

DuraDBH-672 Digital Beachhead

Rugged 16-port GbE Switch, Vehicle Processor and Assured PNT System

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Key Features

- Low-power multi-core ARM vetronics processor with modular Mini-PCIe I/O scalability
- Compatible as VICTORY infrastructure switch and shared processor unit
- Support for optional integrated military GPS receiver, CSAC and IMU
- SWaP optimized and qual-tested to meet extreme environment/EMI conditions
- Filtered MIL-STD-1275D / 704F power supply
- Rugged IP67 aluminium chassis with CARC finish, MIL-38999 connectors

Applications

- Situational awareness upgrades at the network edge
- VICTORY infrastructure switch and shared services processor for ground vehicles
- In-vehicle precision time-stamped GbE LAN switching and routing
- C4ISR technology refresh and vehicle modernization
- Assured PNT distribution capabilities for GPS-denied environments
- HUMS for fleet logistics
- Low-power ARM embedded computing applications
- Modular open architecture, LRU consolidation

Overview

The DuraDBH-672 Digital Beachhead™ is the first rugged Commercial Off the Shelf (COTS) single-box solution integrating a Gigabit Ethernet (GbE) switch and quad-core vetronics processor for supporting VICTORY services and mounted Assured-Position Navigation Timing (A-PNT) capabilities in a MIL-STD qualified, small form-factor chassis. The multi-function DuraDBH-672 builds on Curtiss-Wright's market leadership in VICTORY solutions, adding a lower size, weight, power and cost (SWaP-C) design to the Digital Beachhead family capable of consolidating network switch, vehicle processor, embedded GPS, atomic clock, inertial navigation, solid-state storage, and add-in I/O interface all in a single Line Replaceable Unit (LRU). Featuring 16 ports of fully managed Layer 2 GbE switching and static Layer 3 routing together with a low-power, multi-core ARM-based i.MX6-Quad processor, the DuraDBH-672 system supports not only general-purpose embedded computing and in-vehicle edge networking requirements, but can also serve as a VICTORY Infrastructure switch and shared processing unit for the In-Vehicle Network (IVN) Architecture adopted by the U.S. Army/US Marine Corps' Vehicle Integration for C4ISR/EW Interoperability (VICTORY) initiative. With optionally integrated A-PNT components, including a military SASSM/M-Code GB-GRAM (Ground Based GPS Receiver Application Module), a Chip Scale Atomic Clock (CSAC), and Inertial Measurement Unit (IMU), this highly-capable system can enable cost-effective, accurate Mounted Assured-PNT (MAPS) functionality and affordable PNT hub capabilities using non-GPS augmentation for mounted platforms.

Combining proven, high Technology Readiness Level (TRL) COTS sub-assemblies and open architecture technologies into a single multi-function solution, this next-generation Digital Beachhead delivers a powerful set of standard and optionally integrated capabilities. The unit's carrier-grade network management software provides a powerful feature set for multicast traffic, VLAN, port control, Quality of Service (QoS), Link Aggregation, SNMP management, secure authentication, redundancy, precision timing (IEEE-1588 PTPv2), and data zeroization. It's multi-core processor provides a robust set of vetronics I/O interfaces (USB, GbE, RS-422, RS-232, CANbus, DIO, HDMI, Audio) along with a modular I/O and storage architecture based Mini-PCIe cards and mSATA SSD Flash storage modules to support application-specific I/O requirements (i.e. MIL-STD-1553, ARINC429, COM, DIO modules). Application engineering services are available for modified COTS (MCOTS) configurations at minimal/no NRE cost, including pre-integration of Mini-PCIe I/O cards. Qual-tested to meet harsh MIL-STD-810G and MIL-STD-461F requirements, the unit boasts fanless operation over a wide operating temperature range (-40 to +71°C) and tolerance to extreme shock and vibration conditions, high altitude, and humidity, making it suitable for technology refresh and new platform deployments, including mobile, tactical, aerospace, and ground vehicle applications. It features front-panel MIL-DTL-38999 circular connectors in a sealed IP67 (dust and water proof) aluminum chassis together with industrial temperature grade components, EMI filtering, and isolated MIL-STD-1275/704 power supply that protects against vehicle and aircraft voltage surges, spikes and transients.

