

# Bridge Organisation for Safe and Effective Operation

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## SUMMARY

In 2008 two of Carnival's brand lines – Carnival UK and Princess Cruises -- introduced a new bridge organisation based on roles rather than ranks. The new organisation represented a new and more progressive approach to bridge management. Under this approach, the officers operate as an effective team in managing the bridge based on the specific roles with related functions and tasks needed to be followed and executed. The purpose is to create a more efficient, engaged and resilient organisation in which the team works as a well-coordinated unit to manage disturbances and avoid negative consequences.

The system builds on the airline industry's concept by introducing Navigator and Co-Navigator roles. The Navigator, who is conning the ship, is required to communicate intentions and orders to the Co-Navigator. Co-Navigator's tasks include monitoring, cross-checking and supporting the Navigator. In addition, each officer, regardless of rank, is empowered to speak up should he or she have a question or a concern.

This role-based bridge organization does not in any way diminish the authority and responsibility of the Captain. The Captain continues to maintain full oversight of the bridge and assigns officers to particular roles, based on the watch keeper's competence and experience with the upcoming operation. The Captain provides ongoing guidance to officers, making it a very adaptable system that leverages the knowledge and experience of the Captain and each of the officers.

## 1. INTRODUCTION

Navigating a large cruise ship in confined or restricted waters involve different levels of risks. These risks must be managed on a systemic level, meaning that safety is created in the interaction between human, technical and organisational systems, which is necessary for the adequate performance of the overall socio-technical system (Rasmussen, 1997). The concept of Resilience Engineering takes a systemic view on safety, and may be seen as the ability of an organisation to maintain normal operations and regain a dynamically stable state when responding to abnormal situations. According to the Resilience Engineering concept organisations should not only look at what goes wrong when creating safety, but also look at what goes right (Hollnagel, Woods & Leveson, 2006). There are four abilities to show resilient behaviour that an organisation, such as a bridge team, should have in place to be considered resilient:

- 1) *Responding*. Knowing what to do, how to respond to regular and irregular disruptions and disturbances.
- 2) *Monitoring*. Knowing what to look for, that is, how to monitor that which is or can become a threat in the near term. The monitoring must cover both that which happens in the environment and that which happens in the system itself, that is, its own performance.
- 3) *Anticipating*. Knowing what to expect, that is, how to anticipate developments, threats, and opportunities further into the future.
- 4) *Learning*. Knowing what has happened, that is, how to learn from experience, in particular how to learn from the right lessons from the right experience – successes as well as failures. (Hollnagel, Paries, Woods & Wreathall, 2011).

## 2. TRADITIONAL BRIDGE ORGANISATION

'Traditional' bridge organisation refers here to an organisation where the Captain is acting as the operator conning the vessel. The limitations of the traditional system become obvious after analyzing recent accidents, particularly with regard to, the use of human resources and today's modern equipment. Many accidents have occurred when the Captain has been conning the vessel with a passive bridge team watching and wondering how this will end. They might even have thoughts like; 'He must know something I don't??? When the ship runs aground it becomes clear that he didn't.

Even if officers have been attending a Bridge Resource Management (BRM) course where one of the major learning's is to develop assertiveness, the ability to speak up if there is a deviation from the plan or any other concern, this has not had impact expected. Many accidents could have been avoided if officers would have had the courage to speak up. In order to avoid this situation new paths must be entered to minimise the risk that a variation in performance within the bridge team would lead to negative consequences.

## 3. NEW BRIDGE ORGANISATION BASED ON ROLES

The purpose of the role-based bridge organisation is to create a control system with organisational redundancy. The system builds on the concept of role-based organisation that was first advanced by the aviation

industry, with the roles Pilot Flying and Pilot Monitoring. The maritime version achieves this by the aggregation of operational functions assigned to Navigator and Co-Navigator. This aggregation ensures a certain degree of overlap between operational functions that is necessary to face the dynamicity of the context. The Navigator, who is conning the ship, is required to communicate intentions and orders to the Co-Navigator. This means that no course changes or engine orders will be carried out without an agreement and confirmation from the Co-Navigator. These new protocols also require a double-watch keeping system with a minimum of two bridge officers on watch at all times when the ship is underway.

