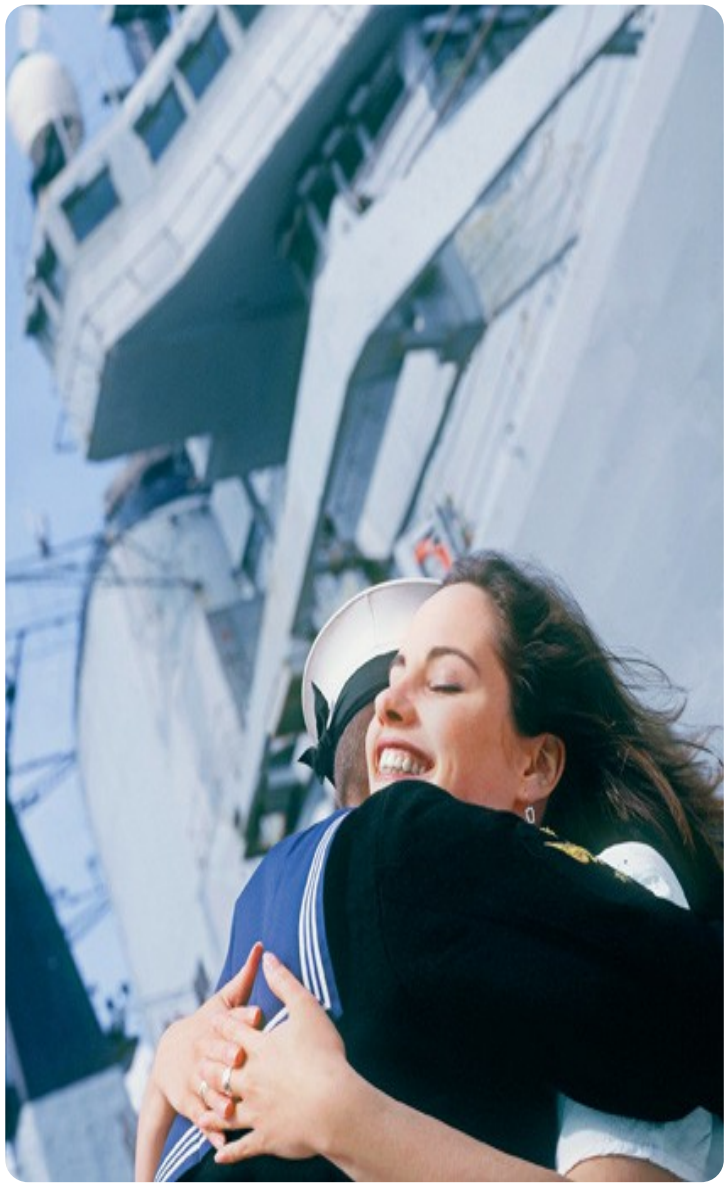


Classification as the ISA

The Role of Classification for a Risk Based Naval Authority

December 2006

DLO Defence Logistics Organisation

Lloyd's Register

Introduction

- Propulsion and Manoeuvring Naval Authority
- Challenge of Risk Based NA's
- Commercial Practice
- LR Project
- Way ahead
- Benefits

JSP430 - Policy Objective

"to ensure arrangements are in place to meet user requirements by achieving compliance with the law where applicable or developing safety requirements, which are at least as effective as statutory requirements, where the law does not apply. The levels of safety risk associated with safety requirements shall be equivalent to, or lower than, those implied by statute, as far as is reasonably practicable;"

