Pilotage Operations Safety Management System (POSMS) (First Principles)

PILOTAGE & PORT LOGISTICS CONFERENCE
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Background

• Request from a manager of a pilotage organisation in late 2012 for assistance in developing a SMS for the unique dynamic risk inherent in pilotage operations

• Request from a port around the same time for assistance with the development of a SMS for pilotage operations (Decision made to develop a SMS for pilotage operations because of the special risks involved)
Background

- Impression of ISM Code on ships - administrative nightmare
- Severe personal impact of an accident on pilot and bridge team. SMS for pilotage to be ‘pilot centric’
- What is the aim/purpose of a SMS?
- Pilotage accident events:
  - Low Probability/High Consequence (Matthew Thomas)
  - Low Frequency/High Severity (James Reason)
  - Black Swan* (Nassim Nicholas Taleb)
*The black swan theory or theory of black swan events is a metaphor that describes an event that comes as a surprise, has a major effect, and is often inappropriately rationalized after the fact with the benefit of hindsight.
- Research revealed no pre-existing suitable model
  - No option but to develop POSMS from first principles
  - Involved 6 months of research
POSMS - Issues

• In pilotage the pilot has a critical role but his/her control of the situation is limited.
• The pilot in compulsory pilotage is in-charge of the navigation whilst the master is in overall command of the ship.
• The pilot has to elicit cooperation from the master and crew for the safe conduct of the ship.
• In an international industry such as shipping communication and other problems arising from multicultural factors have to be resolved in a limited time and acted upon.
POSMS - Issues

- Pilotage is conducted in a dynamic environment.
- Each ship has a different safety climate along with varying levels of crew competence (certificates of competency have been fraudulently acquired), reliability of machinery maintenance and navigation equipment levels. There are serious quality issues with regard to fuel used on ships that have resulted in sudden and untimely breakdowns of the main engine and blackouts. Also there is no built-in redundancy in regard to critical components such as propulsion and steering system.

Developing and implementing an effective SMS for pilotage operations is particularly challenging
Safety Management System

The main purpose of a SMS is to reduce the risk of a large scale accident
Specificity of Safety Management Systems

“...The demands of managing risks of workplace injury are very different to the risks associated with Low Probability/High Consequence (LP/HC/ transportation accidents. Yet a study concludes ‘Even given the very different demands of managing the risks of workplace injury compared to the risks associated with LP/HC accidents, the overarching structures, individual components and major functionality of safety management systems have remained very similar regardless of industrial context.”

Safety Management Systems (SMS) - History

• 1950’s Nuclear Power Industry – challenge of developing safety standards in a totally new industry with extreme set of hazards
• Existing safety standards inadequate and a new approach had to be developed from the ground up with the **goal of zero accidents**
• All hazards were carefully **identified in advance by domain experts** and **systems built-in** to manage all aspects of risk and safety at the **design stage** from construction, and operation to decommissioning – lifecycle of the project
• This **proactive** systematic approach to safety became known as the **Safety Case**
• Model incorporated a high degree of **self-regulation** as the regulators knowledge of the new industry was limited. This was in contrast to the existing prescriptive approach to regulation of safety in other industries
SMS – Chemical Plants

- **Seveso** disaster in 1976 which involved a large scale release of highly toxic dioxin from a small chemical plant in Italy giving rise to the **Seveso II Directive**.

- The **Directive** mandated systematic safety management systems across facilities in Europe that handled dangerous substances.
SMS – Offshore Industry

• **Piper Alpha** was a North Sea oil production platform. On 6 July 1988 an explosion and the resulting oil and gas fires destroyed it, killing 167 men. (Total insured loss was about US$3.4 billion).

• The subsequent inquiry headed by Lord Cullen made 106 recommendations

• Most significant of these recommendations was that operators were required to present a ‘**safety case**’ for managing safety.
Safety Case - Definitions

• A documented body of evidence that provides a demonstrable and valid argument that a system is adequately safe for a given application and environment over its lifetime.

• A safety case is a structured argument, supported by a body of evidence, that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given environment (UK Ministry of Defence MOD 2004)

• A safety case regime is an objective-based regime whereby legislation sets broad safety objectives and the operator, who accepts direct responsibility for the ongoing management of safety, develops the most appropriate methods to achieve those objectives. Government of Western Australia Department of Consumer and Employment Protection

Above definitions have much in common but there is not a single, agreed-upon definition as to what constitutes a safety case.

"Arguably, then, the question is not what is a safety case regime - but rather what kind of safety case regime is being contemplated . . ." Kathryn Heiler (2005) ANU National Research Centre for OHS Regulation Working Paper 45

• In other words, each operator and regulator must determine the nature of the safety case for their particular situation.

Which of above definition best suits a POSMS?

There is no "one size fits all" safety case structure or design
Safety Case - Application

• In principle a safety case* can be developed for any activity. Most appropriate in an activity where in the event of an accident the consequences could be very severe.

• Such high consequence events are referred to as Major Accident Events (MAE).

