Marine Electrical Systems - Controls Group

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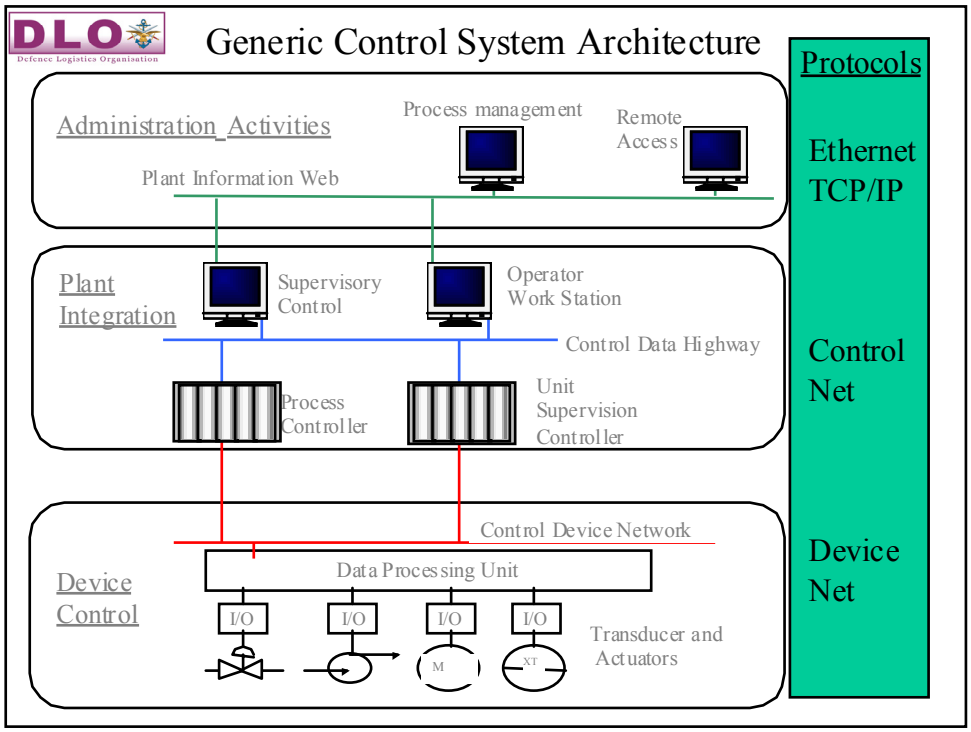
MLS CG1

Platform Management Systems (PMS)

De-risking Ship Control Systems Implementation

Scope of Presentation

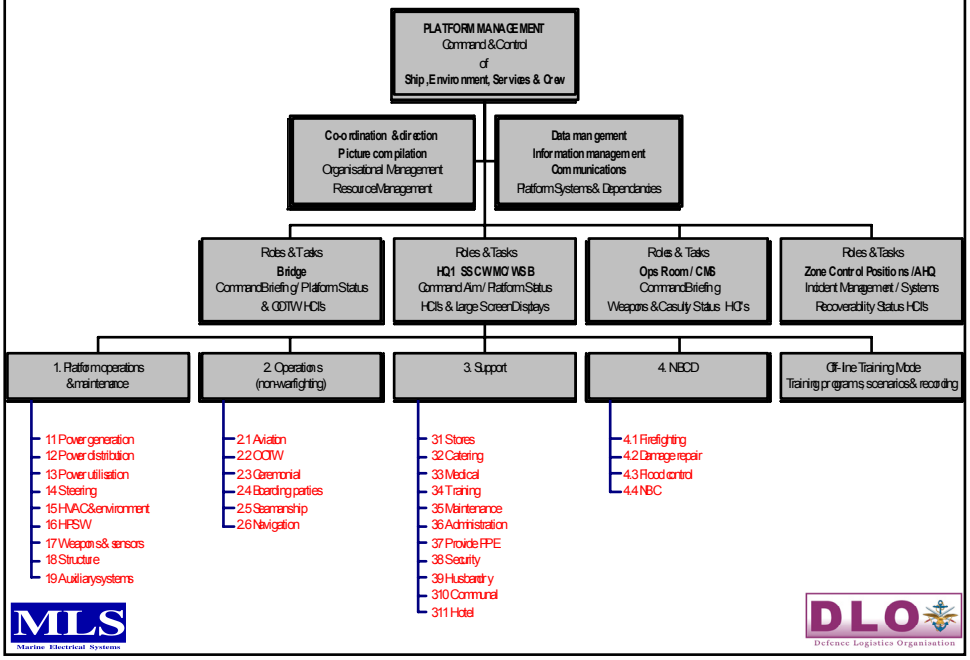
- Generic control system architecture
- What is a PMS
- PMS Risk & Mitigation
- Whole ship, Whole systems approach
- PMS Requirements - Lessons learnt
- Synergy with ISO 17894 (Marine programmable electronic systems)
- PMS Studies & www.warshipautomation outputs
- PMS Implementation - recommendations



