REDUCING THE RISK OF INCIDENTS DUE TO SYSTEMIC FAILURES

Operational guidance for preventing reoccurences

The London P&I Club

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INTRODUCTION

The purpose of this booklet is to provide general guidance and practical advice to ship officers, owners and managers on Safety Management Systems, the risks associated with systemic failures and the precautions that need to be taken to mitigate these risks.

It covers:

- The definition of a systemic failure
- How a systemic failure can affect the ship, and
- How to prevent systemic failures from occurring.

This booklet is not intended to replace official IMO regulations and guidance notes or any document that forms part of a vessel's Safety Management System.

GLOSSARY

ECDIS	Electronic Chart Display and Information Systems
ISM Code	International management code for the safe operation of ships and for pollution prevention (International Safety Management Code)
PPE	Personal Protective Equipment
PTW	Permit To Work
TRA	Task Risk Assessment
Designated person(s)	To ensure the safe operation of each ship and to provide a link between the company and those on board, every company, as appropriate, should designate a person or persons ashore having direct access to the highest level of management. The responsibility and authority of the designated person or persons should include monitoring the safety and pollution-prevention aspects of the operation of each ship and ensuring that adequate resources and shore-based support are applied, as required.
Responsible officer (or person)	A person defined within the Safety Management System, who is responsible for the safe performance of any task for which a permit to work is required.
Safety Management System (SMS)	A documented system implemented in the company offices and on board vessels managed by the company, as required by the ISM code
Systemic failure	A repeated failure within the SMS

STANDARDS

- International Safety Management (ISM) Code (IMO resolution A.741(18) as amended)
- International Safety Guide for Oil Tankers and Terminals, Sixth edition (ISGOTT)
- Code of Safe Working Practices for Merchant Seafarers, MCA, 2015 edition – Amendment 3, October 2018 (COSWoP)
- Any other local regulations

The ISM Code is mandatory for every SOLAS ship.

Ships must have a Safety Management Certificate and the company must have Document(s) of Compliance (one for each Flag of managed vessels), issued by or on behalf of the ship's Flag Administration.

External audits are carried out by or on behalf of the ship's Flag Administration to confirm compliance with the ISM code.

ISGOTT is aimed at the operation of oil tankers and terminals, while COSWoP is intended primarily for merchant seafarers on UK-registered ships. Both, however, contain best practices for any type of ship flying the Flag of any Administration.

THE CONSEQUENCES OF **SYSTEMIC FAILURES**

Systemic failures can have significant and serious consequences for the ship and its crew.

In the very worst cases, a systemic failure can lead to injuries or fatalities.

Systemic failures can also lead to pollution, through incidents such as bunker spills, for example. The costs of clean-up and possible fines can range from significant to catastrophic. In some cases of pollution, seafarers have served jail sentences.

During a Port State Control (PSC) inspection, an extensive list of minor non-conformities may lead to a detention of the ship as the PSC officer may consider it as a major non-conformity regarding the SMS. These deficiencies could be, for example, poor maintenance of safety equipment as required by the SMS and lack of knowledge of the crew in operation of safety equipment.

This may put the ship off hire, and may lead to considerable loss of profit and unnecessary commercial dispute.

▼ *An example of pollution (oil on a beach)*

THE CAUSES OF **SYSTEMIC FAILURES**

The two main causes of systemic failures are non-compliance with the SMS in place on board the ship, or an ineffective SMS.

It is therefore important to review the guidance and procedures provided in the SMS and assess whether they are correct, safe and efficient.

It should never be assumed that the SMS contains the right procedures for the ship. In some cases, during periodical Master's reviews, procedures have been found in the SMS that are not relevant to the ship type.

The Master's review of the SMS is therefore of paramount importance during the life of the system. This would feed in to the mandatory management review of the effectiveness of the SMS.