### 3.1 DEFINITION OF ROLES AND MAIN RELATED TASKS

The following assigned tasks are part of the role-based bridge organization:

#### Operations Director

- Overview of the entire bridge operation, ensuring that it is carried out at all times in accordance with company procedures.
- Provision of guidance and suggestions to other members of the bridge team as necessary or appropriate.
- Direct monitoring of both the Navigator and Co-Navigator, ensuring that safe passage is maintained and that no internal or external influences are permitted to distract them from their primary tasks.

#### Navigator

- Responsible for conning, navigating the ship following the passage plan and collision avoidance practices.
- Ensures that the bridge team (including the Pilot) is aware of planned actions and intentions by “Thinking out aloud.”

#### Co-Navigator

- Monitors and cross-checks the actions of the Navigator.
- Supports challenges and recommends actions to the Navigator.

#### Administrator

- Responsible for fixing the ship’s position when paper charts are in use.
- Responsible for alarm management and actions. Prioritizes alarms as either “urgent” or “non-urgent.”

#### Lookout

- Maintains all-around lookout by sight and by hearing, reporting all sightings and/or sound

signals to the Navigator, unless otherwise directed.

#### Helmsman

- Acknowledges and executes steering orders given by the person with the conn.

### 3.2 THE CAPTAIN AS A LEADER/MANAGER INSTEAD OF AN OPERATOR

It is up to the Captain to decide who should fulfill any of the roles. A Risk Factors Table and a Risk Analysis and Bridge Manning Level Table have been developed to assist the Captain in deciding what manning level to set. Those manning levels are:

#### Green Manning:

- Minimum bridge manning required underway. In Green Manning, the bridge is manned by two officers in the roles of Navigator and a Co-Navigator. In this manning level, the Co-Navigator is also doing the role of Administrator.

#### Yellow Manning:

- Used in situations indicated by the Risk Analysis and Bridge Manning Level Table. In Yellow Manning, the bridge is manned by three officers in the roles of Navigator, Co-Navigator and Operations Director. In this manning level, the Co-Navigator is also doing the role of Administrator.

#### Red Manning:

- Always used for arrivals and departures and for other situations indicated by the Risk Analysis and Bridge Manning Level Table. The Captain must be on the bridge and assume one of the following roles -- Navigator, Co-Navigator or Operations Director.

The philosophy behind the system encourages the Captain to assume the role of Operations Director, acting as a leader/manager while the team undertakes the operation. By delegating the operational tasks, he/she demonstrates trust in the team. This has many positive effects, such as:

- enhanced learning;
- readiness to actively participate in problem solving;
- enthusiasm and motivation to work;
- an engaged team directly leading to increased safety and efficiency.

As officers are entrusted with conducting the vessel, it will increase their job satisfaction and they will be better prepared for their promotion when that time comes.

The Operations Director should monitor the workload of each team member and take action if someone is

overloaded. With the Captain in the role of Operations Director, he/she will have excellent opportunities to coach and supervise -- and intervene if required. In order to confidently take the role of Operations Director, the Captain must know the competence of officers and also have confidence in his own ability and competence to manage the team from behind. If the Captain feels there is a need to closely coach the Navigator he/she has the option to take the role of Co-Navigator. It should be noted that in order to be a good Co-Navigator you first have know how to be a Navigator. If an officer has not been in the Navigator seat and learned the skills required, it will be difficult to be an effective Co-Navigator and speak up if an assertive action is required, which is the most important task of this role.

### 3.3 SITUATION AWARENESS

Di Lieto in his book on Bridge Resource Management writes; 'Full situation awareness can be maintained through the comparison between visual perception of external world and the image of this created by the active monitoring of navigation systems. Active monitoring represents the heart of the integration between man and technology on a bridge and the basis for achieving, maintaining and recovering situation awareness. Active monitoring is based on sequential and cyclic observation of parameters considered critical for a specific navigational phase.'

Team Situation awareness is a major factor for safety and this is maintained by the communication between the Navigator and Co-Navigator. The Navigator is supposed to frequently up-date the team of his/her perception of the situation and intentions by 'thinking out aloud'. If this is forgotten the Co-Navigator should ask; 'Navigator, what is your intention'?