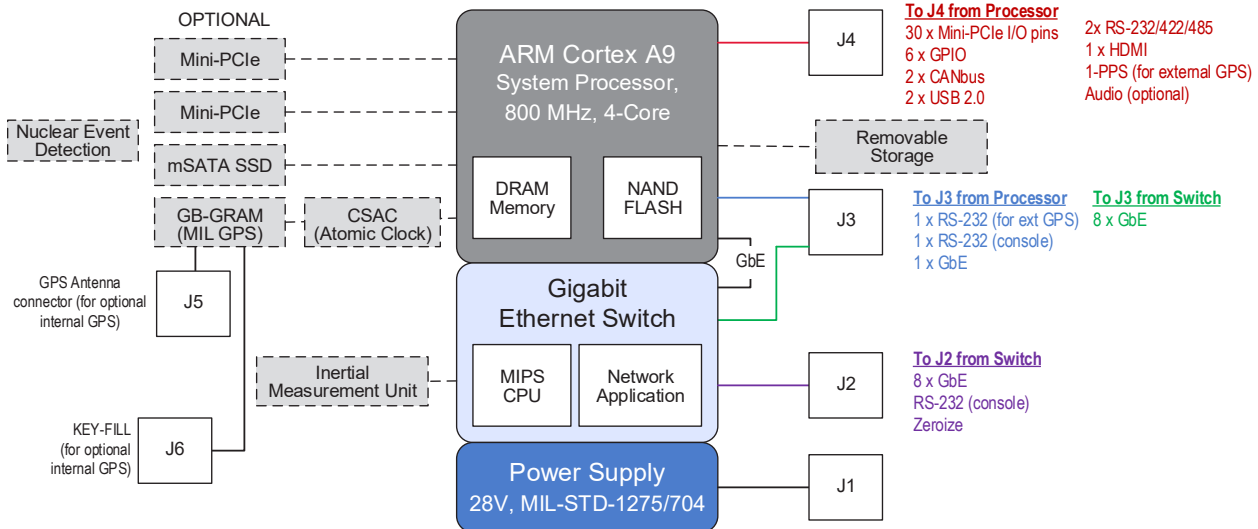


Figure 1: DuraDBH-672 block diagram

Features

Managed Gigabit Ethernet switch

- 16 ports of fully managed GbE switching in SWaP optimized chassis
- Carrier Ethernet switch packet processor with embedded management processor and rich Layer-2 switch features, Layer 3-aware packet processing, service classification and traffic policing
- Robust switch management: IPv4 / IPv6 multicast, VLAN, QoS/CoS, RSTP/MSTP, link aggregation, 1588v2 PTP precision timing, SNMPv3, HTTP server, Web GUI, console CLI, port monitoring, RMON, Syslog, network access server, 802.1X, IGMP snooping, access control lists, zeroization, Built-in Test (BIT) diagnostics, Layer 3 unicast static IP routing

Low-power ARM-based vetronics computer

- Multi-core i.MX6-Quad ARM-based vehicle management computer with flexible vetronics interfaces, including CANbus, serial, audio, video, and digital I/O
- Support for optional Mini-PCle I/O module expansion (for MIL-STD-1553, ARINC429, Wi-Fi, civil GPS, etc.)

VICTORY architecture compatibility

- Infrastructure switch component type
- Shared processing unit component type

Assured PNT Hub services

- Distribute A-PNT services to connected devices over Ethernet network
- Support for direct connection to external GPS input (i.e. DAGR) and 1 PPS input for PTP time accuracy
- Support for hosting government-furnished equipment (GFE) GB-GRAM GPS receiver module (SASSM and next-gen Military Code)
- Roadmapped option for integrated CSAC and IMU for non-GPS augmentation to PNT services

Rugged MIL-STD design

- Validated to meet harsh MIL-STD-810G conditions (temp, shock, vibration, humidity, altitude, and ingress)
- Validated to meet MIL-STD-461F EMI/EMC (conducted and radiated emissions and susceptibility)
- -40 to +71°C fanless extended temp operation with no moving parts
- Corrosion-resistant, aluminium chassis sealed against water and dust (similar to IP67) with Chemical Agent Resistive Coating (CARC) finish
- Circular MIL-DTL-38999 connectors on front panel for reliable network connections
- Filtered, transient-protected power supply for aircraft and vehicle use (per MIL-STD-1275 and MIL-STD-704)

