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MILITARY STANDARD

AIRCREW STATION CONTROLS
AND DISPLAYS: LOCATION, ARRANGEMENT
AND ACTUATION OF, FOR FIXED WING AIRCRAFT



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FOREWORD

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. At their 98th Meeting in July 1984 the Aircrew Station Standardization Panel (ASSP) formed an ad-hoc to revise MIL-STD-203F to incorporate new technology requirements. Some major changes include revising the scope of MIL-STD-203 to include the location, arrangement, and actuation of controls and displays- rather than the assignment of controls and displays in fixed wing aircraft. The requirements for the specific location and arrangement of transilluminated dedicated signal displays were incorporated in MIL-STD-203 after deletion from MIL-STD-411RE, Aircrew Station Systems. Definitions were revised to coincide with associated documents such as MIL-STD-1333 Aircrew Station Geometry for Military Aircraft among others. Detailed figures of specific type cockpit arrangements were added for guidance.

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1. SCOPE

1.1 Scope. This document establishes the requirements for the uniform location, arrangement, and actuation of controls and displays used in the functional crew stations of military fixed wing aircraft.

1.2 Applicability. The requirements contained herein apply to the design of aircrew stations in fixed wing aircraft procured by the military departments. The contents describe requirements location, for the location, arrangement, and actuation of crew station controls and related items of equipment, and the relative location of electromechanical and electronic displays, including the basic flight and engine instrument groups.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-S-3950	Switch, Toggle, Environmentally Sealed, General Specification for
MIL-L-6503	Lighting Equipment, Aircraft, General Specification for Installation of
MIL-C-6781	Control Panel, Aircraft Equipment, Rack or Console Mounted
MIL-P-7788	Panel, Information Integrally Illuminated
MIL-S-8805	Switches and Switch Assemblies, Sensitive and Push, Snap Action, General Specification for
MIL-H-8810	Handles, Control, Aircraft
MIL-M-18012	Markings for Aircrew Station Displays, Design and Configuration of
MIL-L-18276	Lighting, Aircraft Interior, Installation of
MIL-F-18372	Flight Control Systems: Design, Installation and Test of, Aircraft (General Specification for)
MIL-S-22885	Switch, Push Button, Illuminated, General Specification for
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment and Facilities
MIL-C-81774	Control Panel, Aircraft, General Specification for
MIL-L-85762	Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible
MIL-E-87235	Emergency Escape, Aircraft

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STANDARDS

MILITARY

MIL-STD-411	Aircrew Station Signals
MIL-STD-783	Legends for Use in Aircrew Stations and on Airborne Equipment
MIL-STD-1333	Aircrew Station Geometry for Military Aircraft
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MS26518	Handle, Control Aircraft RPM Large
MS26521	Handle, Control, Aircraft Landing Gear
MS26523	Handles, Control, Aircraft Fire Extinguisher
MS33634	Instrument Arrangement, Engine, Standard, Basic, For Fixed and Rotary Wing Aircraft
MS33785	Instrument Arrangement, Flight Standard, Basic for Fixed and Rotary Wing Aircraft

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094)

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

3. DEFINITIONS

3.1 Fixed wing aircraft. All aircraft where the wings remain relatively fixed with respect to the aircraft fuselage. For the purposes of this standard, fixed wing aircraft shall include swing wing, tilt wing, and any other type of aircraft other than rotary wing aircraft.

3.2 Types of aircrew stations. (see Figures 1 thru 4)

3.2.1 Dual pilot. An aircrew station with a single aircrew member.

3.2.2 Dual pilot. An aircrew station requiring two aircrew members to control the aircraft or complete the mission. The second aircrew member may not be required for controlling flight but must be provided with the controls and displays necessary for aircraft control and be capable of performing pilot duties as a backup. In an emergency, either pilot shall be able to safely control the aircraft throughout all mission phases.

(a) Tandem dual. The aircrew members are seated fore and aft with respect to aircraft fuselage.

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(b) Side-by-side dual. The aircrew members are seated laterally with respect to aircraft fuselage.

3.2.3 Multiple. An aircrew station with multiple aircrew members configurations defined by the acquiring activity. Dual and multiple types may include Configurations not requiring a co-pilot, flight controls or displays necessary for aircraft control capability, when defined by the acquiring activity.

3.2.4 Non-standard aircrew stations. Aircrew stations other than the generic types described by Figures 1 thru 4 may involve arrangements for which this standard will have limited application. The application of this standard within a non-standard aircrew station shall be directed by the acquiring activity.

3.3 Geometry and clearance. The arrangement of controls and displays within the aircrew station to accommodate the user population while the user is clad in full complement of clothing and equipment.

3.3.1 Clearance. The distance by which one object clears another or the clear space between them.

3.4 Controls. A control is a switch, knob, wheel, stick, handle, pedal, toggle or pushbutton switch(s), lever, or similar device to which the crew member imparts motion or force to effect the desired action.

3.4.1 Primary controls. Primary controls are normally used by the operator to actuate devices which impart motion or cause to change a situation or event from its static or stabilized mode to a new situation or event.

3.4.2 Alternate controls. Alternate controls are defined as controls which compliment the primary control to provide a secondary path to actuate the same device.

3.4.3 Emergency controls. Emergency controls are controls, other than normally normally operated flight and engine controls, which must be operated immediately to prevent or remedy a hazardous condition.

3.4.4 Primary flight controls. The controls used by the pilot or co-pilot to control the altitude, attitude, or airspeed of the aircraft to maintain flight. Normally included are the stick, wheel, rudder, and thrust vector.

3.4.5 Power plant controls. The controls used by the aircrew member to control parameters such as thrust, condition, and RPM.

3.5 Display. A device which presents information to one or more aircrew members via one or more of the senses.

3.5.1 Signal. The information communicated by display.

3.5.1.1 Visual displayed information. Lettering, numbering, linear markings and symbols displayed to aircrew members in either generated, opaque printed, multicolored or monochromatic format.

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3.5.2 Generated graphics. Variable, projected or electronically generated images.

3.5.3 Primary displays. The displays normally used by the aircrew member to perform the basic aircraft mission and operation.

3.5.4 Primary flight displays. The displays which provide the aircrew-member with information about aircraft altitude, attitude, angle of attack, airspeed, and horizontal situation.

3.5.5 Power plant displays. The displays which provide the aircrew member with information on engine condition such as thrust, and RPM.

3.6 Attention getting device. A device which is normally inactive and is only activated when it is required to provide warning, caution or advisory information to the aircrew member. An attention getting device may either provide the information directly to the aircrew member or alerts the aircrew who must then locate the proper information display. It may be a light signal assembly, mechanical device, electronic display, auditory tone, horn, buzzer or similar device which alerts the aircrew member.

3.7 Control and switch actuation.

3.7.1 Position related. Direction of control movement or detent position is in the direction of the resultant motion of the aircraft or associated structural element being controlled.

3.7.2 Performance related. The direction of control movement that is:

(a) Forward, upward or clockwise. Forward, upward or clockwise, resulting in increased performance of the component or aircraft. Conversely, movement aftward, downward, or counterclockwise results in decreased performance of the component or aircraft.

(1) For side console components. Outboard movement results in increased performance and inboard movements results in decreased performance.

(b) Variable rotary. Clockwise from the "off" position through "low" or "dim" to "high" or "bright" for controls of a variable nature induced by a rotary motion. Operation counterclockwise shall reverse the induced condition.

3.7.3 Single action. Direction of control movement, either momentary or maintained, is oriented without respect to a resultant motion of the aircraft, level of control output or physical relationship to its mounting position.

3.8 Military power. Power or thrust setting between idle and maximum power available without utilizing afterburner(s).

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3.9 Interior vision.

3.9.1 Cone of vision. The cone of vision is the appropriate location for illuminated attention-getting devices and primary/emergency displays. It is defined as a cone subtending 30° with its apex at the aircrew member's design eye position and its axis in the sagittal plane of the crewmember, directed to the center of the visual sector of primary concern to the aircrew member.

3.9.2 Design Eye Position. Defined in MIL-STD-1333.

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4. GENERAL REQUIREMENTS

4.1 General. The requirements for location, arrangement, and actuation of controls and displays shall be as specified herein. Requirements not specified herein shall be in accordance with MIL-STD-1472, MIL-C-81774, MS33634, and MS33785.

4.2 Arrangement of controls and displays. The arrangement of controls and displays within the aircrew station shall provide the user population visual and manual access necessary for safe and efficient system operation while clad in full complement of clothing and equipment.

4.3 Location of controls.

4.3.1 Flight critical controls. Controls for functions, as defined by the acquiring activity, without which the aircraft can not operate. These controls shall be located within zone 1 as defined by MIL-STD-1333.

