MILITARY SPECIFICATION

AVIONICS SYSTEM PERFORMANCE SPECIFICATION

FOR

A-4M/AV-8 BOMBING SET, ANGLE RATE

AN/ASB—19(V)

This specification has been approved 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 performance, installation, test and demonstration requirements for the Avionics System and equipment for the AN/ASB-19(V) Angle Rate Bombing Set (ARBS), when integrated into the A-4M or AV-8 aircraft weapon delivery systems.

1.2 System Function - The ARBS, when integrated into the A-4M or AV-8 aircraft weapon delivery systems, performs weapon delivery and fire control functions.

1.3 Classification - The ARBS equipment consists of the following:

Subsystem and Applicable Specification	Subsystem Unit(s) and Type Designations
Dual Mode Tracker (DMT) MIL-D-85056	Receiver-Processor, R-2028/ASB-19(V) Converter, Signal Data, CV-3393/ASB-19(V) Heat Exchanger, HD-1005/ASB-19(V)

Comments or recommendations which may be of use in improving this document may be sent to the preparing activity when a self-addressed Standardization Document Improvement Porposal (DD Form 1426) appears at the end of this document, or by letter addressed to the cognizant activity.

FSC 1280

Weapon Delivery Computer (WDC) MIL-W-85057	Computer, Digital, CP-1276/ASB-19(V) Converter, Interface Unit, J-3429/ASB-19(V)
Control Unit Subsystem (CUS) MIL-C-85058	Control, Bombing Set, Angle Rate, C-10122/ASB-19(V) Control-Indicator, ID-2085/ASB-19(V)

1.4 Associated Equipment - The equipment associated with ARBS consists of the following:

Equipment	AN Designation or Procurement Spec
A-4M Aircraft Associated Equipment, AN/ASB-19(V)1, ICD 7941503	
Attitude Reference System	AN/AJB-3A
Attitude Director Indicator (ADI)	ID-811/AJB-3A
Relative Wind-Transducer (RWT)	DAC-766058-503
Automatic Weapon Release System	AN/AWE-1
Normal Accelerometer	ABU-13/A
TV Monitor	IP-936-AXQ
Air Data Computer	AXC-666A-102
Head-Up Display/Weapon Data Insert Panel	AN/AVQ-24B
Aircraft Armament Panels and Controls	DAC ICD-7941503
AV-8A Aircraft Associated Equipment, AN/ASB-19(V)2, ICD A 2598	
Attitude Reference System	ASK-32/A24G-39
Bearing Direction Heading Indicator (BDHI)	ID-1013/A
Angle-of-Attack Transducer	Ferranti P/N FE5V/56Z80
Armament Panels and Controls	To be determined (TBD)
Hand Controller	TBD
Normal Accelerometer	ABU-13A
TV Monitor	IP-936-AXQ
Air Data Computer	12002KHA/1
Head-Up Display	TBD
Weapon Data Insert Panel	TBD

2. APPLICABLE DOCUMENTS

2.1 Government Documents - Unless otherwise specified the following Government documents of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-C-172C Amendment I 16 April 1965	Cases; Bases; Mounting; and Mounts Vibration (for Use with Electronic Equipment in Aircraft).
MIL-B-5087	Bonding, Electrical, and Lighting Protection, for Aerospace Systems.
MIL-E-5400	Electronic Equipment, Aircraft, General Specification for.
MIL-E-6051D 7 September 1967	Electromagnetic Compatibility. Requirements, Systems.
MIL-C-6781	Control Panel, Aircraft Equipment, Rack or Console Mounted.
MIL-F-7179	Finishes and Coatings, Protection of Aerospace Weapons Systems, Structures and Parts, General Specification for.
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for.
MIL-M-7793	Meter, Time Totalizing.
MIL-I-8500	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles.
MIL-E-17555	Electrical and Electronic Equipment, Accessories and Repair Parts, Packaging and Packing of.
MIL-T-18303	Test Procedures, Preproduction Acceptance, and Life for Aircraft Electronic Equipment, Format for.

MIL-N-18307	Nomenclature and Nameplates for Aeronautical Electronic and Associated Equipment.
MIL-M-24041	Molding and Potting Compound, Chemically Cured Polyurethane (Polyether-Based).
MIL-C-26482	Connector, Electric, Circular, Miniature, Quick Disconnect, Environment Resisting.
MIL-M-38784	Manuals, Technical: General Requirement for Preparation of.
MIL-P-46843	Printed Circuit Assemblies, Design and Production of.
MIL-H-46855	Human Engineering Requirements for Military System Equipment and Facilities.
MIL-P-55640	Printed Wiring Boards, Multilayer (Plated-Through Hole).
MIL-C-81511	Connector, Electrical, Circular, High Density, Quick Disconnect; Environment Resisting and Accessories, General Specification for.
MIL-D-85056(AS)	Dual Mode Tracker for the Angle Rate Bombing Set AN/ASB-19(V).
MIL-W-85057(AS)	Weapon Delivery Computer for the Angle Rate Bombing Set AN/ASB-19(V).
MIL-C-85058(AS)	Control Unit Subsystem for the Angle Rate Bombing Set AN/ASB-19(V).
MIL-W-85114(AS)	Weapon Delivery Characteristics for A-4M/AV-8 Bombing Set, Angle Rate AN/ASB-19(V).

MIL-T-85115(AS)	Target Characteristics and Sensitivity Requirements of the Dual Mode Tracker for Bombing Set, Angle Rate AN/ASB-19(V).

Naval Air Systems Command
(Code Ident 30003)

AS-4042	Critical Item Product Fabrication Specification for Printed Wiring Boards.
WS-6536	Procedures and Requirements for Preparation and Soldering of Electrical Connections.

Naval Ordnance Systems Command
(Code Ident 10001)

WS-8506	Computer Programing Documentation Standard.

STANDARDS

Military

MIL-STD-100	Engineering Drawing Practices.
MIL-STD-130	Identification Marking of US Military Property.
MIL-STD-198	Capacitors, Selection and Use of.
MIL-STD-454	Standard General Requirements for Electronic Equipment.
MIL-STD-461 Notice 3 1 May 1970	Electromagnetic Interference Characteristics Requirements for Equipment.
MIL-STD-462 Notice 2 1 May 1970	Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-470	Maintainability Program Requirements (for Systems and Equipments).

MIL-STD-471	Maintainability Demonstration.
MIL-STD-480	Configuration Control-Engineering Changes, Deviations and Waivers.
MIL-STD-481	Configuration Control-Engineering Changes, Deviations and Waivers (Short Form).
MIL-STD-680	Contractor Standardization Plans and Management.
MIL-STD-704A Notice 3 11 April 1973	Electric Power, Aircraft, Characteristics and Utilization of.
MIL-STD-749	Preparation and Submission of Data for Approval of Nonstandard Electronic Parts.
MIL-STD-756	Reliability Prediction.
MIL-STD-781B	Reliability Tests: Exponential Distribution.
MIL-STD-785	Reliability Program for Systems and Equipment Development and Production.
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-810B Notice 4 21 September 1970	Environmental Test Methods for Aerospace and Ground Equipment.
MIL-STD-831	Test Reports, Preparation of.
MIL-STD-882	System Safety Program for Systems and Associated Subsystems and Equipments, Requirements for.
MIL-STD-883	Test Methods and Procedures for Microelectronics.

MIL-STD-1375	Provisioning, Initial Support, General Requirements for.
MIL-STD-1378	Standard Hardware Program Modules, Requirements for Employing.
MIL-STD-1390	Level of Repair.
MIL-STD-1472	Human Engineering Design Criteria for Military System Equipment and Facilities.
MIL-STD-1552	Provisioning Technical Documentation, Uniform DOD Requirement for.
MIL-STD-1495	Multilayer Printed Wiring Boards for Electronic Equipment.
MIL-STD-1561	Provisioning Procedures, Uniform DOD.
MIL-STD-2074(AS)	Failure Classification for Reliability Testing.

OTHER PUBLICATIONS

Naval Ordnance Systems Command
(Code Ident 10001)

WR-64	Age Controls of Age Sensitive Elastomeric Parts.

Naval Air Systems Command
(Code Ident 30003)

AR-5	Microelectronic Devices Used in Avionics Equipment, Procedures for Selection and Approval of.
AR-10A Notice 1 16 June 1969	Maintainability of Avionics Equipment and Systems, General Requirements for.

AR-104	Reliability Development Test for Avionic Equipment.
AVMP-184	Maintenance Plan for Angle Rate Bombing Set (ARBS AN/ASB-19(V)).
AV-093	Integrated Logistics Support Plan for Angle Rate Bombing Set, AN/ASB-19(V).

Handbooks

MIL-HDBK-217	Reliability Stress and Failure Rate Data for Electronic Equipment.

Notebooks

RADC-TR-67-108	RADC Reliability Notebook, Volume II.

Technical Manuals

Naval Air Systems Command (Code Ident 30003)

NAVAIR 01-1C-1T-1	Tactical Manual Ballistic Table.
NAVAIR 01-40AVM-1	A-4M NATOPS Flight Manual.
NAVAIR 01-40AV-1T	A-4/TA-4 Tactical Manual.
NAVAIR 01-AV8A-1	AV-8A NATOPS Flight Manual.
NAVAIR 01-AV8A-1T	AV-8A Tactical Manual.

2.1.1 Availability of Government Documents -

(1) When requesting specifications, standards, drawings, and publications, refer to both title and number. Copies of applicable specifications required by contractors in connection with specific procurement functions may be obtained upon application to the Commanding Officer, Publications and Forms Center, Code 105, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

(2) Copies of this specification may be obtained upon application to the Naval Air Systems Command, Navy Department, Washington, D.C. 20361, (Navy) Attention: Avionics Division, AIR-54932.

2.2 Non- Government Documents - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

DRAWINGS

McDonnell-Douglas Corporation
(Code Ident 88277)

A 2598	Interface Control Document for AV-8A/A-4M Air Vehicle IWDS.
7941503	ICD for A-4M Air Vehicle/IWDS.

Hughes Aircraft Company
(Code Ident 82577)

ARBS 1027C	ARBS/A-4M Physical Interface Data.
3366000-310	ARBS/A-4M Aircraft Wire List.
3366000-350	ARBS Electrical Interface Data.

2.2.1 Availability of Non-Government Documents - Non-Government documents shall be available from the following sources:

(1) When requesting specifications, standards, drawings, and publications, refer to both title and number. Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

(2) Requests for copies of McDonnell-Douglas Corporation and Hughes Aircraft Company documents should be addressed to the contracting officer.

3. REQUIREMENTS

3.1 System definition - The ARBS, when integrated into the aircraft weapon delivery system, is intended to provide the A-4M and AV-8 aircraft with an improved capability to find and destroy enemy targets. The primary functions are first-pass target acquisition and weapon delivery. Freefall weapon delivery

computations are based upon the angular rate bombing concept. This concept uses an automatic target tracker to provide measurements of aircraft-to-target line-of-sight (LOS) angle and inertial angular rate information as inputs to the weapon delivery computer. Using the LOS information provided by the tracker, a computer performs the weapon delivery solution and provides steering information via the head-up display (HUD) to the pilot. The pilot has the option of either automatic or manual weapon release. Ballistics algorithms developed for weapon delivery computations will accomplish accurate and effective delivery of a wide variety of freefall ordnance, rockets, cannon projectiles, Shrike and laser-guided bombs. With a dual-mode tracker, either laser or television information may be used as sensor inputs. Additionally, the tracker can automatically search, acquire, and track laser designated targets during Forward Air Controller (FAC) operations to provide first-pass target acquisition.

The ARBS using the dual-mode automatic target tracker and angular rate bombing concepts will therefore enhance the overall A-4M/AV-8 attack capability by performing:

a. Automatic first-pass acquistion, tracking and attack of laser designated target.

b. Automatic tracking of visual (TV) targets.

c. Highly accurate daytime deliveries of unguided free-fall ordnance against a wide variety of laser designated or visual targets.

d. Comparable high delivery accuracy at night against laser designated target.

The ARBS, when integrated into the aircraft weapon delivery system, shall provide weapon delivery capability for all freefall ordnance normally carried and delivered by the aircraft, and may be used for search and acquisition functions as part of laser guided missile operations.

The ARBS is not required for missions such as ground controlled bombing, dispensing of spray or smoke, delivery of special weapons, and some other special miscellaneous missions. The aircraft will retain these existing capabilities, as alternative system configurations.

3.1.1 General Description - The aircraft weapon system is composed of major functional areas, each consisting of one or more subsystems and subsystem elements, as shown in Table I. The equipment covered by this specification consists of the Angle Rate Bombing Set, AN/ASB-19(V).

Table I. ARBS/Aircraft Weapon System Functional Areas, Subsystems and Elements.

ARBS Functional Area	Subsystems	Subsystems Elements
ARBS AN/ASB-19(V)	Dual-Mode Tracker (DMT)	Receiver-Processor (RP) R-2028 Signal Data Converter (SDC) CV-3393 Heat Exchanger (HEU) HD-1005, Cooling Hose Assy, Desiccant Assy
	Weapon Delivery Computer (WDC)	Digital Computer (DC) CP-1276 Converter-Interface Unit (CIU) J-3429
	Control Unit Subsystem (CUS)	Control, Bombing Set, Angle Rate C-10122 Control-Indicator (C-I) ID-2085
	Software	Operational Flight Program
Head-Up Display	Head-Up Display, AVQ-24B	Digital Data Computer (DDC) Digital Display Indicator (DDI) Gyro-Accelerometer Unit (GAU) Night Filter Assembly HV Power Supply (HVPS) Computer Controls (CC) Video Amplifier (VA) Weapon Data Insert Panel (WDIP)
Aircraft Sensors	Attitude Reference System (ARS) Air Data Computer (ADC) Normal Accelerometer (AN) Angle-of-Attack Transducer TACAN	Compass Control Panel 1/ Compass Adapter 1/ Electronic Control Amplifier 1/ Vertical Reference Gyro 1/ Air Data Computer/Sensors 1/ Normal Accelerometer 1/ Angle-of-Attack Transducer 1/
Armament Systems	Armament Fire Control	Armament Control Panel 1/ Weapon Release Control Panel 1/ Weapon Release Programmer 1/
	Racks/Launchers	Bomb Racks 1/ Missile Launchers 1/ Gun Pods 1/ Rocket Pods 1/
Aircraft Controls and Displays	Controls and Displays	Video Monitor 1/ Control Stick 1/ Throttle/Hand Controller 1/ Attitude Director Indicator (ADI) 1/

1/ Existing Aircraft Equipment not covered by this specification

3.1.2 Missions - One of the roles of Marine air is to deliver a wide range of ordnance in support of the ground forces. In this role, attack missions will be performed in Close Air Support (CAS), Deep Air Support (DAS), Armed Reconnaissance (ARREC), and missions involving the Shrike Guided Missile. Additionally although air defense is not a primary role for the A-4M or AV-8, air-to-air gun fire control is required for self-defense. A brief description of the three primary missions is included in Section 6.

3.1.2.1 Mission Phases - A typical A-4M or AV-8 mission sequence is as follows:

a. Navigation ingress to the target area.

b. Target search.

c. Target acquisition and identification.

d. Attack.

e. Recovery.

f. Navigation for return to base (egress from target area).

The ARBS, when integrated into the aircraft weapon delivery system, shall perform the mission functions of search, acquisition, and attack (weapon delivery). Accurate weapon delivery establishes the primary overall system performance requirements for the system. The correspondence between the various aircraft mission phases and the aircraft weapon delivery system functional areas are shown in Table II.

3.1.2.2 System Capabilities - The ARBS, when integrated into the aircraft weapon delivery system, shall provide the following capabilities:

a. Provide the attack aircraft with the capability for first pass attack capability against laser designated targets. In attaining this capability, the navigation capability of the aircraft becomes relatively important, particularly when missions involve long-range operations. The current navigation capability of the aircraft is limited by TACAN position accuracy or pilot visual sighting and identification of known landmarks. Navigational uncertainty must be accounted for in the design of the automatic laser target acquisition function of the DMT. The initial design of the system shall include growth provisions for navigational capability.

Table II. Mission Phases and Aircraft Weapons Delivery System.

ATTACK MISSION PHASES	ARBS TRACKER	ARBS COMPUTER/OFP	HEAD UP DISPLAY	AIRCRAFT SENSORS	ARMAMENT SYSTEM	CONTROLS/DISPLAYS
NAVIGATION, INGRESS TO TARGET, EGRESS FROM TARGET	WARMUP, OPER AND TEST AS SEL BY PILOT	PROVIDES NAV DISPLAY COMPUTATIONS	DISPLAYS HEADING ATTITUDE, SPEED, ALT ADL (OR A/C SYMBOL)	TACAN PROVIDES BDHI STEERING	AS SEL BY PILOT	BDHI NAV "FLY TO" DISPLAY
TARGET SEARCH	AUTO LST SEARCH MAN TV SEARCH	PROVIDES SCAN CONTROL AND STABILIZED PITCH DEPRESSION ANGLE TO TRACKER PROVIDES HUD AIMPOINT AND TPI SYMBOLOGY	DISPLAYS SEARCH PATTERN (TRACKER AIMPOINT/TPI)	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	AS SEL BY PILOT	PILOT SELECTS LST SCAN AND DEPRESSION ANGLE OR REPOSITIONS TV CAGE POSITION
TARGET ACQUISITION LST	AUTO ACQUIRE; PROVIDES LOCKON VALID TO COMPUTER		SYMBOLOGY INDICATES VALID LOCKON DISPLAYS TPI/AIMPOINT DISPLAYS WPN DEL SYMBOLOGY AFTER L/O	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	ARMAMENT SELECTION MADE BY PILOT	PILOT AFFIRMS ACQUISITION SELECTS ARMAMENT SWITCHING
TARGET ACQUISITION TV	-LOCKON TO TARGET UPON DESIGNATE COMMAND BY PILOT -SLEW CONTROL OPTIONAL	PROVIDES GIMBAL CAGE POSITION CONTROL TO DMT	DISPLAY DMT AIMPOINT	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	ARMAMENT SELECTION MADE BY PILOT	PILOT ACQUIRES TARGET VISUALLY COMMANDS LOCKON (DESIGNATE) SLEW CONTROL OPTIONAL
ATTACK	TRACKS TARGET PROVIDES ANGLES AND ANGULAR RATES TO COMPUTER	PROVIDES FILTERING AND RATE FEEDBACK TO TRACKER PROVIDES WPN DEL STEERING INFO TO HUD	DISPLAYS WPN DEL AND STEERING SYMBOLOGY	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	ARMAMENT SELECTION MADE BY PILOT	PILOT CONTROLS AIRCRAFT DURING TRACKING AND STEERING; OPTIONAL ADI AZIMUTH STRG
WEAPON RELEASE	TRACKS TARGET PROVIDES ANGLES AND ANGULAR RATES TO COMPUTER	GENERATES (OPTIONAL) AUTO RELEASE PULSES PROVIDES RELEASE AND BREAK WARNING DISPLAYS	DISPLAY RELEASE AND BREAK WARNING	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	-ROUTE FIRE PULSES TO STATIONS SELECTED AND IN PRIORITY -LAUNCH WEAPONS	PILOT PROVIDES AUTO OR MAN FIRE COMMANDS
RECOVERY/REATTACK	RETURN TO INITIAL CONDITIONS	RETURN TO INITIAL CONDITIONS -OR- PROVIDE DEAD-RECKONING RETURN TO TARGET (WITH TRACKER SCAN CONTROL	RETURN TO INITIAL CONDITIONS -OR- DISPLAY TPI AND AZIMUTH STEERING	PROVIDES ATTITUDE AND AIR DATA INFO TO COMPUTER AND TRACKER	RETURN TO INITIAL CONDITION	PILOT STEERS FOR REATTACK

b. Provide the aircraft pilot with an enhanced capability for visual recognition and identification of the potential target. Direct visual target detection remains the primary method of non-designated target acquisition but use of the DMT television camera and the aircraft video monitor as a backup aid shall be considered in the system design.

c. Provide the capability for laser target acquisition and weapon delivery during day or night operations. Normal visibility conditions shall apply but satisfaction of this requirement shall not be predicated on natural or artificial lighting conditions which would allow use of the television tracker during the attack phase.

d. Provide the capability for angular rate bombing weapon delivery for freefall unguided ordnance against TV and laser designated targets. Weapon delivery accuracy requirements are specified in MIL-W-85114. Target characteristics are defined in MIL-T-85115.

e. Provide the capability for accurate backup delivery modes in the event that a failure occurs in the ARBS tracker.

f. Provide for automatic release delivery of Shrike Guided Missiles. Barometric range computation is performed to establish in-range and release conditions. Appropriate delivery steering information is presented to the pilot on the head-up display and ADI.

g. Provide the aircraft pilot with either automatic or manual weapon release modes selectable by him during the attack phase.

h. Provide for improved delivery accuracy of gun projectiles and rocket ordnance.

i. Retain the capability for delivery of all ordnance that the A-4M and AV-8 can currently deliver as specified herein.

j. Minimize the pilot workload during the target acquisition and attack phases.

k. Maximize, to the greatest extent possible, the capability of the pilot to perform all portions of the attack in a head-up manner.

l. Minimize the time required to execute the attack.

3.1.2.3. Operational Capability - Normal operation within the total attack capability of the A-4M and AV-8 aircraft is required as defined in the A-4M NATOPS Flight Manual, NAVAIR 01-40AVM-1, the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T, the AV-8A NATOPS Flight Manual, NAVAIR 01-AV8A-1, and the AV-8A Tactical Manual, NAVAIR 01-AV8A-1T. Generally these limits are:

Altitude:	0 - 45,000 feet
Attack speed:	250 - 550 knots indicated airspeed (KIAS)
Attitude:	Unrestricted
Attack maneuvers:	Dive glide, dive toss, laydown, loft, over-the-shoulder (OTS)
Normal acceleration:	+7 to -1 gravity units (g)

The ARBS, when integrated into the aircraft weapon delivery system, shall not restrict operations of the airplane in any operational environment. The ARBS shall be capable of providing fire control with mixed loads, establishing display priorities, and providing visual warning of improper armament selection.

3.1.2.4 Operational Mission Conditions - For purposes of this specification, the operational mission is defined as a 2-hour mission, for both the A-4M and AV-8 aircraft. The conditions under which the ARBS equipment must operate over the 2-hour mission are defined as follows:

a. Catapult launch or VTOL (AV-8) take off (NAV Mode).

b. Aircraft high altitude flight of 45 minutes (NAV Mode).

c. Aircraft ingress to target and high-speed maneuvering prior to attack, of 12 minutes (TV/LST Mode).

d. Weapon Delivery of 6 minutes (TV/LST Mode).

e. Aircraft egress from target at high-speed, of 12 minutes (NAV Mode).

f. Return to base at any altitude, in 45 minutes (NAV Mode).

g. Trap recovery or VTOL (AV-8) landing upon return to base (NAV Mode).

In addition to the above mission conditions, Marine operations will require system readiness and operations in short-term launch alert-to-target situations.

The ARBS will be required to operate satisfactorily, within 5 minutes, when subjected to ground ambient atmospheric temperatures between -26 degrees Celsius (°C) and 50°C. Tracking of nominal TV and LST targets specified by MIL-T-85115 shall be required for acceptable operation. Tracking of low light level TV and low intensity LST targets shall not be required until completion of the specified warm-up period. Specified operation in the built-in-test (BIT) mode shall not be required until completion of the specified warm-up period. Degraded DMT performance will be permitted when the mission requirements dictate tracking operation prior to the allowable warm-up period specified by MIL-D-85056.

3.1.2.5 Weapons List - The A-4M and AV-8 are equipped to carry a wide variety of ordnance. A partial listing of weapons is shown in Table III. Mixed loads may be carried on some missions. Detailed listing of weapons and loading options may be found in the A-4M and AV-8 Tactical Manuals.