The main task of the Administrator is to manage elements such as alarms and phone calls – and to make sure that the Navigator and Co-Navigator can focus on their tasks without being distracted or disturbed, which can make them loose situational awareness.

### 3.4 ORGANISATIONAL RESILIENCE

According to the Resilience Engineering concept organisations should not only look at what goes wrong when creating safety, but also look at what goes right. The best opportunities to discuss those matters are at the team debriefing session, which should be conducted after each major event, such as an arrival or departure. If everything has been successful and according to plan the Captain should ask the team 'Why have we been so successful, please analyse? The answers to this question are often in line with the positive characteristics that successful teams have in common, such as:

- They have a detailed plan for the operation
- They work from a shared mental model

- They are proactive and anticipate next condition
- They communicate about the situation
- They adhere to Standard Operating Procedures
- They cross-check all actions before execution
- They challenge any deviation from the plan
- They debrief and learn after each major event
- They don't take past successes as a guarantee for future safety. (Dekker 2010)
- They keep a discussion of risk alive even when things look safe. (Dekker 2010)



Picture 1.  
Bridge on Royal Princess during red manning.  
Co-Navigator & Navigator in front, Captain & Pilot behind, Helmsman middle and Administrator far left.

## 4. TRAINING AND IMPLEMENTATION

BRM is about utilising all available resources i.e. human, technical and organisational; hence we believe that training should include all of those elements. For that reason participants coming first time to CSMART have to do the ECDIS 1 (IMO 1.27 model course) and a type specific Integrated Navigation System course the week before they attend the basic BRM 1 course.

The BRM 1 course deals with operational procedures for normal operation, such as changing manning levels, change of watch, effective communication and related human factors. The ECDIS 1 and BRM 1 courses are corporate requirements for an officer to serve as a third officer onboard a company vessel.

Before promotion to second officer and watch leader an officer will have to do the ECDIS 2 course followed by the BRM 2 course. ECDIS 2 is about the new comprehensive corporate Voyage Planning procedures combined with an in depth use of the INS and automatic track keeping system. The BRM 2 course deals with operational procedures for abnormal and emergency situations combined with related human factors.

The leadership part focuses on moving the Captain from being an operator in front of the team to becoming a leader/manager behind the team. Another module on leadership includes coaching, where the Captain has to coach an officer during preparation and execution of a

simple arrival operation. This creates engaged team members with the opportunity to learn and actively participate in the operation.



Picture 2  
CSMART simulator bridge 1 – Instructor to the right

## 5. ONBOARD IMPLEMENTATION

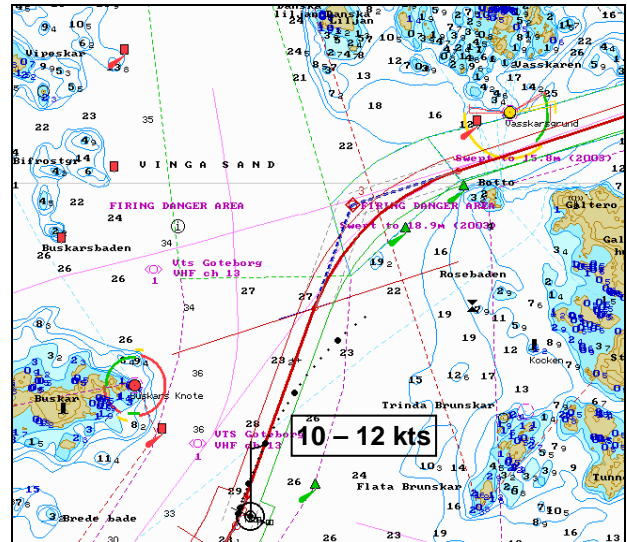
In order to consolidate the training and assist the Captains with the onboard implementation of the new organisation, ten senior Captains were taken out of rotations to make course follow ups. Those Captains first had to do all required courses, including the instructor course, followed by a period serving as assisting instructors to become ‘Fleet Captains.’

The Fleet Captains were sent to each ship for a period of three to five days to make sure that the course objectives trained in the simulator were implemented onboard. The work of the Fleet Captains has been imperative for the successful implementation of the role-based bridge organisation and the new procedures.