*Lord Donaldson considered the ISM Code to be the Safety Case for the shipping industry

Example - a ship grounding or collision even without casualties and or pollution would be classed as a MAE.
SMS - Shipping

- **Herald of Free Enterprise** - 06 March 1987 capsized and sank a few minutes after leaving Zeebruge resulting in the deaths of 193 passengers and crew
- **Scandinavian Star** - On 07 April 1990 a fire broke out and rapidly spread through the ship resulting in the deaths of 158 persons
- Development of **International Safety Management (ISM) Code for the Safe Operation of Ships and for Pollution Prevention**
  - 1990 - 1995 Gestation period
  - 1998 - 2002 Staggered compliance in shipping industry
- One of the ISM’s main goals was to close the gap between the ‘boardroom and the bridge’. It was felt that some risks were ‘created’ in the boardroom and ‘carried’ by the ship’s personnel
- Loss of the **Costa Concordia/Rena/Sewol etc** indicate severe limitations of ISM Code in reducing the risk of large scale accidents
SMS - Ports

• On 15 February 1996 the tanker *Sea Empress* under pilotage became grounded at the entrance of Milford Haven spilling 72,000 tonnes of crude oil into the sea.

• In March 2000 the Port Authority was found guilty under the strict liability *Water Resources Act 1991* for not having a safety management system. This judgement bypassed the civil immunity of the pilot and port that had withstood many challenges since 1913.
SMS - Ports

“The port authority created and then operated a system which resulted in Sea Empress attempting to enter the Haven… at a time as late or later, in terms of proximity to low water, than any comparable vessel had attempted previously. It thereby put (the pilot) in a position where as a direct consequence of the management system operated by the port he could make an error* of navigation.”. Justice Steel


*Error seen as a consequence rather than a cause
Options for Pilotage Operations SMS

• Classification Society - Lloyd’s, DNV, AB etc
• UK Port Safety Code
• International Standard for Maritime Pilot Organisations (ISPO)
  (Classification Society/ISPO/Port Safety Code have a similar approach to the ISM code)
• Safety Case - Systematic proactive approach
Introduction of SMS Concept into Shipping - Issues

• A safety management system can be defined as a planned, documented and verifiable method of managing hazards and associated risks (Bottomley, 1999).

• Proper identification and classification of risk is a critical factor in the protection encompassed in a safety management system.

• In the nuclear power industry safety built in at design stage – ideal situation. Hazards and risks clearly defined.

• Relatively simple to transfer the concept to the process based chemical and offshore industries.

• In shipping the industry to be managed is up and running and has its own strong traditions and culture.
ISM - Deficiencies

• The ISM Code is based on a Quality Management (QM) and Quality Assurance (QA) approach and hastily adopted by the shipping industry after the high profile *Herald of Free Enterprise* and *Scandinavian Star* incidents.

• The **ISM Code** uses the same terminology, tools, techniques and clauses as **QM**.

  Main difference:
  
  - **QM** has focus on the ‘**Customer**’ and ‘**Service**’
  - **ISM Code** has focus on ‘**Safety**’ and ‘**Environment**’
ISM - Deficiencies

• QA/QM based safety management systems such as the ISM Code take an engineering approach to safety
• More suitable for manufacturing and other process driven industries
• Limited application on a moving ship operating in a dynamic environment

In a dynamic environment safe outcomes are achieved through the timely interventions and adjustments of skilled human operators to changes in an uncertain environment

(Many operations in shipping particularly in pilotage are situated in the operational chain where ‘active failures’ occur)
Reason Model of Accident Causation

**Organization**
- Organizational Factors
  - Communications
  - Management Structure
  - Incompatible Goals

**Task/Environment**
- Local Factors
  - Health/Morale
  - Fatigue
  - Equipment
  - BRM
  - Procedures
  - Knowledge/Training

**Individuals**
- Active Failures
  - Slips
  - Lapses
  - Mistakes
  - Violations

**Defenses**

Latent Failures
ISM Code - Deficiencies

• In shipping it was very difficult to identify and classify risks and hazards with the same level of clarity as the process based industries
• It is also possible that existing risk controls in such areas as bridge operations were considered sufficient
• It appears that no appraisal was done to check if existing risk controls were adequate in regard to:
  - meeting contemporary community standards in regard to ‘acceptable risk’ and
  - application of ‘available knowledge’ and concepts on safety
• The practical solution was to consolidate existing practices to establish a standard and amend the system after failures and accidents
ISM - Deficiencies

- In practical terms this has made the ISM Code a **normative, top down** and **reactive** system.
- With the level of safety required for pilotage the POSMS must be proactive.
- Also the dynamic nature of pilotage demands a proactive system.
ISM - Decision Making, Human Factors & Systems Approach/Error Management

- Aim of ISM code to minimize the scope for poor human decisions that contribute directly or indirectly to a casualty or pollution incident through the application of better management
- Decision making is a process thoroughly permeated by human factors
- QM based Safety Management System (SMS) not properly informed by human factors knowledge
- In SMS context human factors implies error management
Error Management