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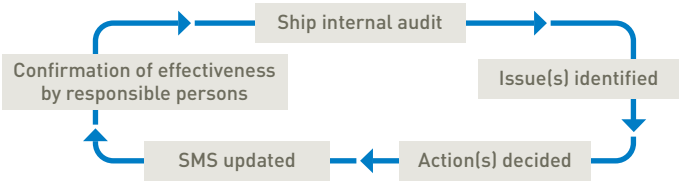
THE CIRCULAR NATURE OF **THE SAFETY MANAGEMENT SYSTEM**



The SMS is a 'live' system and must be updated, when needed, to comply with new regulations and best practice, or in reaction to lessons learned.

This should be done through the circular process of continuous monitoring and improvement shown in the above figure.

The process works by updating the SMS through corrective and preventive actions, and then verifying that these updates are effective through internal audits or ship visits. When incidents occur, root cause analysis must be carried out to ensure that the right corrective and preventive actions are defined and implemented, as well as addressed for the whole fleet as necessary.

Evaluating the SMS through internal audits is a company's mandatory duty, and these as well as the Master's review of the SMS have a vital role in ensuring that the system is effective and relevant.

The contribution of ship's senior officers to the SMS can be considerable. An effective way to empower staff at sea and get their 'buy in' to the ISM Code and the SMS, is to ensure there is a visible investment in ISM Code training. This can also underpin the value of their roles as stakeholders in the system.

Furthermore, if the ship's senior officers are trained as ISM internal auditors, it can assist them in day-to-day evaluation of the SMS they are operating. These qualifications can provide the shore management with a source of experienced and valuable internal auditors for shore offices, which are themselves equally key to the circular process of keeping the SMS updated.

MANAGEMENT OF **CHANGE**

Change in a world of technological advancement can easily be viewed as change for good. However, SMS should incorporate an effective management of change policy in order to ensure that new or replaced equipment does not introduce unexpected risks and does bring all the benefits it claims.

For example, integrating Electronic Chart Display and Information Systems (ECDIS) on board a ship would require a detailed assessment, taking into account factors such as correct installation and familiarity with the system. Failure to do so could create considerable risks. As with all changes, proper training is key.

It is also important to look out for changes in the working environment, particularly when carrying out regularly repeated tasks, where complacency can creep in. These might include changes in the weather, other work taking place around the ship, or new and inexperienced personnel.

Change

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WORK **PLANNING MEETINGS**

Specific task may be carried out in conjunction with other work activities. In order to achieve this, and to ensure that the task is going to be practicable and safe when carried out alongside concurrent planned work, it is good practice to plan tasks in conjunction with heads of all departments. Establishing routine daily work planning meetings, including the ship's safety officer, is a useful way of achieving this.

A responsible officer, who is not directly involved in the concerned work, should be designated to ensure that the plan is followed.

Work planning meetings should ensure that operations and maintenance tasks are correctly planned and managed, with the aim of completing all tasks safely and efficiently.

These meetings may include discussion of:

- Task Risk Assessments (TRA)
- Permits to Work (PTWs)
- Isolation and tagging out requirements
- The need for safety briefings, 'toolbox talks' and correct procedures
- Ensuring staff are properly trained for the task

It may be appropriate to have two levels of meetings – one at a management level and one that addresses the practical issues associated with carrying out specific tasks.

Entry into enclosed spaces and hot work are examples of activities which need a PTW.

Toolbox Talks

Many SMSs provide for toolbox meetings and include associated forms to record them. These meetings serve as an opportunity to review the TRA, PTW and any associated safety equipment or control measures required by the TRA, to ensure that any risks remain tolerable.

Toolbox meetings give all staff involved in the activity on the day the opportunity to raise any concerns and ask questions. Confusion and misunderstandings can undermine all good planning. It is therefore important that all staff not involved in the planning of tasks have an opportunity to familiarise themselves with plans, equipment and emergency procedures.

Furthermore, the nature of the ship's rank structure may lead to responsible officers not asking for crew feedback. While the ultimate responsibility (for the correct implementation of the SMS) still lies with these officers, the ship's crew may have carried out similar tasks in the past and may therefore be able to contribute from their own experience and question any aspect that they feel may not be safe or could be improved. The value of this contribution should not be overlooked.