4.3.2 Flight essential controls. Controls for functions, as defined by the acquiring activity, without which the aircraft will operate in a degrade mode. These controls shall be located within zone 2 as defined by MIL-STD-1333.

4.3.3 Mission critical controls. Controls, as defined by the acquiring activity, for functions without which the aircraft can not accomplish the mission objectives. These controls shall be located within zone 1 as defined by MIL-STD-1333.

4.3.4 Mission essential controls. Controls for functions, as defined by the acquiring activity, without which the aircraft will perform the mission objectives in a degraded mode. These controls shall be located within zone 2 defined by MIL-STD-1333.

4.3.5 Other controls. Controls not specified above shall be located within zone 3 as defined by MIL-STD-1333.

4.4 Location. The following parameters shall be considered in determining the location of controls.

1. Frequency of use
2. Criticality
3. Sequence of use
4. Size
5. Type of control
6. Number of controls
7. Interlinkage of the controls
8. Control operating envelope either specified or necessitated
9. Visual display on the control panel
10. Accessibility with respect to reach zones as defined in MIL-STD-1333

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4.5 Assignment of controls to crew members. The assignment of controls to crewmember shall be in accordance with the results of studies conducted in accordance with MIL-H-46855 or as specified by the acquiring activity.

4.6 Actuation of controls. Controls including switches, shall be so spaced as to permit easy and accurate operation by all aircrew member when clad in a full complement of flight clothing and equipment and shall be in accordance with the requirements of MIL-C-81774 and MIL-STD-1472.

4.7 Other aircrew stations. The following general recommendations shall be applicable to a dual or multiple aircrew station.

(a) When practical, display redundancy shall be available in either optional electronic display, permanent duplication or standby instruments.

(b) The flight engineer should sit facing his instrument panel with the more important instruments grouped at eye level. The pilot should be able to monitor the flight engineer's station or access critical displays at his position.

(c) The flight engineer's station should be located to permit conversation between the pilot and co-pilot crew stations without using Intercoms.

(d) It is desirable that a method be provided to view the engine(s) from the flight engineer's station.

4.8 Interior Vision. The aircrew member shall have an unobstructed view of all controls and displayed information necessary for safe and effective operation of the aircraft. Interior vision provided to the aircrew shall meet the requirements of MIL-STD-411 and MIL-STD-1472.

4.9 Displayed information.

4.9.1 Integrally illuminated control and information panels and switches.

(a) The standardization of panel illumination, graphic layout details, lettering size and selected style, hue, coating reflectance, contrast, attachments, controls, knobs, switches, bezels shall be maintained as a primary requirement.

(b) The displayed information shall be located adjacent to or on the control, instrument or item of equipment to which it pertains.

(c) For night presentation, all displayed information shall meet the instrument and control panel lighting requirements of MIL-L-18276 or MIL-L6503. When specified by the acquiring activity, night vision imaging system compatible lighting shall be in accordance with MIL-L-85762.

4.9.2 Instructional panels, legends, emergency markings, signals.

(a) Printed or engraved permanent graphics, non-illuminated or surface-coated tactile graphics shall be readable with external lighting as required for operations of the aircraft.

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(b) Displayed information in the crew stations shall conform to the requirements of MIL-M-18012, MIL-C-81774 and MIL-STD-783.

(c) Printed instruction, procedures and markings for emergency exits and ditching shall be provided for non-aircrew personnel in the applicable aircraft compartment(s). Printed instructions shall be in accordance with MIL-A-25165.

(d) Design and selection of aircrew station alerting systems shall conform to the requirements specified in MIL-STD-411. Associated signal displays and controls shall be located and actuated in accordance with the requirements specified herein.

(e) Control panels shall be in accordance with the requirements of MIL-C-81774.

4.10 Control knobs, handles, and switches. Control knobs shall conform to MIL-K-25045. Control handles shall conform to MIL-H-8810. Switches and switch assemblies shall conform to MIL-S-8805. Toggle switches shall conform to MIL-S-3950. Pushbutton and limit switches shall conform to MIL-S-8805 and MIL-S-22885. In addition, for control panels, the applicable requirements of MIL-C-81774 shall apply.

4.10.1 Emergency control markings.

(a) Emergency controls and their panel backgrounds shall be provided with orange-yellow and black striping as specified in MIL-M-18012. When provided, the following controls as a minimum shall have emergency marking:

- Ejection mode controls.
- Ejection seat firing control.
- Canopy and hatch/door jettison control.
- Emergency jettison control.
- Landing gear down-lock override control.
- Emergency fuel controls.
- Engine emergency shutdown controls.
- Fire extinguishing agent discharge controls.
- Propeller feathering controls.
- Trim override control.
- Emergency auto-pilot disconnect control.
- Wheel brake emergency control.
- First Pilot's repressurization switch.
- Abandon aircraft control.
- Prepare to eject control.
- Emergency Arrestor hook control.
- Hoist cable cutter control.
- Flotation emergency gear control.
- Emergency power package control.

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4.10.2 Control monitoring.

4.10.2.1 Remote and indirect control monitoring. Controls which are manipulated remotely or indirectly such as radio volume, light intensity, temperature etc., do not require intermediate position markings between extreme control positions at the control location.

4.10.2.2 Direct control monitoring. Controls which are monitored visually at the control location usually require associated markings on the control panel. On plastic lighting plates, an illuminated locator ring shall be employed with each continuously variable control unless the knob itself is illuminated. Where control panel space is at a premium, suitably illuminated control knobs or lighted knob skirts approved by the acquiring activity shall be used. Selector control(s) should have a transilluminated reference line on the pointer.

4.10.3 Control guards. If the inadvertent actuation of any control could or would produce a dangerous situation, that control shall have guarded or safety detent design features.

4.10.4 Markings. Controls and associated panels shall be marked in accordance with MIL-M-18012.

4.10.5 Control coding. Controls within functional groups (e.g. TACAN controls, INS controls) shall be selected to provide ease of identification and actuation for the operator. Shape coding, size coding or other coding techniques approved by the acquiring activity shall be utilized as necessary where tactile information for control selection and actuation is highly desirable. Coding shall be in accordance with MIL-STD-1472.

4.11 Ground maintenance controls and displays. The installation of dedicated ground maintenance displays, controls, and switches in the cockpit area shall be held to an absolute minimum. Ground maintenance controls or switches shall not be located in a space required or normally occupied by controls used during flight operations.

4.12 Cockpit equipment arrangement. Cockpit controls, displays and support equipment on instrument panels and consoles should be arranged as shown in Figures 1 thru 4, and subject to approval by the acquiring activity.

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5. DETAILED REQUIREMENTS

5.1 Flight and ground controls

4.1. Foot actuated rudder control Location - See Figures 1, 2 and 3. Actuation - Right foot pressure causes right yaw. Left foot pressure causes left yaw.

4.1.2 Rudder pedal adjustment control. Location - A single control to adjust both pedals is desirable. If utilized it shall be located forward of and near the centerline of the pilot. See Figures 1, 2, and 3. Actuation - The control motion to extend the rudder pedals shall be clockwise, push, or lift (depending on the type of mechanism employed). Design - If kick type rudder pedal adjustment controls are utilized, a legible numerical index shall be provided to indicate rudder pedal position.

5.1.3 Roll control. Location - See Figures 1, 2 and 3. Actuation - Right pressure, displacement or clockwise rotation of the control shall cause right wing down roll. Left pressure, displacement or counterclockwise rotation of the control shall cause left wing down roll.

5.1.4 Pitch control. Location - See Figures 1, 2, and 3. Actuation - Forward pressure or displacement provides nose down pitch. Rearward pressure or displacement provides nose up pitch.

5.1.5 Surface augmentation. Location - In accordance with Figures 1, 2, and 3 and accessible to both pilots. Actuation - Single action.

5.1.6 Flight control lock. Location - Adjacent to the power control. Actuation - Single action. A flight control lock shall incorporate a device that makes it impossible to apply takeoff power simultaneously to all engines while engaged. However, it shall be possible to apply sufficient power to all engines to permit normal taxiing and low power engine checks. In the case of multi-engine aircraft, it shall also permit takeoff power engine checks on individual engines, provided that not more than 50 percent of the engines may be run up to takeoff power at one time.

5.1.7 Automatic flight controls (auto-pilot).

(a) Single pilot/tandem pilot. Location - On the right-hand side Of the cockpit, except where control stick steering is employed; the control panel shall then be located on the left console. Actuation - Aft motion for an aircraft nose up pitch change, forward for an aircraft nose down pitch change, left (or counter clockwise) for an aircraft roll to the left, and right (or clockwise) for an aircraft roll to the right. Design - An electric disconnect shall be provided on the forward side of the control stick. If a manual disconnect is employed, it shall be located adjacent to or on the automatic flight controls control panel.

