

Electrical Technologies Meeting Notes

November 18 & 19, 2009

Philadelphia, PA

November 18th

- The intent of the first day is to review concerns and issues which the Navy has as well as to develop a focus for the Electrical Panel to support the Navy and the various platforms; past, current, and future.
- Khodrow Monirl of NAVSEA discussed various concerns in each of the different Navy programs
 - Small fast Crafts
 - Under 200 ft
 - Purely electric
 - Manned with small crews
 - Usually built to ABS NVR
 - Conform to IEEE and some MIL-SPECS
 - Very integrated
 - CVN-78
 - In unique with 15 kV
 - *(15 kV is considered “high voltage” to the NAVY)*
 - Good solid design
 - Uses vacuum breakers (along with DDG-1000) – new to USN
 - The electrical plant operation is different from legacy systems
 - Personally – “Khodrow likes it”
 - Nimitz Class
 - It has been around for a while
 - The platform can be made better
 - Is viable for another 50 years
 - DDG-1000
 - The most electrical ship in the fleet
 - Extremely complicated
 - Permanente Magnet motor failed
 - 5kV service
 - Distribution so far is not too bad; but, the it is expected to be very crowded
 - LHD-8 & LHA-6
 - Many cable way issues
 - Generally better than the Nimitz class
 - Hybrid plan
 - 5 kV
 - LHD-8 has significant fuel savings
 - LPD-17
 - Wireway issues but is improving on each ship
 - Principal Voltages

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- Surface Ships
 - 450 VAC
 - 4160 VAC
 - 15k VAC
- Submarines
 - Various DC distribution
 - 270 VDC
 - 700 VDC
 - 250 VDC
 - Cost reduction on the Virginia class was acknowledged
 - Not too many changes / decisions made now – stable program
- George Washington – Fire
 - She was delivered 1993/1994
 - Worst Fire (in peace time)
 - Design worked – ship was able to ‘operate’ under its own power.
 - CHENG was able to configure the plant to keep her underway and fight the fire.
 - Even launched its fighter wing when they entered San Diego.
 - The outcome – there will be a “Cableway Day” for the industry to walk a large ship with regards to the wireways.
 - Source of the fire was the Aux Steam Plant (an MT space) which acted like a chimney for the fire to run through the ship
 - FR 180 aft was completely dark on several decks
 - ABT’s and Load Centers initially acted like they were designed but were ultimately damaged by salt water in extinguishing the fire.
 - Used drawing and cable tags but did not solely rely 100% on cable tages
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- Wireways
 - LPD-17 vs. LHD-8
 - LPD-17 was worse than LHD-8 in terms of cable issues but ALL shipyards have the same issues; however, these ships are the most widely known and publicized.
 - Each Program has issues due to the nature of the ships design
 - Splicing for modular construction
 - Submarines are different – surface ships have longer pulls of cable than submarines, longest pull on a submarine is probably an average pull on a large surface ship.
 - Navy is very interested in having a database listing all cables passing through or in a compartment – George Washington fire incident.

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- There is a push to survey the cableways at deliver then approximately 30 months later using thermal imagery
 - Cannot inspect every cable
 - Ultimately it is the Program Office and SUPSHIP responsibility to work with the shipbuilder
 - This will show degradation – it is not a cure-all but the intent is to highlight areas to address for improvements
 - Bending and separation of cable a concern
 - CAT 1 – must be fixed
 - CAT 2 – these are defensible
 - CAT 3
 - CAT 4
 - PRIOR TO “CABLEWAY DAY” – NEED TO VERIFY STATUS OF THE ‘010’ HANDBOOK
 - Need a strategy to manage cables onboard
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- AIT
 - Holding them responsible for their changes and additions
 - They did not work for the shipbuilder but their impacts can be significant
 - ACTION:
 - invite someone from NAVSEA 04 to a meeting to discuss the concerns
 - NAVSEA 05 Tech Warrant “set-up”:
 - Power Generation - Khodrow Monirul
 - All programs EXCEPT the NUKE side and Submarines
 - 80 electrical engineers in Philadelphia, Crane Indiana, and Carderock, MD
 - Responsible for 836 specs
 - Propulsion & Motors – Dave McMullen
 - Including the electrical-hybrid drive
 - Electric Ship Office – mostly R & D type stuff
 - Ship Tech ‘09
 - A great platform to increase awareness that ships are becoming more electrically advanced.
 - And normally Electrical is the last to get “put-on” on the ship
 - Modular Construction – Royal Caribbean cruise ship – modular construction and larger than an air-craft carrier
 - Current Electrical Technologies Panel Projects and discussions
 - Fiber Optic Tester
 - Proposal submitted for a Panel Project
 - LED Lighting
 - Cable Tags
 - Need new ideas – can’t inspect every cable

