# C3I

## Critical Communications, Controls and Instruments, LLC

**BE THE BEST FOR THOSE WHO SERVE**

# Who is C3I?

▸ Established in 2000 by the company's CTO, Charles J. Wagner

▸ A Small Business Concern (primary NAICS 334511)

▸ HQ Location - 8 Commerce Way, Exeter, New Hampshire

  ◦ 6,500 sq. ft. Engineering, System Labs, Purchasing, Admin, Conference Rooms; 5,500 sq. ft. Production

▸ ACCS® and ALS-CPS systems installed on over 100+ US Navy ships

▸ Focused on serving the needs of the Navy and the rest of the DoD

▸ Specializing in flight deck and shipboard controls, networks, electronics, NVIS compatible devices, and aviation facilities and certifications support

▸ Providing HW and SW engineering, manufacturing, and assembling services and equipment

▸ ISO 9001:2015 quality management system

▸ Our ALS-CPS cybersecure hardware and software is assigned as the Program of Record with an Authority to Operate (ATO) for installation on all new construction Naval and Coast Guard Air Capable Platforms

▸ C3I is a high-performing engineering and manufacturing outfit, dedicated to **providing safe and reliable equipment** to the fleet and those who serve

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# ALS-CPS Products
# Qualified For Fleet Wide Installation With ATO

**C3I designs and manufactures:**

- *The Advanced Communication and Control System (ACCS®) and the Aviation Lighting System Control Panel Set (ALS-CPS) which consist of hardware and software designed to control the U.S. Navy's Next Generation Visual Landing Aids and other devices onboard flight decks of Air Capable Ships*

**C3I products:**

- *12" and 19" Night Vision Compatible Touch Screen Control Panels (NAVAIR Tested & Approved)*
- *Tele-robotic Firefighting Nozzle Control Panels (4 Joystick Controlled 250GPM Flight Deck Nozzles with AFFF)*
- *Network Switches (Distributed, Dual Ring Bus)*
- *Modular Protocol Controllers (Ethernet to RS 485 Fail Safe Architecture)*
- *General Purpose I/O devices*
- *LED Light Drivers (48 Independently Controlled and Driven Outputs)*
- *Legacy Light Drivers (60Hz, 120 VAC, 15 Amp)*
- *Motor Controllers (3Ø, 440VAC, Reversing)*
- *Local Control Switches*

**ALS-CPS 12" and 19" NVIS Control Panel**

**Network Switch**

**Modular Protocol Controller**

**LED Flex Driver Module**

**Variable Transformer Power Control Module**

**C3I Software**

- *Complete Integrated Software Suite With Embedded "Tool Box©" Providing System and Component Tailoring, Additions, Configuration Management, 3 Layer Password Protected Access Levels, etc.*
- *ALS-CPS Software Suite (Derivative of ACCS®) With Authority To Operate*

**C3I supports our customers with:**

- *Obsolescence Planning and Design Improvements*
- *Software Upgrades*
- *Operator and Maintainer Training Courses*
- *Shipboard Installation and Integration Support*
- *Logistics Support*
- *Hardware and Software Technical Documentation*

**C3I products have been qualified to NAVAIR specifications and the following standards:**

- *Environmental: MIL-STD-810G*
- *Shock: MIL-DTL-901E Grade A, Class 1, Type A*
- *Vibration: MIL-STD-167-1A and MIL-STD-810G*
- *EME/EMI/EMC: MIL-STD-461F, MIL-STD-464C and 1399-300*

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# Qualification

The C3I ALS-CPS hardware suite has successfully passed comprehensive and extended military environmental and performance testing to qualify them for installation on all vessels in the US Navy fleet:

- Mil-S-901D Grade A, Class 1, Type A (hard mounted)
- Mil-Std-167-1 Type 1, including resonance amplitude testing.
- Mil-Std-461E EMI/EMC: CE101, CE102, CS101, CS114, CS116, RE101, RE102, RS101, RS103
- Mil-Std-464 Lightning Section 5.4 Indirect Lightning, @1000Amps, 1000V
- Mil-Std-2169 Electromagnetic Pulse
- Mil-Std-1399 DC Magnetic Field Section 070 @ 1600A/M
- Mil-Std-1686 Electrostatic Discharge Section 5.2.2.1 @ 4,000V
- Mil-Std-1310G Electromagnetic Compatibility
- IEC 61000-4-21 Shielding Effectiveness
- Mil-Std-810F Operating Temperature: -20° to +65°C
- Storage Temp -40° - +85°C
- Humidity 5 – 95% Non-Condensing
- Drip Test
- Spray Test