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COMPANY **RESPONSIBILITIES**

Checking SMS maintenance procedures are being followed.

Shipping companies should ensure they have in place a robust and easy-to-use SMS which is applicable to the vessels they manage. The company should ensure that everyone with a role within the SMS, both on board managed vessels and ashore, is familiar with the individual duties and responsibilities that it defines.

When visiting the ships and conducting internal audits, the auditor should review the SMS to ensure that it is being properly implemented, and that permits, as defined in the SMS, are actually being used, and are correctly completed as well as effective.

Company personnel visiting the ship, such as technical superintendents or port captains/marine superintendents, have a key role in this process as they can provide vital support to the Designated Person in assuring that the SMS is properly implemented.

The shore management side of the SMS should not overlook the role of the ship's senior staff in enhancing and developing the SMS. Crew should be interviewed to ensure they are familiar with the SMS and to see whether they have any suggestions for improvement.

THE PERMIT TO WORK (PTW) SYSTEM: **A SEAFARER'S FRIEND**

Standard written procedures can be adequate for many jobs carried out on board, but others require extra care due to the risks involved. Fatalities, serious injuries to seafarers, as well as environmental, ship and cargo incidents, are often caused by not using the PTW system, or because the requirements have been ignored or misunderstood when the PTW has been issued.

According to chapter 7 of the ISM Code, the company should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment.

Compliance with this requirement may be achieved through the PTW system.

▲ *A crane load test should be considered a PTW activity*

Whenever there is a high-risk job taking place, a written PTW procedure should always be used.

A PTW would normally be issued for the following categories of high-risk work:

- Entry into dangerous (enclosed or confined) spaces
- Hot work, including welding
- Working at height or over the side
- General electrical work (under 1000 volts)
- Electrical high-voltage work (over 1000 volts)
- Working on deck during adverse weather
- Working on lift machinery
- Working on machinery or equipment which can start automatically or requires isolation.

This list is not exhaustive. A PTW, following a similar format, may be developed for other categories of work, depending on the type and trade of the ship as well as the work being carried out. Underwater work conducted by divers and dynamic positioning in the 500m zone are good examples.

Permits can be individual or cover a number of work types.

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General

Many operators choose to incorporate a PTW system into their SMS in order to manage hazardous tasks.

A PTW system is a formal written system used to control certain types of work. It should state exactly what work is to be done, when it is being done and the safety controls that must be put in place to avoid injury or death. It delivers a risk-based approach to safety management and requires personnel to undertake and record risk assessments in developing a safe system of work.

Guidance for establishing a PTW system is contained in a number of publications issued by industry organisations and national safety bodies, such as those listed on page 5.

The following should be taken into account in a good system:

- Human factors
- The skill level of the work force
- Unconscious and conscious incompetence
- The objectives and management of the PTW system
- The types of PTW required
- The contents of PTWs
- Time limits on the validity of PTWS.

The PTW system may include one or more of the following documents to control hazardous activities:

- A work instruction
- A maintenance procedure
- A local procedure
- An operational procedure
- A check-list
- A permit.

The measures to be employed when carrying out a particular task are determined by a risk assessment and recorded in the PTW.

A PTW is a single-use item, and should be issued each time a specific task is carried out. The temptation to re-use a permit the next time the task is completed must be resisted. The form should have a valid date and time, as circumstances may change between the times that tasks are carried out.

The Master or the responsible person designated in the SMS must approve the completed permit before the work can begin.

Structure

The structure of the system and the processes employed are very important in ensuring that the system delivers the necessary level of safety and operational integrity.

The PTW system should define:

- Company responsibility
- Responsibilities of all personnel operating the system
- Training in the use of the system
- A measure of the competency of personnel
- Types of permit and their application
- Levels of authority
- Isolation processes
- Permit issuing procedures
- Permit cancelling procedures
- Emergency actions
- Record keeping
- Auditing
- System updating.