(b) Side-by-side. Location - On the center console aft of the power controls and accessible to each pilot. Actuation - Requirement for single pilot/tandem pilot apply. Design - requirements for single pilot/tandem pilot apply. For stick controlled aircraft, electric disconnect

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requirements for single pilot/tandem pilot apply. If a manual disconnect is employed, in wheel controlled aircraft, the electric disconnect shall be located on the side of the wheel opposite the throttle hand.

5.1.8 Trim controls (yaw, pitch roll).

(a) Location

(1) Manual. A wheel(s) or knob(s) shall be used adjacent to the engine power controls.

(2) Electrical. In stick controlled aircraft, the roll/pitch trim switch shall be located on the stick grip so that it is easily operable by the pilots thumb. The yaw trim switch shall be located adjacent to the engine power controls. In wheel controlled aircraft the roll and pitch trim switch shall be placed on each wheel on the side opposite to the throttle hand or on the pedestal adjacent to the engine power controls and accessible to each pilot. The yaw-trim switch shall be placed on the pedestal adjacent to the engine power controls and accessible to each pilot.

(3) Alternate Trim Control. In stick controlled aircraft, the alternate trim control shall be located on the left console so that it can be easily operated by the pilot's left hand. In wheel controlled aircraft, the alternate trim control shall be located so that the pilot(s) can easily operate these functions with the throttle hand.

(b) Actuation.

(1) Pitch trim. Aft or down motion of the trim control shall cause an aircraft nose up pitch change; and forward or up motion of the trim control shall cause an aircraft nose down pitch change.

(2) Roll trim. Left or counterclockwise motion of the trim control shall cause an aircraft roll to the left; and right or clockwise motion of the trim control shall cause an aircraft roll to the right.

(3) Yaw trim. Left or counterclockwise motion of the trim control shall cause the aircraft nose to yaw to the left; and a right or clockwise motion of the trim control shall cause the aircraft nose to yaw to the right.

(c) Design

(1) Trim controls shall be designed to safeguard against inadvertent or abrupt operation.

(2) Means shall be provided adjacent to the trim control to indicate the direction of the control movement required to attain the desired aircraft trim moment.

(3) If required by the acquiring activity, a means shall be provided to indicate the position of the trim device with respect to the range of adjustment. The Indicating means shall be clearly distinguishable day and night over the entire trim range.

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(4) A wheel, knob, or switch shall be used, not a crank.

(5) A trim control emergency override, cutout, or circuit breaker shall be provided and located so as to be readily accessible to the operator's throttle hand.

5.1.9 Landing gear control.

(a) Single pilot/tandem pilot. Location - Forward of and above the primary power controls when the power controls are in the full forward position and operable by pilot. Actuation - Position related: one to retract and one to extend. Design - Where used, the landing gear control knob shape shall conform to MS2651. The indicator light shall be located in the handle and shall be steady "ON" when the landing gear is inconsistent with the handle position.

(b) Side-by-side pilot. Location - Forward of and above the primary power controls when the power controls are in the full forward position. The landing gear control shall be operable by both pilots in their normal seated position. Actuation - for single pilot applies. Design - Requirements for single pilot apply.

5.1.9.1 Emergency retraction control. - As close as practicable to normal control. Actuation. - With one hand, release interlock device and raise landing gear control.

5.1.9.2 Alternate landing gear extension control. Location - The alternate control shall be separate from, but as close as practicable to, the normal control unless specific approval is granted for an integral control. Where cockpit space is a premium, consideration shall be given to integrating this control with the normal gear control. The design shall be such as to preclude interaction between normal and alternate operation. Failure of the normal gear control shall not preclude subsequent successful actuation of the gear system.

5.1.10 Landing gear position indicator(s). Location - On the instrument panel or adjacent to the landing gear control visible to the pilot(s). See Figures 2, 3, and 4.

5.1.11 Landing flap control.

(a) Single pilot/tandem pilot. Location - on the left console aft of and outboard of the power controls, and operable by pilot. Actuation - Shall be forward or up for flaps up, and afterwards or down for flaps down.

(b) Side-by-side pilot. Location - On the center console. Actuation - Actuation for single pilot applies. Design - It shall be possible for either pilot to operate the control while maintaining normal forward visibility out of the airplane.

5.1.12 Landing flap position indicator. Location - On the instrument panel visible to the pilot(s) as close as practicable to the landing gear position indicator.

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5.1.13 Speed brake control. Location - Stick-controlled aircraft - On the power control lever. Wheel-controlled aircraft On the throttle nearest the pilot if electrically controlled and in immediate vicinity of the throttles if mechanically controlled. Actuation and design - The actuation and design of the speed brake control shall conform to the requirements of MIL-F-18372.

5.1.14 Arresting hook control.

5.1.14.1 Normal system operation. Location - To the right of the pilot, on or adjacent to the Instrument panel. Actuation - Direction of motion shall correspond to hook movement. Design - When an indicator light is used, it shall be located on or adjacent to the control handle, and shall be "ON" when the arresting hook is inconsistent with control position. For single seat fighter attack aircraft (Figure 4), the location shall be on the lower right corner of the instrument panel for Navy aircraft and the lower left corner of the instrument panel for the Air Force aircraft.

5.1.14.2 Emergency system operation. Location - Integral with or adjacent to the normal operation hook control. Actuation - Integral with normal operation control: Twist handle counter clockwise and pull to release hook. Separate control: Pull to release hook.

5.1.14.3 Emergency arresting hook control (ground use only). Location - Accessible to the pilot's throttle hand. Actuation - Pushbutton switch - Push to extend hook. Hook shaped switch - Down or aft hook "down". Design - A recessed, guarded pushbutton switch or a guarded hook-shaped, coded toggle switch.

5.1.15 Wing folding control.

(a) Single pilot/tandem pilot: Location - On the left console forward of the engine power control. Actuation - Control shall move forward or outboard to spread; aft or inboard to fold.

(b) Side-by-side pilot. Location - On the center console forward of the engine power control. Actuation - Control shall move forward or to the right to spread; aft or to the left to fold.

5.1.16 Wing locking control. Location - Adjacent to wing folding control. Actuation - control shall move forward, outboard, away from the left pilot's seat or down to lock; aft, in board, toward the left pilot's seat or up to unlock. Design - The wing locking control shall not be able to be positioned in the locked position until the wings are fully spread. In the unblocked position the wing locking control shall provide a physical interference to prevent placing the engine power controls in the military power position. A means to circumvent this interference shall be provided to allow maintenance runs of the engine(s) at and above military power. A warning system shall be incorporated to indicate the existence of an unsafe condition.

5.1.17 Wing sweep control. Location - Adjacent to the engine power controls. Actuation - Position related.

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5.1.18 Brake control.

5.1.18.1 Wheel brake controls. Location - Toe pedals, integral with each rudder pedal. Actuation - Forward pressure to activate brakes. Design - When dual brake controls are incorporated, simultaneous braking by both pilots shall be possible.

5.1.18.2 Parking brake control. Location - On the lower portion of, or under the instrument panel in accordance to Figures 1 thru 4. Actuation - Pull to actuate. Push pedals to release. The pilot shall be provided with an indication when the parking brake is engaged.

5.1.18.3 Emergency brake.

(a) Single pilot/tandem pilot. Location - Forward left side of the cockpit, operable by the pilots left hand; with shoulder harness in place and locked. Actuation - Pull to apply.

(b) Side-by-side pilot. Location - Between the pilot and co-pilot stations accessible to both pilot and co-pilot with shoulder harness in place and locked. If cockpit width precludes equal accessibility to both crewmembers then the control shall be located so as to be accessible to the pilot.

NOTE: When a parking brake control is combined with an emergency wheel brake control, its location shall be as above. A separate and distinct motion's shall be used to distinguish parking brake from emergency brake application.

5.1.18.4 Anti-skid.

(a) Single pilot/tandem pilot. Location-Adjacent to or in the immediate vicinity of the landing gear control, located at the base of the throttle control and operable by the pilot's left hand with shoulder harness in place and locked. Actuation - Performance related.

(b) Side-by-side pilot. Location - Between the pilot and co-pilot stations, in the vicinity of the landing gear control, accessible to both the pilot and co-pilot with shoulder harness in place and locked. Actuation - Performance related. An indication shall be provided to the crew when the anti-skid system has been armed or is "on".

5.1.19 Canopy control (sliding or hinged).

(a) Single pilot/tandem pilot. Location - Right side forward on the canopy rail. Actuation - Forward or down to close (switch must be held closed during transit) aft or up to open.

(b) Side-by-side pilot. Control as above but may be duplicated along both canopy rails. Design - External controls shall be located in path of normal ingress to the cockpit and, when feasible, operable by persons on the ground. Additionally, the external control should include a mechanism to de-energize the canopy closure hooks in case of failure of the ground safety switches, and allow manual opening via a ratchet and speed handle.

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5.1.20 Canopy jettison control.