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- How useful are these?
 - What is the current processes yards use?
 - George Washington – and what part did cable tags ‘play’?
 - Suggestions such as not on both sides of the bulkhead? Something less labor intensive
- SBIR projects – need some suggestions
- Other items of discussion
 - Bonding & Grounding
 - Electrical Safety – big concern – metal to metal
 - MIL-SPEC 1310
 - Motor selection
 - How to select a motor
 - Service A = critical for the operation of the vessel
 - Service C = IEEE motor
 - MIL-STD-17060
 - There is a user selection guide in progress which will aid the user to select the appropriate motor
- QPL
 - New initiative is to expand the list
 - Usually the company makes the effort and cost associated with adding their product to the list
 - First Article Testing
 - is a requirement but is very expensive and drives up the component cost
 - Vendors must perform cost benefit analysis to determine if there product is marketable to our industry
 - Performance Spec
 - Militarized COTS must go through re-inspection
- Machinery Control
 - NAVY wants the ownership rights to the “code”
- Composite Junction Boxes
 - Issues
 - UV complainant
 - Grounding issues
 - Dependent on where and how they are used
 - CODE 270 looking into this
 - CODE 60 from Caderock presented a small brief in the San Diego NSRP meeting the future benefits
- RISE
 - It was not added to the recent revision of “choice”; but, it is approved for use.
- Standardization – OASIS & modularity
 - Lighting

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- 137 current lighting fixtures – found where there could be 58 common fixtures
- LED Lighting – future
 - Discussion centered around PEO Ships wants the least expensive cost, however, the lifecycle costs for LED lighting is much better. Sticker Shock
 - Someone (??) mentioned after seven (7) years one has not been replaced where as the fluorescent bulbs have been replaced 3 to 4 time,
- Commonality of sub-components
 - Will costs more in the acquisition cycle but the lifecycle support will be less
 - Sticker Shock for PEO Ship
- Plug & Play
 - For large systems - initially
 - Could be expanded for other systems such as lighting
- There is an interest for 450/5kV insulation on bus work which meets EPA & OSHA, but still be able to inspect / test the bus
- Safer verification of a dead bus – (discussed more the following day)
- Meeting the National Electric Standard is acceptable unless there is a military reason why....
- Tag-out and Arc Flash are becoming big issues.
- Drawing standardization – why so many different types?
 - Shipyard determined drawing types – but to satisfy a spec requirement
- Testing Load Center components – (pushed to the following day)
- We need to all look at the “simple stuff” for costs savings!

November 19th

- Objective of the meeting is to discuss switchboard & Load Center:
 - Shock, Vib, and EMI Test requirement issues and concerns
 - Present are:
 - Switchboard & Load Center manufacturers, NAVSEA, and shipbuilders
- Shock
 - MIL-DTL-16036L switchboard spec areas of interest
 - Discussed the nature and cost of barge shock tests (~ \$100K> verses a table test. The barge test incorporates the entire ‘piece’ rather than the individual component.
 - Rev L brings the MIL-STD back in-line with 92D.

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- There are exceptions, provide a valid justification for extension.
- Always looking for ways to reduce costs (testing) without sacrificing the end product.
- Rarely does the structure fail – usually one component which was already qualified – which support the rationale for test
- EXAMPLES
 - LPD switchboards
 - 23 separate units
 - These were split into similar groups to reduce testing with NAVY approval
 - Tested 11, extended to 45
 - CVN 78 motor control centers
 - All (100%) were tested
 - DRS stated they tested a variety of units, not all of them and requested extensions.
- This leads to significant issues when RFP's are issued since no one is sure of the extent of testing and thus the costs are usually estimated conservatively. Creates issues as NAVY cannot make decision until after reviewing information and at the time of RFP, firm information does not exist.
- NSWC stated the procedures can be amended – this statement was unknown by many in the meeting.
- QUESTION - If a breaker changes – does the entire unit require retest? The answer – submit justification for extension otherwise YES.
- When components change – NAVY / SUPSHIP must concur and approve.
- ALL (a few exceptions) NEW SHIPSETS WILL REQUIRE FIRST ARTICLE TESTING.
- It was notes that lead free electronics will have slightly higher failure rate.
- Making a common switchboard is difficult since each platform has space / compartment constraints. Unused space in a switchboard is undesirable and adds weight.
- QUESTION – mounting switchgear on shock mounts resolve shock issue? The answer – there is evidence commercial switchboards mounted on shock mounts can pass a barge test.
- FEA can provide data but does NOT override a barge test requirement.
- It was noted commercial vendors meet different requirements for switchgear.

