Three series of tests will be conducted:

a. The first test series will be conducted with anthropomorphic dummies to establish several acceleration level test conditions in increments up to 27g's or 1.5 times the anticipated maximum value, whichever is greater. The anticipated maximum value is defined as the acceleration imposed on the ejection seat assembly by the propulsion system during an ejection with the lightest weight occupant at ICAO standard sea level conditions. The test series will include at least two tests at the anticipated maximum acceleration value and at least one test at 27g's or 1.5 times the anticipated maximum value, whichever is greater.
b. The second test series will be conducted using human subjects, with acceleration levels increasing in increments to within 2.0g's of the anticipated maximum value.
c. The third test series will consist of at least four tests each with a different human subject, at the anticipated maximum acceleration value.

4.5.2.5 Reliability and maintainability. Reliability of the escape system shall be demonstrated as described in 4.5.2.5.1 and 4.5.2.5.2. Maintainability shall be demonstrated in accordance with MIL-STD-2067 to demonstrate compliance with 3.4.2.

4,5.2 .5.1 Reliability assessment. The contractor shall prepare a system reliability assessment for inclusion in the pre DT-IIB design review to demonstrate compliance with the requirements of 3.2.1.7.1. The assessment shall reflect the allocations, predictions, and reliability growth data documented in implementing the reliability program plan of MIL-STD-2067. The contractor shall include the following in the documentation of the system reliability assessment:

a. The achieved constructed system reliability.
b. Using the block diagram format, the block-by-block comparison of the allocated or predicted reliabilities and demonstrated reliabilities.

4.5.2.5.2 Systems tests. System tested reliability shall be demonstrated by the successful completion of the tests of 4.4.2, 4.4.3, and 4.6.1.

4.5.3 Pre DT-IIB design review. The procuring activity will conduct a pre DT-IIB design review to ensure that the escape system design is compatible with the aircraft and the fully-equipped aircrewmember, and is in accordance with the specification requirements. The contractor shall prepare a summary (see 4.7.3.4) of all significant findings and results of the following:

a. DT-IB tests (see 4.4).
b. DT-IIA tests (see 4.5.1 and 4.5.2).
c. Final functional configuration audit (see 4.5.3.1).

The procuring activity will determine, from the data presented, the design compliance to this specification and the suitability of the escape system design for commencement of the DT-IIB tests (see 4.6). Completion of this review is a prerequisite for the commencement of the system track tests (see 4.6.1).

4.5.3.1 Final functional configuration audit (FFCA). A FFCA of the escape system shall be conducted by the contractor in accordance with MIL-STD-1521 within forty-five days of the completion of the DT-IB tests (see 4.4). The results of the DT-IB tests shall be summarized and made available to representatives of the procuring activity. The objective of the FFCA be to verify that the performance and functional characteristics of the escape system and its components and subsystems comply with “the requirements of this specification

4.6 System full-scale development, DT-IIB. The contractor shall demonstrate compliance with the escape system performance and design requirements of section 3 by successful completion of the system track tests (see 4.6.1) and the physical configuration audit (see 4.6.2). The DT-IIB tests shall not commence until completion of all DT-IB tests, DT-IIA tests, and the pre DT-IIB design review.

4.6.1 System track tests. Six system track tests shall be conducted in accordance with the detailed test requirements of the appendix to demonstrate compliance with the performance requirements of 3.3 at representative conditions selected from table II. System track tests shall not commence prior to receipt of the written approval of the pre DT-IIB design review by the procuring activity. Test articles shall be configured in accordance with the testing baseline (see 4.3.2.4) plus any approved changes (see 6.2.1).

4.6.2 Physical configuration audit (PCA). The PCA shall be comprised of a physical audit conducted in accordance with MIL-STD-1521, the production proofing article review (see 4.6.2.1), and the field maintainability article II review (see 4.6.2.2). The physical audit shall formally examine the production proofing article (see 4.6.2.1) against its technical documentation in order to establish a final (production} baseline and shall determine the final qualification of the escape system after the completion of. all testing. The final baseline configuration shall comprise the testing baseline configuration with the modifications required to obtain escape system performance, strength, environmental protection, and component qualification in accordance with the requirements specified herein. Following the completion and approval of all testing, the contractor shall prepare technical documentation to completely describe the final baseline configuration (see 6.2.2). This documentation package shall include, but not be limited to:

a. The proposed production specification.
b. A complete shortage list.
c. A set of acceptance test procedures and associated test data.
d. An engineering drawing index.
e. A list of approved material review board actions on waivers.
f. A proposed DD Form 250, "Material Inspection and Receiving Report".
g. A list of approved nomenclature and nameplates.
h. A set of level 3 drawings and change documents assembled by the top drawing number.

4.6.2.1 Production proofing article (PPA) review. The contractor shall prepare for installation in the appropriate aircrewmember station(s) a production proofing article(s) within 45 days prior to the PCA. In production aircraft programs, the contractor shall install the article(s). In programs for the retrofit of the escape system, the installation shall be performed by personnel designated by the procuring activity to verify installation instructions in accordance with the requirements of MIL-M-81203. In the event the program involves both retrofit and production installation, the contractor shall prepare two articles for each crew station. The PPA review may be conducted concurrently with the FMA-II (see 4.6.2.2). The proofing article(s) shall represent the frozen design of the proposed final baseline configuration (see 4.6.2) embodying all approved changes resulting from previous design reviews or tests. All parts of the article(s) shall be manufactured by production processes. The article(s) shall be inspected to ensure that production components fit when selected at random, that the compatibility of production parts are acceptable, and (for retrofit) that the installation instructions are correct. The production proofing articles installed in an aircraft shall remain in, and be delivered as part of the aircraft.

4.6.2.1.1 Escape system fit and compatibility evaluations. The escape system PPA shall be installed in an aircraft for final verification of escape system fit and compatibility with the aircraft and of aircrewmember accommodation in accordance with 4.3.1.2 through 4.3.1.2.5.

4.6.2.1.2 Final qualification review. At the PPA review, the contractor shall make available adequate documentation to certify qualification of those remaining subsystems or components not previously determined to be qualified as a result of the initial qualification review (see 4.3.1.1) or the follow-up qualification review conducted during the initial functional configuration audit required by 4.3.2.1. The objective of the final qualification review shall be to determine that all components and subsystems of the PPA have been qualified in accordance with the requirements of this specification.

4.6.2.2 Field maintainability article II (FMA-II) review. The contractor shall prepare a maintainability article(s) within thirty days following the PPA review. The maintainability article shall be built in accordance with 4.6.2.1 and shall be used to evaluate final contractual compliance in accordance with 3.2.1.8. The maintainability artcle shall be subjected to a field maintainability verification conducted in accordance with MIL-STD-2067. All ballistic components shall be inert; however, all mechanical firing mechanisms shall be in working order. Peculiar support equipment evaluation articles shall be the proposed final design and shall be manufactured by planned production processes.

4.7 Plans and reports.

4.7.1 Test program master plan (TPMP). The contractor shall develop test program plans for each phase of tests and inspections (see 6.2.2). The engineering demonstration and validation test program plan shall outline all tests to be performed in accordance with 4.3 and 4.4, the reviews and audits to be performed in accordance with 4.3.1, 4.3.2 and 4.3.3, the purpose of each test or event, and the proposed schedule for the conduct of each test or event. The full scale development test program plan shall outline all tests to be performed in accordance with 4.5 and 4.6, the reviews and audits to be performed in accordance with 4.5.3 and 4.6.2, the purpose of each test or event, and the proposed schedule for the conduct of each test or event. Requirements for Government facility test support (see 4.7.4) shall be included in each plan. These plans shall comprise the test program master plan (TPMP).

4.7.2 Test plans. Prior to commencing each separate series of tests, reviews, and audits, the contractor shall plan and develop detailed test requirements (see 6.2.2). Unless otherwise specified by the applicable documentation that governs selected tests in DT-IA (see 4.3) and DT-IIA (see 4.5), all test plans shall include the following elements:

a. Purpose, schedule, conditions, profile, pre-test and post-test events, and procedures.

b. Test facilities, test support equipment, contractor-furnished equipment, Government-furnished equipment, safety precautions, emergency procedures, test fixtures, personnel stations and individual responsibilities, test article configuration, and test article disposition.
c. Data to be obtained during the test; data acquisition, reduction and analysis requirements; type and format of test records,
d. Instrumentation and photographic requirements.
e. Test acceptability criteria as applicable.
f. A standard plan for anthropomorphic dummy positioning which will ensure test-to-test repeatability for all dummy installations. The standard plan shall define the locations of targets installed on the dummy; torque values for dummy joints; dummy position in the ejection seat; positioning of dummy's limbs and extremities; and restraint system installation and adjustment.

DT-IA test plans shall be prepared to advise the procuring activity of test details; all other test plans shall be acceptable to the procuring activity prior to test commencement. The contractor shall ensure that a proposed test series has been structured to provide maximum benefit for evaluation within all design disciplines (i.e. reliability, maintainability, stress, etc.).

4.7.3 Test reports. The contractor shall prepare reports of all tests conducted (see 6.2.2). Unless the report format is otherwise specified by the applicable documentation referenced below, reports shall be prepared in accordance with MIL-STD-831 and as herein modified. Copies of instrumentation and photographic records shall be included in the reports. Motion picture films on reels suitable for use on 16mm projectors shall be included as part of the reports where applicable. The contractor shall also prepare minutes of all reviews and audits which shall include the following documentation after completion of the event (see 6.2.2):

a. Deficiencies in the format of figure 9 that were identified and reported by the procuring activity.
b. Contractor-proposed remedial action.
c. Effect of proposed remedial action upon the escape system and its performance
d. Planned schedule for effecting the remedial action.

4.7.3.1 Flash reports. Within 48 hours following the completion of each test of DT-IB and DT-IIB, and each test series of DT-IA (see 4.3a through 4.3d) and DT-IIA, or after any test failure, the contractor shall prepare a flash report containing the following elements (see 6.2.2):

a. Test article description including nomenclature, part number, serial number, and configuration.
b. Identification of test, test plan number, test facility log number, and test conditions.
c. Results of tests including failures, malfunctions, and anomalies.

	CHIT NO. ________
ESCAPE SYSTEM DEFICIENCY CHIT	
INSPECTION LOCATION:	INSPECTION DATE: ________
ITEM INSPECTED: ______________________ REQUIREMENT REFERENCE (spec/para.): ______________________	
SUBJECT:	
DESCRIPTION OF DEFICIENCY: (Describe deficiency giving all pertinent part nos., pertinent specification references and effect upon system. If feasible, attach sketches or photographs illustrating deficiency and its effects/problems)	
DEFICIENCY AFFECTS: SAFETY __ RELIABILITY __ MAINTAINBILITY __ PERFORMANCE __ COCKPIT COMPATIBILITY __ CREW ACCOMMODATION/PERFORMANCE __	
RECOMMENDATION:	ORIGINATOR'S NAME & ORGANIZATION
CONTRACTOR COMMENTS:	
NAVAIR:	CONTRACTOR:
	Sheet __ of __

FIGURE 9. Sample escape system deficiency chit format.

d. Preliminary data from instrumentation records and traces, including available video coverage.
e. Recommendations.