(a) Single pilot/tandem pilot. Location - Forward on the left hand side. Actuation - Pull to jettison or fracture canopy. Design - "T" or ring pull handle.

(b) Side-by-side pilot. Location, actuation and design for single pilot applies. A control shall be provided forward and outboard of each crewmember. The pilot's jettison controls should actuate all individual canopy segments in multi-crew aircraft.

5.1.21 Nose wheel steering control.

(a) Single pilot/tandem pilot. Location - A pushbutton control to engage and disengage the nose wheel steering shall be provided on the control stick grip. Actuation The pushbutton may be either a push-and-hold type, or a push to engage-push to disengage type, as design requirements dictate. If a push to engage-push to disengage button is used the nose wheel steering shall always be engaged when the pushbutton is depressed and a physical indication for the engaged mode shall be presented to the pilot(s).

(b) Side-by-side pilot. Location - The nose wheel steering control shall be a single wheel tiller, or grip type control located outboard of the pilot's seat(s); or rudder pedal controlled steering actuated by a pushbutton on the flight control wheel on the side opposite to the throttle hand. Actuation - Right or clockwise motion of the steering control shall cause the aircraft to turn right, and left or counterclockwise motion shall cause the aircraft to turn left. If a pushbutton/rudder pedal steering control is utilized, requirements for single pilot/tandem pilot apply.

5.1.22 Drag chute control.

(a) Single pilot/tandem pilot. Location - Handle: Upper left portion of the instrument panel or adjacent subpanel. See figures 1,2, and 4. Switch: Left side of instrument panel or subpanel or forward on left console. Actuation - Handle: Pull to deploy (handle nonrotatable during pull) rotate handle 90° (handle will be capable of both clockwise and counterclockwise rotations) and pull to jettison. switch: Three position leverlock, center for "OFF", forward or up for stowed or jettison, aft or down for deployment. A guard or gate shall be provided between the "OFF" and "jettison" positions.

(b) Side-by-side pilot. Location - Handle: On or adjacent to the right side of power quadrant. Switch: On or adjacent to or immediately aft of the right side of the power quadrant. Actuation - Actuation for single pilot/tandempilot applies.

5.1.23 Catapult hand grip/strut stiff control. Location - Immediately adjacent to and reachable by the throttle hand with the hand on the throttle in the full power position. Actuation - Pull or rotate to provide a grip handle in front of the throttle.

5.1.24 Launch bar control (Navy only). Location - Forward of the throttle quadrant on the-left side Actuation - Forward or down to extend,

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aft or up to retract. Design - An advisory light shall be provided to indicate the extended position. A warning light shall indicate an unsafe condition.

5.2 Power plant controls

5.2.1 Power controls.

5.2.1.1 Reciprocating engines (throttle(s), propeller(s), mixture).

(a) Single pilot/tandem pilot. Location - On the left of the pilot accessible with shoulder harness in place and locked. Actuation - Performance related. Design - The power control(s) shall be arranged from left to right in the following order: Throttle control(s), propeller control(s), mixture control(s). The propeller control(s) shall be shorter than the throttle control(s). It is desirable that the mixture control be to the right and shorter than the propeller control.

(b) Side-by-side pilot. Location - On the center console accessible to both pilots with shoulder harness in place and locked. On aircraft having stick control, and side-by-side seating which requires duplicated primary power controls, one set of controls shall be accessible to the left hand of each pilot when his shoulder harness is in place and locked. Actuation - Performance related. Design - Requirements for single pilot apply.

5.2.1.2 Turboprop engines (power lever(s), condition lever(s)/high pressure cock).

(a) Single pilot/tandem pilot: Location - On the left of the pilot accessible with shoulder harness in place and locked. Actuation - Performance related. Design - The power control(s) shall be arranged from left to right in the following order: Power lever(s), condition lever(s)/high pressure cock. The condition lever/high pressure cock shall be shorter than the power lever and shaped in accordance with MS26518. The condition lever/high pressure cock shall operate from aft to forward in the sequence stated below. The functions (when employed) shall be:

Fixed Shaft Engines:

- (1) Feather.
- (2) Fuel cut-off.
- (3) Automatic Brake Release.
- (4) Engine Run or Fuel-on.
- (5) In-Air Start.

Free Shaft Engines.

- (1) Feather.
- (2) Fuel cut-off.
- (3) Fuel on.
- (4) Minimum RPM (gas producer section).
- (5) Automatic propeller brake release.
- (6) Maximum RPM (gas producer section).

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- NOTE:
1. The high pressure cock will usually have the first three functions only.
 2. Function (5) may be combined with function (4) or precede function (4).

(b) Side-by-side pilot. Location - On the center console accessible to both pilots with the shoulder harness in place and locked. On aircraft having stick control, and side-by-side seating which requires duplicated primary power controls, one set of controls shall be accessible to the left hand of each pilot when his shoulder harness is in place and locked. Actuation - Performance related. Design - Requirements for single pilot apply.

5.2.1.3 Turbojet engines (power lever(s)).

(a) Single pilot/tandem pilot. ~~Location~~ - ~~On the left of the pilot~~ accessible with shoulder harness in place and locked. Actuation - Performance related.

(b) Side-by-side pilot. Location - On the center console accessible to both pilots with the shoulder harness in place and locked. On aircraft having stick control, and side-by-side seating which requires duplicated primary power controls, one set of controls shall be accessible to the left hand of each pilot when his shoulder harness is in place and locked. Actuation -

(c) To preclude inadvertent engine shutdown, the "IDLE" to "OFF" position shall be protected by a safety device in which a separate, distinct action is required for engine shutdown.

5.2.2 Reverse thrust control.

5.2.2.1 Shaft power engines. Location - Integral with the normal power lever. Actuation - The control shall be moved aft through a stop that employs a "lift to reverse" type of control mechanism to obtain reverse thrust.

5.2.2.2 Turbojet and Turbofan engines.

(a) Location

- (1) On the console outboard of the power control(s) and on the same axis as the power control(s), or
- (2) A separate lever attached to the power control(s), or
- (3) As a detent similar to an afterburner detent but at the aft end of the power control(s) travel, or
- (4) As a part of an integrated flight/propulsion system, or
- (5) Other location as dictated by design requirements.

(b) Actuation - Aft, or up and aft, to increase reverse thrust component; forward, or forward and down, to decrease reverse thrust component; or as dictated by design requirements in the case of the automated reverse or variable-vector thrust reverser systems.

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(c) Design - For aircraft with performance related thrust reversers, an indication shall be provided to inform the pilot(s) when the reverser is not in the stowed position. For aircraft with a variable-vector thrust reverser systems, an indication shall be provided to inform the pilot(s) of the amount and direction of net engine thrust.

5.2.3 Fluid injection system controls. Location - Master (pump control) switch shall be adjacent to power control. Actuation - Performance related. Design - The system shall be automatically actuated by the power control.

5.2.4 Afterburner system control. Location - Integral with power control. Actuation - A positive means shall be provided to prevent inadvertent passage between military power and the afterburner range.

5.2.5 Contrail suppression control. Location - On the anti-ice/pilot heat panel operable by the pilot and copilot with shoulder harness in place and locked. Actuation - Performance related. Design - A means of visually monitoring the contrail conditions shall be provided.

5.2.6 Supercharger or turbo-supercharger controls.

(a) Single pilot/tandem pilot. Location - On the left console to the left and aft of the power controls or outboard and on the same axis as the power controls. Actuation - Aft or down for low blower. Forward or up for full blower.

(b) Side-by-side pilot. Location - On the center console to the left and aft of the power controls or outboard and on the same axis as the power controls. Actuation - Aft or down for low blower. Forward or up for full blower.

5.2.7 Assisted takeoff control

5.2.7.1 Firing control. Location - Adjacent to the power controls, operable by the pilot and co-pilot with shoulder harness in place and locked. Actuation - Performance related. A means of preventing inadvertent selection shall be provided.

5.2.7.2 Jettison control. Location - Adjacent to the power controls, operable by the pilot and co-pilot with shoulder harness in place and locked. Actuation - Mechanical: pull to release Electrical: Push to release. Design - Electrical jettison control switch shall be of the guarded plunger type.

5.2.7.3 Combined firing and jettison control. Location - Adjacent to the power controls, operable by the pilot and copilot with shoulder harness in place and locked. Actuation - The firing position shall be performance related and the jettison function selected by motion opposite that required for firing. A means of preventing inadvertent selection of either the firing or jettison position shall be provided. Moving the control from the firing to the jettison position shall require a motion distinctly different from that required to select either position.

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5.2.7.4 Circuit test (Push to test) - Location - Adjacent to the power controls, operable by the pilot and copilot with shoulder harness in place and locked. Actuation and design - Separate from the firing and jettison control(s).

