NSRP | National Shipbuilding Research Program

# Power Panel & Breaker Commonality

GENERAL DYNAMICS
Bath Iron Works

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# Project Summary

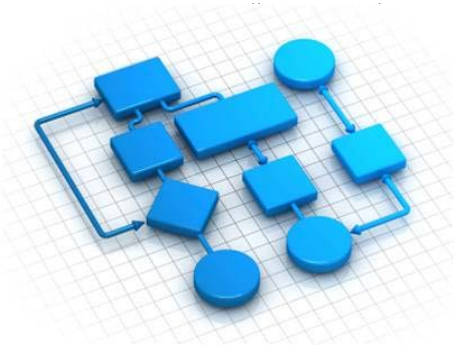
- Overview:
  - Many Variants of Power Panels & Breakers
  - Many Different Applications
  - Multiple Ship Programs
- Goals:
  - Identify Existing Opportunities for Consolidation
  - Reduce the Number of Variants and Breaker – Panel Combinations
  - Drive **Commonality** into Ship Designs

# Project Objectives

- Create Power Panel and Breaker Master List 95% Complete
- Research & Determine Requirements 15% Complete
- Research Applicable Products 5% Complete
- Research Product Opportunity 5% Complete
- Breaker Shock & Vibration Testing Procedure 0% Complete
  - If Determined Necessary
- Design, Build, & Test Demonstrator 0% Complete
  - If Determined Necessary
- Generate Report and Presentation 5% Complete

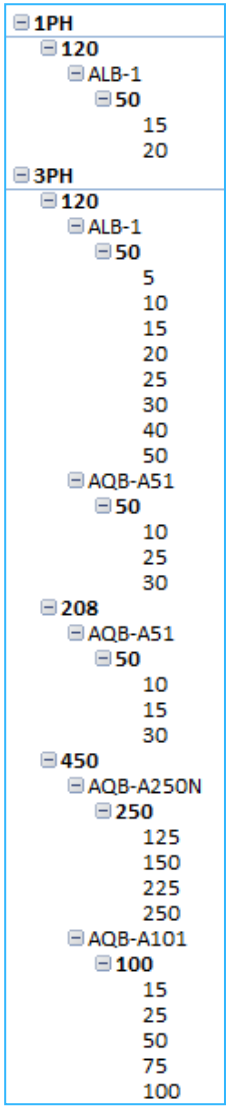
# Project Methods

- General Research & Investigation
- Evaluation of Products & Requirements
- Tools for Project Organization & Data Assessment
  - Microsoft Office Suite
  - Non-Proprietary Business Tools
- Tools for Components & Demonstrator Unit
  - Standard Manufacturing Methods
- Representative Military Specifications & Testing Standards of Interest
  - MIL-S-901D: Shock Testing
  - MIL-STD-167 1A Type I: Environmental Vibration Testing
  - MIL-DTL-23928G: Panels, Electrical, Power Distribution & Manual Transfer, Circuit Breaker Type (ALB, NLB, AQB, NQB)
  - MIL-A-17361: Panels, Electrical, Power Distribution & Manual Transfer, Circuit Breaker Type (ALB, NLB, AQB, NQB)
  - IEEE 45: Electrical Installations on Shipboard
  - UL 489: Standard for Safety – Molded Case Circuit Breakers



# Breaker Data Identified

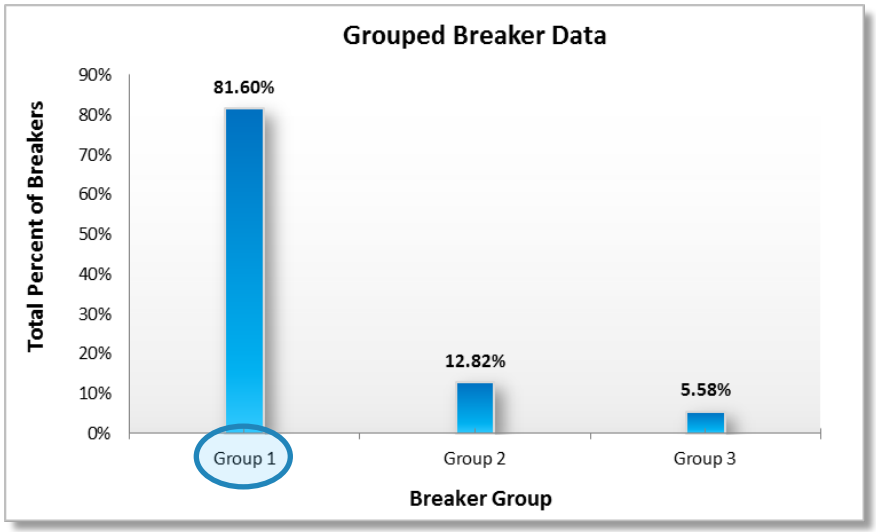
- Identified More Than
  - ~ 6,000 Breaker Applications
  - ~ 70 Unique Breakers
  - ~ 20 Single LV Breaker Types
    - AQB-A101, AQB-A253, etc.
  - ~ 10 Distinctive Breaker Frame Sizes
    - 100, 200, 250, etc.
  - ~ 60 Different Trip Ratings
    - 25, 100, 250, etc.