4.7.3.2 Interim reports. Within 20 days following the completion of each test of DT-IB and DT-IIB, and each test series of DT-IA (see 4.3a through 4.3d) and DT-IIA, or after any test failure, the contractor shall prepare an interim report (see 6.2.2). It shall include test data, test data analyses, results of the marginality of success (MOS) analyses, copies of instrumentation and photographic data, and completed graphical presentations. Where applicable, the report also shall include a data matrix containing the significant data from all previous tests in the same series.

4.7.3.3 Final test reports. For each test series and individual degection tests, the contractor shall prepare a final test report (see 6.2.2) within 60 days following test completion. The report shall include, but not limited be limited to:

a. Elements defined by the test plan and implemented in the test.
b. Deviations from the test plan with justification for each deviation.
c. Actual test data and supporting data as required by the test plan.
d. Test results, observations, graphical presentations, analyses, marginality of success analysis, anomalies, problems encountered, design deficiencies.
e. Conclusions and recommendations.
f. Proposed test classification with supporting rationale.

4.7.3.3.1 DT-IA tests, inspections, reviews, and other events. Final reports of DT-IA tests, unless otherwise specified in 4.7.3.3.2 or 4.7.3.3.3, and all reviews, audits, and other events shall be in the contractor's normal format. As a minimum, the reports shall provide the elements contained in MIL-STD-831, Detailed Requirements.

4.7.3.3.2 Component, subsystem, and system test. Final reports of the DT-IA tests specified in 4.3a and 4.3b and all DT-IIA tests shall be prepared in accordance with MIL-STD-831.

4.7.3.3.3 Ejection tests. Final reports of the DT-IA tests specified in 4.3c and 4.3d, the DT-IB tests, and the DT-IIB ejection tests shall be prepared in accordance with MIL-STD-831 and the appendix.

4.7.3.4 Summary test reports. Upon completion of each phase of the DT program, the contractor shall prepare a summary test report in accordance with MIL-STD-831 (see 6.2.2). The report shall:

a. Identify all conducted tests, test series, and their associated reports.

b. Define all configuration changes.
c. Include a test classification (success, failure, or no-test) for each test and test series.
d. List all applicable motion picture films, failure reports, and failure analyses.
e. For all ejection tests, include a final test data matrix and a composite trajectory plot in accordance with the appendix for each series of tests (i.e., track tests, aircraft canopy and escape path clearance subsystem tests, and inflight ejection tests).

4.7.4 Facility test support. As part of the TPMP (see 4.7.1), the contractor shall prepare a Government facility test support document detailing the specific test support required from and the responsibilities of the Government facility (see 6.2.2). Preparation of the Government facility test support document shall be coordinated with each Government facility participating in the test programs. Facility support requirements peculiar to ejection tests are specified irk the appendix.

4.7.4.1 Test support equipment. The test support equipment used in conducting tests shall be capable of meeting the conditions required by the tests specified herein.

4.7.4.2 Instrumentation. Measurements shall be made with instruments whose accuracy has been verified to the satisfaction of the procuring activity. Complete data and information describing the performance characteristics of the data collection system including transducers, signal conditioning, filtering recording and playback equipment shall be prepared and included in the test plan and the test report. Also, instrumentation methodology including calibration procedures shall be included in the test plan and test report.

4.7.5 Test articles. Except for DT-IA testing, the test articles shall be manufactured and assembled in accordance with the testing baseline configuration (see 4.3.2.4) and any approved changes thereto. There shall be no special selection fittinq, or modification of parts, components or subassemblies to obtain fit, required performance, or to improve test results. In the event a part, component, or subassembly is determined to have a nonconforming characteristic the contractor shall immediately notify the resident Government quality assurance representative of the part number, the nature of the deficiency, the anticipated problems associated with the use of the nonconforming part, action recommended concerning the part, and action to be taken to preclude recurrence of similar nonconformities in future lots. The configuration of the DT-IA test articles shall be the contractor's responsibility. The contractor shall ensure that the configuration of each DT-IA test article is documented by drawings, sketches, production route sheets, or other records acceptable to the procuring activity. DT-IIB test articles shall not be reused. Reuse of DT-IB and DT-IIA escape systems or components thereof shall be specified in the test plans (see 4.7.2). The contractor shall bear full responsibility for any failure resulting from reuse of components or subsystems. For test classification purposes, the failure of a used part shall be treated the same as a failure of a new part. Test article configuration changes and disposition of test hardware will be specified in the contract (see 6.2.1).

4.7.5.1 Track test articles. For the system track tests of 4.6.1, the test articles shall be manufactured and assembled in accordance with production techniques, processes, and procedures, including quality assurance procedures. Track test articles shall not be reused. All lots of parts, components, and subassemblies shall be subjected to planned production and receiving quality assurance procedures as established for each part, component, or subassembly to determine the acceptability of each lot. Prior to assembly of each escape system test article and after the parts, components, and subassemblies have passed lot inspection and have been accepted, each part selected by normal escape system production assembly procedures shall be inspected fully and the information recorded upon worksheets for the serialized test article.

4.7.6 Acceptability of test results. Completion of the initial functional configuration audit (IFCA) as required, (see 4.3.2.2) shall be the criteria for the acceptance of the DT-IA test results. The criteria for determining acceptability of the results of the DT-IB aircraft canopy and escape path clearance subsystem tests shall be based on the performance requirements of 3.2.2.12 and the test requirements of 4.4.1. The criteria for determining the acceptability of the DT-IB system track tests (see 4.4.2), the DT-IB inflight ejection tests (see 4.4.3) and the DT-IIB system track tests (see 4.6.1) shall be in accordance with the appendix. The criteria for determining acceptability of the result of the DT-IIA component and subsystem tests shall be based on the applicable design and performance requirements of 3.2.2 and the test requirements of 4.5. In the test plans required by 4.7.2, the contractor shall propose specific test acceptability criteria for both the DT-IB aircraft canopy and escape path clearance subsystem tests and the DT-IIA tests.

4.8 First flight release. For those escape systems that are being developed as an integral part of, or concurrently with, an aircraft development program, the release of the escape system for the first flight to be conducted by contractor personnel in the development program aircraft shall be contingent upon:

a. Type I approval of all ballistic tests specified in 4.5.1.3 through 4.5.1.4.
b. Completion of all DT-IA and DT-IB tests as required.
c. Completion of the following DT-IIA tests as required:

(1) Crash loads (see 4.5.2.3).
(2) Physiological acceptability demonstrations (see 4.5.2.4).
(3) Recovery subsystem (see 4.5.1.5).

The escape system shall be in accordance with the requirements of MIL-D-8708 prior to approval for use by Government personnel. Completion of all DT-IIA and DT-IIB testing is required prior to completion of the first 300 flight hours in the aircraft test program. Flight restrictions may be imposed based on data from the DT-IB test program.

4.9 Packaging. Each inert ejection seat assembly and each ejection seat assembly set of explosives shall be examined prior to closing the shipping container(s). An ejection seat assembly contents list compiled in accordance with MIL-STD-794 (modified as required) shall be verified to assure that all components have been provided as required for the complete ejection seat assembly installation. Each of the fully prepared shipping container(s) containing the ejection seat assembly and explosive components shall be examined to determine that the packaging, packing, and marking are in accordance with section 5 of this specification.

5. PACKAGING

5.1 Preservation. Preservation shall be level A, B, or C as herein specified.

5.1.1 Level A.

5.1.1.1 Cleaning. Each ejection seat assembly, less any explosive or explosive containing devices, shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Each ejection seat assembly, less any explosive or explosive containing devices, shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative applications. Petroleum base preservative compounds shall not be used. Other preservatives, if necessary, shall be in accordance with the requirements of MIL-P-116.

5.1.1.4 Unit packs. Unless otherwise specified in the contract (see 6.2.1), each ejection seat assembly, less any explosive or explosive containing devices, shall be individually unit packed in accordance with MIL-STD-794, utilizing method II of MIL-P-116. The cushioning, glocking, and bracing shall protect the ejection seat assembly from shock and vibration damage.

5.1.1.4.1 Uninstalled components. The uninstalled components of the ejection seat assembly (i.e., hoses, straps, cables, etc.) and the log book shall be identified (part number and nomenclature) and shall be individually bagged in containers fabricated of material in accordance with PPP-C-795, type II and then consolidated and incorporated within the unit pack.

5.1.1.4.2 Outer container. The outer container shall be in accordance with PPP-B-601 overseas type, style A. Each container shall be provided with skids for handling with mechanical equipment.

5.1.1.5 Explosives and explosive containing devices. Explosive and explosive containing devices shall be preserved and packaged in accordance with the applicable federal or military specification and 49CFR-171 thru -179.

5.1.2 Level B. The requirements of Level A apply except that the outer container shall be in accordance with PPP-B-601 domestic type container.

5.1.3 Level C. The preservation and packaging of the ejection seat assembly, the uninstalled components and explosives and explosive devices shall be in accordance with MIL-STD-794 and 49CFR-171 thru -179, as applicable.

5.2 Packing. No overpacking is required for the ejection seat assembly. Explosives and explosive devices shall be packed in accordance with the requirements of 49CFR-171 thru -179. Aeronautical equipment service records (AESRS) shall be shipped with each assembly in accordance with OPNAVINST 4790.2 if specified in the contract (see 6.2.1).

5.3 Marking. All unit and shipping containers shall be marked in accordance with MIL-STD-129. Additionally, containers of explosives and explosive devices shall be marked in accordance with 49CFR-171 thru -179.

5.3.1 Special markings. The unit and shipping containers of the ejection seat assembly shall be marked on all four sides with a four-inch arrow pointing to the top of the container stating:

Handle With Care

This Side Up

Additional special marking requirements will be specified in the contract (see 6.2.1.).