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- QUESTION – Has there ever been a switchboard failure at sea? The answer – there has been no reported at sea failure by NSWC.
- Spare breaker need rule of thumb is for a carrier, 50 years and for say a cruiser, 25 years.
- QUESTION – During overhauls, breakers change but yet the switchgear is not retested. Therefore, can these same extensions be applied to new construction? The answer – Per NSWC, yes. Submit a justification. The process should be the same.
- If the breakers get lighter in weight, then a retest is not required (usually); however, if the breaker is heavier or orientated differently, then a retest is required (usually).
- EXAMPLE of extension is the AOE to the T-AKE programs.
- NSRP ELECTRICAL PANEL ACTION – Request funding to investigate the possibility of developing a modular switchboard which can be tested once, modified and used across future multiple programs.
- One issue with a modular switchboard is cable entry often different across platforms and even on the same vessel. This becomes an issue when testing requires the switchboards cabled. AN AREA FOR PANEL & NAVY ACTION
- EMI
 - There are major changes from 461C to 461D
 - Most EMI failures get waivers – RISK MANAGEMENT. A redesign is not necessary required.
 - There are usually no issues during First Article Testing; it is when the sensors and automation come into the picture that problems arise.
 - There may be one failure in 8 to 12 tests, these get deviations usually.
 - Testing must be accomplished properly or there could be a long hard road ahead to receive an extension.
 - Usually the issue is from a secondary component.
 - NAVY will develop some approval guidance.
 - Actually there is some evidence to support GFE is more of an issue than CFE.
- Temperature Rise Testing
 - MIL-STD-16036K is not clear to many on how to conduct a heat rise test. Flexibility in the requirements causes problems. Does not require an accredited lab for testing.
 - QUESTION – Who decides which boards are to be tested? The answer – Submit a test plan and once approved, that is what and how the test is accomplished.
 - Tests can be expensive
 - Between 50 to 20 degrees Celsius – perform a mathematical analysis.
 - Shipboard thermal imagery is required post change.
 - Bench testing is difficult due to the amount of shipboard loads.

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- GARY ZIMAK WILL SEND OUT A QUESTIONNAIRE REGARDING HEAT LOAD TESTING.
- Manufacturer comments
 - DRS
 - Why are there different requirements for submarines and surface ships?
 - Why not use the lowest rated component as the limiting factor?
 - Since DDG-91 uses resilient mounted switchboards, why can't all programs use them?
 - ALL WERE TAKEN UNDER CONSIDERATION
 - Jam Nuts – what are the torque requirements? Have there been issues in the past? This is a two person operation which results in higher cost. Larger nut should be first but per specs, thin nut must be first. Commercial industry uses self-locking nuts. These are rated to 250 degrees.
 - Fastener coatings – a problem which results in cost since commercial fasteners don't satisfy requirements. Zinc Phosphate is an approved alternative
 - Head of fastener – why not socket head or other type such as torx as an example?
 - Bus Bar
 - Painting joints is expensive.
 - Joint configurations make adding boot difficult too
 - Need to focus on bus bar distances instead
 - Creepage and clearance specs vary – why?
 - Consider adding insulation where clearance is an issue
 - Why is there grease on bus bars?
 - Corrosion control
 - More uniformity with the bus bar fastener compression
 - COTS breakers in resilient mounted switchboards as a cost savings measure. CVN and DDG are two (2) examples.
 - A solution could be, “COTS EQUIPMENT ACCEPTABLE PROVIDED CERTIFICATION OF FIRST ARTICLE TESTING”
 - If using COTS, then there may be further environmental testing such as salt spray and thermal.
 - NAVY is attempting to standardize COTS selection.
 - Construction in 16036 provides too much detail which adds cost. AS long as it passes shock, it should be acceptable.
 - Painting
 - Not to add so many constraints
 - Consider powder coating
 - Phase rotation, maybe easier if this was relaxed due to switchgear configuration. NAVY states this is a requirement
 - Cable lugs, suggest changing out to crimp-on type.

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- MIL-T-7928 allows for other types. CVN uses different types.
- Suggest allowing smaller cable sizes for control circuits to save weight and space inside the switchgear. On the Virginia class subs, smaller gage wire is allowed. Again, different standards.
- DRS recommend HMI displays. These are economical. A concern is a single point of failure. Not an issue since ECS also monitors the same information.