# ALS-CPS Onboard Air Capable Platforms

**RAST/ASIST**
*Curtiss Wright*
*INDAL*
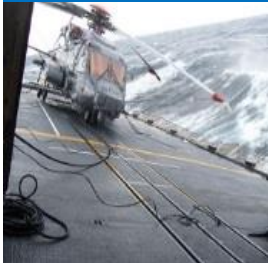
**Advanced Stabilized Glide Slope Indicator**
*L-3 Calzoni*

**Moriah Network Switch**
*AGI/QPI*

NAVAIR's Next Generation Visual Landing Aids (NGVLA) system (or subset variants) will be installed on all Air Capable Platforms with flight decks
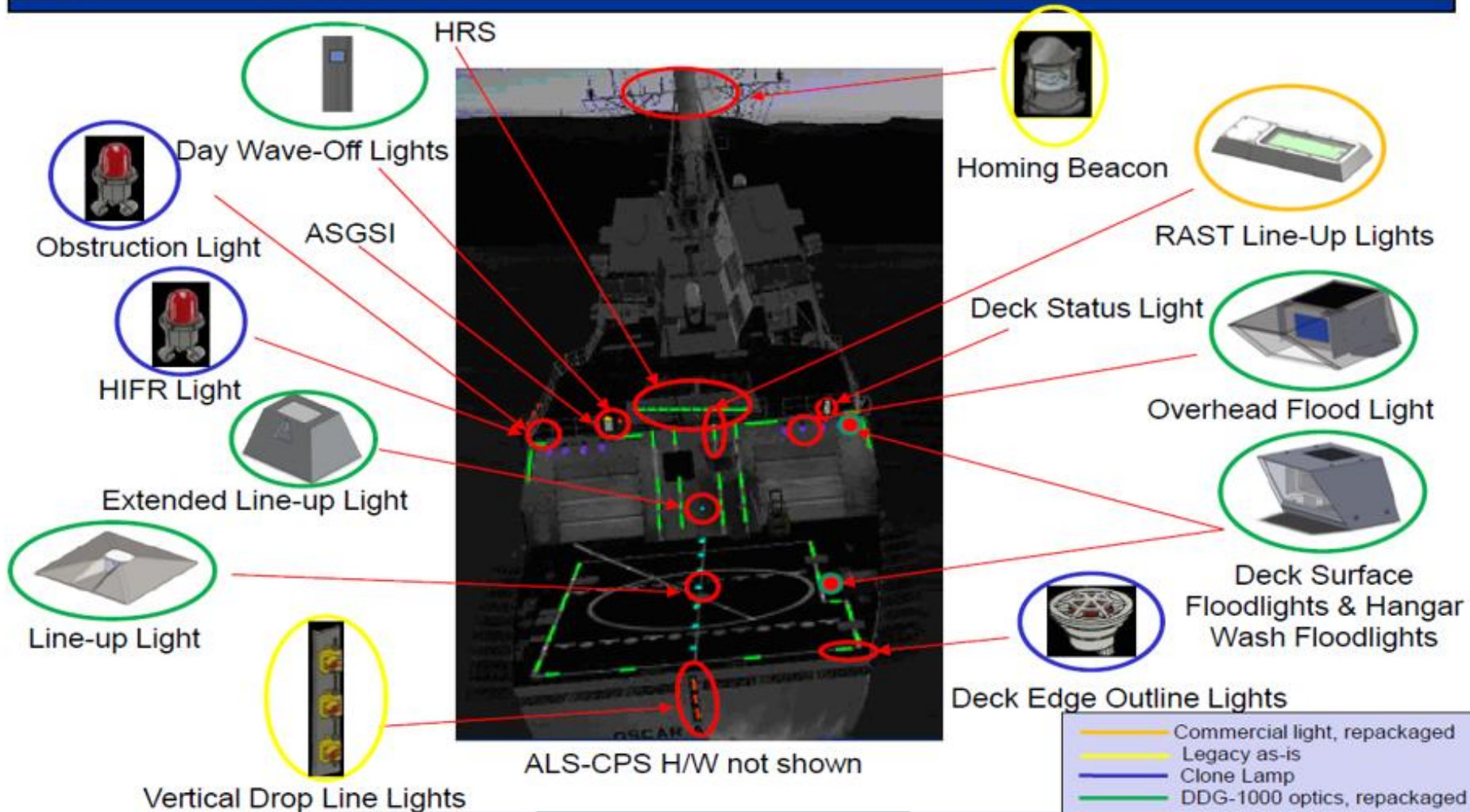
**Advanced Flight Deck Lighting**
*Various*