3.1.2.6 Weapon Launch Envelopes and Release Conditions - A generalized operational envelope for weapon delivery is shown in MIL-W-85114(AS). In addition, the system shall be capable of the long range delivery of laser guided bombs (in cooperation with FAC designation). Typical (not maximum) CAS weapon delivery envelopes are shown in Figures 1, 2, and 3. The ARBS shall impose no restrictions on the weapon release parameters that are not inherently due to weapon characteristics, aircraft performance limitations, or HUD field-of-view (FOV) limits.

3.1.3 Threat - For purposes of this specification, the threat is defined as the scenario of targets against which the system is intended to operate and the adversities associated with the capability of the total aircraft weapon system to find and destroy enemy targets. Table IV lists various targets for each primary mission in relative order of importance based on threat and frequency of occurrence.

Table III. A-4M/AV-8 Weapon List.

Weapon	Remarks
LDGP Bombs	
Mk 81 Mod 1	Conical Fin: E
Mk 81 Mod 1	Conical Fin: M
Mk 81 Snakeye	Unretarded: M
Mk 82 & Mods	Conical Fin: E
Mk 82 & Mods	Conical Fin: M
Mk 82 Snakeye	Unretarded:
Mk 83 & Mods	Conical Fin: E
Mk 83 & Mods	Conical Fin: M
Mk 84 Mod 1	Conical Fin: M, E
HDGP Bombs	
Mk 81 Snakeye	Retarded
Mk 82 Snakeye	Retarded
Mk 83 Snakeye	Retarded
Destructors	
DST Mk 36	Retarded
DST Mk 40	Retarded
Fire Bombs	
Mk 77 Mods 1, 2, 4	
Practice Bombs	
Mk 76 Mod 5	With lug
Mk 89	
Mk 106 Mod 4	
Cluster Bombs	
Mk 20 Mods 2, 3	Rockeye II (1.2 sec and 4.0 sec)
CBU-59/B	APAM (1.2 sec and 4.0 sec)
CBU-55A/B	Improved FAE
CBU-24C/B	
Guided Bombs	
Mk 82 LGB	
Mk 83 LGB	
Mk 84 LGB	
Walleye (I/II)	
Rockets	
2.75" FFAR	
5.0" Zuni	
Guns	
GPU-2A (20 millimeter (mm))	
Mines	
Mk 36 & Mods	
Mk 52 Mods 1, 6	
Mk 56 Mod 0	
Guided Missiles	
AIM-9D/E	Sidewinder
AGM-45A	Shrike

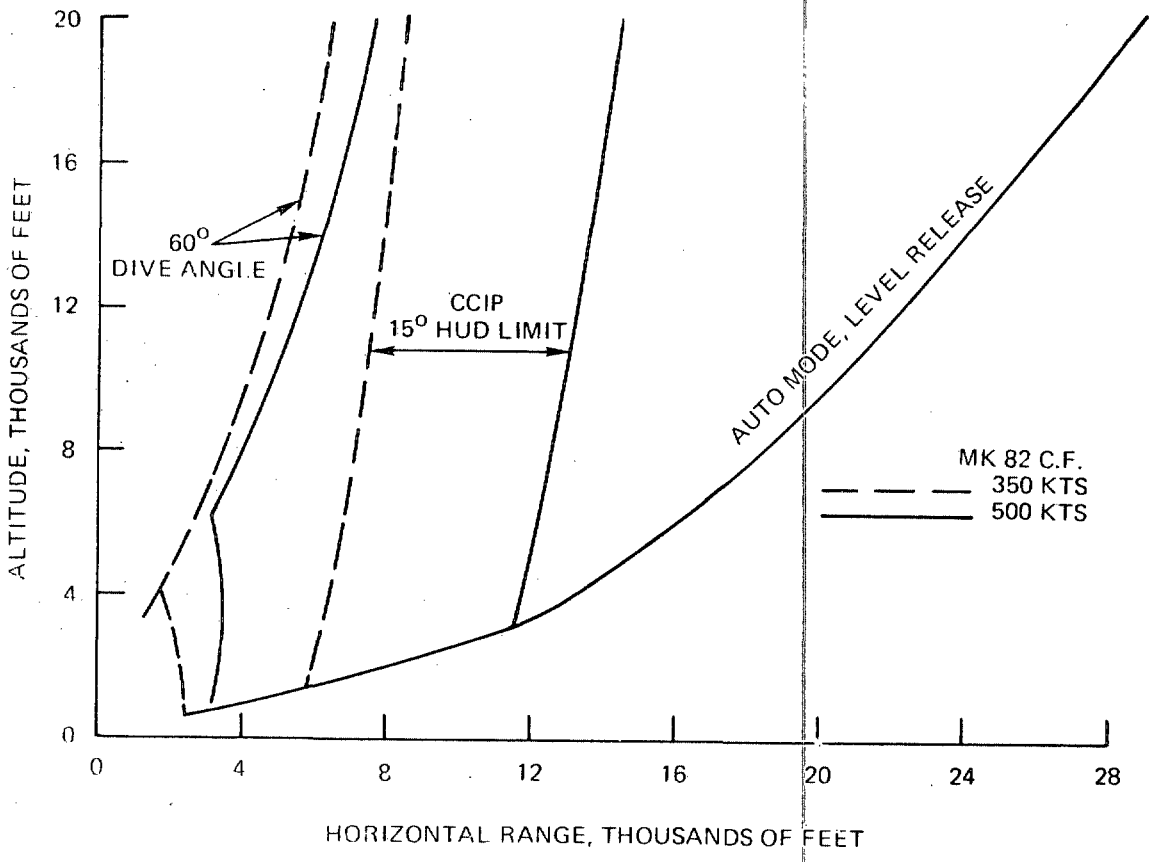


Figure 1. A-4M/AV-8 CAS Low Drag Bomb Release Envelope.

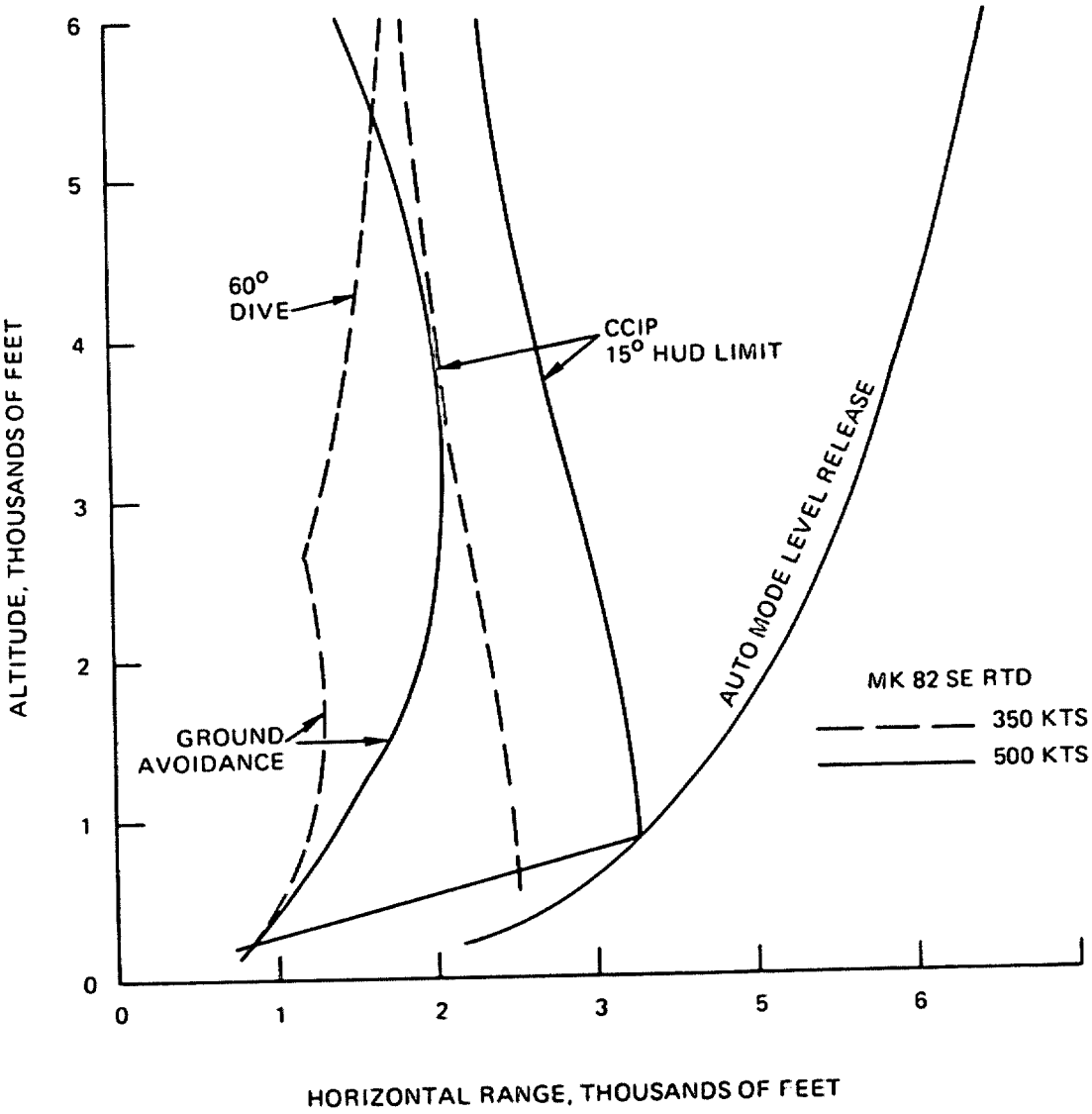


Figure 2. A-4M/AV-8 Retarded Bomb Release Envelope.

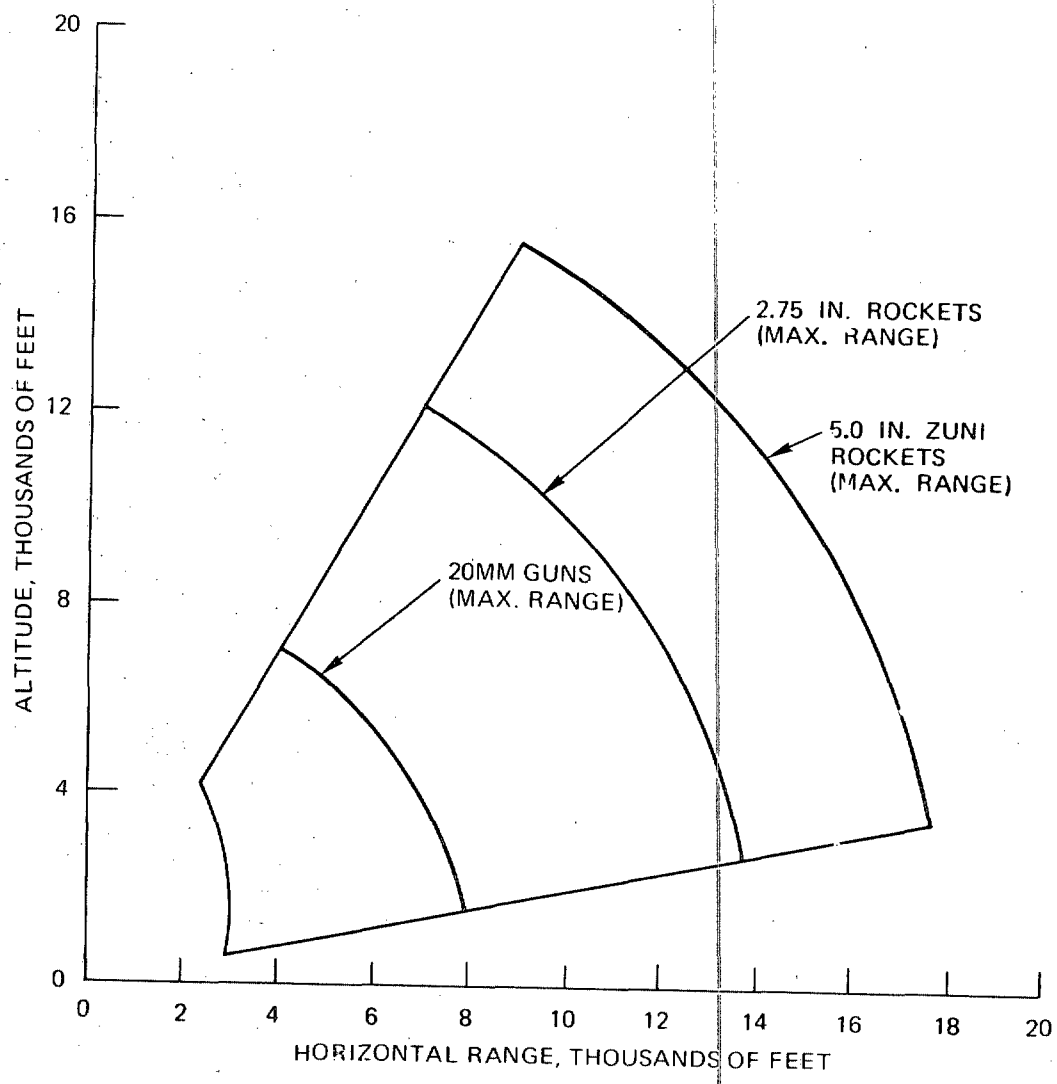


Figure 3. A-4M Guns and Rockets Delivery Envelopes (400-550 KTS)

Table IV. Potential Targets.

Mission	Targets
Close air support	Tanks (T-54) Field artillery (57 mm ZIS-2) Rockets and launchers 9 (140 mm) Armored assault guns (SU-85/100) Armored personnel carriers (BTR-152) Personnel (5 x 10m prone 5-min. assault) (5 x 10m Foxhole 30-sec defense) Field fortifications (bunker, pillbox)
Deep air support (strike)	Antiaircraft artillery (S-60) Defense missiles (SA-2) Airfield Parked aircraft Rockets and launcher (FROG-4) Field artillery (100 mm M55) Tank parks (T-54) Port facilities Supply dump Field fortifications Bridges Buildings
Armed reconnaissance/ interdiction	Komar WBLC Trucks (ZIL-157) Tanks (PT-76) Supply cache Parked aircraft Roads Railroads Bridges

3.1.4 System Diagrams - Diagrams required for the ARBS shall be as specified herein.

3.1.4.1 System Functional Block Diagram - Figure 4 indicates the basic flow of information between aircraft weapon delivery system functional areas. Function description and compatibility requirements for the subsystem elements shown are specified in the remainder of 3.1 and 3.7.

3.1.5 Interface Definitions - Functional and physical interfaces for the ARBS, when integrated into the aircraft weapon delivery system, are defined in the following paragraphs.

The interface and installation characteristics that exist between the ARBS and the A-4M, AV-8A and AV-8B aircraft are defined in the Interface Control Document (ICD) for each aircraft. Aircraft interface requirements have been established using the following assumptions:

a. The A-4M interface requirements are defined in ICD 7941503.

b. The AV-8A interface requirements are defined in A 2598.

c. The AV-8B interface requirements are defined in [TBD].

d. The TV Monitor used in each aircraft will have the same input signal characteristics as those specified for the A-4M.

e. The ARBS Control Unit Subsystem will be identical for the A-4M and AV-8A aircraft; the CUS is not required for the AV-8B.

f. The WDC subsystem will be identical for the A-4M and AV-8A aircraft, except for the electrical interface and cooling system provisions (see items g and h); the ARBS WDC subsystem is not required for the AV-8B aircraft.

g. The Digital Computer will be identical for the A-4M and AV-8A aircraft; cooling fans may be removed for AV-8A cooling provisions.

h. The Computer Interface Unit (CIU) will be unique (and have unique part numbers) for the A-4M and AV-8A aircraft, because of unique electrical interface requirements; cooling fans may also be removed for AV-8A cooling provisions.

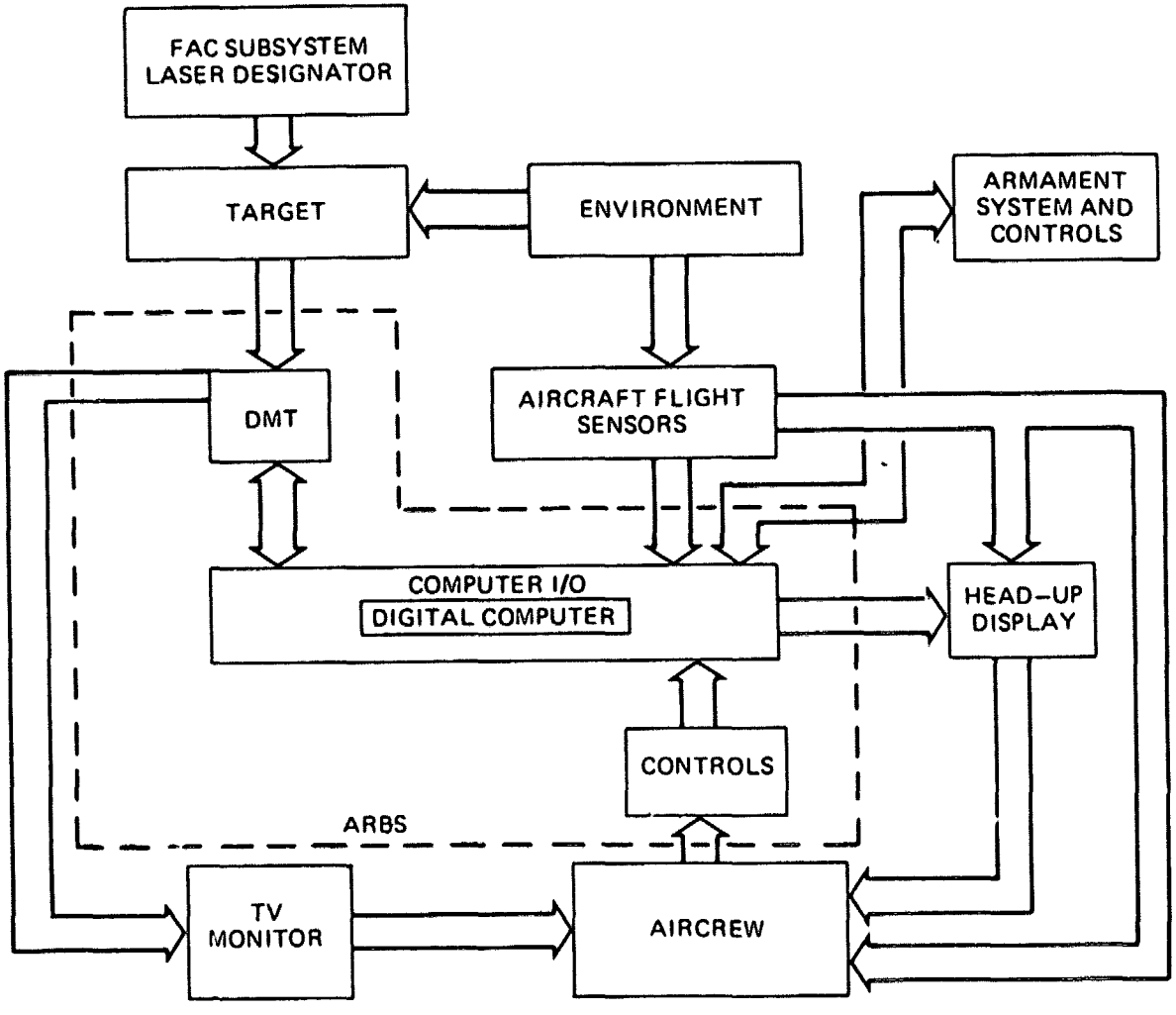


Figure 4. Aircraft Weapon Delivery System Information Functional Flow Diagram.

i. The Dual Mode Tracker (DMT) will be identical for the A-4M and AV-8A aircraft, except for Heat Exchanger cooling provisions (see item n).

j. The RP will be identical for each aircraft (A-4M, AV-8A and AV-8B).

k. The physical size and installation characteristics of the SDC will be identical for each aircraft (A-4M, AV-8A and AV-8B).

l. The SDC will be identical for the A-4M and AV-8A aircraft.

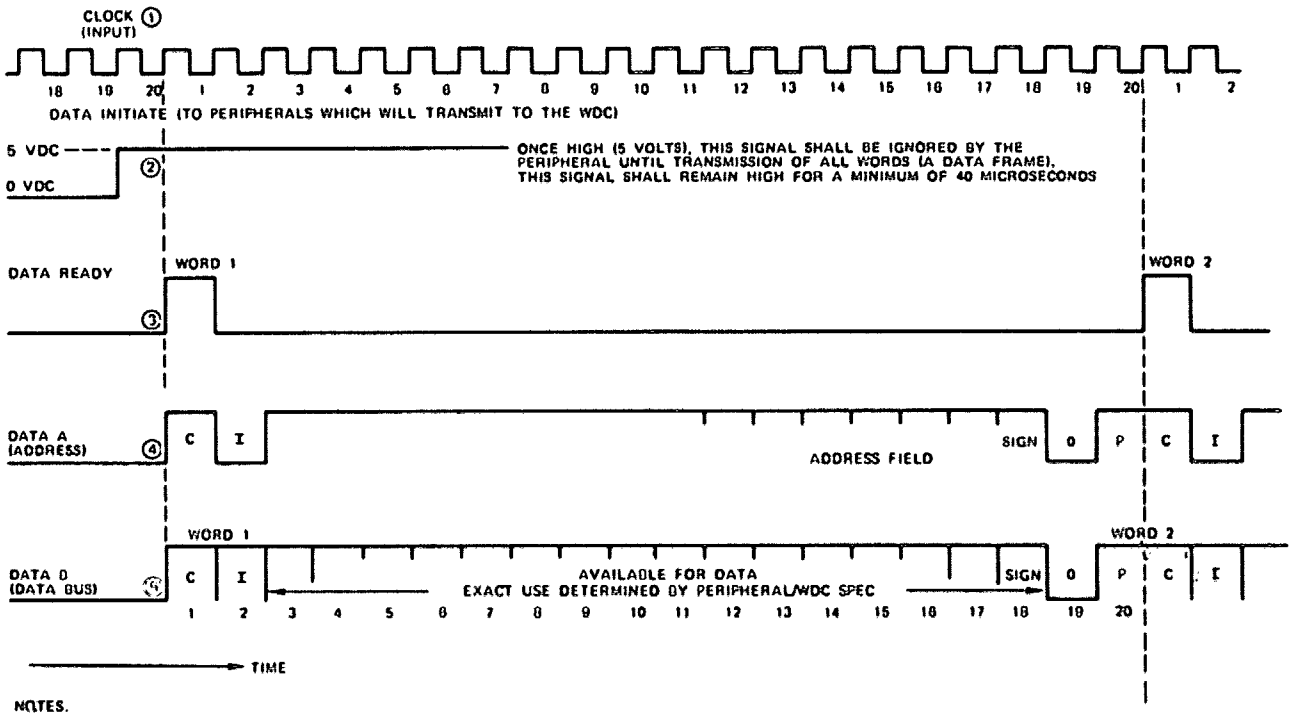
m. The SDC for the AV-8B aircraft will have a unique part number because of unique internal electrical characteristics, as specified in MIL-D-85056; otherwise, all SDCs will be identical.

n. A unique Heat Exchanger Unit (HEU) may be required for each aircraft, because of unique cooling provisions (limited to the removal of the external cooling fan). (A-4M, AV-8A and AV-8B).

3.1.5.1 Digital Interface Requirements - The digital signal interfaces between all ARBS equipment, as applicable, and between the WDC and the HUD system for the A-4M, shall be in accordance with the following paragraphs.

3.1.5.1.1 General Definition - Digital data shall be transmitted to and from the ARBS WDC (and/or the DMT for the AV-8B) in serial form. The serial digital data will be via 50 kilohertz (kHz) data channels. A data channel consists of five unidirectional signal lines with returns: a digital data line usually used for word count to be called the Address word line or Data A line; a digital data line used only for data to be called the Data line or Data B line; a clock line with return and two control lines with returns (Data Ready and Data Initiate). The WDC shall function as the controller for ARBS digital data transmissions. All data transmissions to or from the WDC will be under WDC software control. Data may be transmitted in frames as few as 1 word per line and up to at least 99 words per line with no interword spaces.