A Definition of what a Platform Management System is :

"A system that takes input from either command or the command and control system, dependant on the vessel's action state or situation, and manages the platform's response"

PMS - Whole Ship Functionality



PMS - Core Functionality

- MCAS - Machinery Control and Surveillance
- EPCAMS - Electrical Power Control (inc. Propulsion)
- DSAC - Damage Surveillance and Control
- Maintenance - Condition Monitoring & Analysis
- On Board Training
- Personnel & / Cargo Locators
- Automation - Plant & System

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Ship Controls → PMS - What is the Risk ?

PMS Studies - MLS CG1, BAE Systems & Rolls Royce MES.
5 year programme to de-risk future PMS procurement

- Identification of risks / issues associated with PMS implementation
- Prioritise & mitigate most significant risks.
- Common point of PMS focus for MoD stakeholders.
- Pull - through of knowledge & lessons learnt into industry

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PMS Risks - December 2000

T45, FASM, FSC, CVF & ESTD

Programme analysis / risk identification

- Costs (PMS Cost drivers for UPC & WLC)
- Technology (COTS Awareness / maturity)
- Communications (Knowledge capture & distribution)
- Requirements generation
- Requirements management
- Data fusion / decision support (user, operator, maintainer)
- Localising incident extent of effect
- Career structure (technology impact, operation & support)

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PMS Risks - March 2002

Lessons Learnt

- Technology readiness not in the highest risk category.
- Greatest Risk - No single (MOD) authority enabled to implement generic "desired capability" of any platform
- PMS "Operability" undefined, i.e. match equipment design, training, manpower to ship capability requirements.
- Industry perceive use of new technology/systems as extra risk.
- PMS Solutions are not optimised to meet WLC requirements.

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PMS Risks - March 2002

Lessons Learnt

- Procurement must align to MOD (UK) Smart Acquisition i.e. Requirements Engineering approach.
- Whole Ship / Whole Systems process required, for Marine Engineering domain.
- Must include all Stakeholders throughout CADMID: (**C**oncept, **A**ssessment, **D**evelopment, **M**anufacture, **I**n-service, **D**isposal)
- Stakeholders must define performance & acceptance criteria for requirements to enable effective cost capability trade off.
- Requirements Generation & Management is most critical area of concern for Defence Procurement Agency platform IPT 's.

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Whole Ship, Whole Systems approach

Requirements generation & management

Mapping Operational Roles & Tasks to platform functions

+		Combat Ops Against Land	Organic Air Support	Amphibious Operations	Nuclear Deterence	Evacuation Operations	Peace Support Operations	Naval Diplomancy
Colour Code	H = Functionality is **CRITICAL** to achieve operational task							
	M = Functionality is **REQUIRED** to achieve operational task							
	L = Functionality has a **LIMITED** dependancy to achieve operational task							
	N = Functionality has a **MINIMAL** dependancy to achieve operational task							
Level 2	**Level 3**							
SENSE	**SENSE**							
Sense Platform integrity	Sense watertight integrity	H	M	H	N	M	M	N
	Sense gastight integrity	H	N	H	N	N	N	N
	Sense Platform Structural integrity	L	N	N	N	N	N	N
Sense Platform Internal Environment	Sense Fire	H	H	H	H	N	N	N
	Sense Fluid Leakage	H	N	H	N	N	N	N
	Sense Smoke	H	N	H	N	N	N	N
	Sense Platform Internal Temperture	N	N	N	H	N	N	N
	Sense Platform Internal Atomospheric Purity	N	N	N	M	N	N	N
	Sense Platform Internal Humidity	N	N	N	N	N	N	N
	Sense Platform Internal Systems Damage	L	N	N	N	N	N	N
	Sense Citidal Pressure	N	N	N	N	N	N	N
Sense Platform configuration	Sense Systems Configuration	H	H	H	H	H	H	H
	Sense Damage Control Equipment	L	N	L	L	H	N	N
	Sense Platform Openings Status	H	H	H	H	H	H	H
Sense Platform NBC Contamination	Sense Nuclear contamination	N	N	N	N	N	N	H
	Sense Biological contamination	N	N	N	N	N	N	N
	Sense Chemical contamination	N	N	N	N	N	N	N
Sense Platform Physical Security	Sense Personnel acess to platform	N	N	N	H	H	M	H

