



Coast Guard RCM/CBM Initiatives



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RCM Background



- ◆ **Maintenance Technologies out of control**
 - Acquisition initiatives
 - Widespread use of divergent technology
 - Various maintenance organizations
 - Death by innovation!
- ◆ **RCM was perceived as another improvement initiative.**
- ◆ **3 failed RCM initiatives based on consultants, references, and brainstorming.**
- ◆ **RCM principles provided a means to control the enterprise maintenance system.**
- ◆ **1 successful RCM initiative based on a business processes developed by NAVSEA.**
 - MIL-P-24534P Planned Maintenance Systems
 - RCM Certification
 - Machinery Effectiveness Review (MER)
 - Machinery Assessment Program
 - Condition-Based Drydock
- ◆ **The adoption of NAVSEA RCM processes became part of the Coast Guard's fleet maintenance strategy.**

Strategy: Develop nothing!



RCM Definition



Reliability Centered Maintenance (RCM) - A methodology which identifies the optimum mix of ***applicable*** and ***effective*** maintenance tasks needed to maintain the inherent design reliability of systems and equipment at minimum cost. RCM provides the decision logic for determining objective evidence needed to select the appropriate type of maintenance, e.g. corrective, preventive, or alternative.



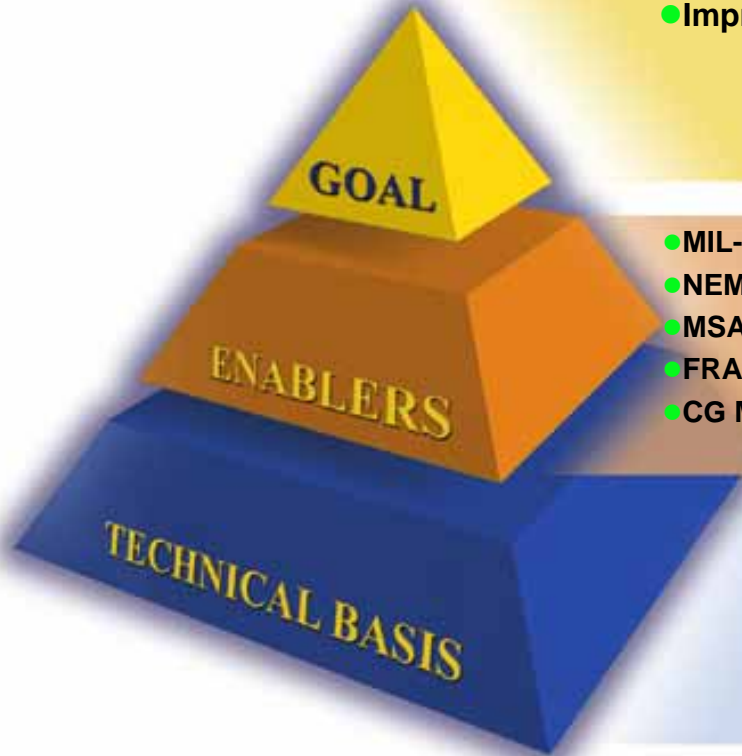
Revised Maintenance Policy



- ◆ **Required MIL-P-24534 PMS (RCM)**
- ◆ **Established central maintenance technical authority**
 - Standard requirements
 - Infrastructure
 - Program Support
- ◆ **Identified organizational responsibilities**
 - Standard capabilities
 - Requirement development
 - IT system use



Coast Guard HM&E Maintenance Strategy



- Improved Ship Readiness and Optimized Maintenance
 - Visibility of material condition
 - Planning of future maintenance needs

- MIL-P-24534 PMS (RCM)
- NEM
- MSAM
- FRACAS and RCFA
- CG MER
- Warrant for PMS Tech Authority
- Deepwater Teaming
- RCM Level II Certification
- PMS Alignment
- CGMAP
- Integrate Maintenance IT Systems
- USCG/NAVSEA MOA

- Overarching CBM Strategy
- RCM Engineering Principles
- Effective Configuration Management