## 6. VOYAGE PLAN

The Voyage Plan creates the foundation for the overall control process performed during the execution of the passage. A voyage plan must as a minimum have limits for speed and navigational margins comprising of a track corridor on both sides of the track. The limits are essential for indicating when a ‘challenge’ due to deviation from the plan should be made. If this has been properly understood even the most inexperienced officer will speak up if limits are exceeded.

Some forward-thinking Pilot organizations have published their routes on their website to allow downloading, which facilitates the Voyage Planning onboard and makes the briefing between Captain and Pilot much easier and faster.



Picture 4  
Voyage Plan with limits

## 7. CONCLUSION

Bridge team performance variability is inevitable due to the variability of working conditions. No matter how competent the people we employ or how much training we do. This is why a resilient socio-technical system must be created to avoid negative consequences caused by mismanagement of performance variability.

The role-based system has all four abilities mentioned to be considered as the cornerstones for a resilient organisation; the Navigator and Co-Navigator are responsible for *responding*, *monitoring* and *anticipating*, while *learning* from past experiences is taken care of during the debriefing sessions. Introducing the role based organisation makes it possible to move into a higher level of safety and effectiveness as people are using technology in a structured way and work as a coordinated team.

Having recognised the major benefits of the role-based bridge organisation and new procedures, all 9 operating lines under Carnival Corporation have implemented this system with a lot of positive feedback.

### End quote:

“The foundation of all understanding of human life is that no static maintenance of perfection is possible and it matters little how distinguished the past. Advance or decadence are the only choices offered to mankind. The pure conservative is fighting against the essence of things.”

“Adventure of Ideas,” Professor A.N. Whitehead



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## 13. AUTHOR BIOGRAPHY

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- Principal Instructor & Manager at Dept. of Shipping and Maritime Technology at Chalmers University of Technology, Gothenburg, Sweden
- Director & Principal Instructor at Star Cruises Ship Simulator, Port Klang, Malaysia
- Senior Maritime Pilot in Port of Gothenburg, Sweden
- Has sailed in all ranks up to and including Master

New Bridge Organisation In 2008 two of Carnival Corporation's operating lines P&O Cruises and Princess Cruises -- introduced the new bridge organisation based on roles rather than ranks. Under this approach, the officers would operate as a coordinated team managing the bridge, with each assigned a role associated with specific functions and tasks. This is exactly what Carnival's new role based bridge organisation is pursuing. At CSMART we have considerable experience in Port Pilotage and Cruise ship navigation. This experience tells us, quite clearly, that if we want both professions to evolve together towards a more efficient and safer working relationship, there is great value in putting forth effort into enhancing mutual understanding. Weakness in bridge organisation and management has been cited as a major cause of marine casualties around the world. BRM reduces that risk by helping a ship's crew anticipate and correctly respond to the changing situation of their ship. When BRM is practised correctly onboard, the result should be a bridge team that:

- Maintains its situational awareness
- Continually monitors the progress of the vessel, making proper adjustments and corrections as necessary, to maintain a safe passage
- Acquires relevant information early
- Appropriately delegates workload and authority
- Anticipates dangerous situations

Effective Organisation – rested watchkeepers must be available to meet navigational demands, navigation equipment must be properly calibrated, monitored and cross-checked. Motivation – an atmosphere that encourages this must be created through good teamwork and recognising the strengths and limitations of team members.

### 1 Bridge Organisation.

Determining the composition of the Watch as per STCW Chapter VIII taking into account factors inside and outside the ship, factors determining if a sole lookout is acceptable, relationships between Master and Bridge Team, communication and assigning duties

### Section 4 (Operations)

of this document addresses the application of existing international rules and guidelines and considers such measures as classification society requirements for their DP class notation and continuing verification processes. It gives guidance on what vessel operators should have in place, as far as certification and documentation are concerned, and also contains guidance on manning, including levels of training, certification, skills and experience. An effective bridge organisation should efficiently manage all the resources that are available to the bridge and promote good communication and teamwork. The need to maintain a proper look-out should determine the basic composition of the navigational watch. The bridge organisation should be properly supported by a clear navigation policy incorporating shipboard operational procedures, in accordance with the ship's safety management system as required by the ISM Code. For those personnel that have a direct involvement in ship operations such as watchkeeping, a reasonable period of time must be allocated for new personnel to become acquainted with the equipment that they will be using and any associated ship procedures.