The system will determine the appropriate controls needed to manage the risk associated with each task and determine the appropriate management tool needed to manage the task, as listed on page 13.

The system need not require that all tasks are undertaken under the control of a formal permit. However, it is important that the work instruction, procedure or permit used for managing a task is appropriate to the work being carried out and that the process is effective in identifying and managing the risks.

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Principles of **operation**

A PTW system should comprise the following steps:

- Identify the task and location
- Identify the hazards and assess the risks
- Ensure the appropriate competency of personnel who will carry out the work
- Define the risk control measures – state the precautions and Personal Protective Equipment (PPE) needed
- Determine communication procedures
- Identify a procedure and initiate a PTW
- Obtain formal approval to perform the work
- Carry out a pre-work briefing
- Prepare the work
- Carry out the work to completion
- Return the work site to a safe condition
- Complete the process, keeping records for audit purposes.

THE ISSUE OF A PERMIT DOES NOT, BY ITSELF, MAKE A JOB SAFE

That can only be achieved by the thoroughness of those preparing, supervising and carrying out the work.

Adhering to the requirements of the permit, and identifying any deviations from the specified controls or expected conditions, are essential in completing the task safely. The system should also identify any conflicts between tasks being carried out simultaneously on board. Permits are also a means of communication between those who carry out the work, the person responsible for their safety and anyone who could introduce a hazard if they are unaware that the work is taking place.

Considerations **when completing a PTW**

- Have staff been properly instructed and trained?
- Are staff properly supervised?
- Does the permit include sufficient information about safety, maintenance instructions, correct PPE and the equipment to be used?
- Does the PTW contain sufficient information about the type of work and the environment being worked in?
- Is the work properly authorised by a responsible person?
- Have human factors such as stress, fatigue, shift work and attitude been taken into account?
- Have sufficient precautions been taken before initiating the PTW (for example, isolation, draining, flushing, environmental monitoring, risk assessment, communication, or allocation of time for the work)?
- Is the responsible person aware of the type of maintenance involved and how long it is likely to take?


Permit to Work – Entry into Enclosed or Confined Space

PERMIT TO WORK
Entry into Enclosed or Confined Space

Date
Time
Work to be done
Location (tank or space)
Tank Rinse or Party master position

Method of communication | OOW to person at entrance | Person at entrance to persons entering space

Person in Charge
Crew details

Period of validity (not to exceed 24 hrs)

Authorising Officer: Signature | Name | Date | Time

Checked | Pre-Entry Checklist
1. Space thoroughly ventilated
2. Continuous ventilation
3. Atmosphere tested for oxygen deficiency (not using personal monitor), toxic and flammable gas, found safe
4. Continual testing of space atmosphere
5. Rescue and resuscitation equipment available at the entrance, tested and crew familiar with use. Rescue difficulty assessed
6. Responsible person at the entrance
7. A system of communication between the persons entering the space and the person at the entrance, and between the person at the entrance and the OOW, is agreed and tested. Persons aware of requirements
8. Access and darkness adequate
9. Method of work established and agreed to by all those making entry. Person in Charge clear to all those involved
10. Protective clothing is worn as appropriate
11. No sources of ignition are taken into the space unless the Person in Charge is satisfied that it is safe to do so
12. Permit displayed in required locations

Initials | Actions/Emergency Procedures – To be reviewed by the Person in Charge
If enforceable hazards or difficulties develop, work is to be stopped and the space evacuated while the situation is re-assessed
If any person feels adversely affected, they give the pre-arranged signal to the person at the entrance and every person must leave the space immediately
If it is necessary to deviate from the agreed method of work, the space must be evacuated until a new method of work has been discussed and agreed
If the ventilation fails, the space is to be re-evacuated immediately
In the event of an emergency requiring entry into an unventilated space, or in the event of a rescue, full pre-wearing BA checks and procedures are to be instituted before entry

NOTE: No person may be required to work in the space until he/she has discussed with the participants, using the Workplace Risk Assessment, the safe system of work agreed upon before commencement. All tools and equipment must be of an approved type.