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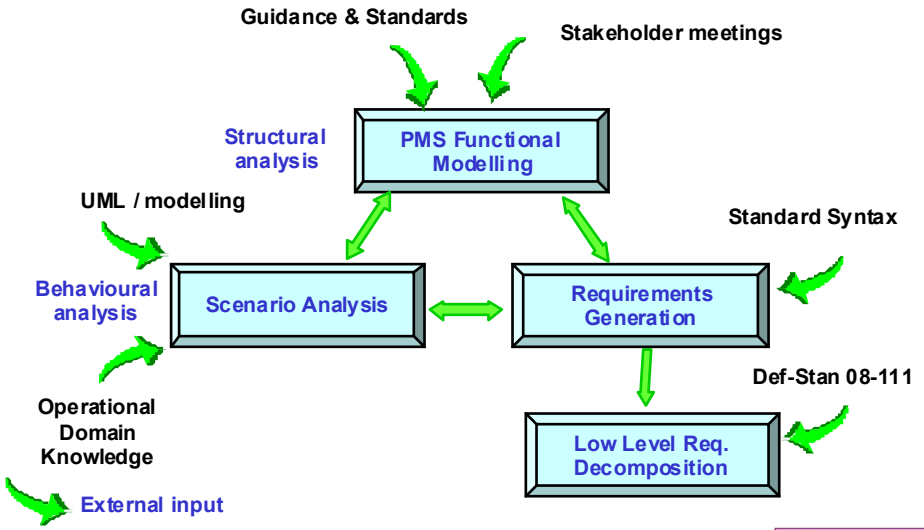
Whole Ship, Whole Systems approach

Requirements generation & management



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PMS Requirements - June 2005

Lessons Learnt

- Generic requirements - structured and formalised approach
- System requirements - linked via operational scenarios to operational roles and tasks providing an audit path
- Material will 'bootstrap' future programmes by providing re-usable material saving time and cost

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PMS Requirements - June 2005

Lessons Learnt

- Material generated can by utilised by future programmes to de-risk the requirements and specification process
  - consistency and completeness of statements
  - wider exposure to stakeholders
  - systems engineering approach providing link to end user needs
  - provides basis of approach to link to design solution and assess capability achieved

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Synergy with ISO 17894

ISO 17894 - advocates good requirements management

- advocates early stakeholder agreement

- advocates capability trade off

- advocates systems engineering design approach

ISO 17894 = PMS Studies approach to marine systems design

PMS Studies & www.warship automation outputs

- Full stakeholder involvement, steering groups, workshops.
- Knowledge database & warshipautomation website
- Cost drivers & technology assessment tools, functionality & process guidance; non - functional requirements assessed, PMS related standards reviewed, Procurement (CADMID) guidelines produced.
- Generic PMS Requirements sets: guidance & process.
- Allows incorporation of "Bottom Up" or legacy solutions into "Top Down" PMS requirements.
- Requirements ownership can be matched to business process.

PMS Engineered for "no surprises"

PMS Implementation
(Unmitigated risks)

• Systems Integration	High risk
• Sensor and data fusion guidelines	High risk
• Open Architecture evaluation	High risk
• Training Needs Analysis guidelines	High risk
• Identification of source data	High risk
• Review of dormant ship requirements	Medium risk
• Study of decentralised control	Low risk
• On-board training	Low risk
• Hardware environmental knowledge base	Low risk

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PMS Implementation

PMS specific Guidance & Standards

High Priority

- Performance - Provide guidelines on PMS performance issues.
- Vulnerability - Provide guidelines on how to evaluate vulnerability.
- COTS - Provide guidelines for use with STANAG to ensure a "rule based" approach.
- Environmental - Provide guidance on how to "navalise" COTS products.

Medium Priority

- HF - Develop common PMS user interface and DC symbol design.
  - TAD for PMS Operator and Maintainer.
  - Provide guidelines in the use of large screen displays and laptops.
  - Update Alarms & Warnings policy to equate COTs & military needs

ARM/ILS - Provide guidance on how to extend ILS into in-Service phase.

Low Priority

- Safety - Abundance of information
- Software Safety - Abundance of information
- Security - Abundance of information

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De-risking Ship Control Systems

Culture change - MOD, Navy & Industry

Increased Integration - Business, platform & system

ISO / Lloyds / Naval Standards - increased alignment

Human Systems Integration - Apply through lifecycle.

Whole Lifecycle Costs - Entire user community take ownership

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