• “Errors fall into recurrent patterns: the same situation keeps on producing the same error in different people” James Reason

• Raising awareness of the types of individual human and teamwork errors that commonly occur and how we might prevent, trap and mitigate these before they lead to an accident is error management

The issue is not that an error occurred, but how it failed to be corrected
SMS for Marine Pilotage – Types of Risks

Principal risks in marine pilotage
- Personal injury particularly during boarding and disembarking
- Grounding and Collision from navigation (human error) machinery malfunction or breakdown

Grounding and Collision accidents in shipping are of the Low Frequency/High Severity type

Example - In the last 10 years the success rate for the Great Barrier Reef pilotage has been 99.9995% (2 major groundings)
No meaningful safety information can be acquired from such limited data
Risk Assessment & Due Diligence

• The ‘combination of probability, frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence’ approach to risk assessment does not provide a legal defence in case of an accident

• The courts in Australia are tending to take a very harsh view of safety management systems based on methodologies backed by experts but contrary to common sense.

• Only a SMS underpinned by a ‘Due Diligence’ approach can provide a credible legal defence against negligence after an accident

• Formal Due Diligence process covered in the next presentation by Richard Robinson, Gaye Francis and Captain Philip Holliday.
ISO 31000 versus Due Diligence

**Costa Concordia**

- According to ISO 31000 Standard for Risk Assessment the *Costa Concordia* was a 1 in a 100 year accident.
- In terms of Due Diligence what would have guarded against the *Costa Concordia* accident?
- Application of Bridge Resource Management (BRM)/Error Management (EM) techniques would have greatly reduced the risk of an accident.

(What is the cost and effort involved in implementing BRM?)
Due Diligence & Bridge Resource Management (BRM)

Due Diligence = Proper identification and classification of Risks by pilots and application of risk controls based on:
- distilled wisdom of all the pilots*
- safety concepts such as Error Management (BRM)
- safety information from all available sources

* POSMS is a repository of current and historical pilotage safety information
Benefits and Features of POSMS

• Provides basis of legal defence for pilot and management
• Provides an opportunity for reappraisal, updating and consolidation of practices in pilotage (necessary with unprecedented level of developments in many areas from safety, and legal and regulatory to technology)
• Defines ‘good practice’ after application of systematic approach to identification and classification of risks (risk assessment) and developing controls (‘good practice’ equates to distilled collective wisdom of all pilots in combination with latest safety concepts)
• New pilots will have ready access to all consolidated safety information available in one document
Benefits and Features of POSMS

• Adoption of systemic approach to selection, induction, training, professional development, check piloting and proficiency checks

• Tracks ‘emerging good practices’ in other pilotage areas such as use of Thermal Image Cameras (TIC) in pilot boats

• Having coping strategies in the event of GNSS failure

• Improved incident/accident investigation

• Implementation of concept of ‘Just Culture’

• Improved record keeping as evidence of implementing ‘Due Diligence’ approach
Benefits and Features of POSMS

• As a proactive system with a reporting culture:
  - Creates opportunities for detecting ‘Risk Creep’ (slow and imperceptible build up of risk)
  - Reporting system (culture of ‘sharing error’ critical part of safety culture)
  - Reporting system should lead to an informed culture
• Identifies emerging issues such as:
  - ECDIS training
  - PPU standards and training
  - Cruise ship piloting
  - Ships with two 3 cm radars
POSMS - Summary

- POSMS is specific to the level of professional development of pilots. (Error management techniques from 2nd Generation BRM course are embedded in the POSMS)
- POSMS is a repository of safety information. Safety information derived from multiple sources (pilots primary source of safety information)
- Due diligence approach applied
- Due diligence extends to actively seeking relevant safety information from Australia and overseas
- Accurate identification of hazards and risks specific to pilotage operations is the cornerstone of the POSMS
- Dynamic risks in bridge operations/pilotage that have not been part of the ISM Code or QM based Pilotage Safety Management Systems are included in the POSMS
POSMS - Summary

• The limitations of statistical risk assessment/management methodology in Low Frequency/Severe Consequences cases has made it necessary to use the more appropriate due diligence approach. The statistical model may be applied in circumstances where the risks are more easily predicted.

• It is informed by human factors knowledge

• Error management is incorporated into the POSMS with the aim of building in multiple defences to guard against the possibility of error leading to an accident
POSMS - Summary

• Pilot’s primary independent risk control role in protecting the environment & critical infrastructure from shipping is clarified in the POSMS
• Hazards and risks are understood at an operational and organisational level
• A safety case framework that involves a proactive approach to risk and safety is used for developing the POSMS
• Incorporates selection, induction, training, check piloting & professional development
• Incorporates periodical reviews to determine effectiveness in managing risks
• POSMS is driven by a spirit of self regulation
End

Ravi Nijjer
Principal Consultant
Marine Consultancy Group Pty Ltd

Ravi.Nijjer@marcon.com.au