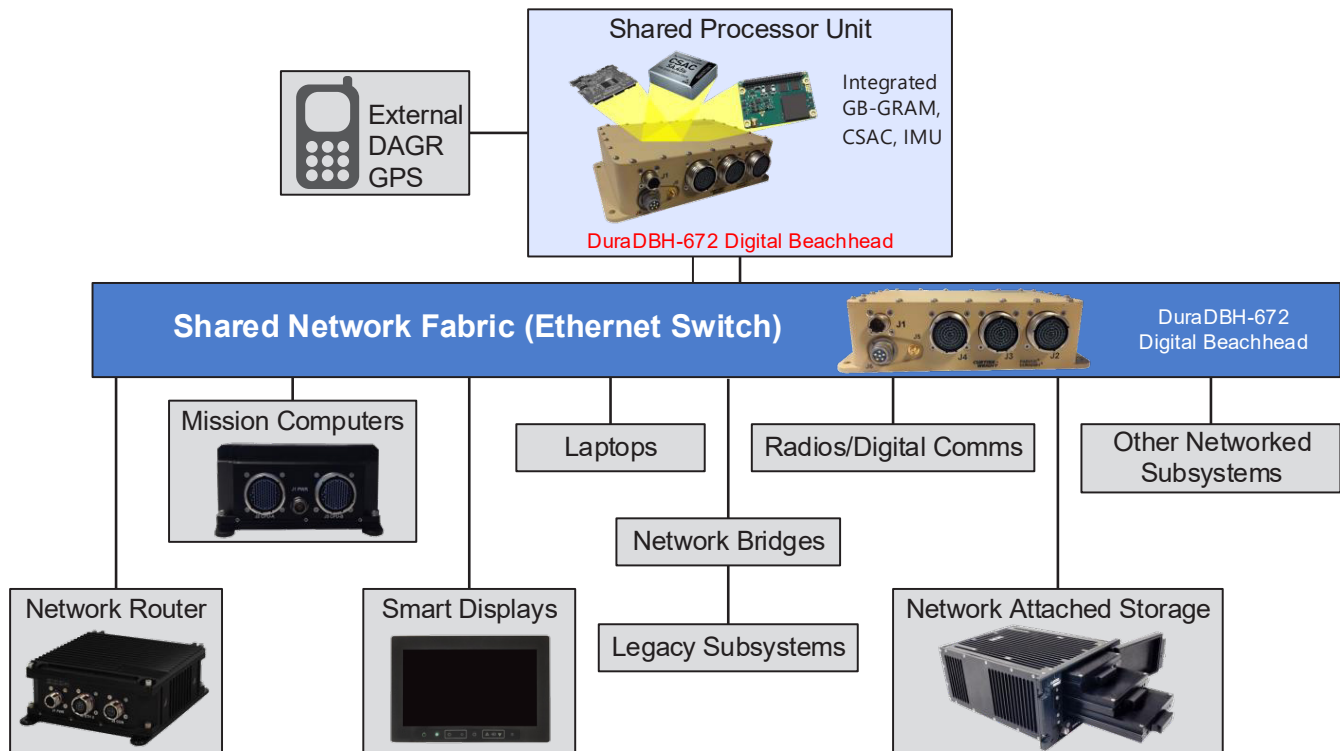


Figure 2: Enabler for Intra-Vehicle Network Centric Architecture

Target Applications

- SWaP-sensitive mobile, tactical, airborne, and vehicle platforms upgrading situational awareness capabilities at the network edge
- U.S. Army VICTORY infrastructure switch and shared services processor requirements for ground vehicles
- In-vehicle precision time-stamped GbE LAN switching/routing for IP-enabled electronics
- C4ISR technology refresh and vehicle modernization
- Assured PNT distribution capabilities for GPS-denied environments
- Health Usage and Monitoring Systems (HUMS) for fleet logistics (management, gathering, and logging of critical vehicle data)
- Low-power ARM embedded computing applications where harsh temperature, shock, vibration, altitude, dust, water environmental and EMI conditions exist
- Modular open architecture, LRU consolidation – multiple I/O and function integration into single box