I am satisfied that all precautions have been taken and that safety arrangements will be maintained for the duration of the work
Person in Charge (Signature)

CERTIFICATE OF COMPLETION
The work has been completed and all persons under supervision, materials and equipment have been withdrawn

Person in Charge
Signature | Date | Time

Example of a PTW

- Does the PTW system involve a formal procedure for any maintained equipment being put back into operation?
- Have all hazards been considered?
- Are all personnel aware of the permit being issued (for example, personnel on the bridge or in the cargo or engine control rooms)?

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Why do **PTWs fail?**

When accidents happen, investigations generally find that the ship's PTW system has been used and a permit has been completed. These are the most common reasons:

- The wrong type of PTW has been used, resulting in the hazards and required precautions not being identified.
- The PTW contains incorrect information about the work to be carried out and has not identified precautions.
- The responsible officer has failed to recognise the hazards where the work is being carried out (flammable substances, for example).
- The PTW has not prohibited the introduction of an ignition source into a controlled flameproof area (welding, non-spark-proof tools or non-intrinsically safe equipment used in intrinsically safe zones, for example)
- The terms of work on the permit have not been adhered to, despite having been identified (failure to isolate plant and/or drain lines of hazardous substances, for example).
- Unauthorised staff have performed PTW functions.
- The permit system has been completed incorrectly or without sufficient thought (a tick-box mentality).
- The PTW system has not been properly monitored (for example, it is out of date).
- The PTW has been issued for too long a period of time, and circumstances have changed.
- The prescribed permit is complicated and is not properly understood.

What happens **if something goes wrong?**

Should an accident or near-miss occur, the PTW will inevitably be scrutinised. Near miss reports are a good way for companies to monitor safe working procedures and are to be encouraged. However, a lack of near miss reporting does not necessarily indicate a safe ship.

Most PTW forms require items to be checked after being identified as required or not required. In the event of an incident, the decisions taken within the form will be analysed. It is therefore good practice to review the completed PTW to ensure that the responsible officer is confident that all aspects of the form can be justified. If this is not the case, the responsible officer should halt the proposed work and revaluate the item in question.

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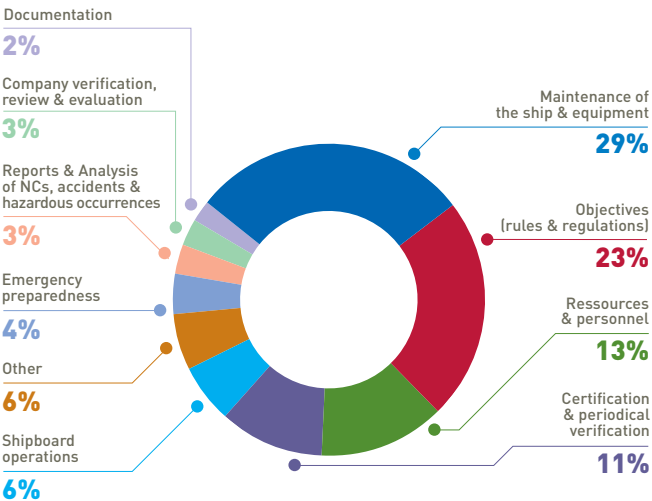
COMMON FINDINGS **DURING COMPLIANCE AUDITS**

Major Non Conformities during ISM audit carried out on board ships by Bureau Veritas on behalf of Flag Administrations



Almost a third of the major non-conformities issued by Bureau Veritas as a recognised organisation during ISM external audits carried out on board ships are related to maintenance of the ship and equipment. This area is also the commonest source of deficiencies during PSC inspections, and tends to be the reason ships are detained for "failure of the SMS".

This data confirms that improving the safety management system will reduce the probability of ships being detained.

