

NSRP | National Shipbuilding Research Program

Power Panel & Breaker Commonality

GENERAL DYNAMICS
Bath Iron Works

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DISTRIBUTION STATEMENT A: Approved for Public Release

Agenda

- Project Team
- Project Summary
- Project Benefits of Commonality
- Project Objectives
- Project Methods
- Project Schedule
- Breaker & Panel Data, Requirements
- Project Schedule Events



Refer to Title Page for Distribution Statement

Project Team

- Lead:
 - General Dynamics Bath Iron Works
- Shipyard Participants:
 - General Dynamics Electric Boat
- Shock & Vibration Laboratory:
 - AeroNav Laboratories, Inc. (Proposed)
- Vendors:
 - TBD



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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 Benefits of Commonality

- Inventory
 - Reduce Inventory / Provisioning / Spare Parts
 - Reduce Inventory Carrying Costs
 - Reduce Configuration Management Costs
 - Reduce Large Parts List
 - Reduce Number of Technical Manuals and Content
 - Improve Inventory Control
- Reduce Maintenance Costs
- Reduce Training
- Enable Simpler Designs
- Improve Affordability



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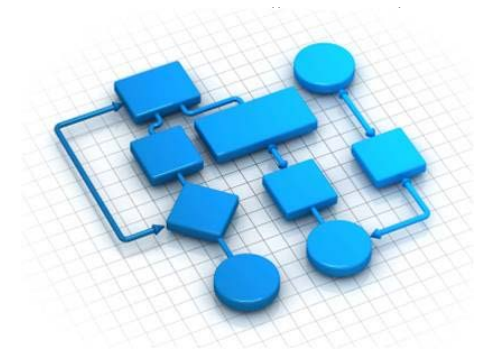
Project Objectives

- 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

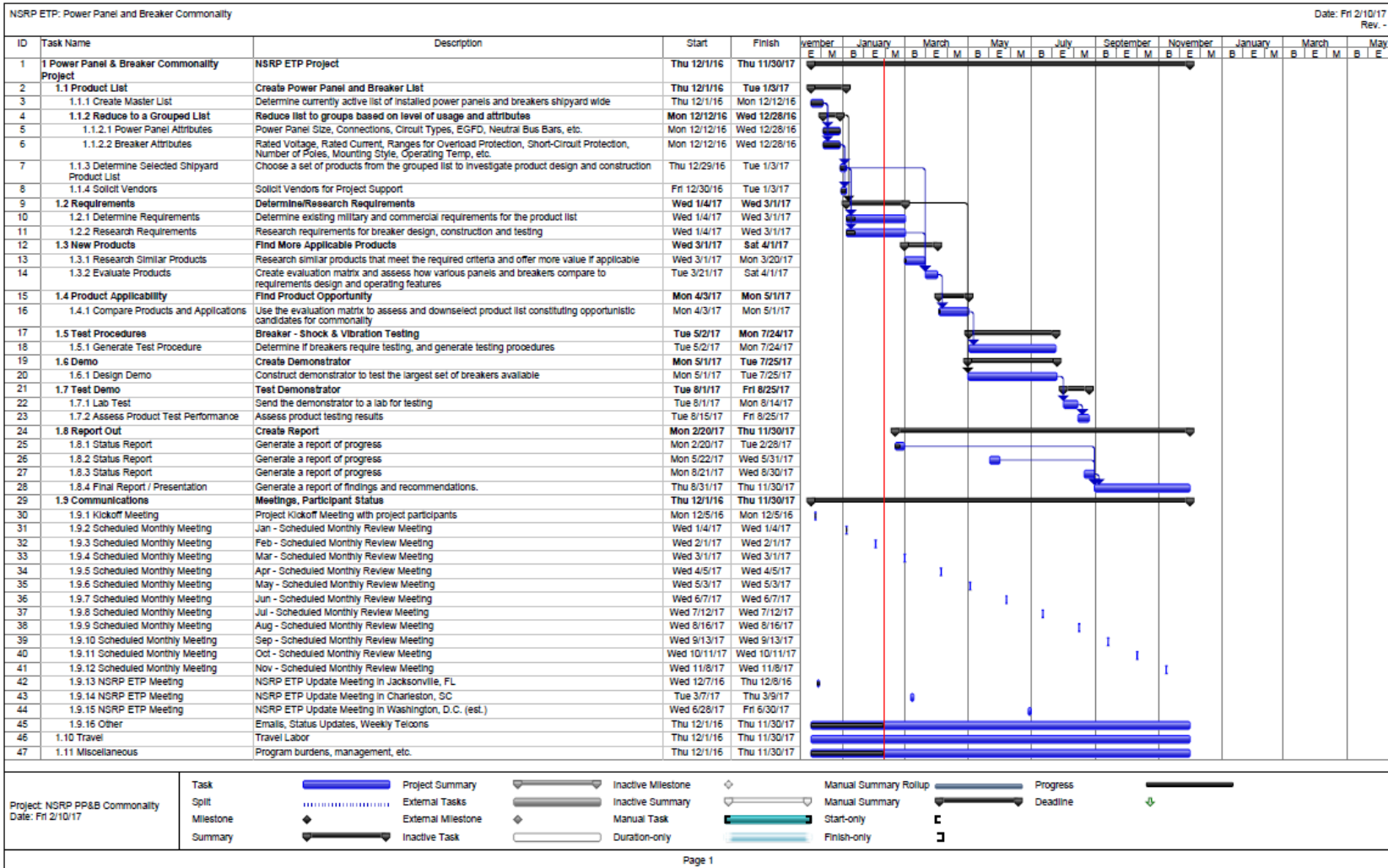


Project Methods

- 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



Project Schedule (on track)