JSP430

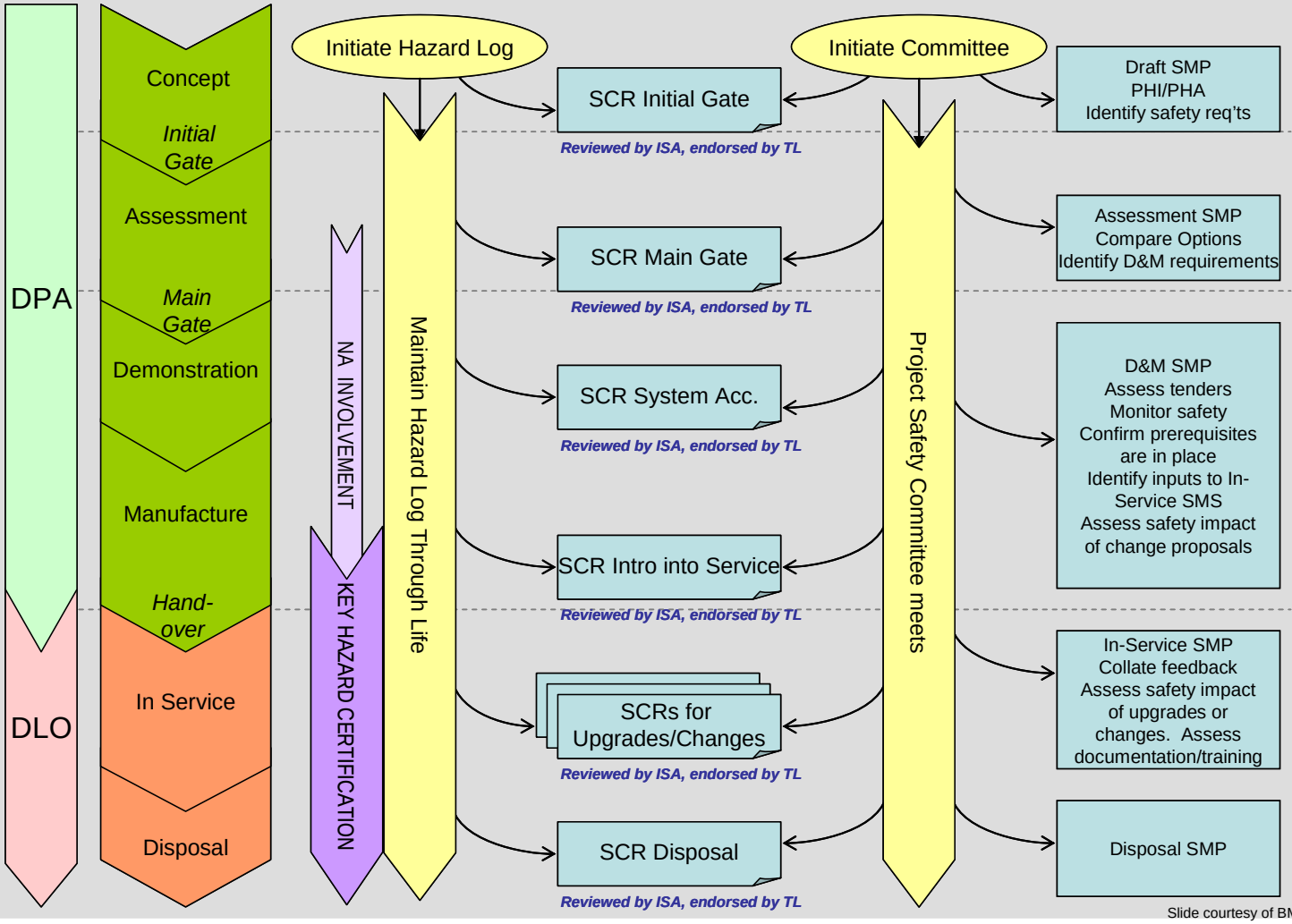
SEC STATE FOR DEFENCE

SHIP SAFETY BOARD

NAV AUTH COUNCIL

- KEY HAZARDS
  - •chapter 04 surface ship stability
  - •chapter 05 surface ship structural strength
  - •chapter 06 surface ship escape & evacuation
  - •chapter 07 fire
  - •chapter 08 explosives
  - •chapter 09 submarine stability
  - •chapter 10 submarine structural strength
  - •chapter 11 submarine manoeuvring & control
  - •chapter 12 submarine atmosphere control
  - •chapter 13 submarine watertight integrity
  - •chapter 14 propulsion & manoeuvring systems

Safety Management Process (JSP 430)



Slide courtesy of BMT Defence Services Ltd

Challenge of Risk Based Naval Authorities

- Who sets level of Risk?
- Who confirms risk mitigated effectively
- Who assures that design has been built
- What oversight exists in service where HF solutions adopted?
- How does process work with contracted out services?
- Does the commercial supply chain recognise operational safety – what evidence do they provide?

LR Project

- QUESTION
  "To what extent does the Machinery section of the Rules and Regulations for the Classification of Naval Ships contribute to Propulsion and Manoeuvring Naval Authority"
- RESPONSE
  - Need common language to gauge extent
  - Task
    - To reverse engineer from the Rules the underlying hazard being addressed
    - Assess how do the two processes give assurance

Where do Rules Come From?

- Rules are not the unilateral decisions of a remote unconnected regulatory organisation
- Rules and Standards are developed in light of past experience
- Discussed and commented on by Industry
- Subject to review in light of emergent experience

LR Project – Identify Hazards in Machinery Rules

- LR Rules and Regulations for Classification of Naval Ships, Jan 2005, Volume 2, Parts 1 to 11 and Volume 3, Part 1 Chapters 1, 2, 3, 5 & 7
- All clauses reviewed for underlying intent
- Intent written up as underlying hazard
- 1120 hazards identified for basic LMC notation
- Further 170 for various optional notations

