DC Voltage Interface Standards for Naval Applications

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Considerations in establishing standard DC interfaces

- Existing commercial and military interface standards should be used to the maximum extent practical.
- Different standard voltage levels should differ significantly. (greater than 25%)
- Higher voltages enable lower currents, and lighter cables.
- Standard voltage ratings of available semiconductor devices and insulation ratings should be considered.
interface terms

- Nominal System Voltage
- Steady State Voltage Tolerance
- Steady State Voltage Range
- Voltage Transient Excursion
- Source
- Load Normal
- Load Abnormal
Proposed Low Voltage DC Standards

• Ship Service Loads
  – 155 V  (MIL-STD-1399 section 390)
  – 375 V  (Based on DDG 1000 and ETSI EN 300 132-1)
  – 650 V  (Based on DDG 1000)

• Special Loads (equipment designed for aircraft and vehicles)
  – 28 V    (MIL-STD-704)
  – 270 V   (MIL-STD-704)
Proposed High Voltage DC Standards

• Intra-zone power distribution and load utilization
  – 1 kV

• Inter-zone power distribution and high power load utilization (inspired by IEEE 1709)
  – 6 kV
  – 12 kV
  – 18 kV
Proposed Pulse Load Requirements

• For pulse loads, the duty cycle, ramp rates, and peak currents must be negotiated in operation through a control interface between the load and the power management system.

• The load may not violate the non-pulse load requirements without first gaining concurrence from the power management system.

• Synchronization of the pulse application by the load and power system dynamics may be required via the control interface.
Proposed Compliance Testing

• **Load Characterization Measurements**
  – Line to Ground Capacitance
  – DC Resistance to Ground
  – Current Ripple
  – Load Current Rate of Change (non-pulse)
  – In-Rush / Initialization Current (non-pulse)
  – Peak In-rush Current Rate of Change (non-pulse)
  – Load Impedance

• **Susceptibility Tests**
  – Voltage Tolerance
  – Voltage Transient
  – Voltage Ripple
  – Voltage Spike
  – Voltage Offset Tests (terminal to ground)
  – Abnormal Service Steady Stage Voltage

• **Pulse Load Tests (if applicable)**
  – Control Interface Operability
  – Power Ramp Rate
  – Maximum Current
  – Pulse Width
  – Pulse Recovery Time
What’s next?

• Conduct additional research in Maximum Load Line-to-Ground Capacitance
• Perform additional development of pulse load requirements
• Incorporate feedback from industry and academia
• Develop new section(s) of MIL-STD-1399