5.2.8 Cooling controls (cowl flaps, intercoolers, oil coolers, etc.). Location - Aft of the power control(s). Actuation - Forward, upward, or clockwise for increased cooling. Activity shall be forward for automatic controls if used.

5.2.9 Air induction system controls (carburetor heat, air filter, alternate air and turbo-by-pass system). Location - Aft of the cooling controls. Actuation - Performance related. Design - A unitary control is desirable.

5.2.10 Air induction system anti-icing control. Location - Aft or outboard of the air induction system control. Actuation - Performance related.

5.2.11 Ignition control switch.

5.2.11.1 Reciprocating engines.

(a) Single pilot/tandem pilot. Location - On the left, forward of power controls, and operable by the pilot. Actuation - Clockwise rotation shall produce the following sequence: "OFF", "FIGHT", "BOTH". Design - individual switches with provisions for emergency grounding should be used for reciprocating engines in multi-engine aircraft. Ignition switches shall be separated electrically and mechanically without provisions for multiple cutoff, unless specified by the acquiring activity.

(b) Side-by-side pilot. Location - Between the pilots, on the overhead if it exists. Actuation - Actuation for single pilot applies. Design - Requirements for single pilot apply.

5.2.11.2 Turboprop or turbojet/turbofan engine. Location - Aft on adjacent to power lever(s) or integral with power lever(s). Actuation - Single action.

5.2.12 Air start control(s).

(a) Single pilot/tandem pilot. Location - Aft of the power lever(s). Actuation - Single action.

(b) Side-by-side pilot. Location - On, aft, or adjacent to the power levers, or on the overhead panel. Actuation - Requirements for single pilot apply.

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5.2.13 Propeller feathering controls.

5.2.13.1 Manual propeller feathering controls.

(a) Single pilot/tandem pilot. Location - On the left, forward of the power controls, operable by the pilot. The control shall be so located or protected or both, to avoid inadvertent operation. Actuation - Push to feather. Design - Feathering controls shall be provided with an indication of power failure or feathering actuation.

(b) Side-by-side pilot, Location - Forward and overhead, accessible to both pilots. Actuation - Push to feather. Design - Requirements for single pilot apply.

5.2.13.2 Automatic propeller feathering controls. Location - Co-located with the manual feathering control. Actuation and design requirements for manual feathering control apply.

5.2.14 Vector thrust-mechanical controls.

5.2.14.1 Nozzle selector control. Location - Adjacent to the throttle. Actuation - Aft or down movement of the control lever shall change the direction of the thrust vector downward through the vertical, if necessary.

5.2.14.2 Nozzle selector stop control. Location - The selector stop control shall move against a calibrated scale, adjacent to the nozzle selector control. Actuation - Aft or down movement of the stop control shall preselect the amount of thrust vector change downward through the vertical, if necessary.

5.2.14.3 Nozzle angle indication. A nozzle angle indicator shall be provided.

5.3 Fuel system controls

5.3.1 Engine fuel feed controls. Location - As close to the power controls as practicable. Actuation - Performance related. Design - the preferred design is one in which fuel feed "ON": will assure a constant supply of fuel to the engine(s) provided fuel is available in any tank. The source(s) of fuel which can be fed to each engine shall be readily apparent to and easily understood by the crew. A means of preventing inadvertent selection of the "off" position shall be provided for each engine fuel feed control. An indication of the fuel quantity available in each feed tank shall automatically be displayed upon selection of that tank.

5.3.2 Fuel transfer controls. Location - As close to the power controls as practicable. Actuation - Performance related - Design - Where fuel may be transferred from tank to tank or groups of tanks a positive means of indicating to the crew where the fuel is coming from and where it is going to shall be provided. Where fuel transfer is used to maintain the aircraft center of gravity, the fuel transfer control shall be designed to prevent the crew from inadvertently selecting a transfer condition which would cause the aircraft center of gravity to shift beyond limits, and a warning of such selection should it occur, shall be provided to the crew.

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5.3.3 Fuel dump control. Location - As close to the power controls as practicable. Actuation - Down or aft to dump fuel. Design - The fuel dump control shall be distinctly shaped to distinguish it from other fuel controls and a means shall be provided to prevent inadvertent selection of the "dump" position.

5.3.4 Inflight refueling.

5.3.4.1 Boom and receptacle system.

5.3.4.1.1 Inflight refueling switches: selector, reset, and manual override. Location - Easily accessible to the pilot(s) left hand while maintaining visual tanker aircraft reference. Actuation - Performance related.

5.3.4.1.2 Disconnect switch - Location - On the stick grip or on the control wheel opposite the pilot(s) throttle hand. Actuation - Performance related.

5.3.4.1.3 Indication lights. Location - Easily visible to the receiver aircraft pilot(s) while maintaining visual tanker aircraft reference. Design - Inflight refueling indicator lights shall be designed in accordance with MIL-STD-411 and shall have the following legend presentation:

READY -	A green light indicating that the receptacle slipway is locked in the "OPEN" position and ready for contact.
LATCHED -	A green light indicating that contact has been made.
DISCONNECT -	An amber light indicating that the tanker and receiver aircraft have separated.

5.3.4.2 Probe and drogue system. Location and actuation - Same as above. Design - A means of preventing inadvertent refueling probe extension shall be provided.

5.4 Fire fighting controls.

5.4.1 Engine emergency shut-down controls. Actuation of the engine emergency shut-down control shall perform all necessary fire extinguishing operations except the discharge of the agent.

(a) Location - On emergency panel, on a multifunction display, above the engine instruments, or on the overhead console if provided. A master fire warning indication shall be provided on the instrument panel in the 30° forward cone of vision.

(b) Actuation - Push button or toggle switch, protected where applicable. Actuation of the toggle switch shall be upward or forward to activate. "T" handle control knob - Pull to shut down affected engine. If used, the control knob shall incorporate a red light which is illuminated when the fire warning system for the area served by the control is activated. If night vision imaging system compatible lighting is required the light shall be in accordance with MIL-L-85762.

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5.4.2 Fire extinguisher and agent discharge control. Actuation of the agent discharge switch shall release the agent to the appropriate area selected by the fire emergency control.

(a) Location - On emergency panel, above the engine instruments, or adjacent to the engine emergency shut-down control.

(b) Actuation - Push button or toggle switch, protected where applicable. Actuation of the toggle switch shall be upward or forward to activate.

5.5 Electrical, engine start, COMM/NAV/IDENT and lighting controls.

5.5.1 Electrical system controls.

(a) Single pilot/tandem pilot. Location - Functionally grouped forward on the right console. Actuation - Performance related. Design - Battery and generator switches shall be operable by the pilot.

(b) Side-by-side pilot Location - Functionally grouped together forward on a console located central to both crewmembers. Actuation - Performance related.

5.5.1.1 Circuit protective devices (breakers).

(a) Single pilot/tandem pilot. Location - Inboard face of the right or left-hand console, functionally grouped together. Design - Only those circuit protective devices which directly affect safety of flight need be located so that they will be accessible in flight to the pilot or crew. The installation of the circuit breakers shall be such as to prevent inadvertent deactivation of the circuit.

(b) Side-by-side pilot. Location - Functionally grouped and located in the cockpit accessible to the responsible aircrew member. Design - Requirements for single pilot apply.

5.5.2 Engine start, primer, oil dilution controls.

(a) Single pilot/tandem pilot. Location - Grouped together forward on the right console. Actuation - Performance related. Design - Where air start and ground start switches are combined, the location shall be that of the air start switch.

(b) Side-by-side pilot. Location - Functionally grouped together forward on a console located central to both crewmembers. Actuation - Performance related.

5.5.3 Lighting controls (interior/exterior).

(a) Single pilot/tandem pilot. Location - Functionally grouped together on the right console, convenient to pilot. Actuation - Performance related. Design- For carrier aircraft, a master exterior light switch shall

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be located on the outboard side of the throttle grip or adjacent to the throttle. operable by the pilot with throttles set to take-off power and shoulder harness locked.

(b) Side-by-side pilot. Location - Functionally grouped on a console centrally located and convenient to both pilots. Actuation - Performance related. Design - Requirements for single pilot apply.

5.5.3.1 Landing/taxi light and searchlight switches.

(a) Single pilot/tandem pilot. Location - Adjacent to landing gear control or adjacent to the power control. Actuation - Performance related. Design - Separate switches shall be incorporated to control filament and movement of the light where a retractable light is used. The "ON" and "EXTEND" position of these switches shall be attained by movement in the same direction.

(b) Side-by-side pilot. Location - Adjacent to the landing gear control or adjacent to the power control. Actuation - Performance related. Design - Requirements for single pilot apply.

5.5.4 Primary voice communications (VHF, UHF) controls(s).

(a) Single pilot/tandem pilot. Location - On the left console aft of the power lever(s) or vertically high on the instrument panel and operable by the pilot's left hand, with harness locked. Actuation - Performance related. Design - The pilot's primary voice communications transmitter (MIC) switch shall be located on the power lever.