3.1.5.1.2 Digital Interface Format - The format of the 20-Bit Digital Data and Address words is shown in Figure 5. Digital Data words and Address words will be transmitted simultaneously and in synchronism with each other and



NOTES.

1. LOGIC IS DRAWN FOR THE TRUE OUTPUT LINE OF THE DIFFERENTIAL LINE DRIVER.
2. FOR EACH LINE (① – ⑤) DATA AND COMPLEMENT SHALL BE TRANSMITTED AND RECEIVED DIFFERENTIALLY ON TWISTED SHIELDED PAIRS.
3. MSB IS RIGHT JUSTIFIED. (REFER TO PERIPHERAL SPECS FOR LSD LOCATION).
4. P = PARITY
   C = CONTROL
   I = DATA WORD IDENTIFIER (VALIDITY)
   ϕ = A CHANNEL 1 = B CHANNEL
5. BITS WITH 1 OR ϕ MUST ALWAYS BE SET TO THAT VALUE.

SIGNAL CHARACTERISTICS

LOGICAL ZERO:	0 ± 0.5 VDC (TYPICAL)
LOGICAL ONE.	3.2 ± 0.8 VDC (TYPICAL)
RISE TIME.	≤2 MICROSECONDS
FALL TIME;	≤2 MICROSECONDS
PULSE COINCIDENCE.	±2.0 MICROSECONDS (ENTIRE DATA CHANNEL)

Figure 5. Digital Format Waveforms.

with the clock line within ±2 microseconds. The Data Ready line controlled by the transmitting device will provide a single pulse, having the characteristics of a single positive bit, in synchronism with Bit One of each word of the frame.

The presence of a data word on the channel can be sensed at the receiving device by the simultaneous occurrence of; positive (Logical 1) clock pulse; a pulse on the Data Ready line; and logical 1's on both the Digital Data A and B lines. Once transmission is initiated, the entire frame shall be transmitted serially with no time gap between words.

Data Transmission from a peripheral to the WDC shall be initiated by the WDC control of the DATA INITIATE line. Upon receipt of the Data Initiate signal, the peripheral will respond by transmitting a frame of data as previously defined.

3.1.5.1.3 Clock Inputs - The clock transmission from the WDC to peripheral shall be a continuous 50.0 ±1.0 kHz square wave with a mark to space ratio of 1 to 1 ±0.1 percent. The mark (Logical "1") shall be nominally 5 volts and the space (Logical "0") shall be nominally 0 volt.

3.1.5.1.4 Data Initiate - This signal shall be transmitted to a peripheral which shall respond by transmitting data to the WDC. A Logical "1" condition shall be represented by a positive 5 volts (typical) and a Logical "0" (zero) condition shall be represented by typically 0 volt. The rise and fall time shall be less than 2 microseconds. Response to these signals shall be as described in 3.1.5.1.8.

3.1.5.1.5 Data Ready - A 20-Bit Data Ready control word shall be transmitted for synchronization of the data words within each data frame. Bit "1" of the Data Ready control word shall be set to Logical "1" and transmitted coincident with Bit "1" of each data word. Bits "2" through "20" shall be set to Logical "0". The Data Ready control word Bit "1" shall be set only during a frame when data is present on the data busses.

3.1.5.1.6 Data A (Address) - The address shall be a 20-Bit word, divided into the following five fields:

(a)	Control (Bit 1)	This Bit shall be set to a Logical "1" when a word is being transmitted.
(b)	Identifier (validity) (Bit 2)	This Bit shall be set to a Logical "0".

(c)	Data (Bits 3 through 18)	For arithmetic data, Bit 18 will be the Sign Bit. Data will be in 2's complement form. For 16-Bit words, the LSB will be Bit 3. For arithmetic words shorter than 16 Bits, unused Bits will be at the LSB end of the computer and channel word. For non-arithmetic data, Bit 18 will correspond with the computer Sign Bit and Bit 3 with computer LSB.
(d)	Spare (Bit 19)	Bit 19 is always a Logical "0".
(e)	Parity (Bit 20)	This Bit shall serve as a Parity Bit for Bits 1 through 19. Odd parity shall be used (i.e., it shall be set to a Logical "1" or "0" so as to make the total number of Logical "1"s in the 20 Bits an odd number). Parity shall be checked by each ARBS subsystem that receives data and generated by each subsystem that sends data.

3.1.5.1.7 Data B Bus - The Data Bus, a 20-Bit Data Word, shall be divided into the following five fields:

(a)	Control (Bit 1)	This Bit shall be set to a Logical "1" when a word is being transmitted.
(b)	Identifier (validity) (Bit 2)	This Bit shall be set to a Logical "1" when a word is being transmitted.
(c)	Data (Bits 3 through 18)	For arithmetic data, Bit 18 will be the Sign Bit. Data will be in 2's complement form. For 16-Bit data words, the LSB will be Bit 3. For arithmetic words shorter than 16 Bits, unused Bits will be at the LSB end of the data word. For non-arithmetic data, Bit 18 will correspond with the computer Sign Bit and Bit 3 the computer LSB.
(d)	Spare (Bit 19)	Bit 19 is always a Logical "0".

(e)	Parity Bit (Bit 20)	This Bit shall serve as a Parity for Bits 1 through 19. Odd Parity shall be used (i.e., it shall be set to a Logical "1" or "0" so as to make the total number of Logical "1"s in the 20-Bits an odd number). Parity shall be checked by each ARBS subsystem that receives data and generated by the subsystem that sends data.

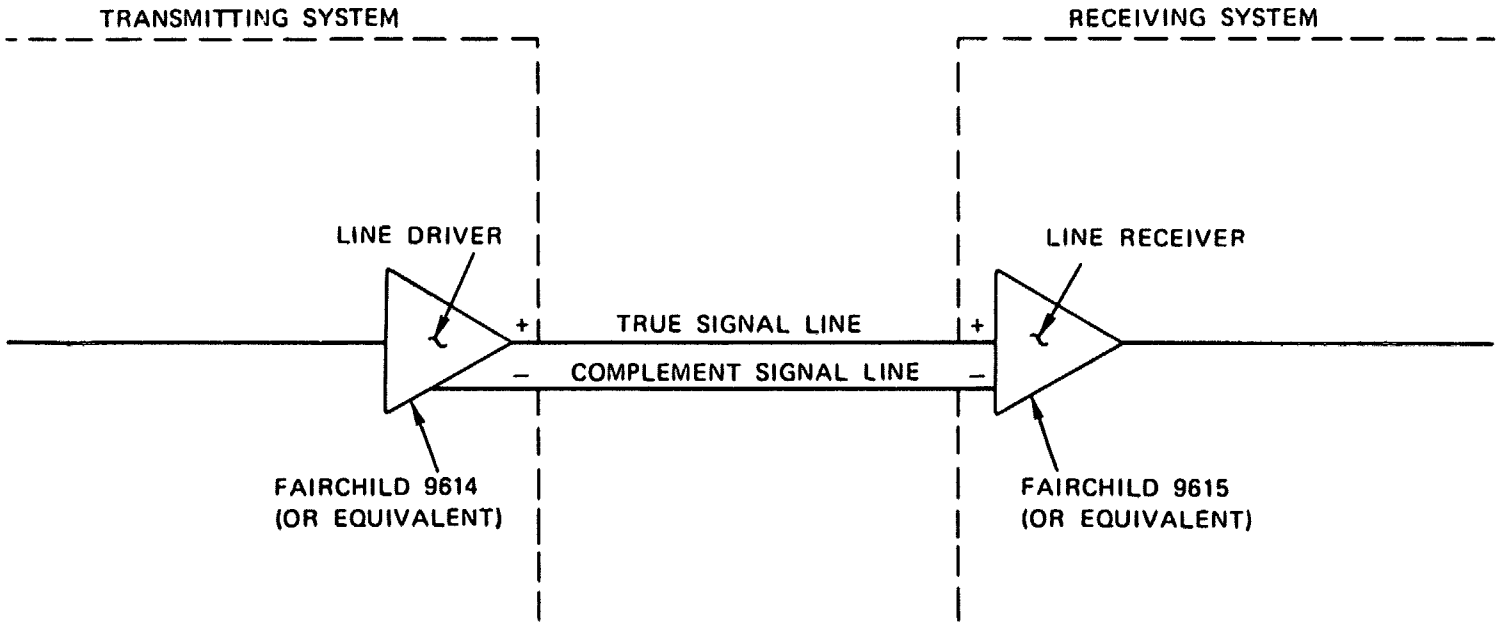
3.1.5.1.8 Data Frame - A DATA FRAME shall be defined as the interval between the beginning of the first data word to the end of the last data word. Details of each data word and its transmission sequence is determined by the subsystem specification. All words within a data frame shall be transmitted serially without space between words as shown in Figure 6.

3.1.5.1.9 Data Input (to WDC) Initiation - Data transmission shall be initiated within 100 microseconds after transmission of the leading edge (a positive transition from Logical "0" to Logical "1" in less than 2 microseconds) of the DATA INITIATE signal from the WDC. The beginning of tramsmission shall be recognized in the WDC by the occurrence of DATA READY (Bit 1) and the two data control bits in synchronization with the 50-kHz clock indicating that data and address information is on the line. Once transmission of the DATA FRAME has been initiated, the full DATA FRAME shall be transmitted regardless of the logical state of the DATA INITIATE. Changes in the DATA INITIATE logical state during transmission of a DATA FRAME shall be ignored and shall not degrade the transmission. At completion of the DATA FRAME, control transmission by the peripheral (DATA READY) shall cease until the conditions stated above have been satisfied again. The WDC shall hold the DATA INITIATE true for at least two clock cycles (40 microseconds).

3.1.5.1.10 Data Output (from WDC) Initiation - Output transmission shall be initiated by WDC command. It shall be possible to initiate output at any time on a channel if DATA FRAME is not currently in progress on that channel.

3.1.5.1.11 Data Transmission Failure Mode - If the WDC supplied CLOCK or subsystem power is removed, the subsystem output channels shall output Logical "0" levels for the Data, Address, and Data Ready lines.

3.1.5.1.12 Data Format - The Data Words within a frame shall be contiguous. Individual Bits leading edges shall be in synchronization within ±2 microseconds with leading edge of the clock pulse transmitted by the WDC (see Figure 6). Each Bit time shall have a duration of one clock period.



1. LOGICAL ONE ▫ 3.2 ± 0.8V (TYP)
   LOGICAL ZERO ▫ 0 ± 0.5V (TYP) (Applies to true Signal Line)
2. TRUE & COMPLEMENT LINES SHALL BE A TWISTED SHIELDED PAIR
3. DIGITAL SIGNAL CHARACTERISTICS:
   a. RISE TIME ⩽ 2 μSEC
   b. FALL TIME ⩽ 2 μSEC
   c. PULSE COINCIDENCE ⩽ 2.0 μSEC IN PHASE WITH CLOCK
   d. FREQUENCY 50.0 KHz ± 1.0 KHz
4. ACTIVE LEVEL OF CLOCKLINE (TRUE) ▫ +5V NOMINIAL

Figure 6. Differential Pair.

3.1.5.1.13 Data Transmission Characteristics - All data words and data controls shall be received or transmitted differentially and shall be compatible with the Fairchild 9614/9615, or equivalent, line driver/receiver pair, with 5 volts (nominal) representing a Logical "1" and 0 volts (nominal) representing a Logical "0". All waveforms shall have a maximum rise and fall time of 2 microseconds. Interfacing signals for the true output signal line of a differential line driver shall be as shown in Figure 6. A Logical "1" in the data word generated by the computer/peripheral shall result in a Logical "1" at the output signal line receiver as shown in Figure 6.

3.1.5.1.14 Transmission Line Characteristics - All signals shall use, as transmission medium, a twisted shielded pair. The cable shall be twisted, shielded, and jacketed, with a distributed capacitance of not more than 30 picofarads per foot. At a frequency of 50 kHz, the impedance shall be no more than 100 ohms, and the cable power loss shall be no more than 1.0 decibels (dB)/100 feet. Transmission line termination shall be used in each subsystem as required to reduce electromagnetic radiation and improve system tolerance to noise.

3.1.5.1.15 Driver/Receiver Connections - The transmission cable shall represent the only connection between subsystems. The connection is shown in Figure 6. No additional connection to the transmission line (stubs, termination networks, parallel receivers, etc.) shall be made except for any required termination resistor.

3.1.5.1.16 Data Contents (Input to WDC) - The contents of each data word shall represent the information available to the data generation circuit not more than 100 microseconds before the transmission of the first Bit of the data frame.

3.1.5.2 Electrical Interfaces - Electrical interfaces for ARBS equipment shall be as specified in the following paragraphs.

3.1.5.2.1 AV-8 Electrical Interface - The electrical interface for the ARBS equipment that is to be used in the AV-8 aircraft will be defined in the procurement contract for that application.

3.1.5.2.2 A-4M Electrical Interface - When installed in the A-4M, the ARBS shall interface with all associated equipment in accordance with the Electrical Interface Data, Drawing 3366000-350, and shall functionally interface as shown in Figure 7.

3.1.5.2.3 Cables and Connectors - The ARBS shall use cables and connectors in accordance with MIL-E-5400.

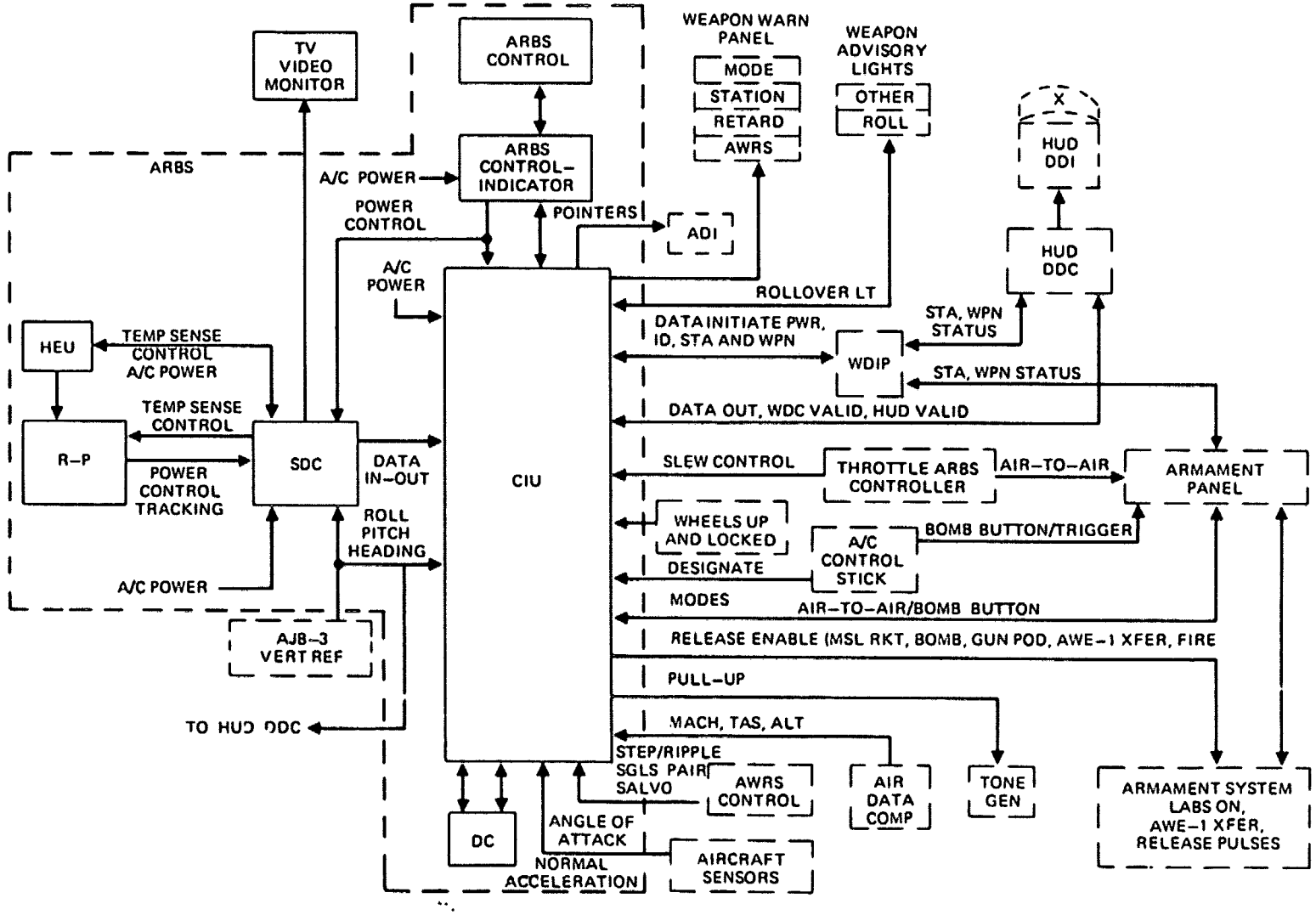


Figure 7. A-4M/ARBS Aircraft Weapons Delivery System Block Diagram.

3.1.5.2.4 Interconnection Cabling. - Interconnection wiring between the ARBS equipment and the A-4M aircraft shall be in accordance with Drawing 3366000-310. External cables and that portion of the connectors to be attached to the cables shall not be supplied as part of the equipment.

3.1.5.2.5 Operating Power. The equipment shall meet the requirements of ICD 7941503, and shall give specified performance when energized from the following power sources having characteristics and limits as defined in MIL-STD-704A. The power required shall not exceed the specified amounts.

(1) AC Power (Single Phase), not applicable (NA).

(2) AC Power (Three Phase), Y-connected, 115V/200V, Category B, 1500 VA total.

(3) DC Power, 28V, Category B, 50 Watts (W).

3.1.5.2.6 Lighting Power - Input power for lighting shall be as specified in MIL-C-85058(AS). Lighting power requirements apply only to the CUS.

3.1.5.2.7 Standby Provisions - The ARBS shall have a standby mode in which rated voltage is applied to all tube filaments and circuits requiring a warmup period. Except for the elements requiring warmup, voltages shall not be applied to other parts of the equipment. The operator shall not be required to select and maintain the standby mode for any specified period of time.

3.1.5.2.8 Overload Protection - The ARBS shall not be damaged by operation of the associated equipment listed in 1.4 in any normal mode of operation (including OFF mode), nor shall the ARBS be damaged in any mode of operation when any of the associated equipment is partly or wholly disconnected from the ARBS.

3.1.5.3 Mechanical Interface - The physical interface and installation characteristics for the ARBS equipment shall be in accordance with ARBS Report 1027, except as modified by unique cooling provisions for the AV-8 aircraft.

3.1.5.4 Environmental Interface - The operating environment for the ARBS equipment will be the same for both the A-4M and AV-8 aircraft. The system shall operate in the environment as specified by 3.2.5.

3.1.6 Major Component List - The ARBS shall interface with the associated equipment listed in Table I. The following Government Furnished Equipment (GFE) will be provided to the contractor when specified in the contract.

1. HUD/WDIP, AVQ-24B
2. Video monitor, IP-936AXQ

3. Aircraft control stick (DAC Part Number 5941954-23)
4. Throttle/hand controller (DAC Part Number 5942590-1)
5. Armament Control Panel (DAC Part Number 5945552-1)

Interfaces with all other equipment listed in Table I shall be simulated by the contractor, using contractor-furnished test equipment for subsystem and system testing.

3.2 System Characteristics - ARBS system characteristics shall be as specified herein.

3.2.1 Performance Characteristic - ARBS performance characteristics shall conform to the requirements of the following paragraphs.

3.2.1.1 Laser-Designated Target Acquisition - Laser-designated targets shall be acquired in accordance with the following subparagraphs.

3.2.1.1.1 Designator Characteristics - The ARBS shall be capable of reliable acquisition and tracking of targets being illuminated with a laser designator having characteristics as specified by MIL-T-85115.

3.2.1.1.2 Laser Tracker Sensitivity - The laser spot tracker (LST) sensitivity shall be as specified in MIL-T-85115.

3.2.1.1.3 Level Target Acquisition Search Pattern - During straight-in entry for a first-pass target acquisition with laser designation, and upon selection of the LST NORMAL mode by the pilot, the dual-mode tracker shall perform a roll and pitch stabilized azimuth search pattern. The search pattern shall be determined by the WDC under an approved Operational Flight Program (OFP) software control. The minimum tracker gimbal limits shall be as specified in MIL-D-85056. The pilot shall be able to adjust the depression angle to lower values to allow greater acquisition range under conditions of good visibility.

3.2.1.1.4 Dive Attack Target Acquisition Search Pattern - Upon selection of the LST ADL mode by the pilot, the tracker shall perform a 2-bar horizontal roll stabilized search pattern. The tracker shall be controlled by inputs from the WDC. The tracker instantaneous FOV shall be slewed in order to cover a minimum of ±12 degrees in azimuth and from +2 degrees to -13 degrees in elevation during the complete scan cycle of 3.5 seconds maximum.

3.2.1.2 Visual Target Acquisition - The ARBS shall not be considered as the primary mechanism for initial acquisition of non-laser designated (i.e., visual) targets. The TV tracker may, however, be used to recognize and identify targets already acquired by the pilot using an alternate means.

3.2.1.2.1 TV Tracker Target Acquisition/Lock-on - The ARBS, when in the TV tracking mode, shall be capable of reliably locking-on and tracking any target visible to the unaided eye. The target characteristics are specified in MIL-T-85115. This capability shall exist throughout the operational envelope of the A-4M and AV-8 aircraft as discussed in 3.1.2 of this specification. The primary method of TV tracker lock-on shall be a head-up operation. A secondary means of accomplishing TV tracker lock-on utilizing the cockpit TV monitor and the aircraft weapon delivery system hand controller shall also be incorporated to allow the track point to be established in a more precise manner, if sufficient time is available to the pilot. There shall be no requirement for the pilot to use this secondary lock-on technique in normal attack operations.

3.2.1.3 Weapon Delivery - The ARBS, when integrated into the aircraft weapon delivery system, shall provide weapon delivery accuracy against stationary targets as specified in MIL-W-85114, exclusive of pilot steering error, weapon dispersion error, and HUD/tracker boresight error. The accuracies for release/fire conditions beyond those specified by 3.1.2.6, but within the aircraft operational envelope, will be commensurate.

3.2.1.3.1 Accuracy Measures - The ARBS shall provide the accuracy for delivery of weapons in accordance with the requirements of the following paragraphs.

3.2.1.3.1.1 Low- Drag Weapons Including Air-to-Surface Guns and Rockets - Delivery accuracies for low- drag weapons are specified herein in terms of milliradians Circular Error Probable (mils CEP). The general method used to determine weapon delivery accuracy for the system in terms of mils CEP using flight test results is:

$$\text{CEP (mils)} = 0.5887 \left(\sigma_y + \sigma_x \right)$$

where

σ_x (mils) = standard deviation of impact miss distance in range

$$\sigma_x \text{ (mils)} = 1000 \left\{ \sum_{i=1}^{n} \frac{x_i \sin \theta_i / R_i}{n-1}^2 \right\}^{1/2}$$

σ_y (mils) = standard deviation of miss distance in azimuth (deflection)

$$\sigma_y \text{ (mils)} = 1000 \left[\frac{\sum_{i=1}^{n} (y_i/R_i)^2}{n-1} \right]^{1/2}$$

where

x_i = elevation impact miss distance, measured in feet-on-the-ground along the projection of the LOS line from aircraft to target at the time of weapon release

y_i = deflection impact miss distance, measured in feet-on-the-ground normal to the LOS line from aircraft to target at the time of release

R_i = slant range from aircraft to target at time of release

θ_i = elevation plane LOS angle at the time of release =

$$\sin^{-1}\left(h_i/R_i\right)$$

h_i = aircraft altitude at the time of release

i = round or bomb number

n = total number of rounds or bombs included in the sample

Range Error Probable (REP) and Deflection Error Probable (DEP) can be defined in terms of the above as:

REP (mils) = $0.6745\ \sigma_x$

DEP (mils) = $0.6745\ \sigma_y$

In normal assessments of weapon delivery accuracy, it is also necessary to define the Mean Point of Impact (MPI) which is given by the expression

$$MPI_x = \frac{\sum_{i=1}^{n} x_i}{n} \text{ feet} \qquad MPI_y = \frac{\sum_{i=1}^{n} y_i}{n} \text{ feet}$$

The aircraft weapon delivery system shall be assumed to have no biases and, accordingly, the MPI values are equal to zero.