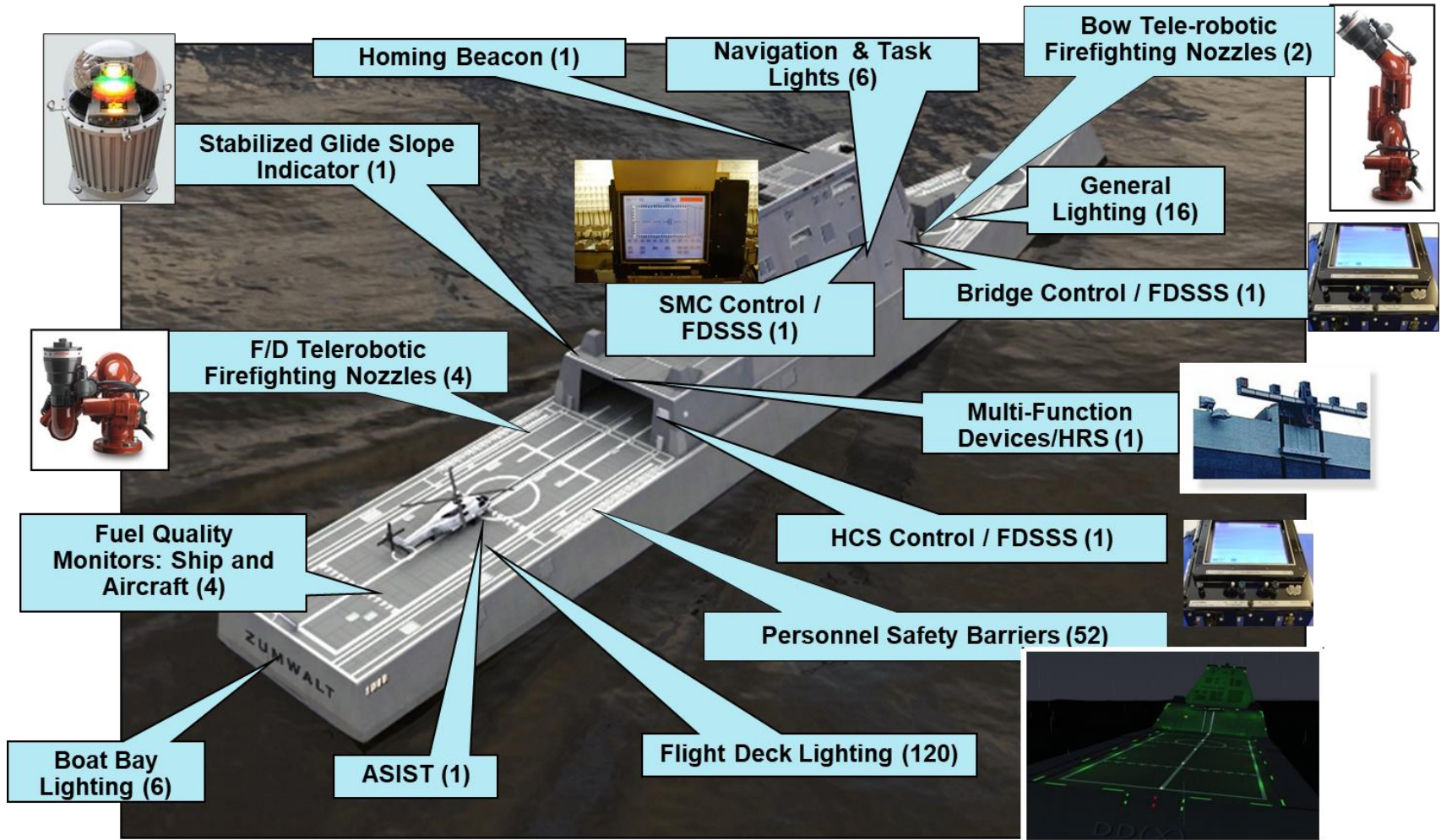**ALS-CPS Control Panels/Network Devices/ Software/Drivers**
*C3I*