(b) Side-by-side pilot. Location - Aft of the power controls on the console or vertically on the instrument panel above and ahead of the power controls accessible to both pilots. Actuation - Performance related. Design - On wheel controlled aircraft, a primary voice communications transmitter (MIC) switch shall be located on the left-hand grip of the pilot's control wheel and on the right-hand grip of the copilot's control wheel. An additional (MIC switch for the pilot may be installed on the nose wheel steering control. On stick controlled aircraft, the MIC switch shall be located on the power lever(s).

5.5.4.1 Channel/frequency indication.

(a) Each crew member having control of voice communications shall be provided with an indication of channel/frequency active for each transmitter. This indication shall be located high on the instrument panel ahead of the crewmember(s) and should be within the primary cone of vision.

5.5.5 Intercommunication (ICS) controls.

(a) Single pilot tandem pilot. Location - On the right side or the cockpit easily operable by pilot's right hand. Actuation - Performance related. Design - Pilot shall have a transmitting (ICS) switch on the power lever. This function may be combined with the MIC switch specified in 5.5.4, in which case switch operation shall be forward or up for MIC and AFT or down

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for its. A center "off" position shall be provided. Switch action shall be momentary in the MIC and ICS positions.

(b) Side-by-side pilot. Pilot's selector control shall be located on the left console. Copilot's selector control on right console. In aircraft which do not have outboard consoles, these controls shall be located on the appropriate side of the center console. Actuation - Performance related. Design - on wheel controlled aircraft, pilot shall have transmitting (KS) switch on the left-hand grip of the control wheel. Copilot shall have transmitting (KS) switch on right-hand grip of control wheel. On stick controlled aircraft, design shall be the same as for single/tandem pilot. ICS and MIC switches may be combined as specified for single pilot.

5.5.6 NAV/AUTONAV/FLT MGMT controls.

(a) Single pilot/tandem pilot. Location - On the right side of the cockpit easily operable by pilot's right hand or on the Instrument panel located below the communication controls. Actuation - Performance related.

(b) Side-by-side pilot Location - Aft of the power quadrant and on a console located central to both crewmembers, or on the instrument panel accessible to both crewmembers. Actuation - Performance related.

5.5.7 Radar beacon (IFF/SIF) controls.

(a) Single pilot/tandem pilot. Location - On the instrument panel grouped with other communication and navigation controls or on either side of the cockpit, right hand side adjacent to the navigation controls preferable. Actuation - Performance related. Design - The IFF "IDENT" control shall be operable by the pilot's left hand with shoulder harness locked.

(b) Side-by-side pilot. Location - On a console readily accessible to both pilots adjacent to the navigation controls. Actuation - Performance related.

5.6 Armament controls.

5.6.1 Armament controls - General.

(a) Single/tandem pilot. Location - All necessary pilot operated armament controls shall be functionally grouped either in a separate armament panel forward on the left console. or on the left side of, or along the upper left edge of the instrument panel. Actuation - Performance related Design - All armament controls shall be operable by the pilot.

(b) Side-by-side pilot. Location - Functionally grouped forward on a console centrally located between each crew member. Actuation - Same as single pilot.

5.6.2 Weapon release controls.

5.6.2.1 Missile/gun firing switch. Location - At the right forefinger position on the control wheel or stick. Actuation - Squeeze to fire. Design - Actuation of the gun firing switch shall also start the gun camera.

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5.6.2.2 Bomb, rocket, torpedo, and external stores controls.

5.6.2.2.1 Normal release switch. - Location - At right-thumb position on the control stick grip or wheel. Actuation - Press to release or fire preselected components of ordnance load.

5.6.2.3 Emergency release of stores.

5.6.2.3.1 Master electrical jettisoning control. Location - Within Zone 1 as defined by MIL-STD-1333, and operable by the pilot's throttle hand. Actuation - Push to release. Design - The switch shall be of the guarded plunger type or pushbutton type.

5.6.2.3.2 Mechanical release of external stores. Location - Within Zone 1 as defined by MIL-STD-1333, and operable by the pilot's throttle hand. It shall be positioned that the pilot may apply maximum force while maintaining normal forward visibility out of the aircraft. Actuation: Pull to release. Design - If employed it shall be in addition to the electrical jettisoning control.

5.6.3 Weapon aiming controls.

5.6.3.1 Sight manual range controls. Location - On the throttle grip. Actuation - Turn clockwise or press for closing range.

5.6.3.2 Radar boresight/caging control. Location - On the throttle grip. Actuation - Depress to cage/uncage.

5.6.3.3 Target designator control. Location - On the throttle grip. Actuation - Up, down, left, right to slew cursor; depress to designate target.

5.7 Displays

5.7.1 Displays - General. Location - In accordance with Figures 1, 2, and 3. Display presentation shall be perpendicular to the operators normal line of sight whenever feasible and shall not be less than 45° from the normal line of sight, as illustrated in Figure 1 of MIL-STD-1472. Design - Display surfaces shall present information in a format to enhance pilot performance and effectiveness. Information shall be grouped factually with priority of placement being given to the most important parameters as determined by the primary mission of the aircraft. All electro mechanical and electronic displays when used together shall be optically compatible with the lighting environment of the cockpit.

5.7.2 Basic flight parameter(s) group. Location - Shall be grouped on the pilots centerline' at the top Of the instrument panel with minimum parallax and arranged in accordance-with MS33785, unless consideration of the following factors or analysis conducted in accordance with MIL-H-46855 dictates otherwise:

(a) The primary operational mission(s) of the aircraft.

(b) The specific type of instruments and/or instrument system(s) to be employed.

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(c) Size and shape of the instruments.

(d) Instrument panel size and configuration. When electronic display techniques are used, the displayed information shall be arranged in accordance with Figures 1 thru 4. Formats to be used shall be as specified by the acquiring activity.

(e) When electromechanical Instruments are used in single seat fighter/attack aircraft, the location of the vertical velocity Indicator shall be in accordance with Figure 4 (immediately to the right of the attitude Indicator).

5.7.3 Engine parameters. When electromechanical engine instruments are used, they shall be arranged in accordance with MS33634 and grouped in the following locations:

(a) Single pilot/tandem pilot.

(1) Air Force. Immediately to the right of the basic flight instrument group.

(2) Navy. Immediately to the left of the basic flight Instrument group .

(b) Side-by-side pilot. Forward of the center pedestal between the first and second pilot's panels. When electronic displays are used they shall be arranged in accordance with Figures 1 thru 4.

5.8 Location and arrangement of signals.

5.8.1 Light signals. Light signals located in or near the pilot's or co-pilot's flight instrument group shall be designed so as not to Interfere with the operation or readability of the instruments.

5.8.2 Arrangement Scheme. A priority arrangement scheme, when specified by the acquiring activity, shall be used so that the most critical condition will appear as follows:

(a) Vertical arrangement. In a vertical arrangement, the positions shall have priority of importance from top to bottom.

(b) Horizontal arrangement. In a horizontal arrangement, the positions shall have priority of importance from left to right. In all cases, related functions shall be located on the same line.

5.8.3 Warning signals.

(a) Single/tandem pilot. Visual warning signals should be installed within the pilot's 30° cone of vision. When space is limited or the required number of warning lights is excessive, warning lights may be grouped outside of the pilots' 30° cone of vision provided that a master warning signal(s) shall be located as specified in 5.8.3.1.

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(b) Side-by-side pilot. Warning signals shall be grouped between the pilots. Visual fire warning signals may be placed outside of the 30° cone of vision, provided that a visual master warning signal is installed within both pilots' 30° cone of vision.

(c) Other aircrew stations. Signals may be installed on the unit or component to which they relate or may be located within a group of other signal assemblies. When possible, visual warning signals shall be within the 30° cone of vision of the operator.

5.8.3.1 Master warning signals.

(a) Single/tandem pilot. The visual master warning signal shall be located within the pilot's 30° cone of vision.

(b) Side-by-side pilot. A visual master warning signal shall be installed on the upper portion of the instrument panel within each pilot's 30° cone of vision if the above criteria cannot be met with one signal assembly, then two master warning signals shall be installed.

(c) Suitable audio warning signals or audio master warning signals should be incorporated in accordance with the requirements of MIL-STD-411.

5.8.4 Caution signals.

(a) Single/tandem pilot. Caution signals shall be grouped at the lower right portion of the instrument panel below the instruments or on the forward portion of the right-hand console. The incorporation of side-arm flight controllers may prohibit placing the caution signals on the right-hand console. In this case, the location shall be approved by the acquiring activity.

(b) Side-by-side pilot. Caution signals shall be grouped at the lower portion of the center instrument panel below the instruments or on the center pedestal immediately aft of the power quadrant. The signals shall be visible to both pilots.