For those aircraft sensors whose outputs are utilized in the ARBS weapon delivery solution, the following sensor accuracies shall be assumed for weapon delivery accuracy and error sensitivity computations (one sigma error values):

Vertical reference system (AJB-3A)	Pitch and roll	1.5 degrees
Air data computer (AXC-666-102)	Airspeed Pressure altitude Mach No.	4 knots 100 feet 0.005 mach
Angle-of-attack vane	AOA	0.5 degree
Normal accelerometer	AN	1.3 feet/ second/second

3.2.1.3.1.2 High-drag (Retarded) Weapons - Delivery accuracies for high-drag (retarded) weapons are specified in terms of CEP in feet miss-on-the-ground. A standard weapon release condition is needed with this type of measure and is defined, for the purposes of this specification, to be:

Slant range at release = 2,500 feet

Dive angle at release = 10 degrees

Aircraft velocity = 400 knots

CEP in feet is established using the same basic relationships as given in 3.2.1.3.1.1, except that:

$$\sigma_y \text{ (feet)} = \left\{ \frac{\sum_{i=1}^{n} y_i^2}{n-1} \right\}^{1/2} \qquad \sigma_x \text{ (feet)} = \left\{ \frac{\sum_{i=1}^{n} x_i^2}{n-1} \right\}^{1/2}$$

3.2.1.3.2 Weapon Release Condition - The conditions for release of weapons shall be as specified herein.

3.2.1.3.2.1 Weapon Release Envelopes - Specified weapon delivery accuracies for low-drag weapons shall be obtainable over the portion of the low-drag weapon release specified by MIL-W-85114. Specified weapon delivery accuracies for retarded weapons shall be obtainable at the release conditions specified in 3.2.1.3.1.2. Accuracies for other release conditions within the allowable release envelope for retarded weapons will be commensurate with those specified herein as established through an approved error sensitivity analysis relating the desired release condition to the baseline release condition specified previously.

3.2.1.3.2.2 Weapon Delivery Environment - The specified weapon delivery accuracies shall be achievable under typical bombing range conditions. During delivery of weapons the following environmental conditions can be expected to occur:

Visibility conditions	Greater than 10 statute miles.
Wind velocity	Components up to 20 feet per second (fps) in both the alongand crosswind directions
Maneuvering	Any combination of pre-attack flight maneuvers and jinking prior to the initiation of pilot steering for delivery that will result in a vertical reference error equal to or less than that specified in 3.2.1.3.1.1.
Rack ejection	Nominal rack/store ejection characteristics as listed in NAVAIR 01-1C-1T1.

Based upon accumulated experience relating test range to combat delivery accuracy, the delivery accuracies specified for the above-stated test range conditions can be expected to degrade by a factor of from 1.5 to 2.0 in an actual combat environment assuming that all system components have been properly maintained and are operating in accordance with the requirements of their individual specifications.

3.2.1.3.3 Weapon Release Profiles - There are two different basic types of release profiles. They are:

a. Dive-glide - weapon releases which occur after tracking in a dive maneuver where the release pullup normal acceleration is from 0 to 1.5 g. Level weapon delivery

profiles (including low level laydown) can be considered to be a special case of the diveglide weapon release trajectory.

b. Dive-toss - weapon releases which occur after tracking in a dive maneuver where the release occurs during sustained normal accelerations of 1.5 to 4 g.

As a special case of the dive-toss maneuver, the following two additional delivery profiles can also be defined:

c. Loft - a weapon release mode which is used for low-level aircraft run-in at constant altitude and ending in the initiation of an approximate 4-g pullup at some pre-established pullup point. This type of weapon release does not normally involve the use of the angular rate bombing concept.

d. OTS - a special case of the loft maneuver where the pullup point occurs over the intended target. OTS weapon delivery is not provided as a selectable mode by ARBS.

3.2.1.3.4 Laser Spot Tracker ARBS Weapon Delivery - Delivery accuracies specified for the laser spot tracker mode shall not allow the use of the television tracker as a supplementary tracking aid.

3.2.1.3.5 Moving Targets - For the purposes of this specification, a tracked moving target may have a maximum speed of up to 60 fps but must be non-accelerating in either velocity magnitude or direction. Under the weapon delivery environment of 3.2.1.3.2.2, weapon delivery accuracy shall not degrade by a factor of greater than 20 percent for attacks against moving targets over that specified for the same conditions against a non-moving target. The 20-percent degradation factor applies to moving targets which have target motion headings uniformly distributed (0 to 360 degrees), relative to aircraft attack heading, and for attack dive angles greater than 10 degrees. Degradation up to 35 percent at level release dive angle is allowed. This requirement shall not apply to the "Backup Delivery Mode", or to guns or rockets.

3.2.1.3.6 Backup Delivery Mode - For the purposes of this specification, the term "Backup Delivery Mode" is reserved exclusively for those ARBS deliveries where the DMT is not furnishing fire control information to the computer at the time of weapon release. This does not exclude, however, the use of the tracker prior to weapon release to establish estimates of parameters which are ultimately used in the backup delivery mode weapon delivery equations. The ARBS and aircraft head-up display shall be used in this mode of delivery.

3.2.1.3.7 Degraded Performance - Degraded performance will be permitted as provided in MIL-D-85056, MIL-W-85057, and MIL-C-85058, as applicable.

3.2.2 Physical Characteristics - The ARBS and associated equipment shall meet the physical limitations and constraints necessary for installation in the A-4M and AV-8 aircraft and as specified in the ICD for each aircraft.

3.2.2.1 A-4M Interface Control Document - The ICD for the A-4M aircraft is ICD 7941503.

3.2.2.2 AV-8 Interface Control Document - The ICD for the AV-8A aircraft is A 2598.

3.2.2.3 Weight Limits - Total weight of the ARBS system shall not exceed 150 pounds.

3.2.3 Reliability - System reliability is defined as the probability that the system will perform its intended function for a specified time under stated mission conditions, conditional on the system being operational at the start of the mission. The mission conditions are specified in 3.1.2. The requirements for ensuring that the reliability objectives for production ARBS will be met are specified in the following paragraphs.

3.2.3.1 Reliability Program - The contractor shall define and conduct a reliability program in accordance with MIL-STD-785.

3.2.3.2 Reliability Program Plan - The contractor shall prepare a written reliability program plan to serve as the master planning and control document for the contractor's reliability program. The plan shall define the design approach, analysis, test and demonstration, procedures and controls by which the contractor intends to assure compliance with the reliability requirements of the contract, the equipment specifications, and this document. Acceptance of the contractor's articles will not be made unless the reliability program plan, as approved, is maintained and implemented by the contractor. The existence of an approved reliability program plan and related documents shall not relieve the contractor of his responsibility to furnish articles which satisfy specified performance requirements, including reliability, or to continually pursue achievement of specified reliability levels.

3.2.3.3 ARBS Equipment Reliability Characteristics -

3.2.3.3.1 Reliability in Mean-Time-Between-Failures (MTBF) - The ARBS shall have a specified (θ_0) MTBF of 300 hours, and a minimum acceptable (θ_1) MTBF of 150 hours, when tested in accordance with the Reliability Quality Assurance Provisions of this specification. In the event that the Weapon Delivery Computer subsystem as defined in 3.7.3 is provided as Government furnished equipment (GFE), the Dual Mode Tracker as defined in 3.7.2 and the Control Unit Subsystem as defined in 3.7.4 shall have a combined specified (θ_0) MTBF of 430 hours, and a minimum acceptable (θ_1) MTBF of 215, when tested in accordance with the reliability quality assurance provisions of this specification.

3.2.3.3.2 Operational Stability - The ARBS shall operate with satisfactory performance, continuously or intermittently, for a period of at least 500 hours without necessity for readjustment of any controls which are inaccessible to the operator during normal use.

3.2.3.3.3 Operating Life - The ARBS equipment shall have a total operating life of 10,000 hours with normal servicing and replacement of parts. Components which require periodic replacement due to normal limited life shall be specified by the contractor and approved by the procuring activity.

3.2.3.4 Electronic Parts Screening - The contractor shall provide for 100 percent screening of all electronic parts which are not standard high reliability parts such as Established Reliability (ER) and JAN Test Extra (TX). Specifications shall be prepared in accordance with the contractor's established format and submitted for approval. In general, nonstandard parts shall be screened to the requirements of the closest standard high reliability part. All integrated circuits and hydbrids shall be screened to MIL-STD-883, Class B.

3.2.3.5 Failure Data and Actions - The contractor shall implement a closed-loop failure reporting, analysis and corrective action system for reporting, analyzing and accomplishing corrective actions on equipment failures which occur during testing and operation of his articles, in accordance with MIL-STD-785. The contractor's existing failure reporting, analysis and corrective action system shall be utilized with minimum changes necessary to meet the requirements cited herein. All failures occurring during acceptance testing shall be recorded and reported.

All failure data shall be retrievable and available for review by the procuring activity upon request.

3.2.3.6 Failure Definitions - Failures to ARBS equipment during acceptance testing shall be defined as follows:

a. Failure to provide the performance specified in 3.7 under the test conditions specified by approved test procedures.

b. Any unplanned maintenance, adjustment or alignment which is normally inaccessible to the operator during field use (and is necessary within the time specified by 3.2.3.3.2).

c. Excessive wear or damage of mechanical components which would cause subsequent failure under operational conditions.

3.2.3.7 Failure Classification - All reported failures shall be subject to classification in accordance with MIL-STD-2074 and MIL-STD-781B. Failure classification shall be done with the concurrance and approval of the procuring activity. Failure classification shall differentiate between, but not be restricted to, those due to equipment failure and those due to human error during manufacturing and testing processes. Use of failure classifications in the determination of equipment MTBF during reliability assurance testing shall be in accordance with MIL-STD-781B. Reclassification of failures shall be in accordance with MIL-STD-2074.

3.2.4 Maintainability Provisions - The maintenance concept for support of the ARBS shall be compatible with existing Marine Corps maintenance concepts. The maintainability of ARBS shall be as specified herein except as modified in the applicable subsystem specifications.

3.2.4.1 Maintainability Program - A maintainability program shall be conducted in accordance with MIL-STD-470.

3.2.4.1.1 Corrosion Control - Preparation and establishment of procedures for the prevention of corrosion and cleaning of repairable assemblies at all levels of maintenance shall be included as part of the maintainability program.

3.2.4.2 Fault Diagnosis - Fault diagnosis at the organizational maintenance level shall be accomplished using cockpit displays, BIT and FIT tests. Intermediate level fault diagnosis and Bit shall be accomplished using common ground support equipment or automatic test equipment (ATE), and any combination thereof.

3.2.4.3 Test Points - Test points shall be provided on the ARBS equipment for intermediate and depot levels of maintenance. The test points shall be compatible with the common test equipment designated and planned for Fleet use. To provide for those situations where the common GSE is not available, all hardware shall have sufficient exposed or accessible test points to permit use of standard Navy test equipment (oscilloscope, VOM, VTVM, etc.), to permit, in the event of weapon replaceable assembly (WRA)/shop replaceable assembly (SRA) substandard performance, ascertaining to the maximum extent possible without ambiguity which module, component, or group of components is at fault. Test points shall be exposed or accessible at each level of maintenance of the WRA as necessary, and sufficient for intermediate and depot level maintenance. The following guidelines shall also apply:

a. Duplication: Duplication of test points necessary for built-in-test equipment (BITE), calibration, alignment, adjustment, etc., is not required.

b. Protection: Each test point shall have loading or isolating characteristics incorporated to prevent circuit damage in the event any test point is accidentally connected to ground.

c. Safety: Safety design and precautions shall be in accordance with MIL-STD-454, Requirement 1, MIL-STD-882, and MIL-STD-1472.

d. Multiple test points: Where multiple tests are required on a WRA, multi-pin connectors may be used to facilitate connection of the GSE or other test equipment to the WRA.

3.2.4.4 Modularization. The ARBS shall be modularized to provide WRAs and SRAs and be functionally modularized in accordance with AR-10A.

3.2.4.4.1 Module Commonality. The number of different types of modules shall be kept to an absolute minimum. This standardization shall be mandatory to ease the testing and spares requirements at all levels of maintenance. Unused functions on a module are permitted if commonality is improved. The use of standard hardware program modules in accordance with MIL-STD-1378 shall be considered.

3.2.4.4.2 Weapon Replaceable/Shop Replaceable Assemblies - In determining which WRAs/SRAs are to be removed/replaced, repaired, or discarded at each of the maintenance levels, consideration shall be given to the training

levels of the personnel, their working environment, availability of tools and test equipment, publications and/or software documentation, the location with respect to other WRAs/SRAs and the complexity of the WRA.

3.2.4.4.3 Module Accessibility - Where practicable and subject to the approval of the procuring activity, subassemblies, modules, and components shall be so mounted that removal and replacement of one does not require removal of others. The following guidelines apply:

a. Standard tools shall be required for removal or replacement of WRAs and SRAs.

b. Fastener Accessibility: Fastening devices used for SRA shall be accessible for engagement and disengagement without use of special tools.

c. Captive Nuts: Captive nuts shall be used whenever unit disassembly or reassembly will be difficult due to limited physical access.

d. Adjustments: Access shall be provided for all adjustments without removal or disconnection of any subassembly, cable, or component.

e. Connectors, receptacles, circuit breakers, or any other electronic part shall not be part of any mounting device.

f. The different types of fasteners (screws, bolts, quick-release fasteners, and similar items) used shall be minimized to reduce the tool requirements.

3.2.4.4.4 Module Pins - Where printed circuit card or modular construction is used, ground potential and operating voltages shall be assigned to pins of all plug-in assemblies in a uniform manner so that a given potential is applied to pins of the same number on all plug-in assemblies which utilize similar packaging.

3.2.4.5 Adjustments and Alignments - Except for the boresight alignment requirements of 3.2.4.13.4(e), all adjustments and alignments shall occur during SRA repair. A list of all adjustments and alignments shall be submitted for approval by the procuring activity. There shall be no adjustments or alignments required for installation of WRAs into the system at the organizational level.

3.2.4.6 Maintainability Indices - The maintainability indices established by AR-10 shall not be degraded without specific approval of the procuring activity.

3.2.4.7 Reversibility - It shall be physically impossible to install any WRA or SRA or mate any cable improperly. Mechanical keying, different size connectors, and any other appropriate design implementation shall be used to preclude these possibilities.

3.2.4.8 Built-in-Test Equipment - A set of functional test equipment shall be designed and implemented into the ARBS. The mechanization of the BITE shall have as its primary goals the requirement to locate a fault and restore the system to full operation in the shortest possible elapsed time. The ARBS with the BITE shall be designed so that at least 95 percent of all ARBS failures that occur shall be isolated to the faulty WRA at the organizational level of maintenance, excluding those functions specifically identified in the applicable subsystem specifications.

3.2.4.9 Equipment Mounting - Equipment mounting provisions shall to the maximum extent possible, facilitate installation and removal at the WRA and major component levels. After initial boresight of the RP, the RP shall be capable of removal and interchange without requirement for further boresight.

3.2.4.10 ARBS Operational Readiness - An operational readiness test shall provide the pilot with an indication of equipment status by energizing an advisory or caution indicator when equipment performance is below an acceptable level, while the aircraft is stationary, as a minimum. This feature shall obviate the need for any auxiliary test devices external to the aircraft for the performance of preflight or postflight equipment checks.

3.2.4.11 Time-to-Repair - The mean-time-to-repair (MTTR) a malfunctioned ARBS subsystem at the organizational level to a specified performance level of operation shall not exceed 30 minutes with no more than 10 percent of the repair times exceeding 60 minutes. These MTTR specifications shall not, however, include failures due to combat damage and shall be independent of administrative and logistic delay times. The maximum TTR shall not exceed 2 hours.

3.2.4.12 Automatic Test Equipment Compatibility - Maintenance provisions of the ARBS shall include compatibility with approved Fleet automatic test equipment. Requirements for special test equipment, tools, and handling equipment shall be minimized. The use of Peculiar Ground Support Equipment (PGSE) to ensure ATE compatibility is permitted. The PGSE may include card extenders and adaptive circuits (interconnecting devices) and may use existing test connectors.

3.2.4.13 Organizational (on-equipment) Maintenance - Organizational on-equipment maintenance shall be performed on the ARBS equipment while installed in the aircraft and including all preventative and corrective maintenance.

3.2.4.13.1 Memory Loader/Verifier (MLV) - A memory loader/verifier will be used at the organizational level for loading/dumping the WDC OFP, and for verifying proper WDC operation. The MLV may also be used for loading special test programs for organizational level maintenance.

3.2.4.13.2 Scheduled Maintenance - Scheduled maintenance consists of all inspection, checkout, repair, replacement, or adjustment actions that are performed because of expiration of specified time, flight times, and cycles of operations. A proposed scheduled maintenance and inspection plan for organizational, intermediate, and depot activities per their levels shall be provided with

scheduled maintenance/inspections. Scheduled maintenance activities requirements shall be kept to a minimum.

3.2.4.13.3 Unscheduled Maintenance - Unscheduled maintenance consists of all corrective action resulting from observed system/component malfunctions or from defects discovered during scheduled maintenance/inspections.

3.2.4.13.4 Organizational Maintenance Activities - Maintenance at the organizational level shall restore the subsystem to operational status in the most cost effective manner and shall be limited to:

a. Fault identification by display indicators during system BIT/ORT and in-place functional tests.

b. Isolation of the fault to one WRA, except for fault isolation ambiguities approved by the procuring activity. Isolation to the faulty WRA for the DMT shall include the use of FIT (Fault Isolation Test).

c. Correction or repair by removal and replacement of the defective WRA.

d. Verification of satisfactory post-repair operation.

e. DMT and HUD electrical boresight alignment.

f. Use of the MLV to load/verify the OFP.

g. Maintenance of the DMT cooling system.

h. Mechanical roll alignment of the RP mounting base.

i. Cleaning of the RP dome glass.

j. Inspection and replacement of the DMT cooling system desiccant.

k. Purging of the DMT cooling system with dry nitrogen gas.

3.2.4.14. Intermediate Level - Maintenance activities performed at the intermediate level shall be in accordance with the ARBS Maintenance Plan, AVMP-184. The MTTR shall be minimized through the use of easily replaceable modular assemblies. Repair of equipment shall include:

a. Verification of a fault to a defective WRA.

b. Isolation of the fault to a defective SRA.

c. Removal and replacement of defective SRAs.

d. Verification of satisfactory post-repair operation.

e. Repair of defective SRAs as identified in AVMP-184.

f. Return WRA to service/supply.

3.2.4.15 Depot Level - Maintenance activities at the depot level shall be in accordance with AVMP-184.

3.2.5 Environmental Conditions - The ARBS, while operating or non-operating, shall withstand the natural and induced environments as specified in Table V, including all logical adverse combinations with repeated exposure to conditions having cumulative adverse effects, and in accordance with the applicable subsystem specification.

3.2.5.1 Non-Operating Conditions - The components of the ARBS shall be capable of withstanding the temperature, humidity, vibration, and shock as shown in Table V without physical damage or subsequent degradation of performance.

3.2.5.2 Operating Temperature-Altitude - The ARBS shall meet the performance requirements of 3.2.1 and 3.7 when exposed to the temperature-altitude environments shown in Figure 8, as follows:

a. The ARBS shall be capable of continuous operation at the extreme limits of Figure 8, Curve A. Continuous operation is defined as indefinite operation within the extremes of Curve A.

b. The ARBS and all associated equipment shall be capable of performing intermittent operations at the extreme limits of Figure 8, Curve B. Intermittent operation of the ARBS is defined as 45 minutes operation (any selected mode) within the limits of Curve A, followed by 30 minutes operation (any selected mode) at extreme conditions of Curve B, followed by 45 minutes operation (any mode) within the limits of Curve A.

c. The DMT shall be capable of performing intermittent operations at the extreme limits of Figure 8, Curve B, and at Point 1. Intermittent operation of the DMT is defined as 45 minutes operation (any selected mode) within the limits of Curve A, followed by 12 minutes operation (LST scan mode) at the upper limit of Curve B, followed by 6 minutes transient operation at Point 1 (track mode) at 70°C (sea level), followed by 12 minutes operation (any mode) at limit of Curve B (sea level).

d. The WDC shall be capable of performing intermittent operations at the extreme limits of Figure 8, Curve B. Intermittent operation of the WDC is defined as 45 minutes (any selected mode) within the limits of Curve A, followed by 12 minutes operation (weapon delivery mode) within the limits of Curve B, followed by 6 minutes intermittent operation (sea level) at 80°C, followed by 12 minutes operation (NAVIGATION mode) within limits of Curve B, followed by 45 minutes operation (any mode) within limits of Curve A.

e. The DMT and WDC shall be capable of performing intermittent operations at the extreme limits of Figure 8, Curve C, without part failure, but performance degradation may occur. Intermittent operation of the DMT

Table V. ARBS Environmental Criteria - Factory to Target.