# ALS-CPS Control of the AFDL



**Standard Configuration AFDL Path Forward**
**AFDL for Legacy Ship Classes (DDG 51 Flt III)**

HRS

Day Wave-Off Lights

Homing Beacon

Obstruction Light

ASGSI

RAST Line-Up Lights

HIFR Light

Deck Status Light

Overhead Flood Light

Extended Line-up Light

Line-up Light

Vertical Drop Line Lights

Deck Surface Floodlights & Hangar Wash Floodlights

Deck Edge Outline Lights

ALS-CPS H/W not shown

Commercial light, repackaged
Legacy as-is
Clone Lamp
DDG-1000 optics, repackaged

# Systems Controlled on DDG-1000



Homing Beacon (1)

Navigation & Task Lights (6)

Bow Tele-robotic Firefighting Nozzles (2)

Stabilized Glide Slope Indicator (1)

General Lighting (16)

SMC Control / FDSSS (1)

Bridge Control / FDSSS (1)

F/D Telerobotic Firefighting Nozzles (4)

Multi-Function Devices/HRS (1)

Fuel Quality Monitors: Ship and Aircraft (4)

HCS Control / FDSSS (1)

Personnel Safety Barriers (52)

Boat Bay Lighting (6)

ASIST (1)

Flight Deck Lighting (120)

**ACCS® Dual Ring Bus is the only ship-wide network system other than Raytheon TSCEI and controls 185 items per DDG1000 class hull**

# C3I Emerging Technologies

- R&D Projects
  - Digital Display Information System (DDIS)
  - Armored Touch Screen
  - CP Presets
  - NVIS Display
  - Universal Smart Driver Module (USDM)
  - Modular Network Switch (MNS)
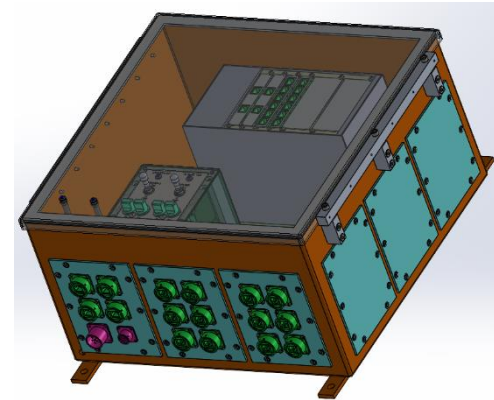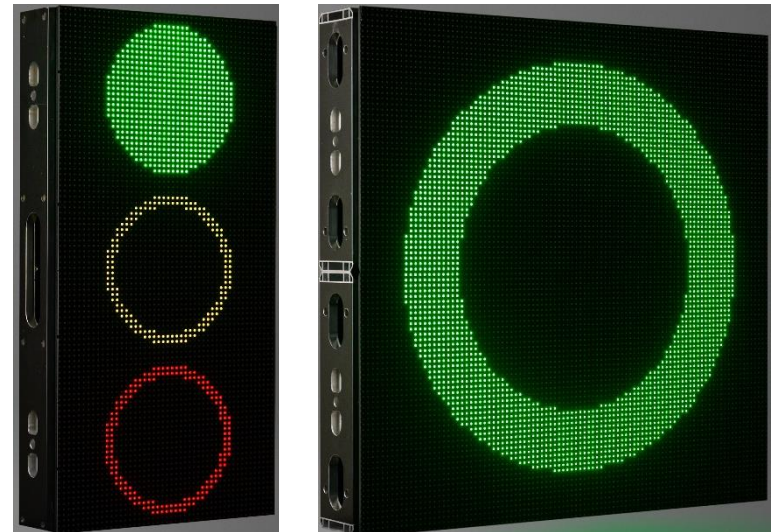
# Universal NVIS Friendly Display

- ▸ **Full-Spectrum LED backlight allows total control of emissions.**

- ▸ **Provides tailored spectrum outputs to fit customer needs.**

- ▸ **Dimmer knob controls brightness and cycles modes.**

- ▸ **Retains the same form-factor as the standard COTS display (VESA mounting, etc.).**