(c) Other aircrew stations. Caution signals may be installed on the unit or component to which they relate or may be located within a group of other signal assemblies.

5.8.4.1 Master caution signals.

(a) Single/tandem pilot. The visual master caution signal(s) shall be located within the pilot's 30° cone of vision, in the upper portion of the instrument panel.

(b) Side-by-side pilot. A visual master caution signal shall be installed on the upper portion of the instrument panel within each pilot's 30° cone of vision. If the above criteria cannot be met with one signal assembly, then two master caution signals shall be installed.

(c) A suitable audio caution or master audio caution signal should be incorporated in accordance with the requirements of MIL-STD-411.

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5.8.5 Advisory signals. Advisory signals shall be grouped by category or function where practical, or associated with a specific unit or component, and shall be so located that they can be observed from the operator's normal position.

5.8.6 Mechanical visual signals. Mechanical visual signals (flags and Indicators) shall be installed where required in the aircraft..

5.8.7 Radar altimeter. When electromechanical radar altimeters are used in single seat fighter/aircraft, the location of the altimeters shall be in accordance to Figure 4 (immediately to the right of the attitude indicator).

5.9 Miscellaneous controls and equipment.

5.9.1 Oxygen system controls and displays (including oxygen "ON" "OFF" valve, oxygen regulator with integral pressure gauge and flow indicator, liquid oxygen quantity).

(a) Single pilot/tandem pilot. Location - Right or left side, forward on console. Design - The Integral pressure gauge and flow indicator (when utilized) shall be placed in a position in order to be readily visible.

(b) Side-by-side pilot. Location - Outboard of each pilot, forward. Design - Requirements for single pilot apply.

5.9.2 Anti-G suit control.

(a) Single pilot/tandem pilot. Location - Aft on the left-hand side of the cockpit adjacent to the seat. Actuation - Performance-related.

(b) Side-by-side pilot Location Outboard of each pilot adjacent to the seat. Actuation - Performance-related.

5.9.3 Enviromental control systems and displays.

(a) Single pilot/tandem pilot. Location - On the right-hand console readily accessible to the pilot. Actuation - performance related.

(b) Side-by-side pilot. Accessible to the responsible crewmember. Actuation - performance related.

5.9.4 Shoulder harness lock.

(a) Single pilot/tandem pilot. Location - Forward on the left side of the seat or immediately adjacent thereto. Actuation - Forward to lock.

(b) Side-by-side pilot. Location - Forward on the left side of each seat or immediately adjacent thereto. Actuation - Forward to lock.

5.9.5 Seat adjustment controls.

(a) Location - On the right side of each seat or adjacent thereto. Actuation - Control actuation shall correspond to seat movement desired.

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5.9.6 Map stowage.

(a) Single pilot/tandem pilot. Location - Preferably right-hand side of pilot.

(b) Side-by-side pilot. Location - Two map stowage positions, one each on right and left console for the copilot and pilot, respectively.

5.9.7 De-icing, anti-icing, and pilot heat controls.

(a) Single pilot/tandem pilot. Location - On the right-hand console readily accessible. Actuation - Performance-related.

(b) Side-by-side pilot. Location - On the overhead panel readily accessible. Actuation - Performance related.

5.9.8 Bail-out alarm switch. Location - on emergency panel operable by the pilot's throttle hand. Design - The switch shall be appropriately guarded to prevent inadvertent actuation.

5.9.9 Emergency power system controls.

5.9.9.1 Ram air turbine control/emergency power unit/auxilliary power unit.

(a) Single pilot/tandem pilot. Location - Accessible and operable by the pilot's left hand with shoulder harness in place and locked. Actuation - Pull to release.

(b) Side-by-side. Location - Center console aft of power controls operable by both pilots. Actuation - Pull to release.

5.9.10 Checkoff lists.

(a) Single pilot/tandem pilot. Location - When required, the landing checkoff list shall be on the left of the instrument panel and the takeoff checkoff list on the right of the instrument panel or adjacent thereto. Design - Each takeoff and landing list shall be applicable to a particular aircraft model. They shall consist of a listing, in the order of normal operation, of only those items permanently fixed in the cockpit and the checking of operations which are necessary for safety of flight during takeoff and landing. Preferably, this list shall consist of a single column. Where multiple columns are used, the listings shall be numbered in order of operation. The listing shall not include operation or actuation data.

(b) Side-by-side pilot. Location - Permanently installed in such a position as to be clearly legible to both the pilot and copilot in their normal positions. If necessary, duplicate sets shall be used. Design - Requirements for single pilot apply.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This document is intended for use during the design of functional crew stations of military fixed wing aircraft to establish the location arrangement and actuation of controls and displays.

6.2 Issue of DODISS. When this is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1).

6.3 International interest. Certain provisions of this standard are the subject of international standardization agreements (NATO STANAGs 3217, 3218, 3219, 3220, 3221, 3258, 3341, 3359, 3370, 3692, 3705, 3869, and ASCC AIR STDs 10/12, 10/13, 10/14, 10/15, 10/16, 10/21, 10/22, 10/23, 10/25, 10/38, 10/44, 10/46, 10/70. When change notice, revision, or cancellation of this standard is proposed that will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.4 Subject term (key word) listing.

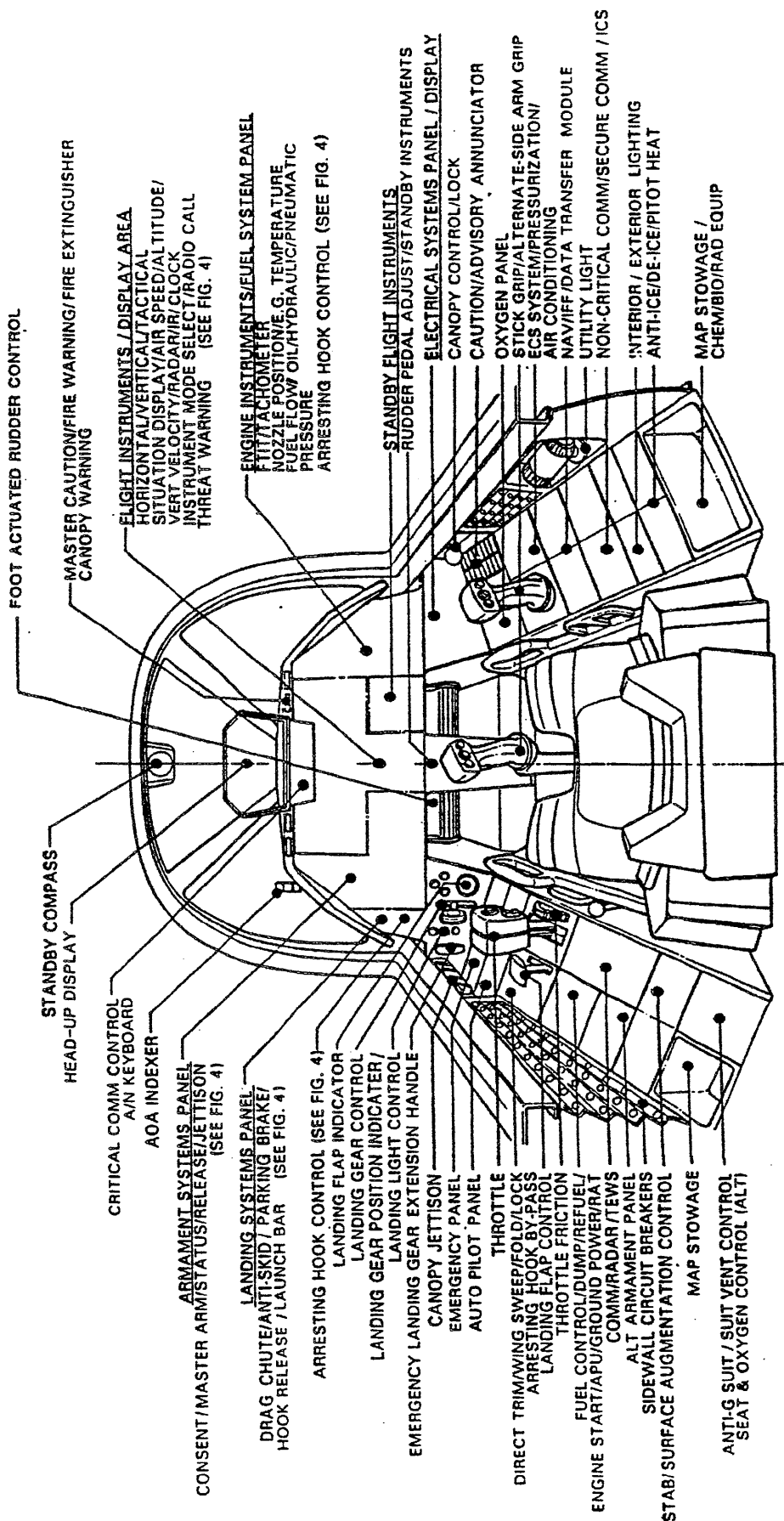
Alternate Signals	Ground
Clearance	Illuminated
Cockpit	Integrally
Controls	Legends
Emergency	Marking
Geometry	Panels
Flight	Vision (Interior)