Environment Item	Event - Condition									
	Transportation				Storage		Handling		Aircraft/Mission	
	Truck	Rail	Ship	Air	Airfield	Carrier	Airfield	Carrier	Non-operating	Operating
Temperature High °C (°F) Low °C (°F)	50 (122) -30 (-22)	50 (122) -30 (-22)	38 (100) -18 (0)	60 (140) -18 (0)	70 (158) -30 (-22)	38 (100) 0 (32)	50 (122) -30 (-22)	30 (86) 0 (32)	85 (185) -54 (-65)	Figure 8 -40 (-40)
Shock °C/min	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	80	
Altitude-feet	NEG	NEG	NEG	50,000	NEG	S/L	NEG	S/L	50,000	S/L to 45,000
Air rate-ft/min	NEG	NEG	NEG	1,000	N/A	N/A	N/A	N/A	40,000	
Vibration Sinusoidal, g (PK) Freq. range (Hz)	2 g, 5-12 Hz 0.5 g, 12-100 Hz	1 g 5-500 Hz	0.7 g 5-70 Hz	0.4 g, 5-40 5 g, 40-700	N/A N/A	N/A N/A	N/A N/A	N/A N/A		
Vibration Random-g^2/Hz Freq. range (Hz)	See above				N/A	N/A	N/A	N/A	0.02 g^2/Hz (Figure 9)	
Vibration Sunfire-g^2/Hz Freq. range (Hz)	N/A								Figure 9) MIL-STD-810B, Meth 519.1 RP: 0.02 g^2/Hz SDC: 0.036 g^2/Hz IE: 0.033 g^2/Hz CP: 0.032 g^2/Hz DC: 0.04 g^2/Hz CV: 0.05 g^2/Hz	
Acceleration Shock (S) Load (L) G (PK), time Waveform	Transportation (in container): 25 g, 25 ms, 1/2 sine wave Loading/unloading (in container): IAW MIL-STD-810B, Method 516, Procedure II								Shock 15 g 11 ms 1/2 sine wave	Load Vert: +7 to -1 g Long: ±1.5 g Lat: ±1.1 g
Acoustic vib. dB	140 dB 53 - 6,784 Hz									
Humidity, lb water per lb dry air	100% humidity over a temperature range from 0°C (0.004 lb water per lb dry air) to 35°C (0.031 lb water per lb dry air)									

NEG = NEGLIGIBLE N/A = NOT APPLICABLE

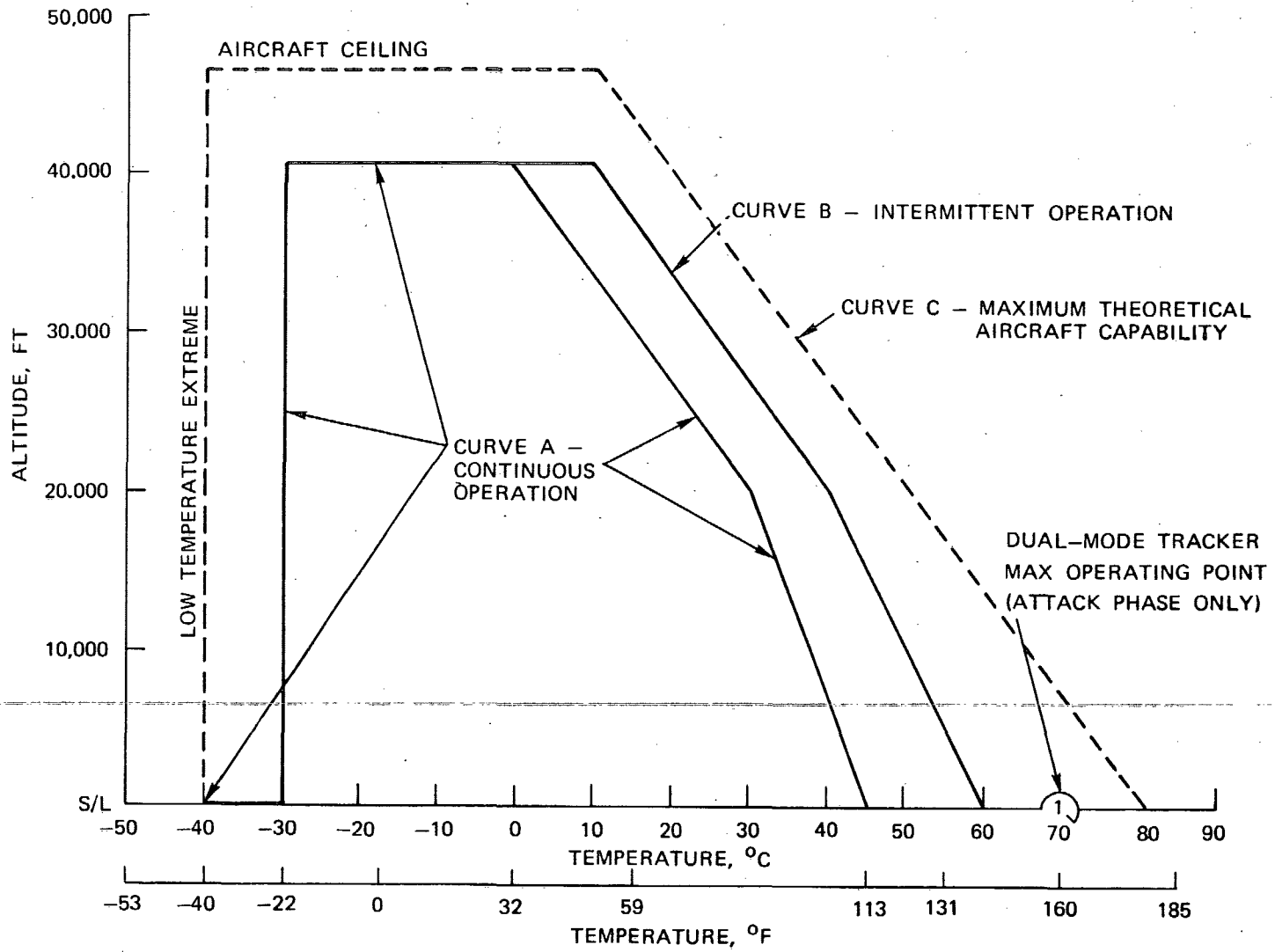


Figure 8. ARBS Equipment Operating Temperature/Altitude.

and WDC is defined as in (c) and (d) above, except that the limits of Curve C shall be substituted for the transient conditions of Point 1 for the DMT and Curve B for the WDC.

f. The CUS shall be capable of performing intermittent operations at the extreme limits of Figure 8, Point 1. Intermittent operation of the CUS is defined as 15 minutes operation (70°C) followed by operation within the limits of Curve A.

3.2.5.3 Humidity - The ARBS equipment shall withstand the effects of humidity as specified in Table V.

3.2.5.4 Vibration - The ARBS shall not suffer damage and shall meet the performance requirements of 3.2.1 and 3.7 when subjected to random vibration in accordance with Figure 9.

3.2.5.5 Shock - The ARBS equipment shall not suffer damage or subsequently fail to provide the performance specified in 3.2.1 and 3.7 when subjected to the shock specified in Table V.

3.2.5.6 Sand and Dust - The ARBS equipment shall withstand exposure to sand and dust as specified in MIL-E-5400.

3.2.5.7 Fungus - The ARBS equipment shall withstand, in both operating and non-operating modes, exposure to fungus as specified in MIL-E-5400.

3.2.5.8 Salt Atmosphere - The ARBS equipment shall withstand, in both operating and non-operating modes, exposure to salt-sea atmosphere, in accordance with MIL-E-5400.

3.2.5.9 Explosive Condition - The ARBS equipment shall not cause ignition of an ambient-explosive-gaseous mixture with air when operating in such an atmosphere.

3.2.5.10 Acoustic Noise - The ARBS shall be capable of performing in accordance with 3.2.1 and 3.7 while being subjected to sound pressure levels as specified in Table V for periods as long as 30 minutes and shall suffer no physical damage as result of exposure to acoustic noise.

3.2.5.11 Gunfire - The ARBS shall be capable of withstanding, in the operating mode, the vibrations induced by gunfire as defined in Table V with no physical damage or degradation of performance.

3.2.5.12 Warmup Time - Equipment warmup time shall be in accordance with 3.1.2.4 and MIL-D-85056, MIL-W-85057, and MIL-C-85058.

3.2.5.13 Critical Item Specifications - Specific operating environmental criteria that subsystems shall meet are specified in MIL-D-85056, MIL-W-85067, and MIL-C-85058.

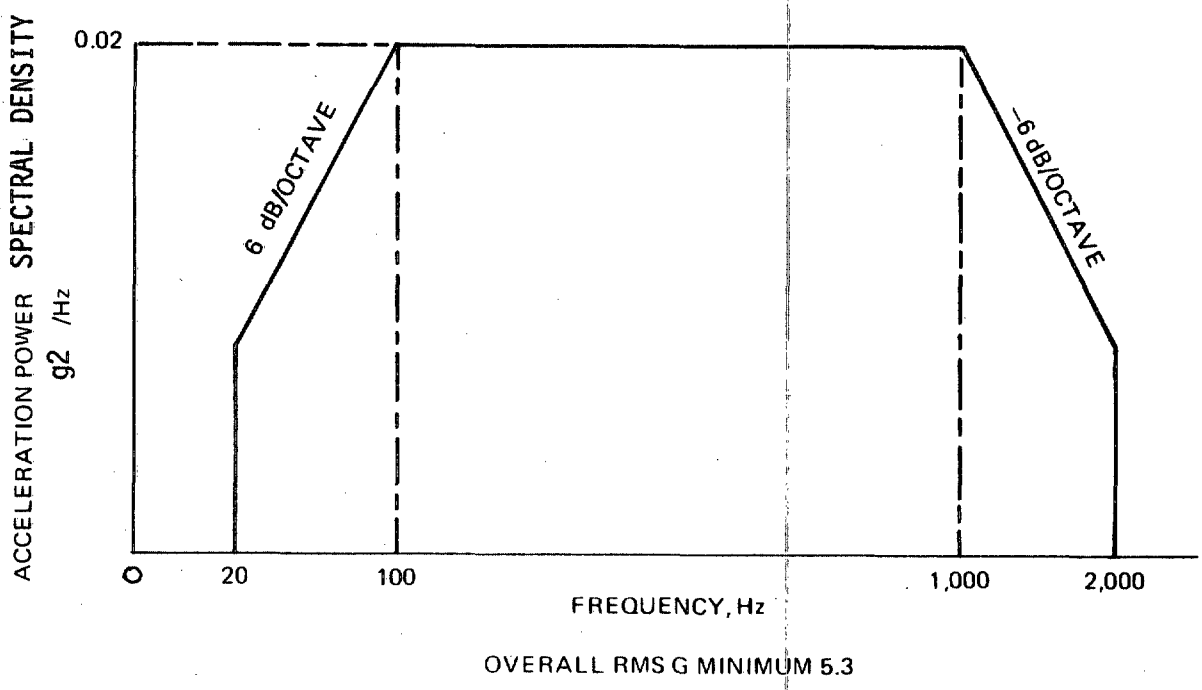


Figure 9. Random Vibration Levels for ARBS.

3.2.5.14 Standard Conditions - The following conditions shall be used to establish normal performance characteristics under standard conditions and for making laboratory bench tests:

Temperature:	Room ambient (25°C ±10°C)
Altitude:	Normal Ground
Vibration:	None
Humidity:	Room ambient up to 90 percent relative
Input Power Voltage:	115 ±5.0 volts alternating current (Vac), 400 ±20 Hz and 28 ±0.5 volts direct current (Vdc)

3.3 Design and Construction - The ARBS shall conform to the applicable requirements of MIL-E-5400 for design and construction except as modified by this specification.

3.3.1 Materials, Processes, and Parts - The selection of materials, processes and parts shall conform to MIL-E-5400 and shall conform to the following subparagraphs:

(1) Microelectronic technology, shall be considered and microelectronic items shall conform to requirements of AR-5.

(2) Other parts and materials requirements shall conform to MIL-E-5400.

(3) Nonrepairable subassemblies shall be used in accordance with AR-10 and as outlined in MIL-E-5400.

(4) When previously produced models of ARBS equipment used repairable subassemblies, the design shall not be changed to employ non-repairable assemblies without the approval of the procuring activity.

(5) Transistors and diodes shall be chosen and applied as outlined in MIL-STD-454, Requirement 30, except JAN TX grade shall be used.

3.3.1.1 Materials and Parts - Military specifications shall be used for procurement of all materials or parts. Any material or part not covered by applicable military specifications shall be approved by the procuring activity and procured by specification or specification control drawing prepared in accordance with MIL-STD-100.

3.3.1.1.1 Standardization - Procedures shall be established to assure the greatest practical uniformity of engineering criteria, terms, processes, and equipments, so as to assure the minimum variety of such items, and to effect

optimum interchangeability of equipment parts and components. The equipment design shall minimize the number of different types of modules and electronic assemblies, cards, mother boards, microelectronic devices, connectors, and parts. A parts standardization program shall be implemented in accordance with MIL-STD-680.

3.3.1.1.2 Non-standard Parts and Materials Approvals - Approval for the use of non-standard parts and materials (including electron tubes, transistors and diodes) other than microelectronic devices shall be obtained as outlined in MIL-E-5400.

3.3.1.1.3 Electronic Piece Parts - All electronic piece parts shall be Type ER, JAN TX, or MIL-M-38510, Class B, procured from suppliers listed on the current Qualified Products List (QPL) of the military specifications applicable to the part. Parts other than those covered above shall be considered non-standard. Any use of non-standard parts requires approval in accordance with MIL-STD-749.

3.3.1.2 Electrical Connectors - Connectors shall meet the requirements of MIL-STD-454, Requirement 10, and MIL-E-5400, except as noted herein. Miniature, quick-disconnect circular connectors shall conform to the applicable requirements of MIL-C-81511 or MIL-C-26482. Connector keying or other suitable methods shall be used to prevent mis-mating of connectors in any location where physical interchange is possible.

3.3.1.3 Adjustment Controls - Adjustment controls shall conform to the following requirements:

a. The equipment design shall minimize the number of adjustments and controls required for maintenance. Interaction among adjustments is to be avoided to eliminate the need for iterative adjustment procedures. Controls for maintenance shall be provided with locking devices. Required organizational and intermediate level adjustments shall be approved by the procuring activity.

b. All adjusting controls which must be set after the equipment is installed in the airplane shall be visible and easily accessible without disconnecting interconnecting cables or removing WRAs from their installed locations. The location of such adjustments shall be subject to procuring activity approval. Controls that can not be properly adjusted on installed equipment shall be inaccessible when installed or labelled to denote that proper adjustment can not be made on installed equipment.

3.3.1.4 Printed Wiring Boards - Printed wiring boards shall conform to the requirements of AS-4042, MIL-STD-1495, and MIL-P-55640, except as approved, in writing, by the procuring activity.

3.3.1.5 Printed Circuit Assemblies - Printed circuit assemblies shall conform to the requirements of MIL-P-46843, except that WS-6536 shall take precedence over specifications and standards cited therein. Exceptions to this requirement shall be approved, in writing, by the procuring activity.

3.3.1.6 Elastomeric Materials - Elastomeric material shall comply with the age controls of WR-64.

3.3.1.7 Soldering - Materials, procedures, and requirements for preparation and soldering of all electrical connections shall be in accordance with WS-6536, except as approved in writing by the procuring activity.

3.3.1.8 Wiring and Wire Coding - Each wire within or external to the WRAs shall be color or number coded in accordance with MIL-STD-454, Requirement 20, except for flex ribbon cable.

3.3.1.9 Surface finishes - Surface finishes shall be compatible with the electrical/electronic bonding requirements and with corrosion control requirements, and conform to the requirements of MIL-F-7179.

3.3.1.10 Logic Circuits - Monolithic integrated logic circuits of the transistor-transistor logic (TTL) and medium scale integration (MSI) types shall be used with the flatpack packages having 14,16,or 24 leads.

3.3.1.11 Screws and Fasteners - Screws and fasteners shall be in accordance with MIL-S-7742. Fasteners requiring the use of tools other than standard Navy issue hand tools shall not be used without prior written approval by the procuring activity.

3.3.1.12 Vibration Isolation - Vibration isolators within an individual unit shall not be used without prior approval of the procuring activity.

3.3.1.13 Shop Accessibility - Subassemblies, modules and SRAs shall be so mounted that removal, replacement and adjustment of one does not require removal of others, except as approved by the procuring activity. This requirement does not apply to the RP.

3.3.1.13.1 Quick Disconnect Fasteners - To the maximum extent practicable, fastening devices used for first level replaceable assemblies shall be captive-type and accessible for engagement and disengagement without the use of special tools.

3.3.1.13.2 Captive Nuts - Captive nuts shall be used whenever unit disassembly or reassembly will be difficult due to limited physical access.

3.3.1.13.3 Adjustments - Access shall be provided for all adjustments to SRAs without requiring removal or disconnection of the SRA or any subassembly or component of the SRA.

3.3.1.14 Handling Provisions - The handling provisions shall be as follows:

(1) Each unit shall be provided with a handle or adapter suitable for use in the removal from aircraft and for use while the unit is being transported; except for the CUS and HEU.

(2) Handles shall be permanent parts of each unit and not interfere with connectors, test points, control, or indicator readings. The RP, HEU and CUS are exempt from this requirement.

(3) Minimum dimensions of the handles shall be 3.5 inches wide (inside dimensions) and 1.0 inch from handle to unit. Minimum diameter of the handle grip shall be 0.31 inch. Exceptions to this requirement shall be approved by the procuring activity.

(4) Special handling devices, used for aircraft installation and removal, and for transportation, if required, shall be approved by the procuring activity.

3.3.1.15 Transportability - The system components, when secured in their respective shipping containers, shall be capable of being transported to the end-use site by common carrier or military transportation, by land, sea and air, utilizing standard handling procedures, and under the non-operating and service conditions.

3.3.2 Electromagnetic Interference and Compatibility (EMI/EMC) - The major assemblies which comprise the ARBS shall operate compatibly as a system. The ARBS shall be capable of performing as specified herein with aircraft and ships systems. The ARBS, when installed in the aircraft, shall not be susceptible to interference from other avionics equipment and shall not cause

interference in other equipment by radiation or conduction from any of its components or interconnection wiring. The ARBS shall conform to the requirements for Class I equipment as defined in MIL-STD-461, Notice 3, and when installed in the aircraft, to the requirements of MIL-E-6051D.

3.3.2.1 Radiation Susceptibility Requirements - The ARBS shall meet the performance requirements of the applicable subsystem specifications and paragraph 3.2 and 3.7 herein when subjected to the following radiation susceptibility levels:

a. 14 kilohertz (kHz) to 35 megahertz (MHz)	10 volts per meter (V/m).
b. 35 MHz to 130 MHz	5V/m.
c. 130 MHz to 2 gigahertz (GHz)	30 V/m.
d. 2 GHz to 40 GHz	to 20 V/m.

When installed in the aircraft, the ARBS shall operate and shall not be susceptible to radiation levels of 200 volts per meter over a frequency range of 14 KHz to 10 GHz. Degraded performance prior to tracking an LST target will be permitted; however, once tracking any target (TV or LST), the system shall be capable of completing an attack maneuver.

3.3.2.2 System Compatibility - The ARBS shall conform to the requirements of MIL-E-6051D and shall demonstrate satisfactory operation within the aircraft environment. To achieve operational compatibility, the ARBS shall be capable of withstanding the effects of conducted and radiated interference through the system aircraft cables from other aircraft avionics equipment and weapon systems. The ARBS shall be capable of shielding out or tolerating interference radiated from aircraft, landbased, and ship sources.

3.3.2.3 Bonding and Grounding - Bonding and grounding shall be in accordance with MIL-B-5087.

3.3.2.4 Lightning Protection - Lightning protection shall be provided by control of the installation provisions in the aircraft.

3.3.2.5 Static Electricity - Static electricity prevention shall be in accordance with MIL-E-6051, except that conductive coatings shall not be applied to the outer surface of the RP glass dome for the purpose of static electricity discharge.

3.3.2.6 Isolation - Decoded/precoded signals shall be isolated from processed/noncoded signals at the unit interfaces.

3.3.2.7 Signal Lines - Decoded/precoded signal lines containing intelligence shall be conducted on a balanced twisted-pair shielded line. The shield shall be frame grounded at a shielding wall and shall not be carried through a connector contact. Signals below -80 dB referenced to 1 milliwatt (dBm) (50 ohm reference) shall be coaxial with the shield grounded on the receive end only to the circuit reference point. Signals with direct current (dc) components shall use balanced differential circuits at the source and load end.

3.3.2.8 Electromagnetic Vulnerability (EMV) - The ARBS shall contain no electro-explosive devices. Degraded system performance will be permitted at radiation levels exceeding 200 volts per meter. Equipment survival testing at radiation levels exceeding 200 volts per meter, if required by the procuring activity, will be performed by an agency designated by the procuring activity.

3.3.2.9 Hazards of Electromagnetic Radiation to Ordnance (HERO) - The ARBS equipment shall contain no electro-explosive devices. Therefore HERO testing does not apply to this specification.

3.3.3 Nomenclature, Nameplates and Identification Marking - The system components shall be marked in accordance with MIL-STD-130. Nameplates shall be in accordance with MIL-N-18307.

3.3.3.1 Serialization - Each SRA designed for normal replacement shall have a permanent serial number. Serial numbers shall be applied at the final assembly of these units. In the event a unit is scrapped, the serial number shall not be reused.

3.3.4 Workmanship - The system and all elements shall conform to the workmanship requirements of MIL-STD-454, Requirement 9.

3.3.4.1 Cleanup - Prior to and after final assembly,all parts, components, and connections shall be thoroughly cleaned of loose, spattered, or excess solder, metal chips, and other foreign matter. Burrs and sharp edges as well as resin flash shall be removed.

3.3.5 Interchangeability - Except as specified in the applicable subsystem specification, ARBS equipment shall conform to the interchangeability requirements of MIL-E-5400 and MIL-I-8500. All WRAs and SRAs having the

same drawing number shall be directly and completely interchangeable with respect to installation, performance, and construction. Iterative harmonization adjustments to WRAs or SRAs shall not be required.

3.3.6 Safety - Provisions shall be made to ensure safety for personnel and equipment during all phases of operation or service use, storage, transportation, handling, test operations, and checkout. The guidelines of MIL-STD-454, Requirement 1 and the requirements of MIL-STD-882, shall be used to ensure maximum safety through the production and operational use of the system. Safety hazard analysis and design considerations shall be in accordance with an approved Safety Plan, as prepared by the contractor. Fail-safe features shall be incorporated where failures may disable the system, cause injury to personnel, damage equipment or cause inadvertent weapon release when installed in the aircraft. Protective devices shall be used on fans and blowers exposed to personnel during normal operation and maintenance.

3.3.7 Human Performance/Human Engineering - Human engineering design requirements shall be in accordance with MIL-STD-1472, except as approved by the procuring activity. System human engineering activities conforming to MIL-H-46855 shall be implemented.

3.3.8 Modules - System equipment shall be packaged in modular form to the maximum extent possible, to facilitate economical maintenance, repair and replacement of defective items in accordance with AR-10. Circuits shall be functionally grouped to facilitate fault isolation and repair.

3.3.9 Control Panels - All rack or console mounted control panels shall conform to the applicable requirements of MIL-C-6781. The configuration of all panels must be approved by the procuring activity prior to preproduction testing.

3.3.10 Cooling - The ARBS equipment shall minimize the requirement for special cooling provisions.

3.3.11 Equipment Survivability (Crash Safety) - The survivability of the required systems shall be compatible, in all respects, with the A-4M and AV-8 aircraft and meet the requirements of MIL-E-5400.

3.3.12 Boresight - The ARBS shall be capable of being boresighted when installed on mounting brackets which may be located ±1 degree in elevation and ±1 degree in azimuth from the aircraft ADL and which may be located within ±1 degree in roll with respect to the aircraft zero roll reference.

3.4 Documentation - All data and documents to be delivered will be listed in the Contract Data Requirements List (CDRL), DD Form 1423, in the Armed Forces Procurement Regulations (ASPR) and in the Naval Air Systems Command (NAVAIR) Procurement Instruction (PR) clauses in the contract.

3.4.1 Computer Software Documention - Software documentation shall be in accordance with WS-8506.

3.4.2 Documentation Tree - A documentation tree shall be prepared and updated through the life of the system. The documentation tree shall include all of the system down to the WRAs and SRAs. Lower level parts and assemblies will be documented in indentured parts lists.

3.5 Logistics - The system shall be capable of being supported logistically within the Navy and Marine Corps operational environment, in accordance with the ARBS Integrated Logistics Support Plan, (ILSP) AV-093.

3.5.1 Maintenance - The system shall be capable of being maintained at the organizational, intermediate and depot levels of maintenance in accordance with the ARBS Maintenance Plan, AVMP-184.

3.5.2 Provisioning of Spares and Repair Parts - When specified by the contract, provisioning documentation shall be prepared by the contractor in accordance with MIL-STD-1552 and MIL-STD-1561 and as specified by provisioning requirements statements issued by the Aviation Supply Office (ASO).

3.6 Personnel and Training - The requirements for personnel and training shall be as specified in ILSP-093.

3.6.1 Personnel - Personnel requirements for all levels of maintenance and support shall be compatible with skill levels currently existing within the Navy and Marine Corps.

3.6.2 Training - Existing training facilities and equipment shall be utilized to the maximum extent possible. Training devices, aids and equipment shall be provided as required, as specified by the contract.

3.7 Major Component Characteristics - Contractor furnished equipment (CFE) shall meet the performance and test requirements of this specification. In addition to the ARBS performance requirements (3.2.1), individual equipment performance shall be provided in accordance with the following paragraphs and applicable equipment specifications.

3.7.1 ARBS and the Aircraft Subsystem Description - When integrated into the A-4M and AV-8 aircraft, the performance and compatibility requirements of the subsystems of ARBS shall be in accordance with MIL-D-85056, MIL-W-85057 and MIL-C-85058, as specified herein. The functional description of the aircraft equipment interfacing with the ARBS shall be as specified herein.

3.7.2 Dual Mode Tracker (DMT) - The DMT shall be in accordance with MIL-D-85056. The DMT shall consist of following:

a. RP, R-2028/ASB-19(V).

b. Converter, Signal Data, CV-3393/ASB-19(V).

c. Cooling System hoses (2 required).

d. Heat Exchanger, HD-1005/ASB-19(V).

e. Dessicant assembly.

The primary function of the DMT is to track ground targets automatically during the attack phase of bombing missions. Ground targets will be either TV contrast targets or laser designated targets. Automatic acquisition of laser targets is an important feature of the tracker, providing potentially long range first-pass target acquisition while the aircraft is approaching the target area. The DMT shall provide sensor output signals to the WDC for weapon delivery computations.