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Power Panel and Breaker List

- Power Panel and Breaker Data are Based Upon Two Ship Programs from GDBIW
 - GDEB Data Collecting is Currently in Process and Will Be Consolidated and Assessed Upon Completion
- Data Does Not Contain
 - Switchboards
 - Turnkeys
 - Spares
 - Fuses
- Data Based on Active Items

Power Panel Attributes	Breaker Attributes
Panel Dimensional Size	Breaker Type (ALB, NLB, AQB, NQB, etc.)
Breaker Types Allowed	Trip Rating
Breaker Quantity Allowed	Frame Rating
Electrical Ground Fault Detection (Yes or No)	Rated Voltage
Neutral Bus Bars (Yes or No)	Physical Size
Physical Location	Trip Curve Information
Input Phases	Max Instantaneous Trip
Allowed Voltage	Operating Temperature
Panel Type (Wye, Delta, etc.)	Short-Circuit Protection
Ground Lights	Ranges for Overload Protection
Manual Bus Transfer	All Breaker Settings
Shunt Trip	Breaker Class (Thermal, Electronic, Magnetic, etc.)
CTs Device	Part Name
IP Rating	Power Panel Residing In w/Physical Location
Entry Style (Door?)	# of Poles
MIL-Specs / Requirements	Interrupt Rating
Belonging Ship Class	Cable Type Used
Power Lights	MIL-Specs / Requirements
	Belonging Ship Class



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.

1PH	
120	
ALB-1	
50	15
	20
3PH	
120	
ALB-1	
50	5
	10
	15
	20
	25
	30
	40
	50
AQB-A51	
50	10
	25
	30
208	
AQB-A51	
50	10
	15
	30
450	
AQB-A250N	
250	125
	150
	225
	250
AQB-A101	
100	15
	25
	50
	75
	100

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

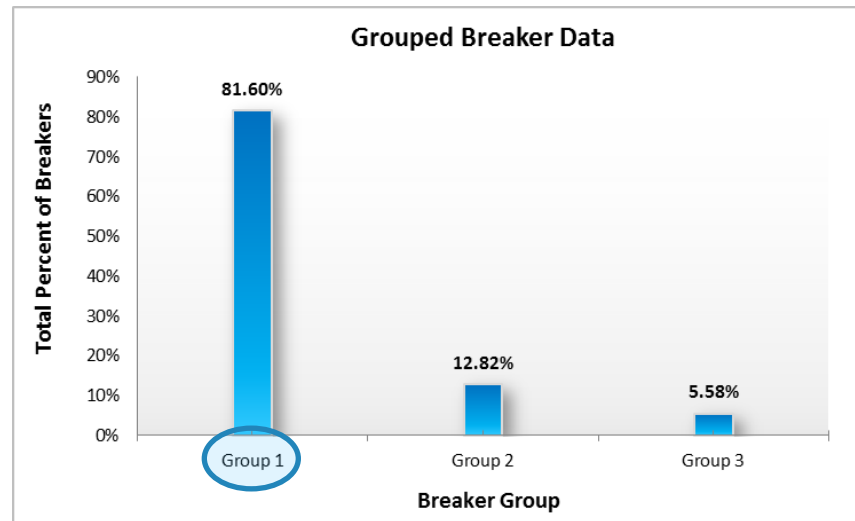


Breaker Data Grouped

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



Opportunity to consolidate?



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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

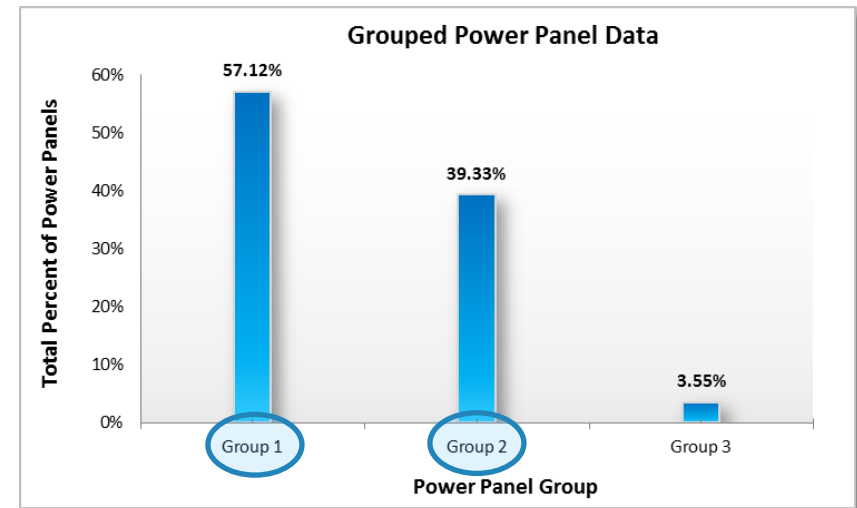
▣ 3PH
▣ 120
▣ Delta
▣ ALB-1
6
8
12
14
18
▣ AQB-A50
4
6
▣ Wye
▣ ALB-1
6
12
18
24
30
36

- 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.)



Project Schedule Events

- Upcoming
 - Collect GDEB Data and Compile into Master Product List
 - Validate Additional Opportunities
 - Solicit Vendors for Project Support
 - Expertise
 - Products
 - Determine Requirements for Product List
 - Research Applicable Products & Opportunity



"Coming together is a beginning. Keeping together is progress. Working together is success."

-- *Henry Ford*



Source: <http://www.inc.com/dave-kerpen/15-quotes-to-inspire-great-team-work.html>

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Power Panel & Breaker Commonality

NSRP ETP



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