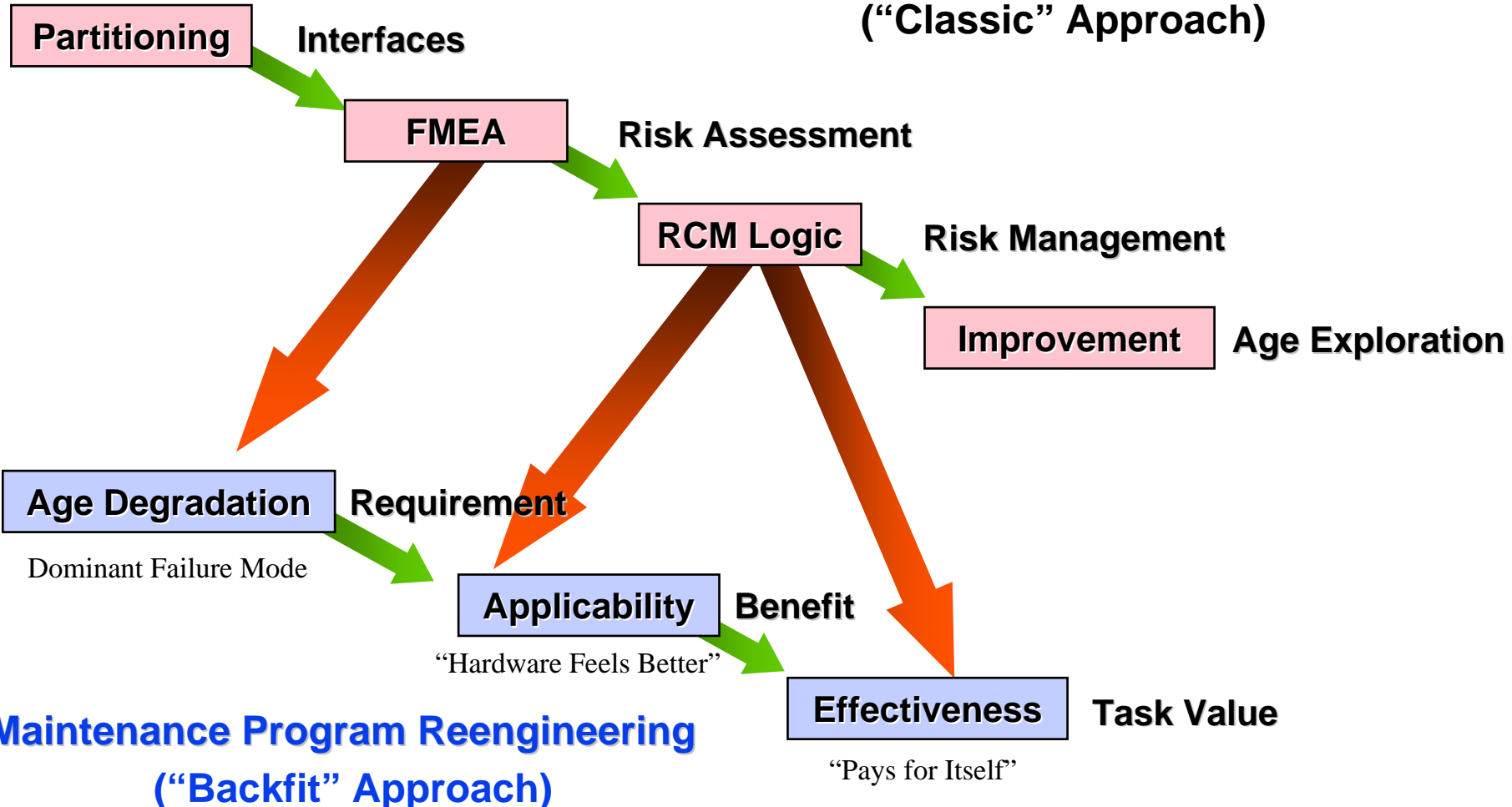
RCM: Right Maintenance, Right Equipment, Right Time, for the Right Reasons



Two Processes



Initial Requirements Development ("Classic" Approach)





RCM Enabling Program



- ◆ **ELC Initiated an RFP for Coast Guard Machinery Assessment Program (CGMAP) for cutters 175' and above with annual visits utilizing CBM technologies**

- > Vibration Monitoring
- > Thermal Imaging
- > Motor Circuit Analysis
- > Flow Measurement
- > Laser Alignment
- > Laser Alignment
- > Bore-scopic Inspections
- > Ultra-sonic Inspections