3.7.2.1 Description - The DMT shall consist of the following functional elements:

a. Gimbal-stabilized sensor platform.

b. A vidicon TV camera and TV tracker electronics.

c. LST detector and LST tracker electronics.

d. Gimbal stabilization and servo electronics.

e. Tracking filter electronics.

f. Digital interface electronics.

g. Electrical power converters.

h. Mode logic.

i. Heat exchanger.

j. BITE source and drive electronics.

k. Fault-Isolation-Test (FIT) electronics.

l. Sun sensor and electronics.

The gimbal-stabilized sensor platform provides isolation from the airframe, and the angular freedom required to track ground targets during aircraft maneuvers. Ground target tracking capability is provided by use of electro-optical sensors sharing a common optics element that is isolated from the aircraft airframe through a gimballed structure. TV and laser sensors with associated electronic tracking circuitry shall provide automatic ground target tracking capability.

3.7.2.2 WDC Control and Interface - The DMT shall perform system operations controlled by the WDC through the digital interface channels and under an approved OFP software control. A summary of the interface control functions between the DMT and WDC that are determined by the OFP are shown in Table VI.

3.7.3 Weapon Delivery Computer - The WDC shall be in accordance with MIL-W-85057. The WDC shall consist of the following:

a. Digital Computer (DC), CP-1270/ASB-19(V)

b. Converter, Interface Unit (CIU), J-3429/ASB-19(V)

3.7.3.1 Digital Computer - The DC shall be a general purpose airborne digital computer and shall be capable of performing computational and operational functions associated with ARBS. These functions shall include:

a. Weapon release/fire control computations.

b. Position control of DMT during target acquisition.

c. Digital filtering of tracker angular rate signals.

d. Feedback to DMT during target tracking.

e. Logic and control functions to DMT, HUD, and armament system.

f. Symbology information to the HUD.

g. Automatic fire/release signals to aircraft armament system.

h. BIT.

i. Display to ADI.

Table VI.a Summary of Tracker Operating and Control Modes (Azimuth and Elevation Servo).

INPUT MODE SIGNALS	DMT ON	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MODE A	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	MODE B	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0
	MODE C	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	SLEW				0	1	0	1	0	1	0	1	0	1	0	1	SEE LST	SEE LST
	LOCK ON				0	0	1	0	0	0	1	0	0	0	1	1		
	CORRELATE								0	0	0	0	1	1	1	1		
	FILTER ON (1)				0	0	1	1	0	0	1	1	(9)	(9)	1	1		
	GATE WIDTH (1)				1	1	0	0	1	1	0	0	0	0	0	0		
	AZ COMMAND (1)			(5)	(5)	(6)	(7)	(8)	(5)	(6)	(7)	(8)	(7)	(8)	(7)	(8)		
	EL COMMAND (1)			(5)	(5)	(6)	(7)	(8)	(5)	(6)	(7)	(8)	(7)	(8)	(7)	(8)		
SERVO RESPONSE MODES	POSITION CONTROL	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	SEE LST	SEE LST
	RATE CONTROL	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1		
	TV TRACK	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0		
	LST TRACK	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0		
SYSTEM MODE		OFF (4)	WDC (4)	STBY	TV				LST								BST	BIT

NOTES:

(1) THESE INPUT SIGNALS ARE NOT USED TO DETERMINE THE SERVO MODE; THEY ARE INCLUDED IN THIS TABLE FOR INFORMATION AND UNDERSTANDING OF TOTAL ARBS SYSTEM OPERATION.
(2) DELETED.
(3) AZ AND EL TORQUERS ARE DISABLED IN STBY IF RP TEMPERATURE IS ABOVE 10°F (UNDERHEAT INVALID).
(4) THESE MODES WILL NOT EXIST IN ARBS OPERATION BUT CAN OCCUR DURING TRACKER TESTING.
(5) COMMANDS FROM WDC SHALL BE USED AS AZ AND EL POSITION COMMANDS TO POINT RP OPTICAL AXIS.
(6) COMMANDS FROM WDC SHALL BE USED AS AZ AND EL RATE COMMANDS TO POINT RP OPTICAL AXIS.
(7) COMMANDS FROM WDC SHALL BE USED AS AZ AND EL TRACKING RATE AIDING COMMANDS.
(8) COMMANDS FROM WDC SHALL BE USED AS AZ AND EL RATE COMMANDS TO KEEP RP POINTED AT SAME GROUND POSITION.
(9) THIS SIGNAL IS DELAYED BY THE WDC UNTIL AFTER LINEAR TRACK GOES TRUE.

Table VI.b Summary of Tracker Operating and Control Modes (Roll Servo).

Input Mode Signals	DMT On	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Mode A	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
	Mode B	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0
	Mode C	1	1	0	0	1	1	0	0	0	0	1	0	1	0	0
	Roll Reset	X	X	X	X	X	X	0	1	0	1	Same as TV	Same as TV	Same as TV	X	X
Rolled Over						0	1	X	0	1	1				0	1
Servo Response Modes	DMT Ready	N/A		N/A		1	0	1	1	1	0	Same as TV	Same as TV	Same as TV	1	1
	Pot Loop					0	0	0	0	0	0				1	1
	Momentary Cage					0	1	0	0	0	1				0	1
System Mode		OFF	ROLLED OVER	WDC	ROLLED OVER	STAND BY	ROLLED OVER	TV (VERT REF)	RESET NOT ACCEPTED	ROLLED OVER	RESET ACCEPTED	LST NORM	LST ADL	BORESIGHT	BIT CAGE TO -165°	ROLLED OVER

NOTES:
(1) Roll Gimbal is reset: only if rolled over (>265° <-265°) and Commanded by Standby (end of 10 seconds from turn-on) or Roll Reset from WDC.

Basic features required of the digital computer include:

a. A minimum of 16,384 sixteen-bit words with capability for expansion to 32,768 words with no modification of computer architecture.

b. An interrupt and buffered input-output capability will be provided for minimal delays between commands to convert information and completion of the conversion.

3.7.3.2 Computer Interface Unit - Included as a part of the onboard digital computer subsystem shall be an interface unit which shall serve as the signal converter unit between the computer central processor unit and the remainder of the ARBS. The principal function of this interface unit shall be to perform serial data formatting, analog-to-digital and digital-to-analog signal conversions between the aircraft sensor units, cockpit controls and displays, and other components of the ARBS and the digital computer. The design of the interface unit may be such that the portion associated with conversion of the DMT signals may be performed using equipments located with the DMT. Minimum CIU requirements for the A-4M aircraft are listed in Tables VII and VIII.

3.7.3.3 Computer Software - Software (provided as GFE) will include double precision arithmetic, a logical instruction set that includes, as a minimum, AND, OR and EXCLUSIVE OR, a full word shift capability and certain BIT capabilities. The functions of the ARBS OFP are:

a. Executive.
b. Test.
c. Air data processing.
d. Weapon priority and moding.
e. DMT monitor and control.
f. Angle rate filtering.
g. Target designation.
h. Weapon ballistics.
i. Weapon release and steering.
j. ARBS controls.
k. ARBS displays.

Operational and test computer software developed by the contractor, and as required by the contract shall conform to the requirements of WS-8506.

Table VII. CIU Output Signal Requirements for The A-4M.

Output Type	Name	Output Type	Name
Synchro analog: no channels		Relay closures: eight channels, 2 growth	MODE A MODE B MODE C
DC analog: two channels, no spares	AZIMUTH STEERING COMMAND ELEVATION STEERING COMMAND	a. Switch closure ground return b. AC switch ground	WHEELS UP RETURN AWRS REFERENCE MODE GROUND STATION LIGHT MODE LIGHT RETARD LIGHT AWRS LIGHT ROLL OVER LIGHT
28 Vdc discretes: nine channels, 2 spares	BOMB ENABLE ROCKET ENABLE MISSILE ENABLE GUN POD ENABLE PULL UP (TONE) AWE-1 TRANSFER ADI ENABLE FIRE SEQUENCE ARBS VALID	Serial digital: four channels, 1 growth	HEAD-UP DISPLAY TRACKER ELECTRONICS UNIT INSTRUMENTATION RECORDER CONTROL UNIT SUBSYSTEM

Table VIII. CIU Input Signal Requirements for the A-4M.

Input Type	Name	Input Type	Name
Synchro analog: three channels, no spares	PITCH ROLL HEADING	5-Vdc differential discretes: one channel, (spare)	
DC analog: eight channels, 2 spares	TRUE AIRSPEED MACH NUMBER PRESSURE ALTITUDE ANGLE OF ATTACK NORMAL ACCELERATION AZIMUTH SLEW COMMAND ELEVATION SLEW COMMAND RELEASE INTERVAL	Switch closures open circuit/ ground discretes: ten channels, 2 spares	INTERVAL MULTIPLIER STEP/RIPPLE SINGLES PAIRS SALVO WEAPON QUANTITY SELECT BIT 1 WEAPON QUANTITY SELECT BIT 2 WEAPON QUANTITY SELECT BIT 3 WEAPON QUANTITY SELECT BIT 4 WHEELS UP
28 Vdc discretes: fourteen channels, 3 spares	PITCH SENSE MASTER ARM NAV MODE CCIP MODE AUTO MODE LOFT MODE BOMB BUTTON DESIGNATE AIR-TO-AIR INTERNAL GUN SELECT INTERNAL GUN CHARGED EXTERNAL GUN CHARGED LABS ON TRACKER STABILIZATION WDC ON HUD VALID	Serial digital (includes 5-Vdc differential discrete for data initiate): three channels, 1 growth	TRACKER ELECTRONICS UNIT WEAPON DATA INSERT PANEL ARBS DATA ENTRY UNIT

3.7.3.3.1 Digital Filter - The ability to adequately filter the LOS angular rate signals derived from the DMT determines, to a large extent, how well the ARBS will perform in its primary weapon delivery mode. The angular rate tracking filter system, as a whole, shall combine the tracker angles and angular rates with other system inputs to compute best practical estimates of:

a. Target position relative to the aircraft.

b. Relative lead angle.

c. Cross velocity.

These estimates are selected to be in a form easily used in the weapon delivery computations. To accomplish the required filtering, the filter shall first average the rate integrating gyro measured inertial angular rates (ω) over a moderate time using lead terms (ω) that are computed using other measures of aircraft inputs. The average angular rate values so determined shall be fed back to the tracker torquer in a manner such that the TV or laser tracker output signals now become variation terms about these bias values. Accordingly, the TV and laser tracker bandwidth response requirements will be significantly reduced which, in turn, will reduce tracker overall sensitivity to noise and disturbance inputs.

3.7.4 ARBS Control Unit Subsystem (CUS) - The ARBS CUS shall conform to MIL-C-85058. The CUS shall have provisions for control, data entry, and data readout of information from the WDC as required by the pilot. The CUS shall consist of the following:

a. Control, Bombing Set, Angle Rate, C-10122/ASB-19(V).

b. Control-Indicator, ID-2085/ASB-19(V).

3.7.4.1 On-Off - The CUS shall include provisons for applying power to the WDC and DMT.

3.7.4.2 Data Entry - The CUS shall include, as a minimum, provision for entering the following data items into computer memory:

a. Entry/readout functions:

(1) Mean sea level pressure.

(2) Target elevation.

(3) Weapon burst height.

(4) Fuze delay time.

(5) Selected release range for elevation steering cue.

(6) LOFT mode initial point (IP) range to target.

(7) LOFT mode IP bearing to target.

(8) LOFT mode pullup range to target.

(9) LOFT mode release angle.

(10) Wind speed and direction.

(11) Laser coding.

(12) Destination latitude and longitude.

(13) Maintenance biases, scale factors, constants, and provisions for other selected variables, such as: Magnetic Variation.

b. Readout functions only:

(1) Range and bearing to destination.

(2) Distance and time to go to destination.

(3) Present position.

(4) Provisions for the other selected variables, such as: Ground speed; ground track.

3.7.4.3 Data Readout - The CUS shall include provisions for display of any of the data items that can be entered into computer memory by the pilot. The mechanism of this display should be such that when the particular data item is selected, the display should indicate the value currently stored in computer memory for that item. After a data entry, the new value stored should be immediately displayed.

3.7.4.4 Number of Targets - The CUS shall include provisions for entering target information as listed in 3.7.4.2 for at least two different targets.

3.7.4.5 Self-Test - The CUS shall include a provision for initiation of the computer self-test mode and the readout of the appropriate test data.

3.7.4.6 Operating Modes - The pilot shall have the option of selecting, as a minimum, the following system operating modes:

a. OFF: All power removed from the WDC and DMT.

b. WDC: Applies power to WDC (power applied to WDC in all subsequent modes).

c. STANDBY: In the STANDBY Mode, power shall be provided to the DMT in accordance with MIL-D-85056. (Power shall be applied to the DMT in all subsequent modes.)

d. TV: Normal television tracker operation. Prior to lock-on, the DMT shall be caged to computer commanded cage angle(s). LST acquisition is inhibited.

e. LST: Normal laser spot tracker operation. Type of scan is determined by position of scan mode switch (see 3.7.8.1). TV lock-on can be commanded to over-ride LST tracking. LST tracking can be resumed by de-designating.

f. BST: System boresight alignment.

g. BIT: Used to command built-in-test.

3.7.4.7 STANDBY Pause - When any operating mode is selected from the OFF mode, the system shall automatically sequence through STANDBY in accordance with MIL-D-85056.

3.7.5 Head-Up Display (HUD) - The ARBS, when integrated into the aircraft weapon delivery system, shall provide aircraft HUD display symbology and control in accordance with the aircraft ICD. The HUD will present a combination of flight command and situation information projected onto the pilot's forward visual field throughout all mission phases. Flight information will be presented in symbolic form and shall overlie the real-world cues in a 1:1 correspondence, except for those instances where human factors and flight-test data dictate otherwise. When a HUD failure has been determined, indication of this condition shall be transmitted to the WDC by means of a discrete and displayed on the CUS.

3.7.6 Aircraft Sensors - The ARBS, when integrated into the aircraft weapon delivery system, shall interface with the aircraft sensors in accordance with the ICD 7941503 and as specified herein.

3.7.6.1 Vertical Reference - The primary function of the vertical reference is to provide aircraft pitch and roll information and pitch sense to the WDC, for use in solving the weapon delivery equations. The vertical reference unit will also supply aircraft heading information to the WDC for use during attack or re-attack mission phases.

3.7.6.2 Air Data Computer - The air data computer supplies the ARBS computer with inputs of pressure altitude, true airspeed and Mach number.

3.7.6.3 Relative Wind Transducer - The Relative Wind Transducer supplies an indicated angle of attack which is then converted into a true angle-of-attack for use in the ARBS weapons delivery computations.

3.7.6.4 Normal Accelerometer - The normal accelerometer output is used by the ARBS to filter angle-of-attack data, to provide rate aiding signals to the DMT, and as a basic indicated "g" information sensor for elevation steering in the LOFT delivery mode.

3.7.7 Armament System Interface - The existing armament systems included in the A-4M and AV-8 aircraft will be retained and used in conjunction with the ARBS, as defined in the ICD for each aircraft.

3.7.7.1 A-4M Armament System Interface - When installed in the A-4M aircraft the ARBS will interface with the armament system in accordance with 3366000-350. Armament functions which the ARBS receives are listed below:

Delivery Mode Selector Switch (NAV, CCIP, AUTO, LOFT)

Bomb Button

Internal Guns Selected (left and right)

Internal Guns Safe/Charge

External Guns Safe/Charge

Master Arm

Designate

Quantity Selected

Interval Multiplier

Step/Ripple Release
Singles/Pairs/Salvo
Air-to-Air
Wheels Up
Release Interval (Spacing in Feet)
Low Altitude Bombing System (LABS) On

Discretes which the WDC must supply to the armament system are:

Fire Sequence
Bomb Enable
Rocket Enable
Missile Enable
Gun Pod Enable
Pullup-Warning/Release Tone control
AWE-1 Transfer
ADI Enable

3.7.7.2 AV-8 Armament System Interface - When installed in the AV-8A aircraft the ARBS will interface with the aircraft in accordance with MDC A 2598. When in a computer air-to-ground attack mode, the weapon system computer will read from the Weapon Control Panel: (1) the stations selected, (2) the release mode (singles, pair), and (3) the desired spacing on the ground in discrete feet (20,40,80, 160, 320) between bombs using the release time interval readout directly and supplying properly spaced release pulses to the Weapon Control Panel. In non-ARBS attack modes, the Weapon Control Panel will revert to a pre-ARBS mode of operation.

3.7.8 Aircraft Weapon Delivery System Controls - Controls for the aircraft weapon delivery system shall be as specified in the following paragraphs. The ARBS shall interface with controls in accordance with drawing 3366000-350.

3.7.8.1 LST Scan Mode Select - The aircraft shall have provisions to allow the pilot to select between the normal single bar scan pattern and the dive attack two bar scan pattern (see 3.2.1). The ARBS shall interface with the LST Scan Mode Select Switch in accordance with drawing 3366000-350.

3.7.8.2 Weapon Data Insert Panel - The ARBS, when integrated into the A-4M aircraft weapon delivery system, shall interface with the WDIP in accordance

with Drawing 3366000-350 the WDIP will provide to the WDC, over a serial digital channel, the following information:

a. The station(s) selected.

b. Rack type(s) for the selected station(s).

c. Weapon type(s) on the selected station(s).

d. Optional drag weapon selected.

The weapon rack data may be inserted into the WDIP by the ground crew or the pilot, prior to flight.

3.7.8.3 Slew Controls - The ARBS shall include analog input signal provisions to slew the DMT about its pitch and yaw axes. These slew commands shall be routed to the tracker via the WDC so as to allow proper coordinate conversion and compensation to be applied. In addition to the analog slew commands, a pilot controlled slew discrete will be provided and sent to the WDC.

3.7.8.4 Designate/Lock-on/Handoff - The aircraft control grip stick includes provisions to allow the pilot to designate or lock-on to an intended target and/or handoff the tracker from one tracking mode to another. The ARBS shall interface with the aircraft grip stick in accordance with Drawing 3366000-350.

3.7.8.5 Weapon Advisory Lights - The ARBS shall contain provisions to illuminate the following aircraft weapons warning panel illegal lights when an illegal weapon selection has occured:

a. Mode.

b. Station.

c. Retard.

d. AWRS.

3.7.8.6 Roll Reset - The ARBS shall have provisions to indicate to the pilot the need to reset the DMT roll gimbal to 0 degree thereby removing accumulated roll angle buildup in the roll axis flex leads.

3.7.9 Modes of Operation - The ARBS shall operate in the modes defined herein.

3.7.9.1 Navigation - Navigation requirements for the ARBS shall conform to the following paragraphs.

3.7.9.1.1 Initial Ingress/Final Egress Navigation - Navigation information derived and processed by existing navigational equipments shall be displayed on the head-up display unit by computer OFP software control.

3.7.9.1.2 Re-attack Navigation - After the selected target has been designated by the pilot, the relative position of the target with respect to the aircraft shall be automatically computed for use as an initial condition input to an air-mass dead-reckoning navigation computation. The output of this computation shall be available for use in re-attack target acquisition until such time as the pilot indicates to the ARBS that the information is no longer needed. The re-attack navigation information shall be displayed on the HUD, ADI, or other appropriate cockpit display unit.

3.7.9.2 Target Acquisition - Target acquisition shall be performed as specified herein.

3.7.9.2.1 Laser-Designated Targets - Laser-designated targets shall be acquired in accordance with the following paragraphs.

3.7.9.2.1.1 First-pass Acquisition - The ARBS shall provide the pilot with a first-pass target acquisition capability against laser designated targets in accordance with the requirements of 3.2.1.1 of this specification. These targets may be designated by ground-based FACs or airborne TACAs, or using either hard-mounted, stabilized, or hand-held USMC operational designators. No special constraints on the laser designator shall exist for employment of the ARBS laser spot tracker device. The attack aircraft pilot shall be capable of inflight selection of the laser spot tracker search angle and pattern as specified in 3.2.1.1. After the selection has been made, the WDC shall automatically control the tracker azimuth and elevation depression angles to maintain the selected on-the-ground search pattern accommodating changes in the aircraft altitude and attitude. During laser spot tracker search operations, the head-up display shall display appropriate LST search pattern information and shall instantaneously indicate to the pilot when a lock-on has occured. The pilot shall be capable of, using the cockpit hand controls, stopping the automatic computer controlled search scan and manually directing the DMT to a particular point on the ground. Upon selecting the manual override, the DMT shall become inertially stabilized. DMT command inputs are received from the hand controls via the WDC.

3.7.9.2.1.2 Loss of Track Indication - If, for any reason, the laser spot tracker stops tracking the designated target, the loss of track shall be immediately indicated to the pilot.

3.7.9.2.1.3 Countermeasure Resistance -The ARBS shall include provisions to reduce the susceptibility of the laser spot tracker to enemy countermeasures. Such counter-countermeasure features shall include system compatibility with the laser designator coding specified herein.

3.7.9.2.1.4 Coding - The ARBS shall include provisions for decoding and tracking coded laser designated targets. Decoding requirements shall be as specified in MIL-T-85115.

3.7.9.2.1.5 Last Pulse Logic - The ARBS shall incorporate sufficient last pulse logic features to prevent tracking of the FAC designator, in accordance with MIL-D-85056.

3.7.9.2.2 TV Targets - Tracking acquisition of TV targets shall be initiated by the pilot. The pilot will command TV lock-on by depressing the aircraft control stick Designate ID Button. The command function is sent to the computer which will then command DMT TV lock-on according to the appropriate operating and control mode.

3.7.9.3 Weapon Delivery - Weapon delivery by the ARBS shall be performed in the modes specified herein.

3.7.9.3.1 Angular Rate Bombing Fire Control Solution/Bombs - The primary mode of delivery of unguided freefall bombs for the A-4M and AV-8 aircraft shall be the angular rate bombing technique.

3.7.9.3.1.1 TV Tracker LOS Parameter Inputs - The ARBS shall, when operating in the TV tracker mode, include the following operating features:

a. Automatic and manual release: Both automatic and manual release of the selected ordnance shall be included as a part of the TV mode of weapon delivery. The pilot shall have an indication of the mode selected displayed on or near the head-up display unit combining glass.

b. Automatic release: With the automatic release mode selected, the pilot shall be presented with aircraft steering information on the head-up display which will

provide for elimination of azimuth steering errors. While nulling the azimuth error indication through proper control of the aircraft, an automatic release of the selected bombs shall occur when the downrange weapon release criterion is satisfied. In addition, the pilot shall also be provided with an elevation steering cue which, if he so chooses to use it, shall effect a weapon release at a pre-selected distance from the target. Use of this selected release range steering information shall be a pilot option.

c. Manual release: The pilot shall be provided a means of selecting a manual release mode which will allow release of the selected weapons at any point in the flight trajectory at his discretion. Use of the manual release mode shall allow the pilot to bomb targets which are in the vicinity of the track point by flying the aircraft so as to position the CIP indicator on the target and manually depressing the bomb release button.

d. Computed impact point display: With either automatic or manual release selected, the pilot shall have displayed, on the head-up display, the computed point of bomb impact should the weapon be released at that instant. With the automatic release mode selected, the weapon release shall not occur until the proper firing sequence is initiated by the WDC even though the pilot has the bomb release button depressed.

e. Tracker failure: If the TV tracker fails, the WDC shall automatically revert to barometric (BARO) computations for weapon delivery. A positive indication shall be presented to the pilot when this condition exists.

f. Lock-on date: With either mode of release selected, the pilot shall have the option of updating the TV tracker lock-on point using the cockpit hand controls. He may accomplish this using either the indicated track point display on the head-up display or on the TV picture shown on the cockpit monitor.

g. Aircraft armament system interface: Accomplishment of weapon delivery using the TV track mode shall be performed in conjunction with the controls and displays associated with the existing A-4M and AV-8 armament systems to the maximum extent possible.