6. NOTES.

6.1 Intended use. The aircrew automated escape system is intended to provide and emergency means to return an aircrewmember to the earth in an uninjured condition such that he is able to perform the tasks associated with the survival and enemy evasion phases of escape when the aircraft has lost its ability to return to earth in a normal fashion. The ejection seat is also intended to provide a comfortable and secure seat for the aircrewmember during all flight operational phases.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specifications
b. Drawing requirements (see 3.1.2).
c. Selection of applicable levels of preservation (see 5.1).
d. Whether or not an aeronautical equipment service record (AESR)- is required to be shipped with each ejection seat assembly in accordance with OPNAVINST 4790.2 (see 5.2).
e. Whether any additional special markings are, required (see 5.3.1).
f. Requirements for retesting following changes in design or configuration (see 4.7.5).
g. Disposition instructions for test hardware (see 4.7.5).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved data item description (DID) (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph No.	Data Requirement Title	Applicable DID No.	Option
3.1.1	Program Parts Selection List (PPSL)	DI-E-7027A	___
3.1.1	Non-standard Part Approval Requests/ Proposed Additions to an Approved PPSL	DI-E-7028A	___
3.1.1.1	Process Specification	DI-E-3130	___
3.1.1.1	Material Specification	DI-E-3131	___
3.1.1.2	Corrosion Prevention and Control Requirements	DI-S-3598A	___
3.1.2, 4.3.2.4	Drawings, Engineering and Associated Lists	DI-E-7031	___
3.1.3	Human Engineering Design Approach Document - Maintainer	DI-H-7057	___
3,1.8	Ammunition Data Card	DI-E-2001	___
3.1.8.5	Explosive Hazard Classification Data	DI-H-1321A	___
3.1.8.5	Explosive Ordnance Disposal Procedures	DI-M-3403B	___
3.1.11, 3.4.1.1, 3.4.1.1.1	Report, Design	DI-R-24039A	___
3.1.15	Production Plan	DI-P-1612	___
3.2.1, 3.2.1.7.3, 3.2.2.6.4, 3.2.2.9 3.2.2.9.1, 3.2.2.13	System/Design Trade Study Reports	DI-S-3606	___
3.2.2.17	Military Specification	DI-S-7097	___
3.4.1, 3.4.2	Reliability/Maintainability Program Plan	DI-R-3533	___
3.4.1, 3.4.2	Report, Reliability and Maintainability Allocation	UDI-R-21133	___
3.4.1, 3.4.2	Report, Reliability and Maintainability Prediction	DI-R-7095	___
3.4.1, 3.4.2	Reliability/Maintainability Program Status Reports	DI-R-3542	___
3.4.1, 3.4.2	Report, Reliability and Maintainability Test Plan	UDI-R-21135	___
3.4.1, 3.4.2	Report, Reliability and Maintainability Test Results	UDI-R-21136	___
3.4.1	Report, Failure Summary	UDI-R-21139	___
3.4.1	Report, Failure	UDI-R-21141A	___

Paragraph No.	Data Requirement Title	Applicable DID No.	Option
3.4.1	Failure Mode, Effects and Criticality Analysis Report	DI-R-7085	
3.4.1.1, 3.4.1.1.2	Tolerance Analysis Report	DI-E-5251A	
3.4.1.1, 3.4.1.1.3	Report, Environment	UDI-R-21138	
3.4.3	System Safety Program Plan	DI-H-7047	
3.4.3	System Safety Hazard Analysis Report	DI-H-7048	
3.4.3	Safety Assessment Report	DI-H-7049	
3.4.3	System Safety Engineering Report	DI-H-7050	
3.4.4	Plan, Configuration Management	DI-E-2035	
3.4.4	Notice of Revision/Specification Change Notice	DI-E-1126A	
3.4.4	Engineering Change Proposals (ECPs) and Requests for Deviations and Waivers (Long Form)	DI-E-2037	
3.4.4	Summary, ECP (Engineering Change Proposals)	UDI-E-21351	
3.4.4.2	Report, Configuration Status Accounting	DI-E-2039	
4.3.1.2.1	Report, Final (Short Form)	UDI-E-21353A.	
4.6.2	Description, Product Baseline	UDI-E-22102B	
4.7.1. 4.7.4	Master Test Plan/Program Test Plan	DI-T-30714	
4.7.2	Test Plan	DI-T-5204	
4.7.3, 4.7.3.1, 4.7.3.2, 4.7.3.3, 4.7.3.4	Test Reports	DI-T-2072	
4.7.3	Minutes of Formal Reviews, Inspections and Audits	DI-E-3118	

6.3 Safety precautions for handling explosives. Safety procedures recommended to contractors for observance during the manufacture, packaging shipping, and storage of the escape system are specified in DOD 4145.26. Additional safety procedures are specified in MIL-D-21625 and MIL-A-85041 These procedures and precautions are mandatory for Government activities.

6.4 Definitions.

6.4.1 Seat intersect point. The seat intersect point is the intersection of the back tangent and the seated surface tangent.

6.4.2 Neutral seat intersect point. The neutral seat intersect point is the seat intersect point with the seat in the nominal mid-position of the seat adjustment range. The neutral seat intersect point location is coincident with and determined in the same manner as the neutral seat reference point defined by MIL-STD-1333.

6.4.3 Back tangent. The back tangent is established by straight line in the plane of symmetry of the ejection seat assembly and tangent to the back of a seated aircrewmember at the thoracic region and buttocks (posterior).

6.4.4 Seated surface tangent. The seated surface tangent is established by a straight line passing through the SIP, in the plane of symmetry of the ejection seat assembly and tangent to the bottom of a seated aircrewmember at the buttocks (ischial tuberosities).

6.4.5 Ejection plane. The ejection plane is defined as a plane parallel to the ejection seat rails, slippers, or other fixed guide structure that determines the ejection seat path during its initial upward travel.

6.4.6 Catapult pressure baseline. The catapult pressure baseline is a theoretical smooth acceleration curve producing equivalent seat velocities at some selected point in time prior to catapult separation (see 30.3.8.i).

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity

Navy - AS

(Project 1680-N510)

APPENDIX
Details Of Ejection Test Requirements

10 SCOPE

10.1 Scope. This appendix details the ejection test facility, data, classifications, and report requirements of the specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20 APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein:

MILITARY SPECIFICATIONS

MIL-A-81973	Aircrew Automated Escape Systems, Test Vehicles For Ground Track Performance Testing, Rocket And/ Or Jet Engine Propelled, General Specification For

MILITARY STANDARDS

MIL-STD-1572	Telemetry Standards
MIL-STD-1573	Test Methods For Telemetry Systems And Subsystems

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officers.)

30 REQUIREMENTS

30.1 Test facilities. The area of the locale(s) selected for test(s) shall ensure maximum safety of test personnel and the protection of personnel and private property adjacent to the test areas. Test area access control shall be exercised by the testing activity to preclude personnel not specifically authorized by the test facility test director from entering the test area during test preparations, testing, post-test data acquisition, and test article recovery and inspection phases. Access to test articles shall be controlled to ensure that articles are not disturbed or damaged. Failure to control access to test articles in the post-test recovery and analysis phase of a test may result in a procuring activity classification of the affected test(s) as “no test” and shall require such tests to be reconducted at the expense of the activity responsible for the failure to maintain access control.

APPENDIX

30.1.1 Frequency allocation. For all testing requiring the use of telemetry, whether at contractor, Government, or independent test facilities, the contractor shall initiate appropriate frequency allocation applications directly with such Government agencies having approval cognizance in sufficient time to ensure receipt of frequency assignments prior to the scheduled start of the affected tests. The contractor shall coordinate all frequency allocation applications with the affected test activity and shall keep the procuring activity fully apprised of all actions affecting the submittal and processing of such applications.

30.1.2 Test vehicle for performance demonstrations. The DT-IB and DT-IIB track test vehicle shall be in accordance with the requirements of MIL-A-81973. The contractor shall be responsible for providing the fuselage section. Throughout the design and construction of the test vehicle the contractor shall maintain an active liaison with the test activity to ensure compatibility of the fuselage section with the track test vehicle.

30.1.3 Flight clothing for test subjects. Typical flight clothing and survival equipment worn by aircrewmembers in ejection seat equipped aircraft are listed in table IV. For all tests specified in section 4 that require live or dummy subjects, the test plan shall specify the applicable flight clothing selected from table IV.

30.2 Test articles. Test articles shall be in compliance with 4.7.5 and 4.7.5.1 as applicable. for all ejection tests involving the use of dummies, dummy installation shall comply with the test plan.

30.3 Test data requirements. Test data requirements shall be incorporated into test plans for written procuring activity approval and shall comply with 4.7.2 and the following paragraphs to provide a common basis and uniform procedures for evaluating ejection test results.

30.3.1 Pretest data. As a minimum, the following pretest data shall be obtained for each ejection test:

a. Complete identification of test facility, test articles, test personnel, witnesses, anthropomorphic dummies, and flight gear. Serial numbers shall be assigned to test articles, dummies, and individual items of flight gear as required.
b. Meteorological conditions and elevation of the test site above mean sea level.
c. Weight, size, and serial number, if applicable, of each test article, each item of flight gear, each fully attired dummy and each mass to be ejected.
d. Center of gravity data for the following:

    (1) Empty ejection seat (a one-time determination of this data in a laboratory environment will suffice for each significant change in ejection seat configuration).

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TABLE IV. Typical flight clothing and survival equipment worn" by aircrewmembers in ejection seat equipped aircraft.

Item	Typical min wt (lbs)	Typical max wt (lbs)
Coverall, flyer's, summer	1.81	1.88
Gloves, flyer's, summer	0.12	0.13
MA-2, torso harness	4.38	4.38
Oxygen mask (w/hose & regulators)	1.69	1.69
Anti-g garment (w/hose)	2.25	2.25
Helmet, HGU-33/34, form fit	3.0	3.0
SV-2 survival vest (empty-full)	2.25	7.13
Boots, safety, aircrew (sizes 9 1/2 - 13)	3.56	4.56
CWU-21/P, CWU-59/P anti-exposure suit (sm. - lg.) 1/	3.2	3.2
CWU-23/P liner 1/	1.7	1.7
LPU-23A/P vest	4.56	4.93
Gloves, flyer's, HAU-6/P (w/wool inserts)	0.36	0.38
Leg garters	0.5	0.5
Modified torso harness with integral survival vest 2/	22.1	22.1
Jacket, flyer's, cold weather CWU-45/P 1/	3.5	4.5
Trousers, flyer's, cold weather CWU-18/P	3.5	4.5

1/ For winter use only.

2/ When used, replaces MA-2 torso harness and SV-2 survival vest.

(2) Ejection seat and dummy combination.

e. Mass moment of inertia about each of the three axes and the cross-moments of inertia for each combination of ejection seat and different sized dummy.
f. Elevation of the seat intersect point above the test facility ground level reference point (after final ejection seat adjustment).
g. Location and orientation in three dimensions with respect to the applicable reference point for each motion picture camera, transducer, and probe. Each locating dimension shall be established within an accuracy of ±1 percent of the distance to the applicable reference point.
h. Photographs of test article buildup, as required.
i. Installation photographs showing critical configurations, connections, and riggings as required.
j. Instrumentation system calibration data as specified in the test plan and consistent with the test facility's standard calibration procedures.
k. Data verifying that dummy installation complies with the dummy positioning standards included in the test plan.