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

Cutodians:
Army - AV
Navy - AS
Air Force - 11

Preparing activity:
Navy - AS
(Project No. 1510-0021)

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**FIGURE 1. COCKPIT ARRANGEMENT
 FIGHTER/ATTACK • SINGLE EJECTION SEAT**

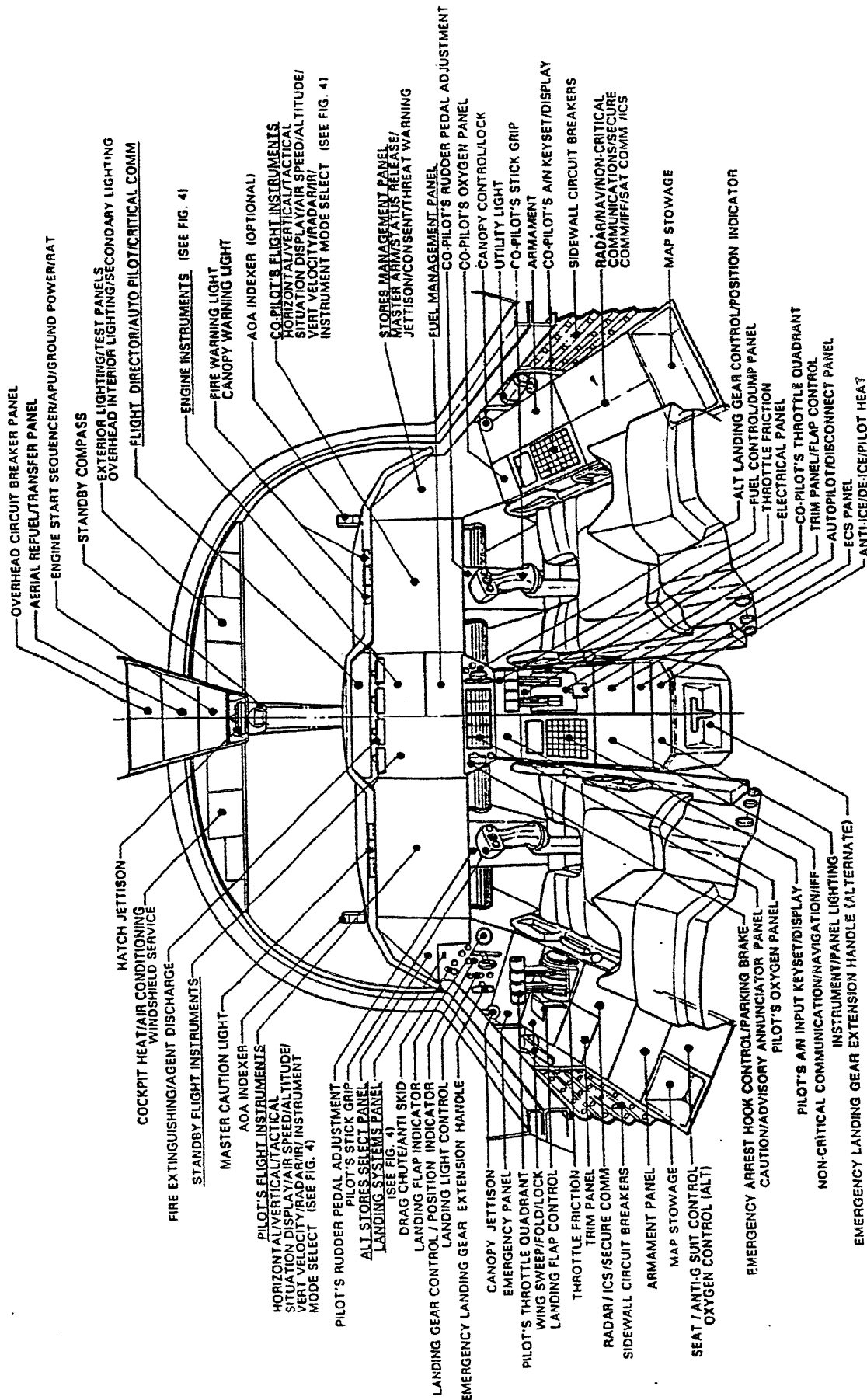


FIGURE 2. COCKPIT ARRANGEMENT
 ATTACK/BOMBER/ASW
 SIDE-BY-SIDE • EJECTION SEATS

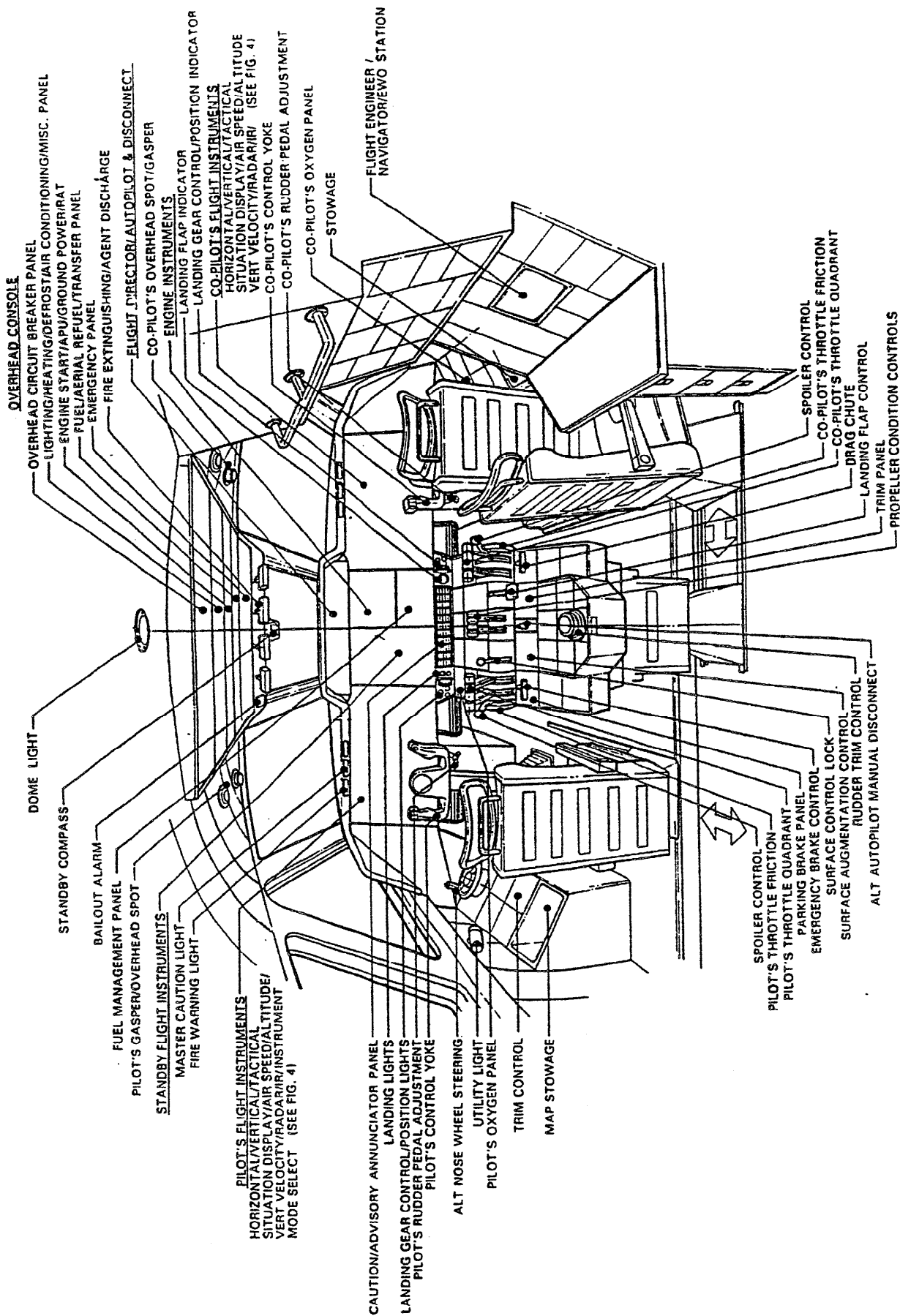


FIGURE 3. COCKPIT ARRANGEMENT

PATROL/CARGO/TRANSPORT/AEW
 SIDE-BY-SIDE/MULTI-FLIGHT CREW/NON-EJECTION SEATS