- Example of data under evaluation
- Several categories of frame, trip setting, size exist
- Overlapping attributes and performance requirements may drive consolidation opportunity

# Breaker Data Grouped

- Consolidated into 3 Groups
  - Groups Primarily Based Upon
    - Breaker Type
    - Breaker Quantity
    - Greatest Possible Opportunity

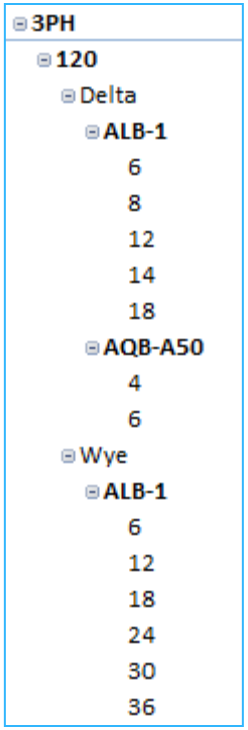



# Potential Breaker Opportunities

- Determine the Feasibility of a Single Breaker Replacing Several Breakers
  - Example
    - Replace Multiple Frame Sizes with 1 Frame Size
    - Replace Multiple Trip Units with 1 Adjustable Trip Unit (Spanning the Range Needed)
  - Benefits
    - Reduce Configuration Management Costs
    - Reduce Rework
    - Reduce Inventory
  - Challenges
    - MIL Qualified Components
    - May be an Added Cost Per Application

# Power Panel Data Identified

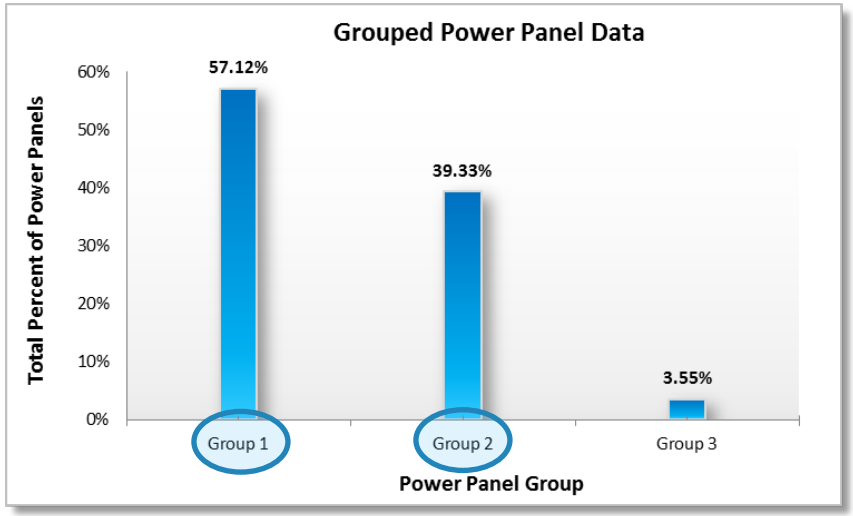
- Approximately 100 Unique Power Panels Identified
- Major Differences Creating Uniqueness Include
  - Power Configuration
  - Ground Indicator Lights
  - Power Available Lights
  - Door Availability & IP Rating
  - Electrical Ground Fault Detection
  - Quantity & Type of Breakers Held




- Example of data under evaluation
- Several categories exist
- Coupled with breakers, many combinations exist

# Power Panel Data Grouped

- Grouping has Accounted for Multiple Frames
  - Input Phase
  - Voltage
  - Configuration Type
  - Breaker Type & Frame Size
  - Breaker Quantity
  - Panel Usage
  - Special Circumstances



# Potential Power Panel Opportunities

- Determine the Feasibility
  - Example
    - Standardize by Increments of 6 Circuits/Panel; Instead of by 2
    - Examine Using Standard Indicator Lights
  - Benefits
    - Reduce Number of Variants
    - Simpler Designs
  - Challenges
    - May Consume More Space than Needed Over Life Cycle
    - Special Circumstances (Multiple or Unique Breaker Types)
    - May be an Added Cost Per Application

# Research & Evaluate Requirements

- When Addressing Consolidation, Consider the Following Within Prescribed Requirements
  - Dimensional Requirements
  - Interfacing Requirements (i.e. Stabs, Clips, etc.)
  - Trip Curve Capability, How Closely it Matches Engineering Application Requirements
  - Method of Setting Trip Units (i.e. Preselected via Thermal Magnetic Devices)
  - General Product Support (i.e. Spare Parts, Obsolescence, etc.)