## Efficient, Flexible, Simple

# Universal NVIS Friendly Display

## C3I NVIS Friendly Display

☑ **Fully Dimmable in all modes**

☑ **Preserves Visibility and Chromaticity**

☑ **Full Spectrum Emission Control**

☑ **Makes ANY COTS display NVIS Friendly**

## Current System

☒ **Non-dimmable Displays**

☒ **Loss of Color Information**

☒ **Ease of Accidental Light Pollution**

☒ **COTS Displays and User Interfaces without Night Modes**

**C3I Provides a Simple and Cost-Effective Solution to Shipboard Light Pollution**

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# Modular Network Switch (MNS)

- General application network switch for **Distributed Secure** installations on board US Navy vessels
  - **Layer 3 functional performance**
  - Multiple switches and enclosure sizes
  - Provides interface to shipboard cabling
  - Modular design to allow for a distributed network
  - Water-tight, EMI-proof, and environmentally resilient
  - Physical and Cyber security
  - UPS or redundant power supply
  - Potential for self-healing RS485 multi-drop wrap-around module
  - Ports and interfaces completely configurable
  - Standard, not proprietary, ring topology
  - **Accepts most Network Switch supplier technologies:**
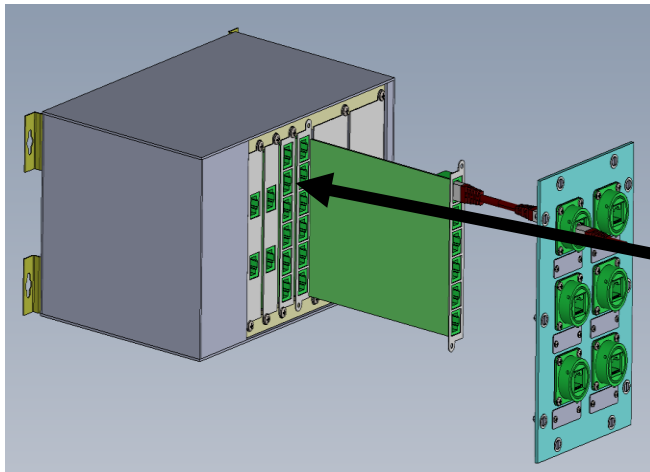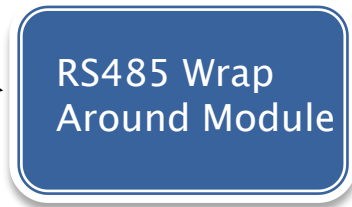    - Cisco, Siemens, Hewlitt Packard, NVIDIA,
    - Rockwell Automation, etc.
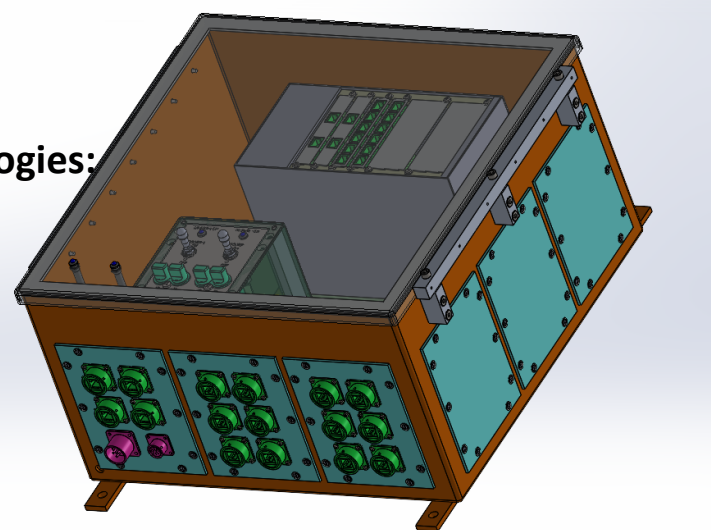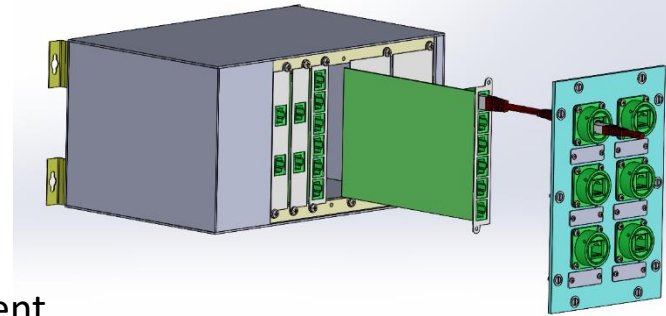
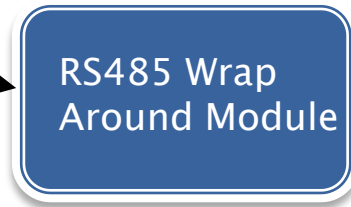# Accepts Designers Choice of Layer 2/3 Network Switch Technologies
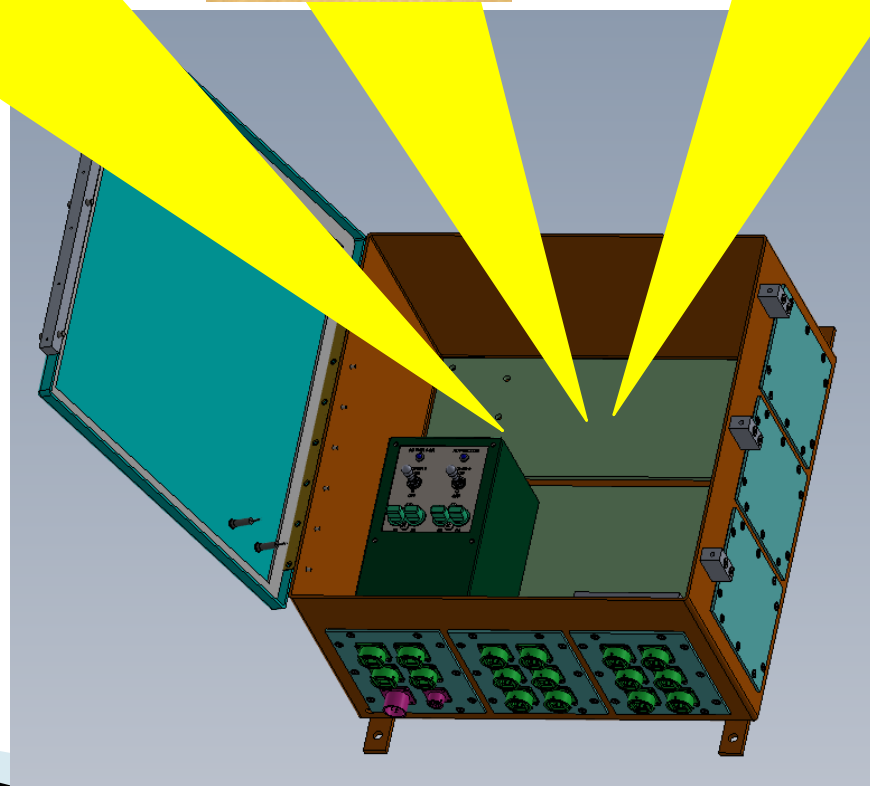
# Designed To Accept Multiple Fault Tolerant, Self-Healing RS485 Network Wrap Around Modules
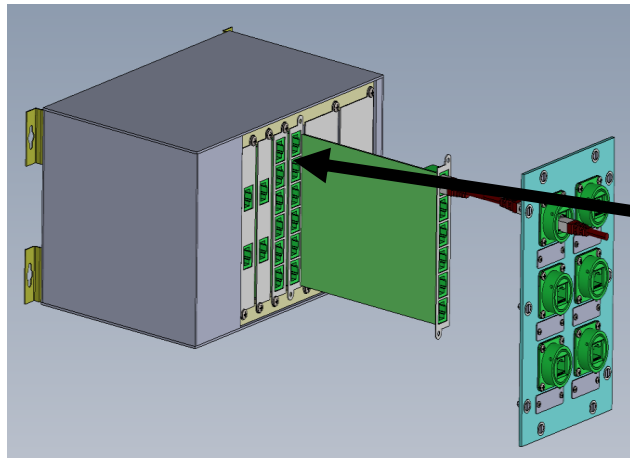
Ethernet