LR Project – Typical Results

Rules Reference	Notation	Rule Requirement	Hazard
Vol 2, Part 1, Chapter 2, section 4.13	LMC	Interlocks are to be provided to prevent starting of engines under conditions that could hazard the machinery. These are to include 'turning gear engaged', 'low lubricating oil pressure where oil pressure is essential for the prevention of damage during start-up', 'shaft brake engaged' and where machinery is not available due to maintenance or repairs. The interlock system is to be arranged to 'fail safe'.	Equipment attempted to be operated in conditions that could hazard the machinery itself
Vol 2, Part 1, Chapter 2, section 4.15.3	LMC	Any hydraulic, pneumatic or electrical control and alarm systems are to be arranged so that any diesel engine or gas turbine operating at the time of failure will continue to operate safely for a period of at least one hour under the control mode selected at the time of failure, i.e. successful control system changeover is not to be a precondition for continued safe operation. Engine monitoring and alarm systems required by the Rules are to be available at all times.	Diesel engine or gas turbine shuts down in event of control system failure
Vol 2, Part 2, Chapter 1, section 6.1 Diesel Engines	LMC	Cylinder relief valves are to be fitted to engines having cylinders over 230 mm bore. The valves are to be loaded to not more than 40 per cent above the designed maximum pressure and are to discharge where no damage can occur.	Excessive pressure in combustion space not relieved in safe manner

LR Project – Generic Hazard Listing

- List of 29 ‘Generic Hazards’ identified from full list
- Includes:
  - **Design Stage**
    - System capability not matched to operational intent
    - Unsuitable materials used in system or equipment
    - Control systems and shut down systems have common mode failure
  - **Manufacture**
    - Manufacture of system does not reflect design intent
    - Manufacture/ installation has compromised design intent
    - Installation of system does not allow for vessel environment
  - **Operation - Normal**
    - Operators unable to control system effectively
    - Operators operate system incorrectly due error of identification
    - Failure of single item causes loss of total capability
    - System contaminated by external environment
    - Failure or fault in operation leads to secondary hazard
  - **Operation - Emergency**
    - Operators unable to operate system in event of emergency
    - Failure of system containing hazardous fluid causes injury to personnel
    - Unable to regain required level of capability after system failure

Blending Naval Standards into Class

Safety Case

Functional requirement

Design Feature

LOW IMPACT ON PRIMARY CAPABILITY

HIGH IMPACT ON PRIMARY CAPABILITY

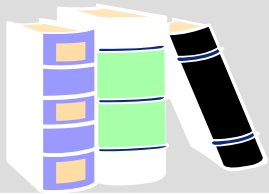
Merchant Type Standard

Hybrid Standard

Naval Standard

NSR

Statutory



Tailoring Document

Naval Standard
MilSpec
DefStan
BwB
etc

Certification Requirements

SYSTEM NAME	System or Equipment	NOTATION	CATEGORY	DESIGN VERIFICATION DESCRIPTION	EQUIPMENT Verification/ Certification	MATERIAL Verification/ Certification
Machinery system	**S**	+LMC PSMR	Mobility	NSR	-	-
Gas Turbine Alternator	**S**	+LMC	Mobility	SR NSR Transversals FMEA	LR SR + transversals	LR see components for details
Gas and Power turbine	E			SR + TA Procedures	LR SR QAM	GT Manufacturers approved system
Alternator	E			None	LR SR	Nat 3.1 +LR Shaft
Control system	E			SR + NSR Transversals	LR SR for Consoles	Nat 3.1
Software	E			SR + ISO 17894 (or equivalent)	-	-
Enclosure	E			NSR	LR NSR	Nat 3.1
Insulation	E			SOLAS	LR/EU Flag	evidence
Fire suppression	E			IMO FSS	LR TA	Nat 3.1
Ventilation	E			NSR	LR NSR	Nat 3.1
Start module hyd	E			SR	LR SR	LR class II or Nat 3.1 if dia<50mm (non flam)
Alt LO Module	E			SR	LR SR	LR class II p>7bar and dia>50mm
Fuel Module	E			SR	LR SR	LR class II p>7bar and dia>50mm

Report Conclusions

- Classification uses a different language, but deals with risk in a way commercial supply chain understands
- Classification provides assurance that Capability specified is ‘safe’
- Class process is ‘end to end’
- Class is timely (has to meet pace of commercial projects)
- CS’s provide ‘free’ service of knowledge management by update of Rules and standards
- All based on ‘Satisfying’ an independent SQEP working in a large support infrastructure

Summary

- Standards provide a significant contribution to Risk Based Safety Regulation
- Selection and tailoring need to be undertaken early in a project's lifecycle
- Significant 'Added Value' from integration to commercial procurement practices are realised
- Costs of retaining Corporate Knowledge are minimised by adopting Through Life Certification
- Classification Societies are a unique resource available to defence asset assurance
- Ship Classification has a greater scope than that provided by a JSP 430 ISA

- Question: What Added Value does a Naval Authority offer over Class?

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LIFE MATTERS

The Lloyd's Register Group works to enhance safety and approve assets and systems at sea, on land and in the air – because life matters.