30.3.2 Test data. As a minimum, test performance data specified below shall be measured and permanently recorded as functions of elapsed test time. All continuous and discrete event electronic signals and all photographic data shall be synchronized to provide a common time base for all test records Timing shall continue to an end of test time reference point following touch-down of the last test article or dummy. The minimum data that shall be specified in the test plan shall include the following items:

a. Electronic:

(1) Linear accelerations and linear and angular velocities for the test vehicle, test article and dummy, as appropriate. Ejection seat linear accelerations shall be obtained redundantly.
(2) All pertinent signals (electrical, ballistic, pneumatic, etc.) and all ballistically generated actuation pressures.
(3) Catapult pressure.
(4) All pertinent non-ballistic pressures related to escape system parameters such as altitude, airspeed, reservoir charge level, etc.
(5) Forces acting on critical devices such as parachute risers, drogue bridle(s), restraint straps, etc.
(6) Discrete event times.
(7) Impulse noise levels (zero speed tests only).

b. Photographic:

(1) Tracking and trajectory of each ejection seat and each test dummy.
(2) Head-on and side views, closeup and remote as required.
(3) Other events and sequences critical to escape system operation.
(4) Limb flail motion picture records.

30.3.3 Post-test data. As a minimum, the following post-test data shall be obtained for each ejection test:

a. Rechecks of the instrumentation system calibration as required and consistent with the test facility's standard procedures.
b. Photographs of the undisturbed, recovered condition of all test articles, dummies, flight gear and cockpit aircrewmember stations, with particular emphasis placed on components suspected of having malfunctioned or failed, and on visible areas of damages
c. Completed parachute canopy, dummy and equipment damage charts complying with the sample charts in accordance with 30.5. (For parachute canopies other than circular, special damage charts will be furnished by the procuring activity.)
d. Other photographs as required for failure and MOS analyses.

30.3.4 Cameras and transducers. Motion picture cameras, transducers, switches, and other event markers shall be mounted in a manner which minimize modification of the escape system, particularly the ejection seat assembly. DT-IA modifications shall not alter the functions of tested components in a manner that would degrade or compromise their performance. DT-IB modifications shall not alter fit or function of ejection seat assembly components that are used during the test. For example, instrumentation may be substituted for standard equipment in the survival equipment container, provided no alteration in container geometry, location, orientation, external function, weight, or center of gravity results. DT-IIB instrumentation shall be based upon a trade-off between maximizing the use of unmodified production hardware and retaining the defined DT-IB instrumentation. The resulting DT-IIB test article configuration with non-essential instrumentation eliminated shall be defined in the test plan for review and written approval by the procuring activity. Motion picture camera placements exposure rates, timing mark resolutions etc., as required to calculate trajectories establish angular relationships and meet other analysis objectives shall be specified in the test plan for review and written approval by the procuring activity. Film specified shall be of the highest quality and lowest grain commercially available. The minimum transducer characteristics to be included in the test plan shall include, as applicable:

a. Nominal full scale range (not to exceed 200 percent of the anticipated range of the variable to be measured).

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b. Steady state accuracy expressed as a percent of full scale and combining on a root-mean-square (RMS) error basis, and the contributions of repeatability, hysteresis, noise, long-term drift, temperature, etc. RMS transducer error shall not exceed 1 percent of nominal full scale range for accelerometers and 2 percent for rate sensors.

c. Bandpass cutoff, order, and tolerance. If on-line filtering is used, the filter's cutoff frequency and tolerance, order and type shall also be listed, The filter shall not reduce the transducer's minimum passbands. Accelerometers shall have a minimum passband of 0-200Hz and rate sensors a minimum passband of 0-100Hz.

d. Damping ratio. Accelerometers must exhibit damped response with a damping ratio of no less than 0.6 of critical. Rate sensors shall be free of resonance in the 0-300Hz range.

accelerometers and angular sensors shall be aligned to provide outputs in terms of the X, Y, and Z axes defined in figure 5.

30.3.5 Data acquisition system. The approved test facility shall include a data acquisition system capable of transmitting, conditioning, and recording ejection test signals generated by sled, ejection seat, and dummy mounted instrumentation. The data acquisition system shall be such that it will not reduce the transducer's minimum passband characteristics. Digital recording shall be used in preference to analog recording. Data shall be acquired in accordance with IRIG standards. Telemetry equipment shall comply with MIL-STD-1572 and MIL-STD-1573.

30.3.6 Calibration. Transducer calibrations shall be current, traceable to the National Bureau of Standards, and available for inspection by the procuring activity. Transducers showing evidence of damage or suspected of internal damage shall be removed for recalibration. The data acquisistion system shall be calibrated prior to each test using a simulated signal wherein each sensor is replaced by a known voltage source in several steps over the full signal range, first ascending and then descending. System calibration runs shall include the timing channel.

30.3.7 Accuracy. End-to-end instrumentation accuracy for each data channel shall be established on the basis of transducer and data acquisition system characteristics and included in the test plan.

30.3.8 Data analysis. Analysis of test data to establish compliance with specified values shall comply with the below listed requirements:

a. Test data filtered prior to transmission shall be used without further filtering.

b. Data obtained without filtering shall be filtered prior to further analysis using a low pass filter having detailed characteristics as listed in the test plan. This filter shall not reduce the sensor's specified minimum passband

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c. For purposes of determining compliance with specified values, acceleration test data (filtered in accordance with 30.3.4c or 30.3.8b) shall be subjected to the following procedure:

(1) Convert data to 10 milliseconds (ms) moving averages, G_{MA}, using the equation

$$G_{MA}(t) = (1/11) \sum_{i=t-5}^{i=t+5} G_i$$

where t = time in ms.
G_i = filtered resultant acceleration values at one ms intervals.
$G_{MA}(t)$ = 10ms moving average acceleration at time t.

(2) Use the applicable data channel end-to-end instrumentation accuracy to calculate upper and lower limits, $G_{MA_{UPPER}}$ and $G_{MA_{LOWER}}$. If end-to-end accuracy cannot be readily determined, assume an accuracy of 10 percent.

(3) Round off $G_{MA_{UPPER}}$ and $G_{MA_{LOWER}}$ to the same number of significant figures as the specified value.

(4) Use $G_{MA_{LOWER}}$ to determine compliance with the specified value.

(5) As an example of the above procedure, if G_t varies linearly from 19.0g's to 24.0g's over a ten millisecond time period and the measuring process has an overall accuracy of ±5 percent, the procedure is applied as follows to determine if a specified value of 20.0g's is being met:

(a) G_{MA} = (1/11)(19.0 + 19.5 + 20.0 + 20.5 + 21.0 + 21.5 + ... + 24.0)g's

= 21.5g's

(b) $G_{MA_{UPPER}}$ = 21.5g's + 5% = 22.6g's

$G_{MA_{LOWER}}$ = 21.5g's - 5% = 20.4g's

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(c) Rounded $G_{MA_{UPPER}}$ = 23g's

Rounded $G_{MA_{LOWER}}$ = 20g's

(d) G_{MA} when varied to its rounded lower limit does not exceed the specified value at the midpoint of the 10 ms time interval.

d. Accelerations shall not be calculated from motion picture data.
e. Methods of measurement and acceptable tolerance for pitch, roll, and yaw angles to be specified in the test plan (see 3.2.2.5 and figure 5).
f. Accelerations prior to separation of the aircrewmember and ejection seat shall be obtained from ejection seat-mounted accelerometers. If angular motion is present, values shall be first mathematically transferred to the seat intersect point.
g. Accelerations subsequent to separation shall be obtained from dummy-mounted accelerometers, provided that dummy angular rates do not exceed 1000 degrees per second. Whenever rates exceed 1000 degrees per second, then accelerations taken from a dummy chest cavity shall be considered invalid for that particular test ("no test" classification shall not apply).
h. Velocities and displacements shall be calculated from space position data and not from acceleration data, except as provided in item i.
i. For purposes of establishing compliance with the dynamic loading limits of 3.2.2.12.1c and 3.2.2.12.2b, catapult pressure and z axis ejection seat acceleration data, subjected to identical filtering in accordance with either 30.3.4c or 30.3.8b, shall be used. Data processing shall consist of the following procedure:

(1) The effects of catapult pressure shall be expressed in suitable dimensional form using the equations:

$$a_{CAT} = PA/W$$

$$V_{CAT} = (32.2) \int_{t_o}^{t_2'} a_{CAT}\, dt$$

and

$$t_o < t_2' \leq t_2$$

where

a_{CAT} = catapult dynamic parameter, g's

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P = catapult pressure, psig

A = effective catapult cross-sectional area, square inch

W = weight of the ejected mass, pounds

V_{CAT} = area under the a_{CAT} curve, feet per second

$t_{2'}$ = selected end point for the integration process, seconds

t_2 = time at catapult separation, seconds

t_o = time at ejection seat first moton, seconds

t_1 = time at start of the first escape path clearing pulse, seconds

(2) Z axis seat acceleration test data, a_{SEAT} shall be used to obtain seat velocity V_{SEAT} feet per second, from the equation

$$V_{SEAT} = (32.2) \int_{t_o}^{t_2} a_{SEAT}\, dt$$

(3) Initially selecting $t_{2'} = t_2$ the ratio V_{SEAT}/V_{CAT} shall be calculated.

(4) The catapult pressure baseline is equal to (a_{CAT}) $[(V_{SEAT})/V_{CAT}1$

(5) The catapult pressure baseline shall be compared to a_{SEAT} to define the escape path clearance retarding pulse (peak amplitude and pulse duration} as defined in figure 7.

(6) Within limits imposed by the calculation procedure, the catapult pressure baseline shall coincide with the a_{SEAT} trace over the interval to to t_1. If the baseline and a_{SEAT} curves do not coincide over the interval to to t_1, t_2 shall be reduced in increments and steps (3) and (4) above repeated until agreement of the two curves in the interval t_0 to t_1 is achieved. Individual baseline overlays of a_{SEAT} shall be reviewed by the procuring activity to provide a basis for approval of the $t_{2'}$ value which provides the best fit.

(7) Peak amplitude and base duration of escape path clearing pulses shall be measured by the deviations of a_{SEAT} from the approved catapult pressure baseline.

30.4 Classification of individual track and inflight ejection tests. Individual DT-IB track and inflight ejection tests and individual DT-IIB track tests shall be assigned one of the classifications listed below, based upon criteria in accordance with 30.4.1.

a. No test.
b. System failure.
c. Limited success.
d. System success.

30.4.1 Criteria for individual test classification.

a. "No test" criteria shall be defined by the contractor and included in the test plan prepared for procuring activity written approval. "No test" criteria shall be defined in terms of test condition limits, test support equipment failures, instrumentation and camera failures, and other conditions and actions which could negate or invalidate test results. Tests in which one or more failures occur shall not be classified "no test" unless subsequent formal failure analysis confirms that "no test" conditions were the cause of failure.
b. "System failure" classification shall apply to those tests in which the recovery subsystem parachute canopy fails to achieve initial opening prior to ground impact.
c. "Limited success" classification shall apply to those tests which are not classified as a "system failure" or a "no test" and in which one or more of the following conditions occurred:

(1) Component or subsystem failure.
(2) Failure to meet system performance requirements of 3.3.
(3) Marginal success demonstrated by MOS analysis.
(4) A condition that caused system failure can be readily demonstrated through component test.

d. "System success" classification shall apply to those tests in which the performance requirements of 3.3 were met, no component or subsystem failures occurred, no marginal success was demonstrated by the MOS analysis and the "no test" classification did not apply.