RS485 Wrap Around Module

Fail Safe Self-Healing Wrap Around RS485 Networks

Ethernet

RS485 Wrap Around Module

C3I Patented Technology Installed on DDG 1000 Class Vessels

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# Universal Smart Driver Module

- Current Carrier Card Driver Modules are individually designed to drive specific LEDs
  - Logistical bloat of supporting multiple CC layouts

- USDM replaces ALL existing varieties of Flex LED Driver Modules
  - Form/Fit replacement for current modules
  - Programmable to drive all LED light types supported by the LFDM, and future light types
  - Only 1 CC and Driver module type for logistical support

- HW build complete
  - Modest development and testing remaining

Current



USDM
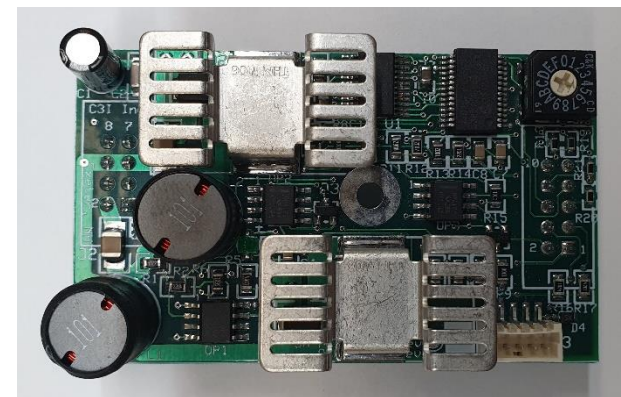
# C3I EQUIPMENT



**NETWORK SWITCH TECHNOLOGIES**

- The Type 1 network switch for distributed applications with battery back-up UPS
    - 6 - 10/100Base TX
    - 3 – 100/1000Base SFP SX  fiber optic channels;
- Type 2 network switch for distributed applications with battery back-up UPS
    - 3-10/100Base Tx
    - 5-100/1000Base SFP SX fiber optic channels respectively,
- Coming in 2022/2023: Type 3, Type 4 and Type 5 Network Switches for distributed applications
    - Customizable by the system architect for:
        - Supplier technology and desired number of channels in a single enclosure
            - up to 48-10/100/1000Base Tx
            - 16-100/1000Base SX,
            - 8-10/20GBase FX
            - 16-SFP/SFP+ channels
    - Redundant power supplies

# C3I EQUIPMENT



**MODULAR PROTOCOL CONTROLLER (MPC)**

- Links a vessel's shipboard Ethernet network to the distributed controlled end devices of the NGVLA, or any other device on the RS-485 multi-drop network. This includes:

    - All lights,

    - power actuators,

    - pilot information devices,

    - robotic firefighting nozzles, and

    - various controlled assemblies located on the flight deck.

- Processor-controlled device that provides a 10/100 Ethernet uplink and two RS485 multi-drop downlinks.

- Houses the specialized RS-485 multi-drop network self-healing software

- Contains an embedded Uninterruptible Power Supply (UPS).

# C3I EQUIPMENT



**GENERAL PURPOSE INPUT/OUTPUT MODULE (GPIO)**

- Provides an interface to equipment requiring discrete digital input and output signals.
    - 27 optically isolated digital inputs
    - 27  isolated digital outputs.

- Designed to interface with legacy equipment and other specialty equipment that do not employ a communication interface, but require discrete inputs and outputs to effect their control, or to provide their status information.

- Converts discrete information into an Ethernet  compatible message, and transmits/receives these messages over a 10/100 BaseTx  network link.

# C3I EQUIPMENT

**SPECIAL PROTOCOL CONTROLLER (SPC)**

- Processor based protocol controller and message management device
    - Provides the communication interface between a RS422 serial protocol communication network and an Ethernet communication network.
    - Ethernet communication interface is a 10/100Base TX port.

- Primary function is to receive ships roll rate and status information from the TSCEI network, via a GDAP device, and to place that information on the ALS-CPS network
    - For use by all devices on the ALS-CPS network,

- Provides protocol conversion to RS422 interface for the ASIST/RAST devices

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# C3I EQUIPMENT



**ACUATOR CONTROL BOX (ACB) 440 VAC, THREE PHASE REVERSABLE MOTOR POWER CONTROL MODULE**

- Houses the communication, drive and control interface to provide
    - Reversable drive for a 1 KW, 3Ø 440VAC motor,
    - Several 115VAC heating elements,
    - Multiple temperature sensors,
    - Current sensors,
    - Voltage sensors,
    - Fail-safe safety switch,
    - Position sensor .
- The ACB controls the opening and closing of the Personnel Safety Barriers (PSBs) and provides the temperature-controlled de-icing circuitry for PSB operation in sub-zero temperatures.

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# C3I EQUIPMENT



**VARIABLE TRANSFORMER POWER CONTROL MODULE (VTPCM)**

- Provides true sinusoidal power diming to analog devices.

- Specifically designed to operate on the flight deck, where high power 0 – 100% voltage control is desired to be delivered without unwanted EMI signal emissions.

- Up To 4 Outputs Each