System Architecture

Ethernet Switch

- Switch interfaces:
 - + 16 x 10/100/1000BASE-T GbE ports
 - + 1 x RS-232: management console
- Switch packet processor:
 - + Microsemi-Vitesse carrier-grade Ethernet switch engine
 - + Non-blocking OSI data Layer 2+, IPv4 / IPv6 multicast, low-latency, Auto-MDI/MDIX, auto-negotiation, auto-detect, speed auto-sensing, auto-crossover, and full/half duplex modes
- Management processor: embedded MIPS CPU with DDR-2 memory
- Networking software: Microsemi-Vitesse CE Services carrier Ethernet application

- Layer 2 Switching:
 - + Port control: port-speed, duplex mode, flow control, port frame size (jumbo frames), port state, port status (link monitoring), and port statistics (MIB counters)
 - + QoS traffic prioritization and queuing: 8 priorities, 8 CoS queues per port, strict or deficit-weighted RR scheduling, shaping and policing per queue and per port, and storm control
 - + VLAN: 8K MAC addresses, 4K VLANs, 802.1Q static VLAN, protocol-based VLAN, MRP, MVRP, MVR, IEEE-802.10ad provider bridge, and link aggregation (IEEE-802.3ad)
 - + IEEE-802.1 D/w/s Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP)
 - + L2 IEEE-1588v2 Precision Timing Protocol (PTP) time stamping
- Layer 3 Routing:
 - + Layer 3 IPv4/IPv6 unicast static routing support for IP routing to attached WAN and radio ports (limited to <3 MBps throughput; dynamic routing not supported)
- Management:
 - + In-band Ethernet management using Web GUI or Simple Network Management Protocol (SNMP) or Command Line Interface (CLI) over RS-232 console for Telnet / SSH / terminal
 - + HTTP/HTTPS Web server, SNMP v1 / v2 / v3 client, DHCP Client, IEEE 802.1X authentication, system Syslog, SSHv2, IPv6 management, IGMP/MLD/DHCP Snooping, Access Control Lists (ACLs), port mirroring, BPDU guard, RMON, Cisco Discovery filtering, IEEE-802.10AB LLDP
 - + Built-in Test (BIT) functionality to detect system faults
- Security:
 - + Network Access Server (NAS) IEEE-802.1X, RADIUS accounting, MAC address limit, TACACS, Web and CLI authentication, ACLs, and IP source guard
 - + Declassification: data zeroization support to erase non-volatile Flash memory and restore board to factory default configuration
- Storage expansion:
 - + mSATA Flash SSD (~up to 256 GB)
 - + Removable Flash storage option (road mapped)
- Standard I/O:
 - + USB: 2 x USB 2.0
 - + CAN: 2 x CANbus
 - + Serial: 2 x RS-232/422/485, 1 x RS-232 (for external GPS input), 1 x RS-232 (console)
 - + Network: 1 x GbE (+ 1 x connected internally to switch)
 - + DIO: 6 x general-purpose digital I/O
 - + Video: HDMI output
 - + PCIe MiniCard I/O: 2 x module slots, 30 spare pins on DTL-38999 for add-on I/O modules
 - + 1-PPS interface for external GPS (DAGR) or internal embedded GPS receiver (GB-GRAM/Polaris™ Link), SMA antenna interface and KEY-FILL interface
 - + Internal host module site for Ground-Based GPS Receiver Application Module (GB-GRAM)
- Optional I/O:
 - + Optional stereo audio support
 - + Optional pre-integrated Mini-PCIe I/O modules: MIL-STD-1553 / ARINC429 / other application-specific I/O can be special ordered