30.4.2 Acceptability of test series. For each of the test series (DT-IB track tests, DT-IB inflight ejection tests and DT-IIB track tests), successful completion shall consist of the completion of the test series where all individual tests are either "system success" tests or accepted "limited success" tests. Accepted "limited success" tests are tests which meet the criteria of 30.4.2.1. During any test series, the occurence of a "system failure" shall require a failure analysis, rerunning of one or more tests, and revalidation or invalidation of any or all previously conducted tests The degree of invalidation or revalidation, and the number of tests to be rerun will be determined by the procuring activity after receipt of the contractors failure analysis.

30.4.2.1 Criteria for acceptance of "limited success" tests. Individual "limited success" tests shall be considered accepted "limited success" tests upon meeting either of the following criteria:

a. Component failure, subsystem failure, degraded performance or marginal success has been resolved by the successful completion of a corrective action program. The corrective action program shall include as integral parts:

(1) Corrective action plan approved in writing by the procuring activity.
(2) Component or subsystem redesign and retest as required.
(3) Re-evaluation of the classification of previously completed "system success" tests.
(4) Rerun of one or more system tests at the option of the procuring activity.
(5) Procuring activity written approval of the completed corrective action program.

b. The procuring activity establishes that:

(1) Performance improvement beyond that observed cannot be achieved within the current state of the art.
(2) Redesign to reduce or eliminate the observed degradation would introduce another, more objectionable degradation.
(3) The risk associated with the probability of occurrence of the observed degradation is acceptable when compared to available alternatives.

30.4.2.2 Compliance with specification acceleration load limits. Compliance with specified acceleration load limits shall not constitute sole cause for acceptance or rejection of a system. Due to the state of the art, it is expected that certain tests, particularly the higher speed tests, may not comply entirely with load limits. The degree and frequency of non-compliance needs evaluation to determine whether or not the state of the art is met, improved, or degraded. Therefore, occurrences of non-compliance with specified acceleration load limits shall constitute cause to classify a non-complying test as a limited success test.

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30.5 Ejection test reports. For each DT-IA (see 4.3.c and 4.3.d), DT-IB and DT-IIB ejection test, the final report required by 4.7.3.3.3 shall include the standard escape trajectory plot for the test see figure 10), the updated composite standard escape trajectory plots for each test series, parachute damage charts (see figures 11 and 12) for all recovery, stabilization or other system parachutes, dummy damage charts (see figures 13 and 14), and equipment damage charts (see figures 15 and 16). The standard escape trajectory plot (see figure 10) shall note all major events including, but not limited to, the following as applicable:

a. Escape system initiation.
b. Aircraft canopy first motion or aircraft canopy severance.
c. Ejection seat first motion.
d. Catapult ignition.
e. Aircraft canopy clear of escape path.
f. Rocket ignition.
g. Catapult separation.
h. Start of each stabilizer/deceleration action.
i. Rocket burnout.
j. Completion of each stabilizer/decelerator action.
k. Aircrewmember-ejection seat separation.
l. Recovery subsystem initiations.
Recovery subsystem parachute container opening.
n. Recovery subsystem parachute canopy full line stretch.
o. Recovery subsystem parachute canopy first full open.
p. Achievement of steady state descent, as defined in 3.2.2.6.1.e.

Ejection test reports shall be prepared in the format described in figure 17.

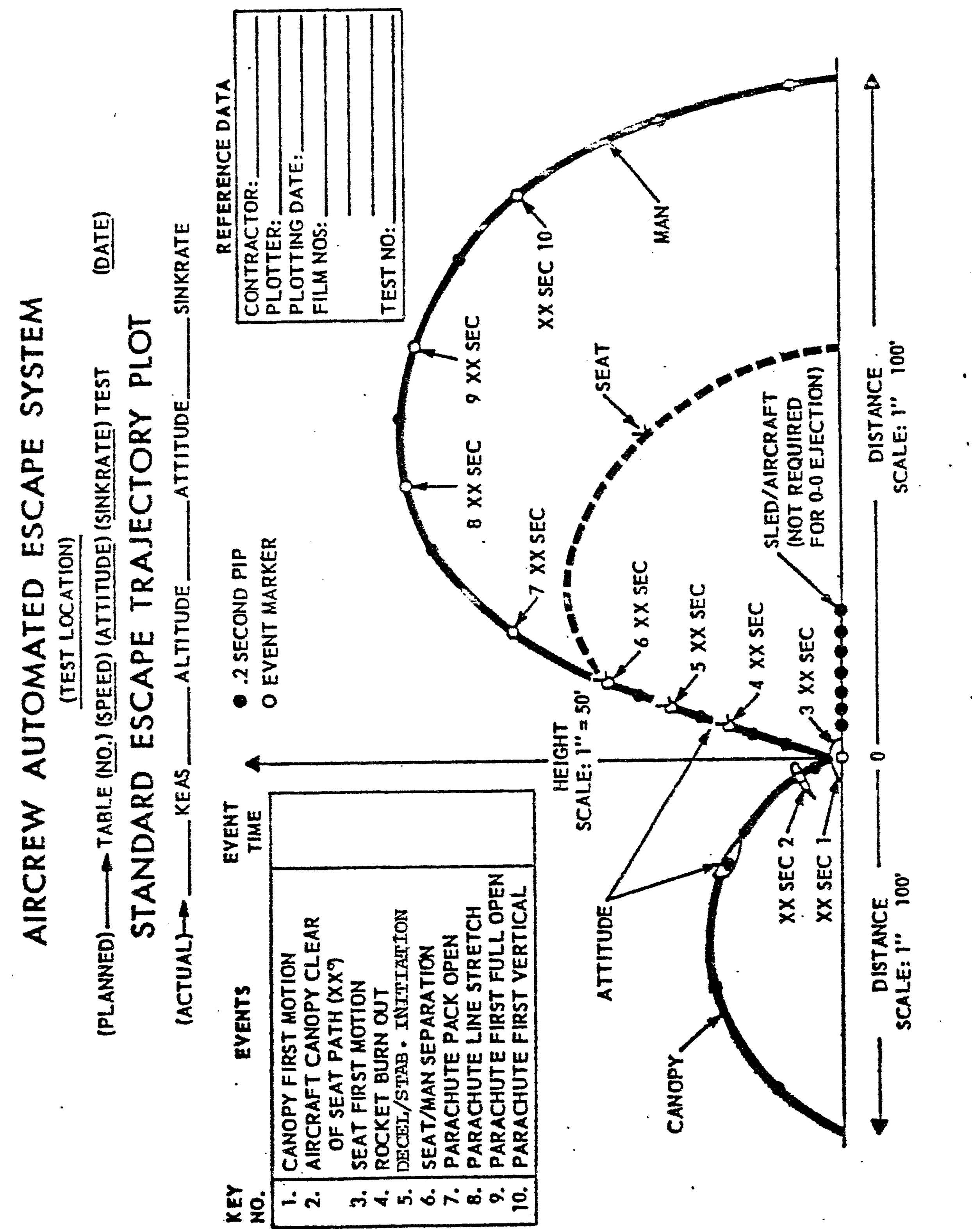

FIGURE 10. Sample standard escape trajectory plot.

CANOPY DAMAGE CHART

—FOR 24—FOOT AND 28-FOOT FLAT CANOPIES—

ACTIVITY				DATE
DATE OF MANUFACTURE	CONTRACT NO.	SERIAL NO.	INSPECTOR (PRINT)	

INSTRUCTIONS

1. USE FOLLOWING SYMBOLS TO INDICATE LOCATION AND TYPE OF DAMAGE ON CANOPY DIAGRAM.

6	TEAR, 6—INCHES LONG
3 4	TEAR, "L" SHAPED WITH 3— AND 4—INCH LEGS
3 4	TEAR, "T" SHAPED WITH 4—INCH BASE AND 3—INCH LEG
8	RUPTURE, 8—INCH DIA AT WIDEST POINT
	BURN MARKS
	STRAINED AREA
	PULLED DRAG SURFACE THREAD

	SINGLE BROKEN DRAG SURFACE THREAD
	WEAVE SEPARATION
S/D	STAINS/DISCOLORATION
3	BROKEN SEAMS STITCHES ALONG 3 INCHES OF SEAM
	PULLED OR LOOPED SEAM THREAD
	OTHER DAMAGE: EXPLAIN

2. MARK DAMAGE USING SYMBOLS TO SHOW AREA AFFECTED.
3. CANOPY DIAGRAM CONTAINS 28 GORES FOR CANOPIES WHICH HAVE 24, DELETE EXTRA GORES IN DIAGRAM BY MARKING THEM "N/A" NOTE THAT 28— AND 24— FOOT DIA FLAT CANOPIES HAVE 28 AND 24 GORES RESPECTIVELY.
4. AS DAMAGE IS REPAIRED ON EACH GORE, PLACE SYMBOL "OK" ADJACENT TO SKIRT AT END OF EACH GORE.
5. 24—FOOT DIA CANOPIES MAY HAVE NAMEPLATE ON GORE 1 OR ON SKIRT HEM AT GORE 1.
6. 28—FOOT DIA CANOPIES HAVE NAMEPLATE ON GORE 28.

REMARKS: ______________________________

THIS IS A PERMANENT RECORD DO NOT DISCARD.
UPON COMPLETION OF REPAIRS, THIS CHART IS TO BE AFFIXED TO THE PARACHUTE HISTORY CARD. (FRONT)

FIGURE 11. Sample parachute canopy damage chart.