3.7.9.3.1.2 Laser Spot Tracker LOS Parameter Inputs - The ARBS shall, when operating in the laser spot tracker mode, include the following operating features:

a. Automatic and manual release: Both an automatic or manual weapon release by the pilot shall be included when operating in the laser spot tracker mode of weapon delivery. In the automatic mode, the pilot shall have aircraft steering information presented identical to that presented in the TV mode of operation. The tracker aim point symbol display on the HUD shall serve as a pseudo-target. In the manual release mode, the pilot shall be provided a means of manual release of the weapons.

b. Computed impact point display: With either automatic or manual release selected, the computed impact point symbol shall be displayed identical to that presented in the TV mode of operation. The tracker aim point symbol shall again serve as a pseudo-target.

c. Track valid: The DMT subsystem shall supply a correlate valid signal to the WDC. The WDC will supply a signal to the pilot indicating that the laser tracker has achieved and is maintaining a valid lock-on.

d. Tracker hand-off: The pilot shall be capable of switching from use of the laser tracker to the TV tracker to provide LOS parameter information to the computer during the attack maneuver. This tracker hand-off shall be achieved by use of the designate button on the joystick. In addition, he shall have presented to him information telling him which tracker mode is currently being used.

e. Loss-of-lock: If a loss-of-lock should occur after a laser tracker lock-on, a loss-of-lock indication shall be displayed to the pilot on the HUD. During this period, the WDC shall automatically sense the loss-of-lock using the correlate signal and revert to a previously

established back-up delivery mode. Upon re-acquisition of the target by the laser tracker, the WDC shall continue to use the back-up delivery mode until such time as to have allowed satisfactory settling of the filtered output LOS information.

f. Aircraft armament system interface: Accomplishment of weapon delivery using the laser track mode shall be performed in conjunction with the controls and displays associated with the existing A-4M and AV-8 armament systems to the maximum extent possible.

3.7.9.3.2 Barometric Back-up Fire Control Solution/Bombs - A back-up mode of delivery of all ordnance shall be implemented in the WDC using barometric altitude and aircraft dive angle derived range information.

a. HUD symbology: Pilot steering and status information displayed while in the barometric back-up mode of weapon delivery shall be, to the maximum extent possible, indentical to that used in the angular rate bombing system modes of operation.

b. Automatic regression: Provisions shall be included in the software to provide automatic regression to the barometric back-up mode if either the tracker should lose its lock-on during an attack or if a tracker hardware failure should occur.

c. Pilot select: Provisions shall be included in the design to allow the pilot to select, at his discretion, the barometric back-up mode while in flight.

d. Tracker information input: Provisions shall be included to allow weapon delivery parameter information computed during a normal angular rate bombing system attack to be used in the barometric back-up weapon delivery mode, if that mode is reverted to during an attack.

3.7.9.3.3 Loft Fire Control Solutions - The ARBS shall include provisions for delivery of unguided freefall bombs in the loft maneuvers. These provisions will supplement the Low Altitude Bombing System (LABS) capabilities existing in the A-4M aircraft. BARO computations shall be used for loft deliveries.

a. HUD steering information: Pilot steering information for LOFT weapon delivery shall be displayed on the aircraft HUD using, to the maximum extent possible,

symbology provided for the primary weapon delivery modes. This information shall include azimuth steering, pullup initiation, g profile and anticipated weapon release data.

b. Back-up steering: Steering and g profile signals shall be provided for back-up (head down) information diplayed on the ADI.

c. Pullup discrete: The computer shall provide a pullup warning discrete to the tone generator and the signal transfer relay (Shrike) when the pullup point has been reached.

d. Automatic release: An automatic weapon release shall occur provided the pilot has also depressed the aircraft bomb release button.

3.7.9.3.4 Guns and Rocket/Air-to-Surface Fire Control Solutions - The aircraft weapon delivery system shall include a capability for accurate delivery of gunfire and rocket ordnance. Because of the small angular rate of the LOS in normal gunfire and rocket delivery attack maneuvers, it is not anticipated that an angular rate weapon delivery equation solution will be employed directly. The DMT may be used, however, to track points on the ground in the vicinity of the target to obtain information on aircraft height above target and local wind conditions.

a. HUD display: Pilot steering information for guns and rocket attack shall use display symbology similar to that used with the CIP mode delivery of bombs. Symbols should retain the same identity in either the bomb delivery or the guns/rocket delivery situation.

b. Manual release: Gunfire and rocket delivery shall be performed only in a manual release mode.

3.7.9.3.5 Guns/Air-to-Air Fire Control Solution - Growth provisions in the ARBS shall include a capability for providing an air-to-air gunfire control solution for the AV-8.

a. AV-8 precedence: Selection of the air-to-air guns mode by the pilot using the appropriate armament system

control selection and pilot steering HUD display taking precedence over any other previous selected weapon delivery mode.

b. A-4M precedence: Air-to-air computations will be performed by the Head-up Display System.

c. Manual release: Air-to-air gunfire delivery shall be performed only in a manual release mode. Guns must be charged by the pilot prior to firing.

3.7.9.3.6 Shrike Guided Missile/Automatic Release - The ARBS shall include provisions for an automatic release mode delivery of the Shrike guided missile. The aircraft weapon delivery system will interface with the Shrike missile and Shrike Improved Display System (SIDS) as necessary to provide this capability.

a. HUD display: Pilot steering information for automatic release delivery of the Shrike shall be, to the maximum extent possible, identical to that presented for automatic delivery of unguided bombs.

b. Weapon release solution: A barometric ranging release mechanization shall be employed for the automatic release of the Shrike missile.

3.7.9.3.7 Other Guided Weapons - Incorporation of the ARBS in the A-4M and AV-8 aircraft shall not adversely impact the capability of those aircraft to deliver other qualified guided missiles or freefall weapons as specified in the aircraft tactical manual.

3.7.9.3.8 Manual Release By-pass - Incorporation of the ARBS in the A-4M AND AV-8 aircraft shall not eliminate the capability of the pilot to select, at his discretion, a non-ARBS manual release mode of weapon delivery.

3.7.10 Data Entry and Display - Data shall be entered and displayed in accordance with the following paragraphs.

3.7.10.1 Pre-takeoff Data Entry - The aircraft weapon delivery system shall have provisions for insertion of ordnance information (i.e., weapon code and rack type per station) by the aircraft ground crew any time prior to takeoff and with all power removed from the aircraft. Upon powering-up the onboard digital computer, each ordnance data insertion will be loaded into computer memory.

3.7.10.2 In-flight Data Entry - The ARBS data entry panel shall have the capability to enter, readout, and display, to the pilot, key information items stored in the computer memory while in flight.

3.7.10.3 Number of Targets - The ARBS shall include provisions for entering and displaying targetting information for at least 5 targets, for use during weapon delivery. Entering, selection and display of target data shall be readily accomplished in-flight.

3.7.11 Illegal Mode/Weapon Select Warning - The ARBS shall be capable of sensing pilot selection of illegal modes or improper combinations of control settings for the stations selected and advising the pilot of this situation using the head-up display and using the appropriate legend light.

3.7.12 Boresight Adjust - The ARBS shall include provisions for in-flight adjustment of the boresight between the HUD aiming reticle and the DMT optical centerline.

3.7.13 Pullup Warning - The ARBS shall automatically sense and warn the pilot that an aircraft pullup is required to avoid a ground collision or to avoid the bomb fragment pattern. The pullup warning signal shall be predicated on the pilot executing a 4-g pullup to avoid the danger. The pullup warning shall be displayed on the HUD and on the video monitor for a heads-down warning.

3.7.14 Remote ADI - Azimuth steering will be displayed on the ADI using the vertical needle. The horizontal needle is used in the LOFT/OTS modes for nearness to pullup and for a fly-to g indicator. Whenever Shrike is selected, the needles will be connected to the Shrike Seeker to enable the pilot to boresight the aircraft on a radiating target.

3.7.15 Self-Test - The ARBS, under control of an approved operational flight program, shall perform an operational readiness test (ORT), both in-flight and on the ground. The ORT shall consist of an end-to-end functional test of the system, including LST and TV acquisition and tracking operations and display of output functions. The ORT shall be initiated by the pilot, by selection of the BIT Mode on the ARBS Control Unit. GO-NOGO indicators shall display the ready/fail condition of the tracking functions and subsystems.

3.7.16 Growth Capabilities - The ARBS shall have the capability for expansion of the computer OFP as specified by MIL-C-85057.

3.7.16.1 Air-To-Air Gun Mode - The ARBS, when integrated into the AV-8 aircraft weapon delivery system, shall provide growth capability for A-A Gun mode computation. This capability shall include appropriate HUD symbology control and weapon delivery computer implemented fire control solutions.

3.7.16.2 NAV Function - The ARBS, when integrated into the aircraft weapon delivery system, shall provide growth capability for NAV computations. This capability shall include appropriate HUD symbology control.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection - Unless otherwise specified, the contractor is responsible for the performance of all test requirements as specified herein. Except as otherwise specified, the contractor may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the tests set forth in this specification where such tests are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Classification of Tests - Items covered by this specification shall be subjected to the tests (listed in Table IX), to determine compliance with all applicable requirements (see Figure 10):

(1) Preproduction (First Article) Tests (see 4.2).

(2) Acceptance Tests (see 4.3)

(3) System Performance Demonstration Test (see 4.4).

(4) Special Tests (see 4.5).

4.1.2 Special Working Environment - The contractor shall provide adequate facilities for the fabrication, assembly, and testing of supplies to be delivered in accordance with this specification.

4.1.3 Government Verifications - All quality assurance operations performed by the contractor will be subject to verification by the Government at any time. Verifications shall consist of the following:

(1) Surveillance of the operations to determine that practices, methods, and procedures of the written system description are being properly applied.

(2) Government product inspection to measure the quality of the product being offered for acceptance. Failure of the contractor to correct deficiencies discovered by himself or of which he is notified shall be cause for suspension of acceptance until corrective action has been made or until conformance of the product to prescribed criteria has been demonstrated.

4.1.4 Test Conditions - Unless otherwise specified, all tests for acceptance of items covered by this specification shall be conducted under the standard conditions of 3.2.5.14.

Table IX. Quality Assurance Test Requirements

Requirements paragraph(s)	Method Paragraph(s)	Title	Preproduction Tests	Acceptance Tests	System Tests
3.2.5	4.2.2.1	Environmental Tests	X		
3.3.2	4.2.2.3	EMI Tests	X		
3.2.4.14	4.2.2.4	Maintainability Demo (I-Level)	X		
3.2.4, 3.3	4.3.1.1	Examination of Product (Table X)	X	X	
3.2.3	4.3.1.2, 4.6.1	Thermal Screening	X	X	
3.2.3	4.3.1.3, 4.6.2	Random Vibration (Screening)	X	X	
3.7	4.3.1.4	Operational Tests (per subsystem specifications)	X	X	
OPTIONAL	4.3.1.5	Optional Mfr's Burn-in	OPT	OPT	
3.2.3	4.3.2, 4.6.3	Production RAT		X	
3.1.5, 3.7	4.4.1, 4.6.4	System Integration			X
3.7.3, 3.7.4	4.4.2, 4.6.4	Software Verification Tests			X
3.2.4	4.4.3	Maintainability Demo (O-Level)			X
3.3.2	4.4.4	EMC Tests			X
3.1.2, 3.2.1	4.4.5	Flight Tests			X
ALL	4.5	Special Tests (As Required)	AR	AR	AR

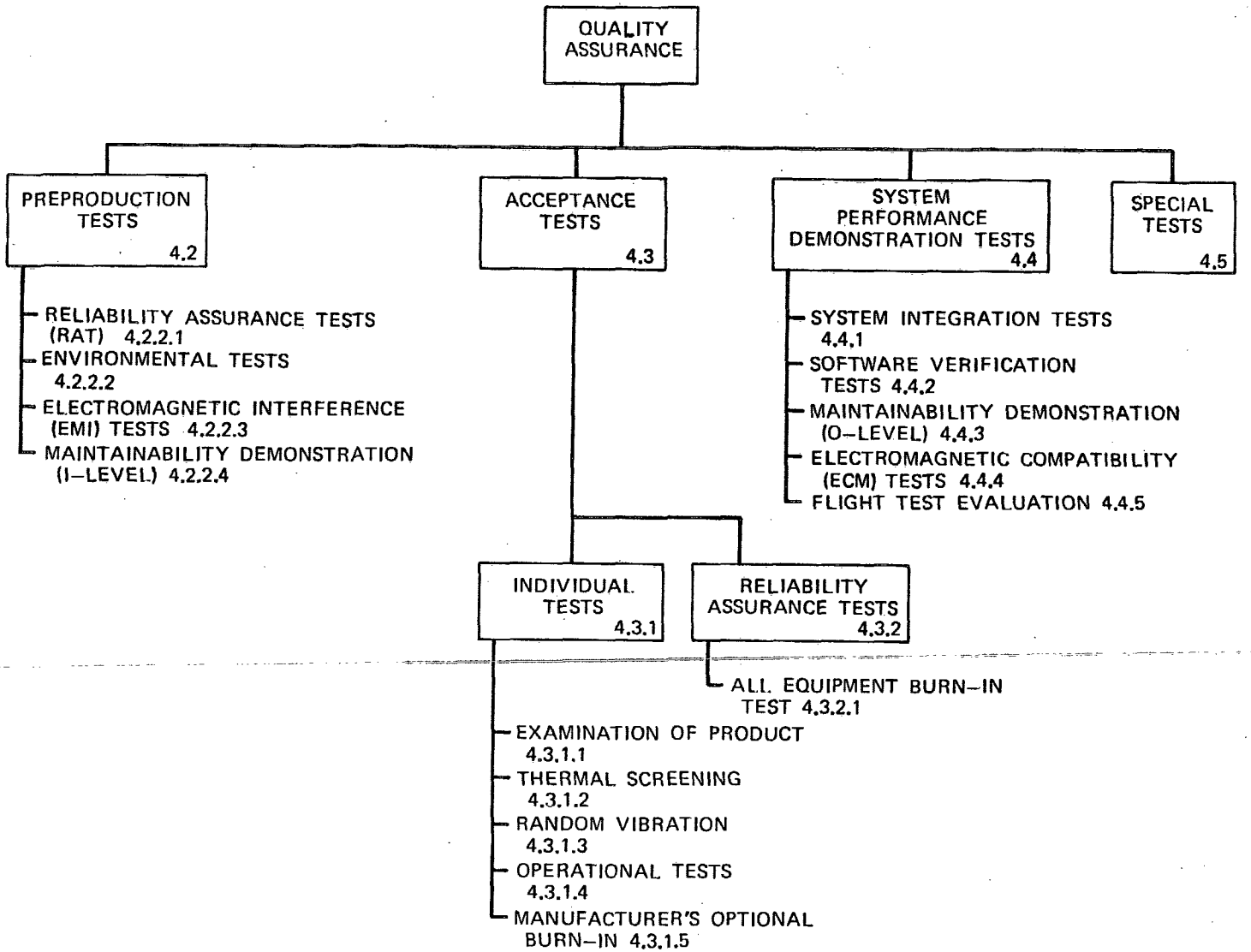


Figure 10. Classification of tests.

4.1.5 Spare Equipment Provisioning (WRA/SRA) Acceptance - Unless otherwise specified by the contract, it is intended that the items covered by this specification shall be accepted at the subsystem/system level of assembly, to ensure equipment compatibility and to ensure that the Maintainability requirements of 3.2.4 and the Interchangeability requirements of 3.3.5 are met. Acceptance of spare WRAs and SRAs may be performed at lower levels of assembly than the subsystem level, provided that the interchangeability of spare items procured under the contract is adequately demonstrated by the contractor.

4.1.5.1 WRA/SRA Acceptance Requirements and Test Procedures - When specified by the contract, acceptance requirements and test procedures shall be prepared by the contractor and submitted for approval by the procuring activity, for acceptance of WRAs and SRAs.

4.1.6 Manufacturing Reliability Screening - Each item covered by this specification shall be subjected to manufacturing reliability screening, to ensure that the applicable requirements of 3.2.3 and 3.3 are met. The acceptance test requirements shall include thermal screening and complex/random vibration, as specified in 4.3.1.2 and 4.3.1.3, for the purpose of screening the equipment for defective workmanship and parts. The screening tests may be performed at the WRA, subsystem or system level. Random vibration tests are preferred, however quasirandom/complex vibration is permitted when test facilities are limited, provided the test levels are consistent with the requirements of 4.6.2.

4.2 Preproduction (First Article) Tests - Preproduction tests shall be conducted by the contractor on an equipment representative of the production equipments to be supplied under the contract. Preproduction tests shall be accomplished under the approved test procedure of 4.6. The Government inspector and the procuring activity shall be advised when tests are to be conducted so that a Government representative may be designated to witness or supervise the tests when so desired. Contractors not having adequate facilities to conduct all required tests shall obtain the services of a commercial testing laboratory acceptable to the Government.

4.2.1 Preproduction (First Article) Test Data - The contractor shall submit all data collected in conducting these tests to the procuring activity for review.

4.2.2 Scope of Tests - Preproduction tests shall include all tests deemed necessary by the procuring activity to determine that the equipment meets all the requirements of this specification, other applicable specifications and the contract. Preproduction tests shall include:

(1) Individual Tests. (4.3.1).

(2) Reliability Assurance Tests. (4.2.2.2).

(3) Environmental Tests. (4.2.2.1).

(4) EMI Tests. (4.2.2.3).

(5) Maintainability Demonstration (I-Level). (4.2.2.4).

4.2.2.1 Preproduction Reliability Assurance Tests (RAT) -The preproduction articles shall be subjected to 48 hours of the All Equipment Burn-in Test specified by 4.3.2, prior to the performance of the environmental, EMI and the maintainability demonstration tests.

4.2.2.2 Environmental Tests - Environmental tests shall be conducted at the subsystem level in accordance with the applicable subsystem specification (MIL-D-85056, MIL-W-85057, MIL-C-85058), to verify that the requirements of 3.2.5 are met.

4.2.2.3 Electro-magnetic Interference (EMI) Tests - EMI tests patterned after MIL-STD-462, shall be performed by the contractor. An EMI test plan shall be prepared by the contractor and submitted for approval by the procuring activity.

4.2.2.4 Maintainability Demonstration (I-Level) - First level (I-Level) maintainability requirements shall be verified to ensure that the applicable requirements of 3.2.4 have been met. The maintainability demonstration tests shall be performed in accordance with MIL-STD-471, Test Method 2, when specified by the contract.

4.2.2.4.1 Maintainability Test Requirements and Procedures - When specified in he contract, maintainability test requirements and test procedures shall be prepared by the contractor and submitted to the procuring activity for approval. The test procedures shall include requirements and procedures required for alignment of and adjustments to WRAs and SRAs at all levels of assembly.

4.2.3 Preproduction (First Article) Approval - Approval of the preproduction sample shall be by the procuring activity upon satisfactory completion of all tests. No production equipments shall be delivered prior to the approval of the preproduction sample. Disposition of the preproduction sample shall be as specified by the contract (see 6.2).

4.2.4 Preproduction and Special Test Failures - Should a failure occur during preproduction or special tests, the following actions shall be taken by the contractor:

(1) Determine the cause of failure.

(2) Determine if the failure is an isolated case or design defect.

(3) Submit to the procuring activity for approval, proposed corrective action intended to reduce the possibility of the same failure(s) occurring in future individual tests.

4.2.5 Production Equipment - Equipment supplied under the contract, shall in all respects, including design, construction, workmanship, performance and quality, be equivalent to the approved preproduction sample. Each equipment shall be capable of successfully passing the same tests as imposed on the preproduction sample. Evidence of non-compliance with the above shall constitute cause for rejection. For equipment already accepted by the Government, it shall be the obligation of the contractor to make necessary corrections as approved by the procuring activity.

4.3 Acceptance Tests - The contractor shall be responsible for accomplishing the acceptance tests. All inspections and testing shall be under the supervision of the Government inspector. Contractors not having adequate facilities for conducting all required tests shall engage the service of a commercial testing laboratory acceptable to the procuring activity. The contractor shall prepare test records showing quantitative results for all acceptance tests. Such records shall be signed by an authorized representative of the contractor or laboratory, as applicable, and shall be available for review upon request by the procuring activity. Acceptance tests shall consist of the following:

(1) Individual Tests. (see 4.3.1).

(2) Reliability Assurance Tests. (see 4.3.2).

4.3.1 Individual Tests - Each equipment submitted for acceptance shall be subjected to the individual tests. These tests shall be adequate to determine compliance with the requirements of material, workmanship, operational adequacy and reliability. As a minimum, each equipment accepted shall have passed the following tests:

(1) Examination of Product. (see 4.3.1.1).

(2) Thermal Screening. (see 4.3.1.2).

(3) Random Vibration. (see 4.3.1.3).

(4) Operational Tests. (see 4.3.1.4).

(5) Optional Mfr's Burn-in. (see 4.3.1.5).

4.3.1.1 Examination of Product - Each equipment shall be examined to determine that the material and workmanship requirements have been met in accordance with the test requirements listed in Table X and the applicable subsystem specification.

Table X. Preproduction and Production Examination Requirements.

REQUIREMENT PARAGRAPH	TITLE	PREPRODUCTION ACCEPTANCE	PRODUCTION ACCEPTANCE
3.2.4	Maintainability Provisions	X	
3.3	Design/Construction (MIL-E-5400)	X	
3.3.1	Parts and Materials (MIL-E-5400)	X	
3.3.1.2	Connectors	X	X
3.3.1.3	Adjustment Controls	X	
3.3.1.4	Printed Wiring Boards	X	X
3.3.1.5	Printed Wiring Assemblies	X	X
3.3.1.6	Elastomeric Materials	X	
3.3.1.7	Soldering	X	X
3.3.1.8	Wiring/Wire Coding	X	
3.3.1.9	Surface Finishes	X	X
3.3.1.10	Logic Circuits	X	
3.3.1.11	Screws and Fasteners	X	X
3.3.1.12	Vibration Isolation	X	
3.3.1.13	Accessibility	X	
3.3.2.5	Bonding and Grounding	X	X
3.3.3	Nomenclature/Nameplates/ID	X	X
3.3.3.1	Serialization	X	X
3.3.4	Workmanship	X	X
3.3.4.1	Cleanup	X	X
3.3.5	Interchangeability	X	
3.3.8	Modules	X	
3.3.10	Cooling	X	
3.3.12	Boresight Provisions	X	

4.3.1.2 Thermal Screening - Each item shall be subjected to thermal screening tests, using the procedure outlined in 4.6.1. Failures that occur shall be recorded and reported as specified in 3.2.3.5.

4.3.1.3 Random Vibration - Each item covered by this specification shall be subjected to random vibration using the test conditions and procedures outlined in 4.6.2. Failures that occur during the tests shall be recorded and reported as specified in 3.2.3.5.

4.3.1.4 Operational Tests - Each item shall be subjected to the operational tests specified by the applicable subsystem specification. The operational tests shall be conducted prior to, and at the completion of, the reliability assurance tests.

4.3.1.5 Manufacturer's Optional Burn-in - Optional burn-in tests may be performed by the contractor in preparation for the reliability assurance all-equipment burn-in tests.

4.3.2 Production Acceptance Reliability Assurance Tests (RAT) - The production acceptance RAT shall consist of the all equipment burn-in test, to be conducted in accordance with MIL-STD-781B, Test Plan XXIX as modified by 4.3.2.1, and shall conform to the requirements of 3.2.3. The RAT shall be performed at the system level of assembly.

4.3.2.1 All Equipment Burn-in Test - Each item submitted for acceptance shall be subjected to a minimum number of hours of burn-in as follows:

Preproduction articles	48 Hours
System 1	300 Hours
System 2	150 Hours
System 3	96 Hours
System 4 (and all subsequent systems)	48 Hours

The test conditions specified in 4.6.3 shall be used, except that, in the event that the Weapon Delivery Computer subsystem shall be subjected to the standard conditions of 3.2.5.14 in lieu of the conditions of 4.6.3. The functional tests of 4.6.4 shall be performed during RAT.

4.3.2.2 Test Failures - Failures that occur during RAT shall be reported, analyzed and corrected in accordance with MIL-STD-781B.

4.4 System Performance Demonstration Tests - System performance tests shall be conducted to demonstrate compliance with the applicable requirements of this specification, and shall consist of the following:

(1) System Integration Tests. (see 4.4.1).

