

# DC Voltage Interface Standards for Naval Applications

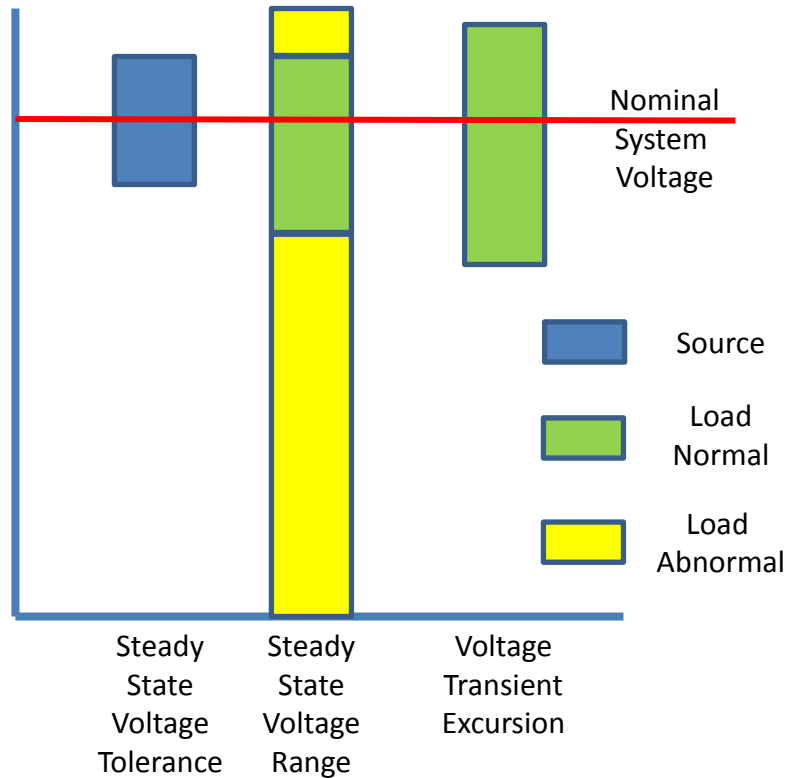
Dr. Norbert Doerry and Dr. John Amy  
Naval Sea Systems Command

IEEE Electric Ship Technologies Symposium  
Alexandria, VA  
June 22-24. 2015

# 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



# 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 State 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