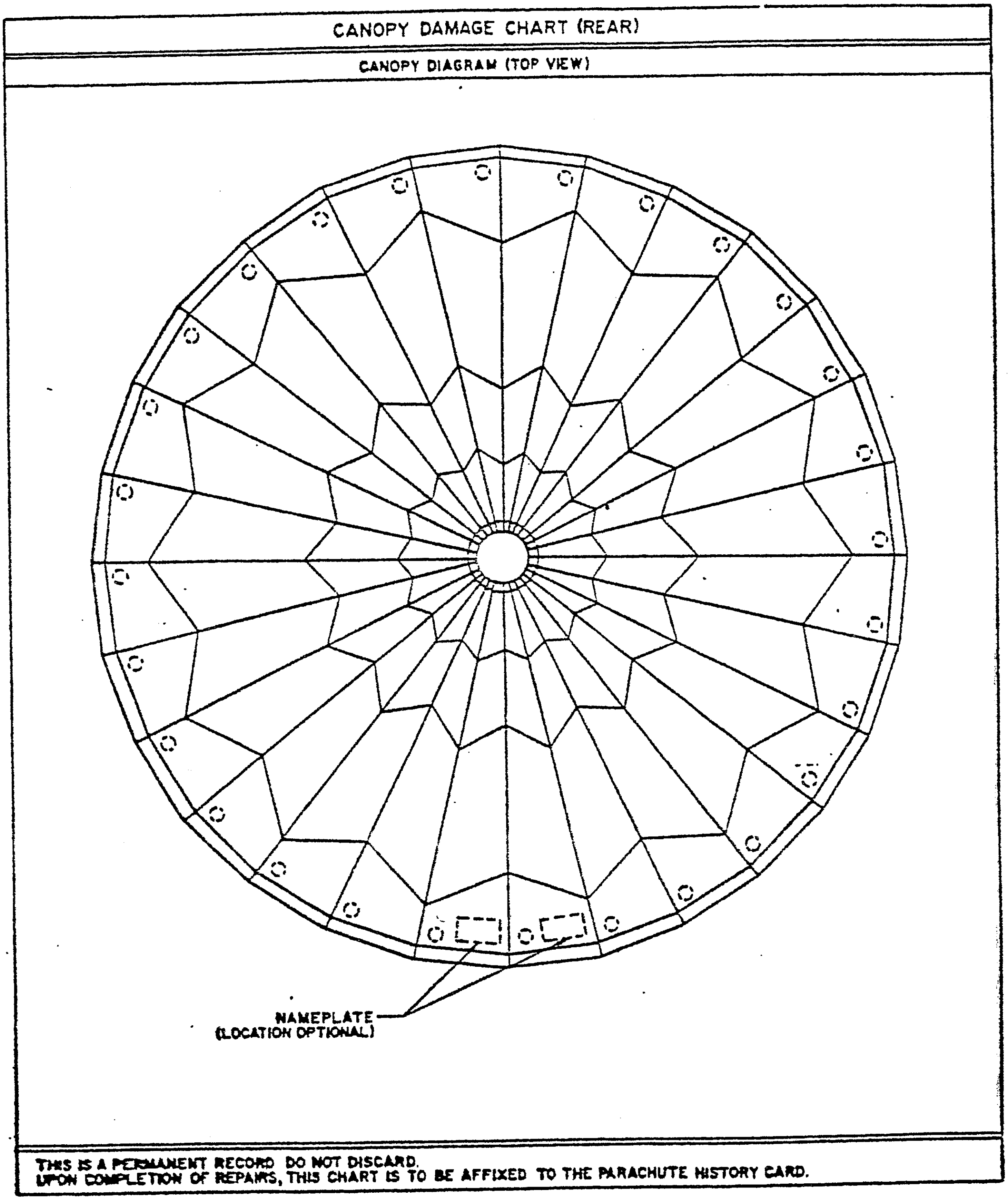

FIGURE 12. Sample parachute canopy damage chart.

DUMMY DAMAGE CHART

ACTIVITY			DATE
DATE OF MANUFACTURE	CONTRACT NO.	SERIAL NO.	INSPECTOR (PRINT)

INSTRUCTIONS

1. USE FOLLOWING SYMBOLS TO INDICATE LOCATION AND TYPE OF DAMAGE ON DUMMY DIAGRAM.

6	TEAR, 6 — INCHES LONG		ABRASIONS
3 4	TEAR "L" SHAPED WITH 3 — AND 4 — INCH LEGS	S/D	STAINS/DISCOLORATION
3 4	TEAR "T" SHAPED WITH 4 — INCH BASE AND 3 — INCH LEG		AMPUTATED PART
8	RUPTURE. 8 — INCH DIA AT WIDEST POINT		BREAK
	BURN MARKS		OTHER DAMAGE: EXPLAIN

2. MARK DAMAGE USING SYMBOLS TO SHOW AREA AFFECTED.

REMARKS: ______________________________

(FRONT)

FIGURE 13. Sample dummy damage chart.

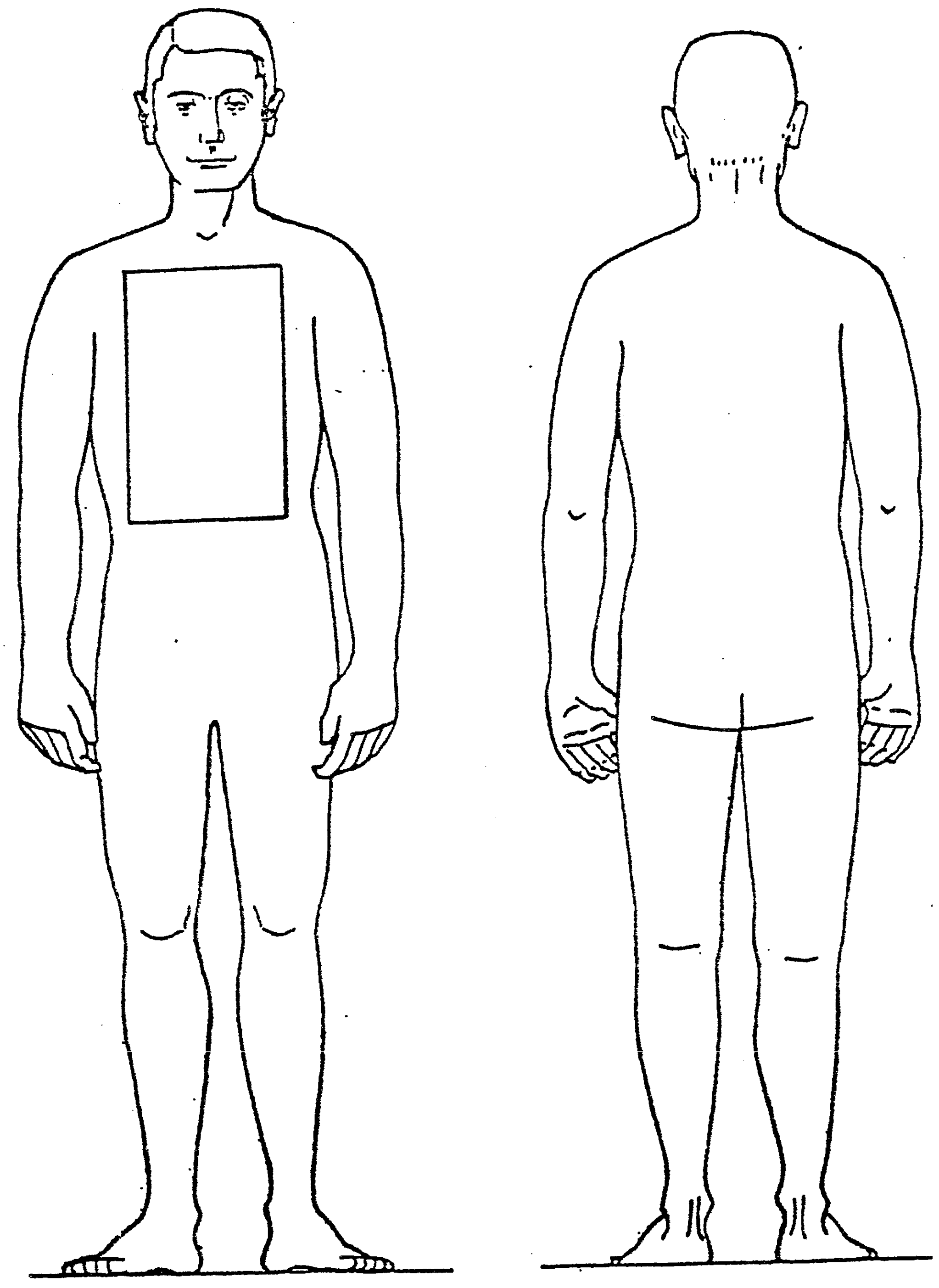

FIGURE 14. Sample dummy damage chart.

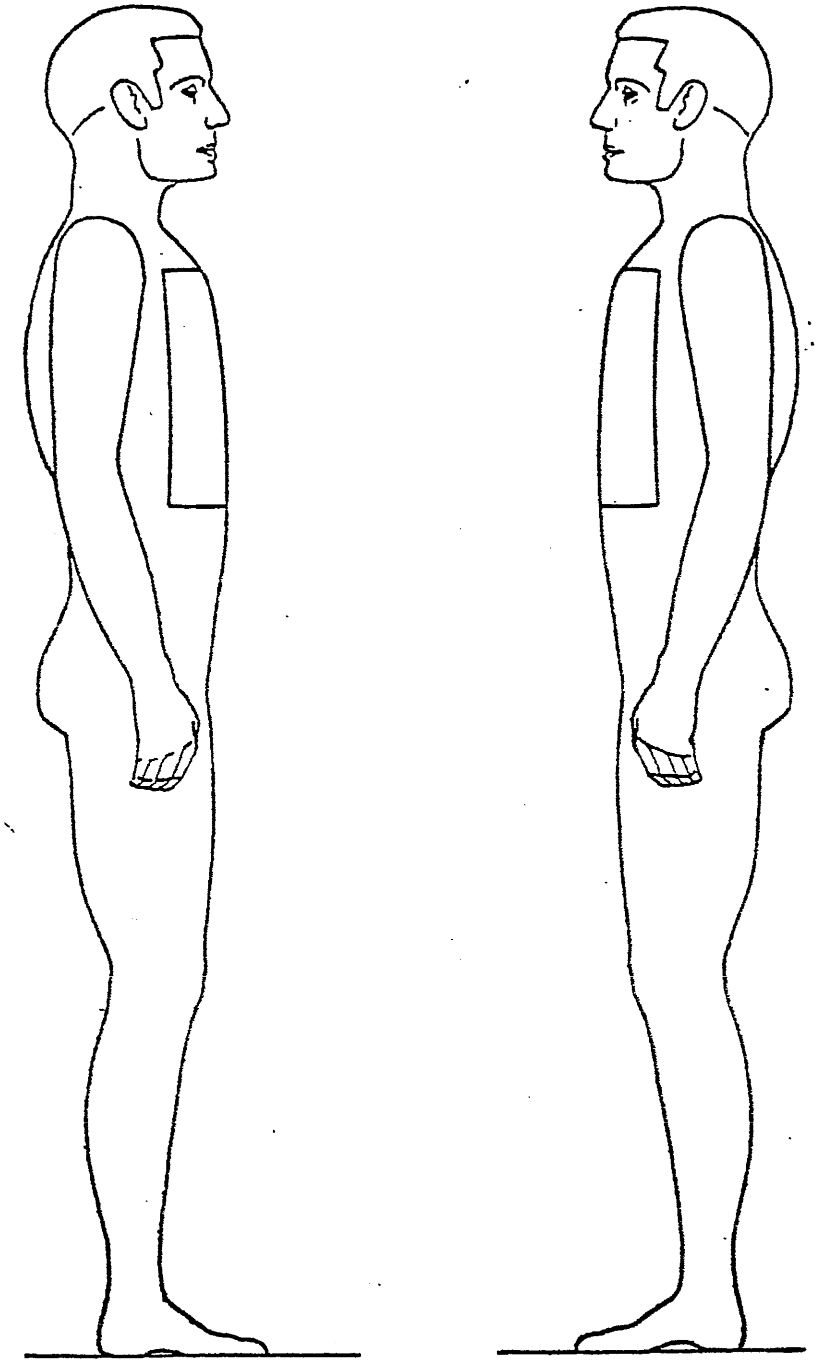

FIGURE 14. Sample dummy damage chart - Continued.