Optional PNT Services

- Military GPS
 - + Internal host module site compatible with Rockwell Collins Polaris™Link SPS C/A code module or government-furnished (GFE) Ground-Based GPS Receiver Application Module (GB-GRAM) SASSM type I / II or GB-GRAM-M Military Code embedded GPS modules
 - + External interface for DAGR / D3 (DAGAR Distributed Device) GPS console and 1-PPS signals
- Atomic Clock (road mapped)
 - + Microsemi-Symmetricon SA.45s Chip Scale Atomic Clock (CSAC)
 - + 1PPS signal for synchronization without GPS
 - + High accuracy timing: $\pm 5.0E-11$ accuracy at shipment
 - + Integrated thermal management device for CSAC extending operational temperature ranges beyond supplier ratings
- Inertial Measurement Unit (road mapped)
 - + High accuracy IMU for inertial navigation/relative localization

Vehicle computer

- Low-power ARM processor: NXP® (Freescale) i.MX6-Quad (ARM Cortex-A9 Core, 800 MHz, 4-core, 32-bit)
- Operating system software: Linux®
- Memory/storage:
 - + 1 GB RAM
 - + 4 GB on-board NAND Flash for storage memory/boot



VICTORY Component Type

Can provide capabilities for adding VICTORY services to a vehicle or platform to enable a centralized network-centric architecture whereby common network services are available to all connected and authorized equipment to support command and control, situational awareness, data communications, automotive systems and logistics, sensors and data acquisition, among others.

- VICTORY Component Type C1-Switch (VT50900), Copper interfaces, 1 Gbps Ethernet
- VICTORY Component Type E1-Shared Processing Unit (VT51900)

When integrated with VICTORY software application based on U.S. Army TARDEC libVICTORY API, system can meet other VICTORY component type requirements, provide time and position services (through integrated/external time and position source), low-level shared processor unit services, and VICTORY databus management capabilities (Note that VICTORY software is ITAR-controlled)

Power

- 28 VDC nominal power input voltage, input range: 9-36 VDC
- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, and surges for normal, transfer, abnormal, emergency, starting, and power failure
- MIL-STD-1275D 28 VDC compliant for ground vehicle operation: steady state DC voltage variations, no fault/single fault conditions, ripple voltage susceptibility on input power leads, imported voltage spikes, overvoltage and undervoltage surges, starting disturbances, and electrostatic discharge (ESD) immunity
- Power consumption (estimated): 20-23W typical; < 28W maximum, excluding GPS or Mini-PCle I/O
- Support for Energy Efficient Ethernet (IEEE 802.3az), Vitesse ActiPHY and PerfectReach technologies to reduce active Ethernet power for unused / idle links and/or shorter cable lengths



Figure 3: Front view



Figure 4: Side view

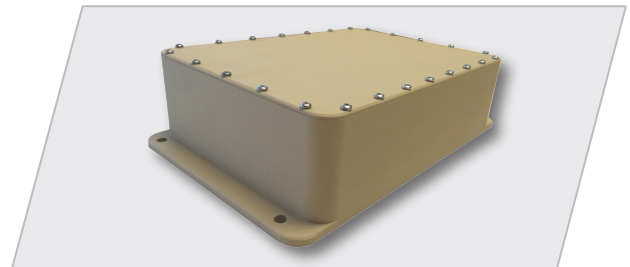


Figure 5: Rear view

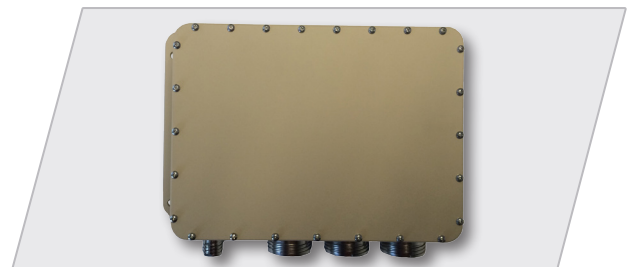


Figure 6: Top view

Physical

- Dimensions (approx.) (H x D x W, excluding connectors and mounts):
 - + 2.53 x 6.19 x 8.4" (~6.43 x ~15.72 x ~21.33 cm)
- Weight: approx. 4.0 lbs (1.81 kg)
- Installation: base flange mount with 4 x mounting holes
- Ingress protection: dust and water proof (similar to IP67)
- Connectors: MIL-DTL-38999 series III (for computer + switch I/O, power), SMA (for GPS antenna), MIL-DTL-55116 (for KEY-FILL port)
- Cooling: passive natural convection without forced air or fans; no moving parts
- Enclosure/finish: corrosion resistant, aluminium alloy with Chemical Agent Resistant Coating (CARC)
- Human factors: designed to MIL-STD-1472 for sequenced connector spacing, rounded corners