(2) Software Verification Tests. (see 4.4.2).

(3) Maintainability Demonstration (0-Level). (see 4.4.3).

(4) EMC Tests. (see 4.4.4).

(5) Flight Tests. (see 4.4.5).

4.4.1 System Integration Tests - System integration tests shall be performed by the contractor to verify that the system interface requirements of 3.1.5 and the performance requirements of 3.7 are met.

4.4.2 Software Verification Tests - When specified in the contract software verification tests shall be performed by the contractor to verify that the performance requirements of 3.7.3 and 3.7.4 are met.

4.4.3 Maintainability Demonstration (0-Level) - A system 0-level maintainability test shall be performed in accordance with MIL-STD-471 to verify that the requirements of 3.2.4 are met.

4.4.4 Electro-magnetic Compatibility (EMC) Tests - When specified by the contract, EMC tests shall be performed on the total system after integration of the system into the aircraft. EMC tests in the aircraft will be performed by a testing activity designated by the procuring activity. Laboratory EMC tests shall be performed by the contractor, and shall be included, if required by the contract, as part of the EMI test plan.

4.4.5 Flight Test Evaluation - Flight test evaluation of the system shall be performed in accordance with the Test and Evaluation Master Plan (TEMP 308) to ensure that the requirements of MIL-W-85114 are met.

4.5 Special Tests - Special tests shall be conducted for the purpose of checking the effect of any design or material change on the performance of the equipment and to assure adequate quality control.

4.5.1 Special Test Schedule - Selection of equipments for special tests shall be made as follows:

(1) On an early equipment after an engineering or material change.

(2) Whenever failure reports or other information indicate that additional tests are required. (This will be determined by the procuring activity).

4.5.2 Scope of Tests - Special tests shall consist of such tests as approved by the procuring activity. Test procedures previously approved for the preproduction tests shall be used where applicable. When not applicable, the contractor shall prepare a test procedure and submit it to the procuring activity for approval prior to conducting the tests.

4.6 Test Procedures - The procedures used for conducting all tests specified herein shall be prepared by the contractor and submitted to the procuring activity for review and approval. The right is reserved by the procuring activity or the Government inspector to modify the tests or require any additional tests deemed necessary to determine compliance with the requirements of this specification or the contract. MIL-T-18303 shall be used as a guide for preparation of test procedures. When approved test procedures are available from previous contracts, such procedures will be provided and may be used when their use is approved by the procuring activity. However, the right is reserved by the procuring activity to require modification of such procedures, including additional tests, when deemed necessary. System and subsystem level tests shall be in accordance with the following paragraphs.

4.6.1 Thermal Screening - Each item covered by this specification shall be subjected to a minimum of 25 temperature cyclings from -40°C to +60°C to -40°C at a rate of change of not less than 10°C per minute (the contractor may adjust the temperature values provided the range from minimum to maximum temperature is not less than 100°C). There shall be no dwell time required at any temperature level. Each unit shall be operating during periods of increasing temperature and non-operating during periods of decreasing temperature. The unit under test shall be functionally tested during operation and continuously monitored. Normal systematic cooling provisions shall be provided. Failures that occur shall be recorded and reported as specified in 4.3.3. The last three consecutive test cycles shall be failure free.

4.6.2 Random Vibration Tests - Each equipment shall be subjected to random vibration in one axis for a time period of 10 minutes. The test item shall be attached to the vibration exciter according to the mounting techniques paragraph of MIL-STD-810, Method 514.2. Equipment hard-mounted in service

is to be hard-mounted to the test fixture. Equipment soft-mounted in service shall use service isolators when mounted on the test fixture. If service isolators cannot be made available during the qualification test, isolators shall be provided with characteristics such that the isolator/equipment resonant frequencies shall be between 20 Hz and 45 Hz with resonant amplification ratio between 3 and 5. The acceleration power spectral density shall be 0.02 G^2 per Hz, and shall be in accordance with Figure 11 with an allowable variation from the nominal level of ±3dB. The equipment shall be operated during the random vibration test, and if conducted at the system level, the functional tests of 4.6.4 shall be performed during the test. The operational tests specified in the subsystem specification shall be performed after the vibration tests.

4.6.3 RAT Test Procedures - Reliability assurance and burn-in tests shall be performed at the conditions specified in Table XI, and shall conform to the test profile shown in Figure 12.

Table XI. RAT/Burn-in Test Conditions

Chamber Temperature Cycling	In accordance with Figure 12
Chamber Temperature Rate	10 ±2°C/minute minimum
Vibration	2.2 g ±10 percent peak acceleration at contractor selected nonresonant frequency between 20 and 60 Hz. The duration of vibration shall be 30 minutes during each hour of equipment operating time. Axis as defined by test procedure.
Equipment ON-OFF Cycling	See Figure 12
Input Voltage	115 V, 3 Ø, 400 Hz; ±5 percent
Input Voltage Cycling	100 to 121 V, 380 to 420 Hz once every hour

4.6.4 System Functional Tests - System functional tests shall be performed in accordance with the following paragraphs.

4.6.4.1 Functional Test A - Functional Test A shall be performed as follows:

a. Place the test specimen in WDC mode.

b. Enter the initial data by the CUS.

c. Verify that the DEU displays correct data.

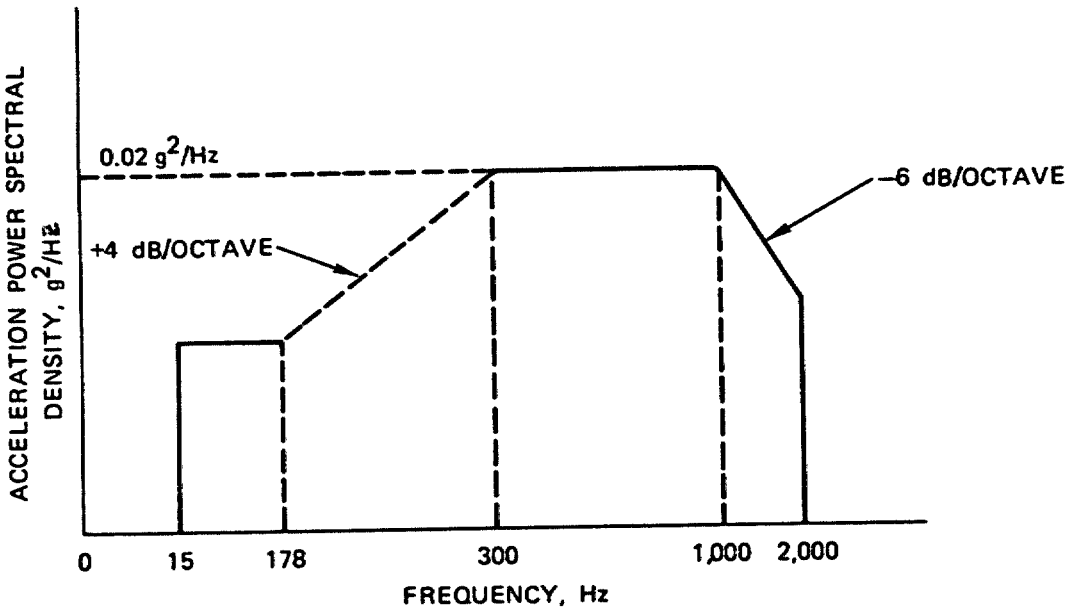


Figure 11. Random Vibration Test Envelope.

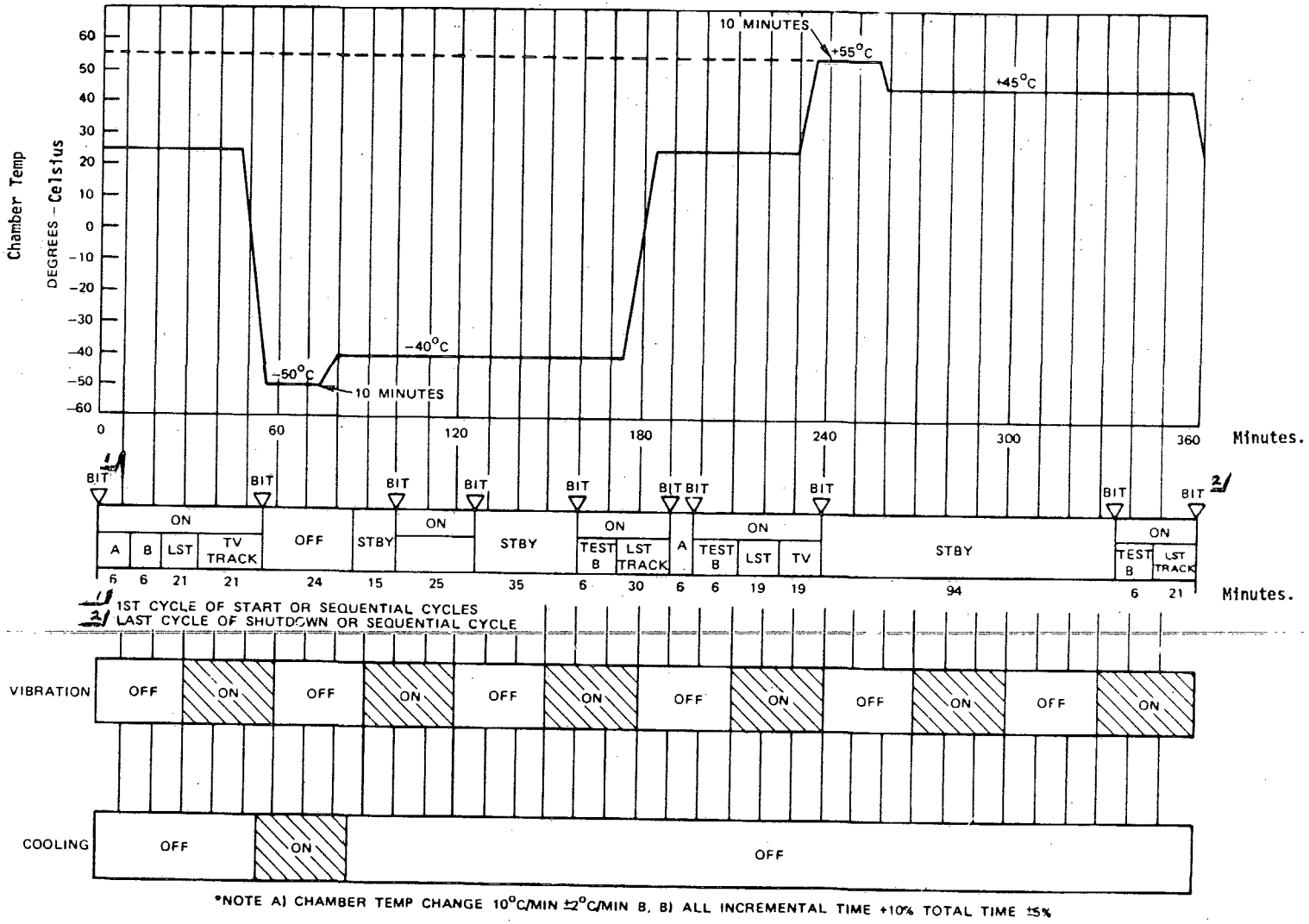


Figure 12. Reliability and burn-in test profile (single test cycle).

4.6.4.2 Functional Test B - Functional Test B shall be performed as follows:

a. Place the test specimen in the LST mode and set the LST scan switch to ADL.

b. Observe the TV monitor to verify that a scan has been initiated and LST acquisition has occurred on the light-emitting diode (LED) target.

c. After LST lock-on, press the DESIGNATE switch to initiate HAND-OFF to TV tracking. Then, activate the TRACKER STABILIZATION switch. Verify that the tracker can be slewed by means of the slew controller by observing the TV monitor.

d. Re-acquire and obtain lock-on to the TV target by releasing the TRACKER stabilization switch.

e. Actuate the light filter by setting the RED/YELLOW switch to YELLOW. Observe TV monitor to determine scene brightening. Return the switch to RED. Observe TV monitor for scene darkening.

f. Depress the DESIGNATE switch to return the system to LST tracking.

g. Return the system to the pretest Mode condition.

4.6.4.3 Functional Test C - Perform the system operational readiness (BIT Mode) test.

4.7 Reconditioning of Tested Equipment - Equipment which has been subjected to tests shall be reconditioned by the contractor by replacing all worn or damaged items. After reworking, the contractor shall resubmit the equipment for acceptance.

4.8 Presubmission Testing - No item, part or complete equipment shall be submitted by the contractor until it has been previously tested and inspected by the contractor and found to comply, to the best of his knowledge and belief, with all applicable requirements.

4.9 Rejection and Retest - Equipment which has been rejected may be reworked or have parts replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Government inspector.

5. PREPARATION FOR DELIVERY

5.1 General - All major units and parts of the equipment shall be preserved, packaged, packed and marked for the level of shipment specified in the contract or purchase order in accordance with MIL-E-17555.

6. NOTES

6.1 Intended Use - Attack aircraft provide the air arm of the Navy striking force. These Marine Corps and Navy aircraft are required to perform close air support and strike missions in direct support of ground and sea operations. Of utmost importance in these missions is accuracy and first-pass attack capability against a wide variety of targets, stationary and moving, during day and night conditions. A major portion of these operations is conducted in visual flight conditions not requiring the sophistication, cost and complexity of all-weather delivery systems.

Recent technological advancements have made guided weapons using laser, TV or infrared seekers possible for use in these missions. The weapons, although effective, are not always cost effective or operationally desirable in all situations. There exists a need for an accurate delivery method for air launched conventional unguided weapons in order to give the air forces the required flexibility for the best possible neutralization of all enemy target threats.

The A-4M weapons delivery system is intended to provide the Marine Corps with an accurate bombing system for use in close air support against targets in close proximity to friendly troops. The weapons system will deliver guided and unguided ordnance under day and night conditions but will not have an all-weather capability. The system is expected to operate in an environment which exposes the aircraft to hostile missile attack and ground fire, therefore making accurate first-pass weapon delivery an imperative requirement.

The method used to achieve high accuracy in the unguided weapon delivery is angular rate bombing. The system will consist of DMT, computer, and head-up display. Working together as an integrated system, pilot steering information and selectable automatic weapon release firing pulses will be generated for both visually acquired targets (TV mode) and laser designated targets (laser mode). The system will be designed to be physically and functionally compatible with the A-4M and AV-8 aircraft.

The Marine Model A-4M Skyhawk is a single place attack aircraft. Designed as a high performance aircraft, it mounts two 20 mm guns internally, carries a wide variety of external stores, and is capable of operating from a carrier or shore base. The current weapon delivery system is composed of several independent subsystems integrated into the aircraft. The primary weapon delivery system is the CP-741. These systems are limited to relatively canned weapon delivery maneuvers in visual daylight operation. Current night close support operations are conducted with the aid of flares. More effective and accurate weapon delivery is a basic requirement for the A-4M aircraft.

The U.S. Marine Corps AV-8 attack aircraft, known as the Harrier, is designed and built by Hawker-Siddeley of the United Kingdom. This aircraft is a single seat, single engine, transonic vectored thrust designed for vertical or short take-off and landing (V/STOL). The Harrier is characterized by two forward and two aft rotatable nozzles, shoulder mounted swept anhedral wings, and a bicycle landing gear with outriggers at the wing tip. Except for V/STOL capability, the Harrier is similar in size, weight, and performance to the A-4M aircraft. Two Aden 30 mm guns may be carried in fuselage pods in addition to the five ordnance pylons. The current Harrier weapon delivery system is a part of the Ferranti FE-541 integrated navigation and weapon aiming system which utilizes an inertial platform as a primary sensor. Aircraft delivered to the Marine Corps after Mod 800 will have the FE-541 system replaced with a less complex and lower cost system termed the interface and weapon aiming computer (IWAC) provided by Smith's Industries, Ltd.

6.2 Ordering Data - Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

(1) Title, number, and date of this specification.

(2) Documentation (see 3.4).

(3) Spare equipment provisions (see 4.1.5).

(4) Selection of applicable levels of Packaging and Packing (see 5.1).

(5) WRA/SRA acceptance requirements and test procedures (see 4.1.5.1).

(6) Disposition of preproduction sample (see 4.2.3).

(7) Test procedures (see 4.6).

(8) Test reports.

(9) Software Verification Tests (see 4.4.2).

6.3 Type Designations - The type designation may be modified by the procuring activity upon application by the contractor for assignment of nomenclature in accordance with 3.3.3. The correct type number shall be used on nameplates, shipping records, and instruction books, as applicable.

6.4 Mission Definition - The missions for use of the ARBS as specified in 3.1.2 are defined in the following paragraphs.

6.4.1 Close Air support - Close air support is defined as a mission against hostile targets which are in close proximity to friendly-forces and which requires detailed integration with the fire and movement of those forces. These missions must be accomplished quickly because of the urgency of the combat situation and may be needed at night or in bad weather.

CAS missions are generally characterized by the following:

(1) Operations are limited to a minimal three mile visibility.

(2) The aircraft is vectored to the target area for visual contact with the FAC and acquisition of laser designated targets. Two-way communication with the FAC is maintained.

(3) Positive identification of the target is required.

(4) The target is usually in close proximity to friendly troops.

(5) Accurate weapon delivery is mandatory.

(6) Run-in and weapon delivery direction is usually made parallel to friendly forces.

Weapons usually used for close air support missions include freefall bombs, guns, and rockets. Accurate air-to-ground fire control of these weapons is a requirement of the ARBS.

6.4.2 Deep Air Support - Deep air support for the Marine Corps is a primary mission against pre-briefed enemy surface targets. Included are three sub-categories: Defense suppression which has the main objective of long and short term destruction of and suppression of enemy defenses that are or could be used against air strikes; Friendly-force defense which is the destruction of long term enemy offensive capability; and Air interdiction where the primary purpose is to deny the enemy facilities and lines of communication. All targets are heavily defended and it is desirable to minimize the number of strikes. Night and foul weather operations may be required. DAS missions are further characterized by:

(1) Missions and target locations are usually preplanned.

(2) Navigation to and from the target area is a basic requirement, since these missions imply long ranges.

(3) Friendly troops are usually not present in the target area.

(4) Targets are generally more heavily defended.

(5) Long standoff release ranges are required.

Airborne laser designation of strike targets may be available and weapon delivery against those targets is a potential requirement of ARBS during these missions.

6.4.3 Armed Reconnaissance/Interdiction - Armed reconnaissance is the interdiction of mobile logistics vehicles and targets of opportunity. This mission is characterized by:

(1) Mission not generally preplanned.

(2) Defenses can vary widely and land targets are usually small, mobile and can be easily hidden or camouflaged.

(3) Targets of opportunity generally preclude the use of laser illuminators for the attack phase.

6.5 Acronyms - The following acronyms are used in conjunction with the ARBS:

AAI - Aircraft Attitude Indicator

ADC - Air Data Computer

ADI - Attitude - Director Indicator

ADL - Armament Datum Line

ADLM - Aircraft Datum Line Marker

AFCS - Automatic Flight Control System

AFPR - Armed Forces Procurement Regulations

AGE - Aerospace Ground Equipment

AGL - Above Ground Level

ARBS - Angle Rate Bombing System

ASL - Azimuth Steering Line

ASO - Aviation Supply Office

ATE - Automatic Test Equipment

AWRS - Automatic Weapon Release System

BARO - Barometric

BDHI - Bearing-Distance-Heading Indicator

BIT - Built-In-Test

BITE - Built-In-Test Equipment

CAL - Computer Azimuth Lead

CAS - Close Air Support

CDRL - Contract Data Requirements List

CEP - Circular Error Probable

CFE - Contractor Furnished Equipment

CIP - Computed Impact Point

CIU - Converter Interface Unit

CRR - Chosen Release Range

CUS	- Control Unit Subsystem
DAS	- Deep Air Support
dB	- Decibels
dBm	- Decibels referred to 1 milliwatt
DC	- Digital Computer
DEP	- Deflection Error Probable
DMT	- Dual-Mode Tracker
DRS	- Doppler Radar Set
ECP	- Engineering Change Proposal
EMC	- Electromagnetic Compatibility
EMI	- Electromagnetic Interference
EMV	- Electromagnetic vulnerability
ER	- Established Reliability
FAC	- Forward Air Controller
FIT	- Fault Isolation Test
FPM	- Flight Path Marker
fps	- Feet per second
GFE	- Government Furnished Equipment
GHz	- gigahertz
HERO	- Hazard of Electromagnetic Radiation to ordnance
HD	- High Drag
HSI	- Horizontal Situation Indicator
HUD	- Head-Up Display

IOT&E	- Initial Operational Test and Evaluation
ICD	- Interface Control Document/Drawing
ILSP	- Integrated Logistics Support Plan
IP	- Initial Point
kHz	- kilohertz
LABS	- Low Altitude Bombing System
LED	- Light Emitting Diode
LOR	- Level of Repair
LRU	- Line Replaceable Unit
LSB	- Least Significant Bit
LST	- Laser Spot Tracker
MAS	- Master Armament Switch
MAFS	- Master Attack Function Switch
MEA	- Maintenance Engineering Analysis
MHz	- megahertz
mils CEP	- milliradians Circular Error Probable
MLV	- Memory Loader/verifier
MPI	- Mean Point of Impact
MSB	- Most Significant Bit
MSI	- Medium Scale Integration
MSL	- Mean Sea Level
MTBF	- Mean-Time-Between-Failure

MTTR	- Mean-Time-To-Repair
NA	- Not Applicable
NTE	- Naval Technical Evaluation
OFP	- Operational Flight Program
ORT	- Operational Readiness Test
PGSE	- Peculiar Ground Support Equipment
PIM	- Pulse Interval Modulation
PR	- Procurement Instruction
PRF	- Pulse Repetition Frequency
QPL	- Qualified Products List
REP	- Range Error Probable
RP	- Receiver-Processor
SIDS	- Shrike Improve Display System
SRA	- Shop Replaceable Assembly
SRBSF	- Short Range Boresight Fixture
SSE	- Special Support Equipment
TACA	- Tactical Air Coordinator Airborne
TEMP	- Test and Evaluation Master Plan
TNS	- TACAN Navigaiton Set
TTL	- Transistor-Transistor Logic
TX	- Test Extra
VAST	- Versatile Avionics Shop Test System

V/M - volts per meter

W - watts

WBLC - Water Borne Logistic Craft

WDC - Weapon Delivary Computer

WDIP - Weapon Data Insert Panel

WSIC - Weapon System Integration Contractor

WRA - Weapons Replaceable Assembly

6.6 Precedence The precedence of requirements and documents shall be as specified herein.

6.6.1 Precedence of Requirements - In the event of conflict between requirements specified herein, the following design disciplines shall be given precedence in the order in which they are listed:

a. Performance.
b. Reliability.
c. Human Engineering/Operability.
d. Safety.
e. Maintainability.
f. Electromagnetic Compatibility.
g. Interchangeability.
h. Transportability.

Minimum size and weight, simplicity of operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of this specification are objectives which shall be considered in the production of this set. Where it appears a substantial reduction in size or weight or improvement in simplicity of design, performance, ease of maintenance or reliability will result from the use of materials, parts and processes other than those specified in MIL-E-5400, their use should be investigated. When investigation shows advantages can be realized, a request for approval shall be submitted to the procuring activity for consideration. Each request shall be accompanied by complete supporting information.

6.6.2 Precedence of Documents - When the requirements of the contract, this specification or other applicable specifications are in conflict, the following precedence shall apply:

a. Contract. The contract shall be given precedence over any specification.

b. This Specification. This specification shall be given precedence over all applicable subsidiary specifications.

c. Referenced Specification. Any referenced specification shall be given precedence over all applicable subsidiary specifications referenced therein. All referenced specifications shall apply to the extent specified.

6.6 Revisions - In specification revisions and superseding amendments an asterisk "*" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the asterisk notations and relationship to the last previous issue.

6.7 Cognizant Activity - This specification is under the cognizance of Naval Air System Command, AIR-54932, Washington, D.C. 20361.

Preparing Activity
(NAVY - AS)
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NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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