EQUIPMENT DAMAGE CHART

ACTIVITY			DATE
DATE OF MANUFACTURE	CONTRACT NO.	SERIAL NO.	INSPECTOR (PRINT)

INSTRUCTIONS

1. USE FOLLOWING SYMBOLS TO INDICATE LOCATION AND TYPE OF DAMAGE ON EQUIPMENT DIAGRAM.

6	TEAR, 6 — INCHES LONG
3 4	TEAR "L" SHAPED WITH 3 — AND 4 — INCH LEGS
3 4	TEAR, "T" SHAPED WITH 4 — INCH BASE AND 3 — INCH LEG
8	RUPTURE, 8 — INCH DIA AT WIDEST POINT
	BURN MARKS
	STRAINED AREA
	PULLED DRAG SURFACE THREAD
	SINGLE BROKEN DRAG SURFACE THREAD

#	WEAVE SEPARATION
S/D	STAINS/DISCOLORATION
3	BROKEN SEAMS STITCHES ALONG 3 INCHES OF SEAM
	PULLED OR LOOPED SEAM THREAD
	SEPARATED PART
	BREAK
	OTHER DAMAGE: EXPLAIN

2. MARK DAMAGE USING SYMBOLS TO SHOW AREA AFFECTED.
3. COMPLETE ONE OF THESE SHEETS FOR EACH EQUIPMENT SKETCH COMPLETED.

REMARKS: ______________________________

(FRONT)

FIGURE 15. Sample equipment damage chart.

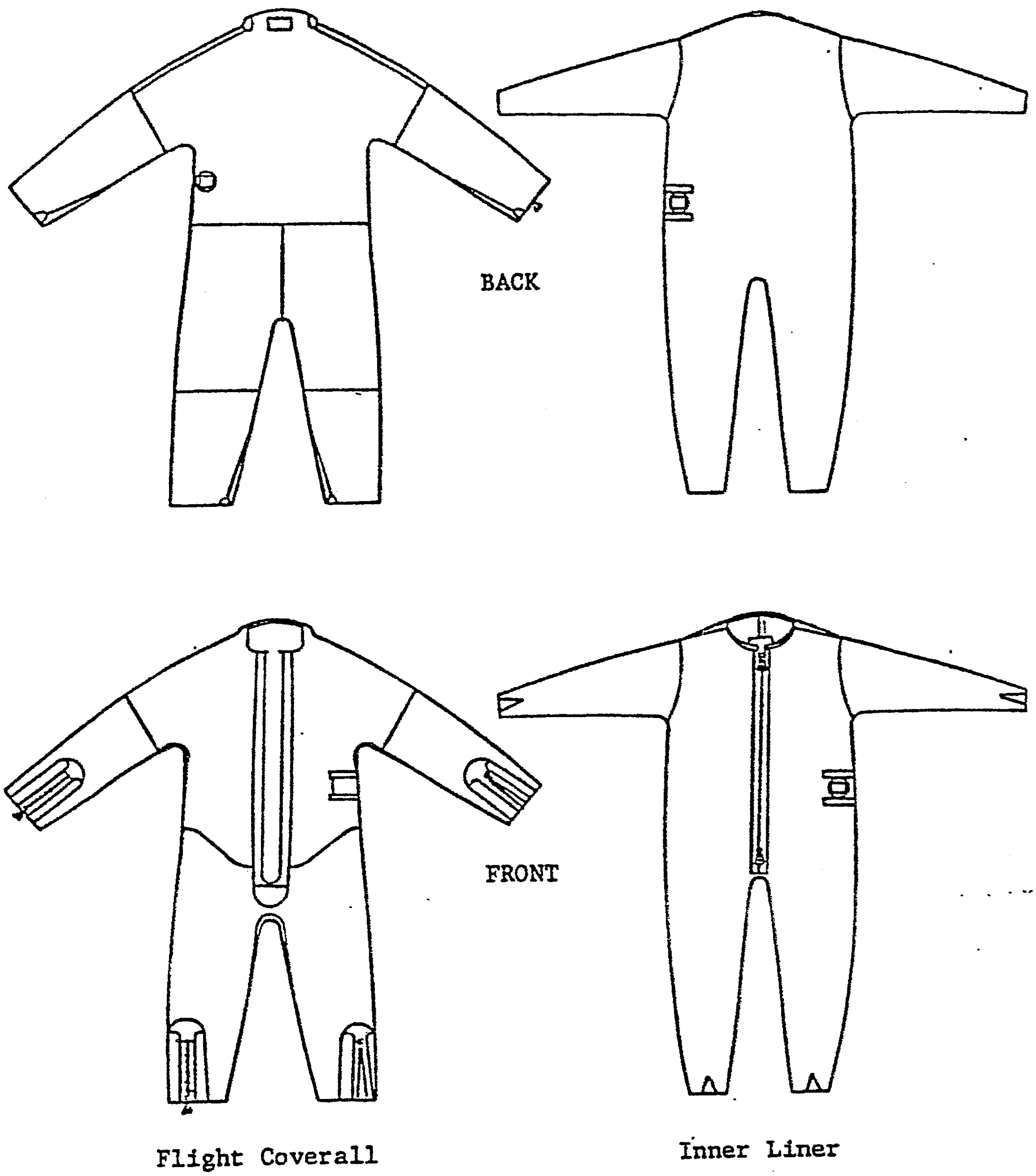

FIGURE 16. Sample equipment damage chart.

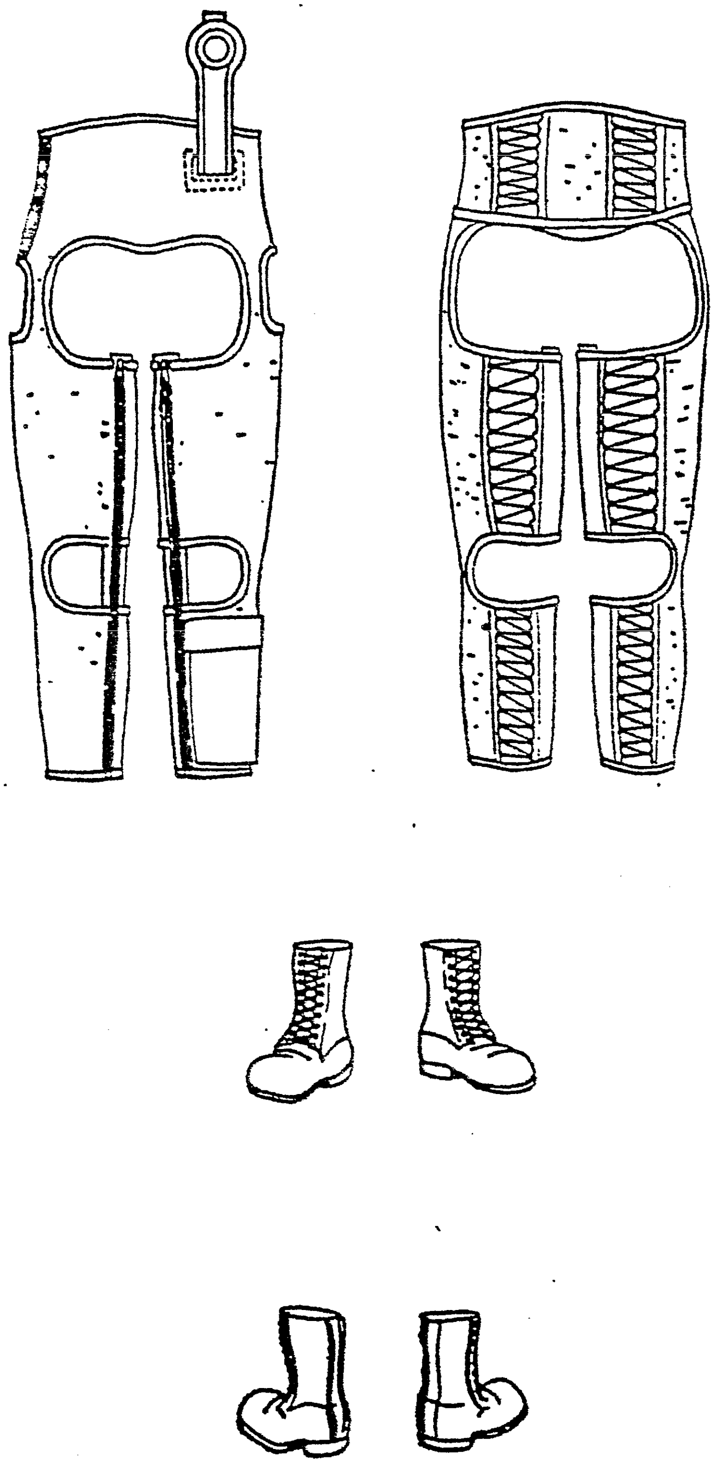

FIGURE 15. Sample equipment damage chart - Continued.