Motor Circuit Analysis



Vibration Monitoring



Bore-scopic



Laser Alignment



Ultra-Sonic

CBM technology provides the tools to gather objective evidence of need

CBM Technology	Vendor	Rationale & Justification			
		Failure modes this CBM tech./equip. detects	Units to use this technology (MAT, AT, AEC, K, Yard)	Ratings, pay grades and labor categories to use this technology	How often this technology is used (Periodicity)
Vibration Analysis	DLI	Assesses each machines condition (950 fault templates & 4700 rules). e.g. bearing faults, misalignment, imbalance, gearbox, electrical faults, pump internals.	Cutters, Nesu, MAT	E1 - E6. MSC and Navy Cv's, (aircraft carriers), support from vibration engineers	Quarterly on average.
Motor Circuit Analysis	BJM Corp	For motors, transformers and coil wound equipment. e.g. turn faults, phase faults, ground faults, cable faults, connection resistance faults, rotor eccentricity faults, broken rotor faults, boats casting voids.	All units/ships. Can be used on anything with an electric motor.	Anybody could be trained to use it, easy to use.	At least quarterly and for troubleshooting and commissioning.
Vibration Monitoring	DLI	Same as Vibration Analysis -----	-----	-----	-----
Electric Motor Testing and Analysis	PdMa	PdMA supports electric motor testing, motor failure mode identification, and fault analysis. Electric motor failures can be categorized into six convenient Fault Zones . They are (1) AIR GAP, (2) POWER QUALITY, (3) POWER CIRCUIT, (4) ROTOR, (5) STATOR, and (6) INSULATION.	All units/ships	All personnel with a working understanding of electricity.	Motor testing periodicity will be paced by the priority level assigned by each type commander, in concert with his mission requirements, the requirements of the surface assets and the mission-critical priority assigned.
Motor Health/Rotating Equip. Diagnostic	Sensoplan	Motor failure, pump failure, pump wear, compressor & blower failure, turn to turn and phase to phase current leakage, rotor bar deterioration	All units/ships	EM3 (electrician), machinist. Manufacturing, pulp and paper, oil refining, petro-chemical.	90 days or quarterly
Flow Measurement	FTSCP	Worm impelors, wearing rings, reverse rotation, faulty valves		E5 - E6	Monthly
Boroscopic Inspections	Olympus			SEMA, PMA, NESU Portsmouth	
Leak Detection	UE Systems	Gas and water leaks, vacuums, any turbulence		Used by all skill levels. Industrial, energy, and environmental.	Whenever a problem exists or during routine inspection.
Infrared Thermography	FTSCP	Used on bus transfers, fuse boxes, power panels, controllers, electrical equipment, etc. Example faults are loose connections, dirty connections, aging wires, etc.	All units/ships	E6 and above, very expensive equipment.	Ship survey happens 2 to 4 times per month on average.
Laser Alignment	FTSCP	Bearing wear		E5 - E6	Weekly



Maintenance Conferences



- ◆ **Maintenance Effectiveness Review (MER) used for existing maintenance systems.**
 - Cost Avoidance ~\$6M
 - ROI ~1,400%
- ◆ **RCM used for new systems**
- ◆ **RCM process useful for addressing policy changes of initiatives**
 - CBD, MAP
 - Cost avoidance \$4.2M
 - ROI ~300%

Date	PLATFORM / EQUIPMENT:	Conf Type
Aug-02	A/C PLANTS/ BOILERS	MER
Sep-02	WELIN-LAMBIE DAVITS/ REVERSE OSMOSIS UNITS	RCM
Mar-03	ALCO MDE'S & SSDG'S	MER
May-03	SCBA / P-100 / OWS	RCM
Jun-03	110' WPB PAXMAN MDE'S / SINGLE-POINT DAVIT	MER
Oct-03	47' MLB	MER
Nov-03	25' RB-HS	MER
Jan-04	110' WPB CAT MDE'S / 270' WMEC GEN'S / CMAP	MER
Mar-04	225' MDE'S / SSDG'S, CPP, ELEC. / RED GEAR	MER
May-04	225' WLB AUX / ELEC	MER
Sep-04	225' WLB CBD	CBD
Dec-04	87' WPB PMS	MER
Jan-05	25' TPSB PSU	MER
Mar-05	175' WLM CBD	CBD
May-05	TANKS & VALVES	MER
Aug-05	87' WPB CMP	MER
Sep-05	CAT ENGINES	Policy



Coast Guard Experience



◆ Adoption of RCM required...

- Policy support
- Organization
- Process

◆ RCM provided...

- Engineered improvement
- Technology control
- Increased capacity
- Cost avoidance