Environmental

Qualified to meet MIL-STD-810G:

- Operating temperature: -40 to +71°C (-40 to +160°F) ambient (per MIL-STD-810G Methods 501.5 and 502.5)
- Storage temperature: -46 to +85°C (-51 to +185°F) per MIL-STD-810G Method 502.5 and Method 501.5
- Humidity (operating/transport): up to 100% RH, non-condensing (per MIL-STD-810G, Method 507.5, Procedure II)
- Operating shock: 40 g, 11 ms, 3 pos/neg per axis, 18 terminal peak shock pulses per MIL-STD-810G Method 516.6, Procedure I
- Crash hazard shock: 75 g, 11 ms, 12 terminal peak shock pulses, 2 pos/neg per axis (per MIL-STD-810G Method 516.6, Procedure V)
- Transit drop, transportation shock: per MIL-STD-810G
- Random vibration: 3 axes, 1 hour/axis (per MIL-STD-810G, Method 514, per Procedures I and II per combined jet-helo-tracked vehicle profile)
- Ingress (dust/sand): no ingress (designed for compliance to IP67, MIL-STD-810G Method 510.5, Procedure I and II)
- Water immersion: no leakage per 1 meter submersion, 30 minutes (similar to IP67 and MIL-STD-810G, Method 512.5, Procedure I, 1 meter, 30 minutes)
- Operating altitude: +50,000 ft (15,240 meters) per MIL-STD-810G, Method 500.5, Procedures I-II
- Storage altitude: up to 60,000 ft (18,288 meters) per MIL-STD-810G, Method 500.5, Procedures I-II
- Salt-fog, fungus, ozone, fluid contamination: per MIL-STD-810G (qual by analysis)

EMI/EMC

Qualified to meet MIL-STD-461F:

- Conducted emissions
 - + MIL-STD-461F, CE102, power leads, 10 KHz to 10 MHz, basic curve, fig CE102-1
- Conducted susceptibility
 - + MIL-STD-461F, CS101, power leads, 30 Hz to 150 KHz, curve 2, figure CS101-1 (28V and below)
 - + MIL-STD-461F, CS114; bulk cable injection, 10k-200MHz; curve 3, figure 1
 - + MIL-STD-461F, CS115; bulk cable injection, impulse excitation; impulse, figure 1
 - + MIL-STD-461F, CS116; damped sinusoidal transients, cables/power leads, 10k-100MHz; transient, figures 1-2
- Radiated emissions
 - + MIL-STD-461F, RE102, electric field, 10 KHz to 18 GHz, fixed wing internal < 25 meters, figure RE102-3
- Radiated susceptibility
 - + MIL-STD-461F, RS103, electric field, 2 MHz to 18 GHz, 200 V/m, table VII, RS103 limits

Reliability

- Designed and manufactured using AS9100 aerospace grade and ISO 9001:2000 certified quality program
- No moving parts, no active cooling required
- Conformal coated PCBs for humidity/tin-whisker mitigation, staked components, under filled BGA
- Mean Time Between Failure (MTBF) calculated per MIL-HDBK-217F: See qual test report
- Built-in-Test (BIT) self-diagnostics capabilities to detect critical systems faults via initial Power-On Self-Test (POST) and Continuous BIT (CBIT)

Breakout Cable Set

- Optional starter breakout cable sets mates with MIL-DTL-38999 connectors transitioning to traditional commercial connectors (i.e. RJ-45/DB-9/USB/HDMI, etc.) for lab and testing purposes

Export Jurisdiction

- ITAR-free (ECCN 5A002.A.1) variants: system integrating network switch and processor - without military GPS receiver, nuclear event detection, or libVICTORY shared services software
- ITAR controlled (USML XI c) variants: system integrating military SASS/M-Code GB-GRAM, nuclear event detection, and/or libVICTORY shared services software

Ordering Information

- DBH672-4F0: 16 x GbE switch + 4-core i.MX6 processor with full vetronics computer I/O
- CBL-DBH672-4F: Starter breakout cable set for DuraDBH-672 with full system I/O (DBH672-4F), mating DTL-38999 to commercial connectors
- Other system variants integrating (a) CSAC, (b) NED, (c) removable storage, (d) IMU, (e) GB-GRAM and/or (f) libVICTORY software road mapped.