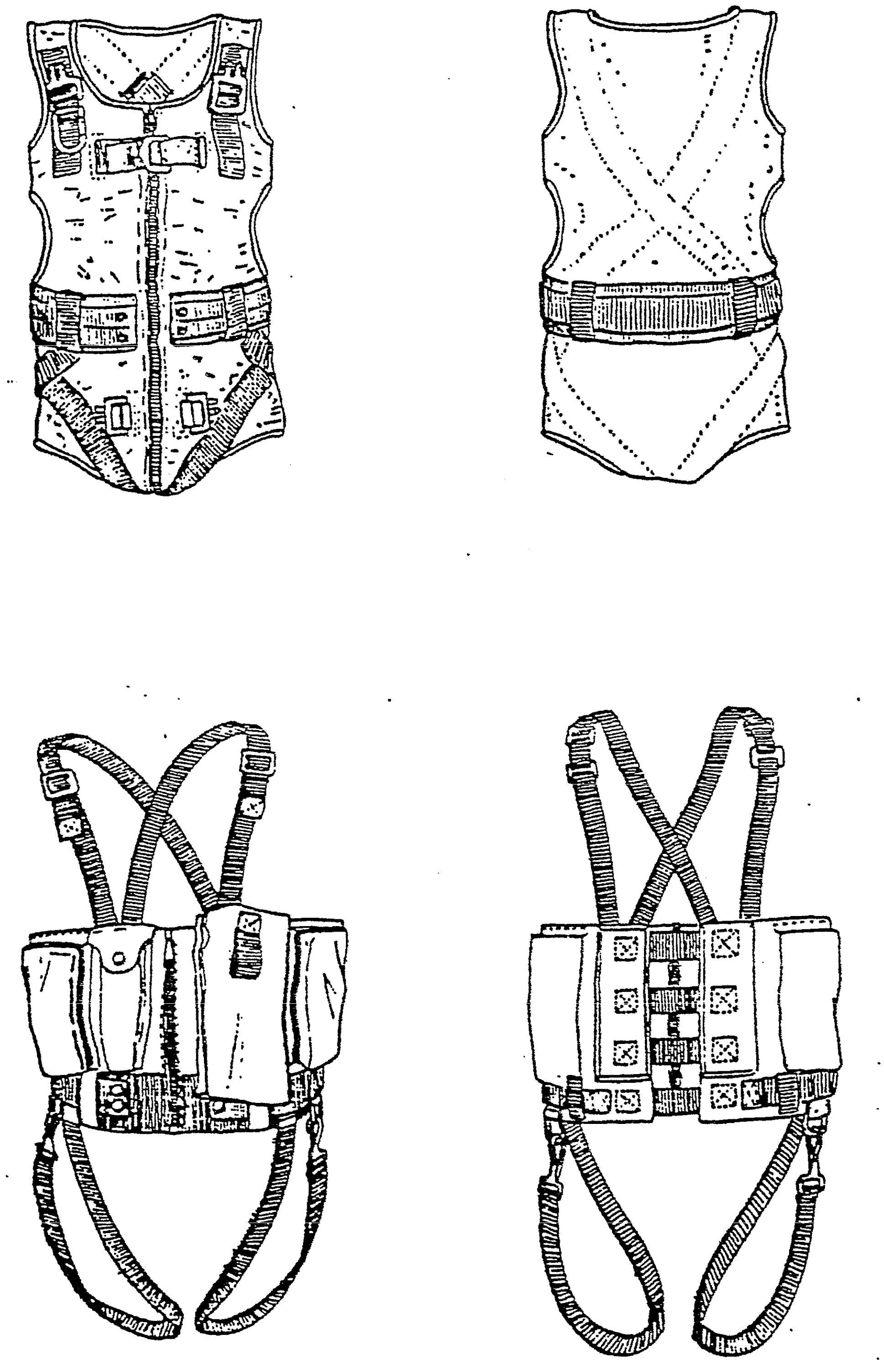

FIGURE 16. Sample equipment damage chart - Continued.

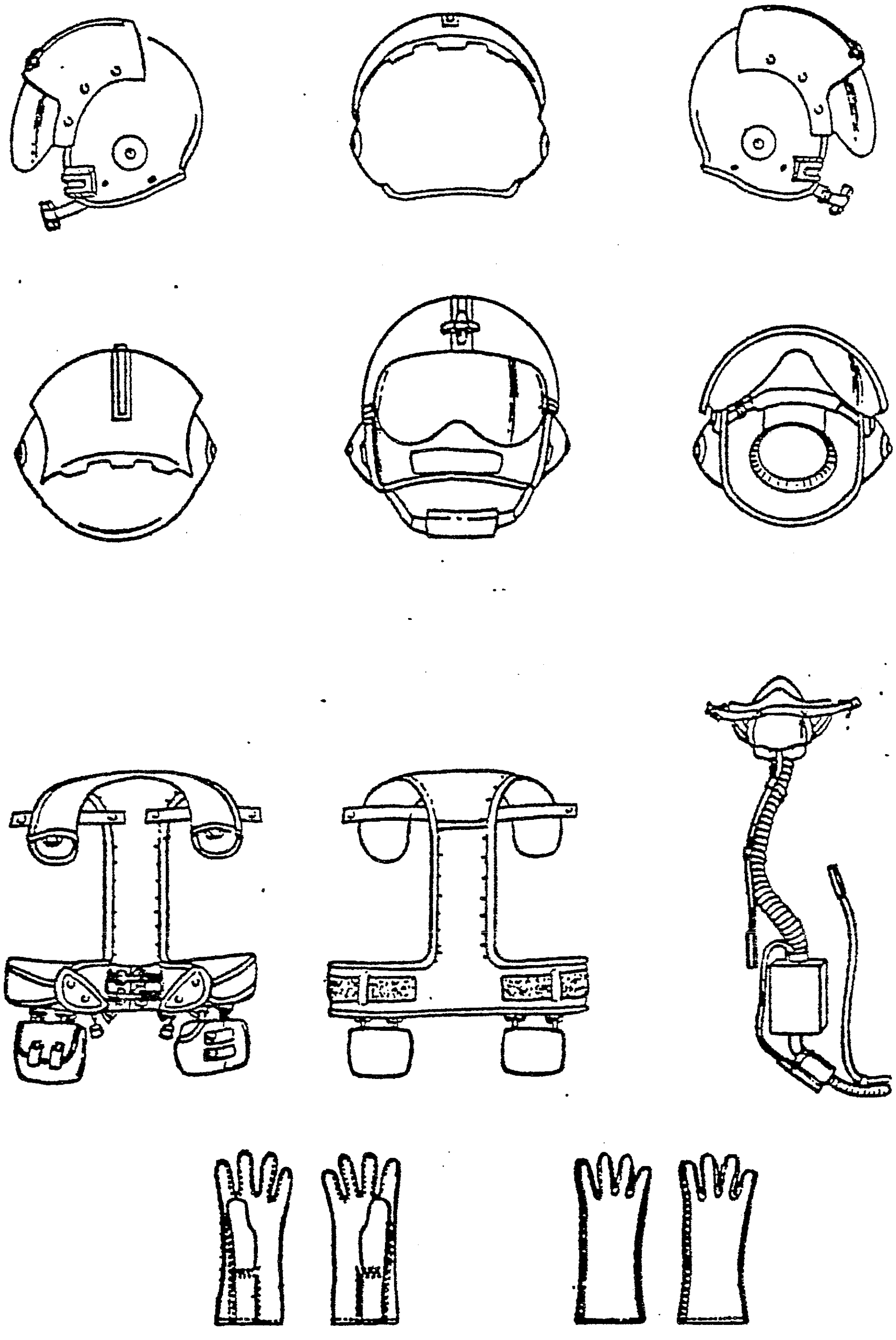

FIGURE 16. Sample equipment damage chart - Continued.

1. TITLE PAGE

   a. Company Name and Address.
   b. Report Number.
   c. Date of Release.
   d. Author's Name, Title, and Signature.
   e. Reviewers' Names, Titles, and Signatures.
   f. Report Title.
   g. Contract Title.
   h. CDRL (DD Form 1423) Numbers.
   i. DID (DD Form 1664) Number.

2. ABSTRACT

   a. Synopsis of Testing Conducted (i.e., the number of tests conducted in the series covered in the report and the location of the test(s) covered in relation to the test series and test program).
   b. Synopsis of Findings (i.e., brief statement describing the successes, failures, anomalies, and problems encountered during the reported tests).

3. TABLE OF CONTENTS

4. LIST OF TABLES

5. LIST OF ILLUSTRATIONS

6. TEST DESCRIPTION

   a. Test Purpose.
   b. Test Article (i.e., provide a complete detailed description of the test article configuration, including a description of each change from previous test article configuration with supporting rationale for each change).
   c. Test Fixture.
   d. Data to be Acquired/Measured During Test.
   e. Instrumentation (i.e., provide nomenclature model number, part number, serial number, and calibration record for each piece of test instrumenation, including data transmission and recording systems, and provide a chart depicting camera locations citing for each the lens focal length, film speed, and type of film). Transducer location shall be included.
   f. Test Procedures.
   g. Data Reduction and Analysis Techniques.
   h. Test Classification Criteria.

FIGURE 17. Test report format.

7. TEST RESULTS

a. Test Data Matrix.
b. Test Data Graphical Presentations.

(1) Single Test Smoothed Graphs.
(2) Running/Trend Graphs Covering All Tests to Date for Specific Types of Data.

c. Failure/Marginality of Success Analysis.
d. Analysis of Test Results.
e. Description of Test and/or Test-to-Test Anomalies.
f. Description of Design Deficiencies.
g. Proposed Test Classification with Supporting Rationale.

8. CONCLUSIONS AND RECOMMENDATIONS

9. PROPOSED REMEDIAL ACTION

a. Description and Supporting Rationale.
b. Proposed Incorporation Point Within Program.

10. PROGRAM FOR NEXT INTERVAL

11. APPENDICES

a. Motion Picture Films and Video Tapes.
b. List of References.
c. Bibliography.
d. List of Test Witnesses.
e. Quality Assurance Records for Test Article.
f. Disposition of Test Article.
g. Instrumentation Records.
h. Test Data Analysis Worksheets.
i. Data Tapes.
j. Calibration Records.
k. Failure Reports.
l. Parachute damage charts (figures 11 and 12).
m. Dummy damage chart (figures 13 and 14).
n. Personnel equipment/garment damage chart (figures 15 and 16).

FIGURE 17. Test report format - Continued.

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QQ-P-416	Plating, Cadmium (Electrodeposited)	3.1.1.2.3	Plating
PPP-B-601	Boxes, Wood, Cleated Plywood	5.1.1.4.2 5.1.2	Outer container Level B
PPP-C-795	Cushioning Materials, Flexible, Cellular, Plastic Film For Packaging Applications	5.1.1.4.1	Uninstalled components
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MIL-P-514	Plate, Identification, Instruction And Marking, Blank	3.1.14.5 3.1.14.5.1	Identification, instruction, and marking plates Identification of product
DOD-D-1000	Drawings, Engineering And Associated Lists	3.1.2 4.3.2.4	Drawings Testing baseline configuration audit (TBCA)
MIL-S-5002	Surface Treatments And Inorganic Coatings For Metal Surfaces Of Weapons Systems	3.1.1.2.1	Finishes
MIL-B-5087	Bonding, Electrical, And Lighting Protection, For Aerospace Systems	3.2.1	System design

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MIL-C-5541	Chemical Conversion Coating On Aluminum And Aluminum Alloys	3.1.1.2.2	Anodizing, chemical surface treatment, and chromium plating
MIL-C-6021	Casting, Classification And Inspection Of	3.1.1.1.1.2	Castings
MIL-E-6051	Electromagnetic Compatibility Requirements System	3.1.10	Electromagnetic interference and electromagnetic compatibility (EMI/EMC)
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		4.3.2.2	Escape system fit and compatibility evaluation
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1. DOCUMENT NUMBER
MIL-S-18471G(AS)

2. DOCUMENT TITLE SYSTEM, AIRCREW AUTOMATED ESCAPE, EJECTION SEAT TYPE: GENERAL SPECIFICATION FOR

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

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