Special Order Options

- Special-ordered, feature/cost-optimized variants
- Turnkey, pre-integrated Mini-PCIe I/O or datacom modules (e.g. MIL-STD-1553 / ARINC 429 databus controllers, video capture, CANbus interface, multi-port serial/DIO, Ethernet NIC, etc) available with application engineering services
- MIL-DTL-38999 connector caps, mechanical changes, custom metal finishes, ESS screening
- Program-specific delta qualification tests (additional MIL-certifications and environmental testing)

Line Drawings

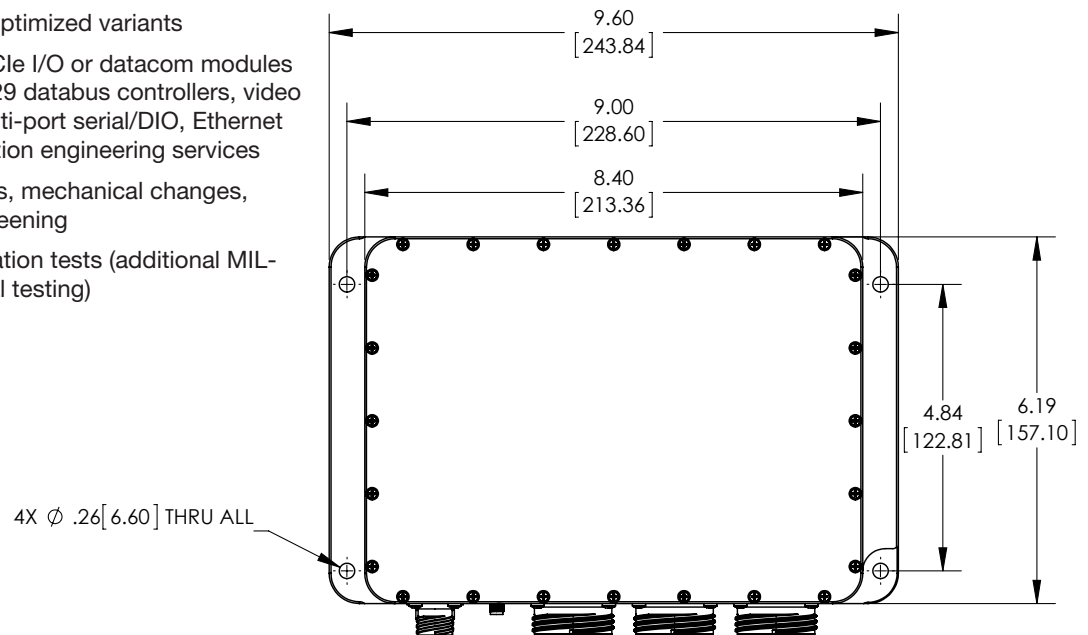
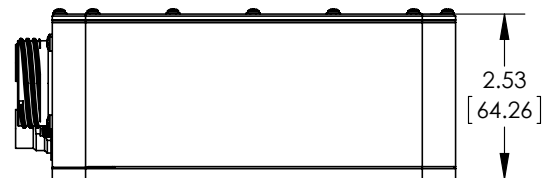
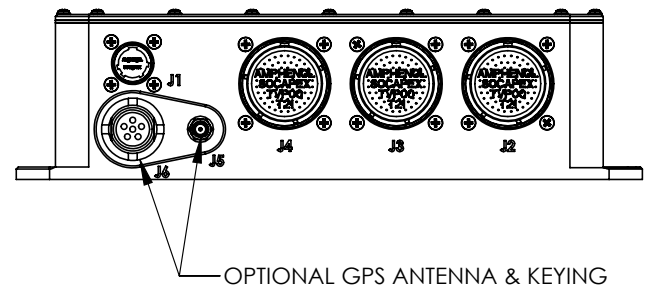


Figure 7: DuraDBH-672 dimensional line drawings
(measurements shown are in inches and [cm])