RECOMMENDATIONS

This section brings together the main recommendations and guidance contained in this booklet. Putting these recommendations into practice may be the difference between occurrence and reoccurrence.

PREVENTIVE ACTIONS

- Ensure the SMS is efficient and well implemented through internal audits, the Master's review of the SMS and at any other opportunity, for example when the ship is attended by shore staff.
- Take senior staff feedback into account in the process of improving the SMS.
- Ensure the implementation of all new equipment is included in the SMS.
- Consider training senior ship's staff as ISM internal auditors in order to become catalysts for SMS improvement.
- Ensure there has not been any change to the workplace before a job commences.
- Ensure the ship and its equipment are well maintained.
- Ensure a PTW is properly issued before carrying out specific categories of work.
- Complete PTWs correctly and carefully.
- Make sure PTWs are within the specified date and time.
- Remember that the PTW could save your life or the lives of those you are responsible for.
- Organise work planning meetings and toolbox talks.

CORRECTIVE ACTIONS

- Carry out root cause analysis further to any incident. This process should be contained in the SMS
- Improve the SMS of the whole fleet as necessary following any incident.

AN EFFICIENT ISM SYSTEM SHOULD NOT BE A BURDEN

The SMS should not be seen as just an additional paperwork task for the crew, but a way of helping to ensure their safety.

The crew should use the SMS to ensure the ship is properly maintained and the company supplies all the necessary equipment.

It is important that issuing a PTW does not become routine or a 'tick box' exercise. Each PTW must be issued after proper consideration; remember it is there to avoid injuries or fatalities.

SUMMARY

The circular nature of the SMS is its most important feature.

The vital role of senior staff both ashore and onboard should not be underestimated. The ship's senior staff should not only be seen as the implementers of the system, but should be trained to an enhanced level in ISM auditing in order to empower them to play both a performing role in the SMS and a useful critiquing role at the operational end of the system.

In the age of technological development, management of change is a vital risk control measure. Proper assessment of integrating new equipment such as ECDIS will help ensure a seamless operational transition without inadvertently introducing risks.

The aim of the PTW system is to ensure that potentially dangerous work activities are conducted in a manner that protects life, the environment and property. The PTW that is issued for a specific task should be the result of a full assessment of the task as well as all its risks and control measures.

The importance of the underpinning TRA should not be overlooked. Indeed, most PTW operations are likely to require the performance of a risk assessment in line with the requirements of the company SMS.

Before commencing work there should always be a toolbox meeting. This can be very useful in enhancing and verifying the content of the TRA. The toolbox meeting should be taken as an opportunity to not only consider the specific circumstances that exist on the day of the work, but to also allow crew involved in the work to share their own experiences of carrying out similar tasks in the past. Ships' officers should not underestimate the possible contribution that the crew may make in this way.

PTW operations should not be conducted in isolation. Work planning meetings can reduce the risk of safety issues arising from concurrent operations.

The role of responsible officers should not be underestimated. They must be able to justify every decision made in issuing a PTW. If this isn't the case, they should halt the work and re-evaluate the PTW.

CASE STUDIES

A.

A tanker arrived in port to load her cargo. Before the commencement of cargo operations it had been arranged for a spare cylinder liner to be landed ashore at the port, in anticipation of being transferred to a company ship of the same class calling there in the next few weeks. The agents chartered a small work boat on which to land the cylinder liner for carriage ashore. The crane was prepared and the cylinder liner was transferred to the main deck via the engine room hatch in time for the arrival of the workboat. The workboat arrived and the transfer began. The liner was lowered vertically onto the deck of the work boat, but as the weight came off the crane and transferred to the deck, the high centre of gravity of the cylinder liner overwhelmed the stability of the workboat, causing her to capsize. There was no loss of life in the incident, but the workboat required salvage. On investigation it was found that no lifting permit had been issued, no TRA had been performed and no toolbox meeting had taken place with any member of the crew of the workboat. The opportunity to establish the mis-matched capacity of the workboat had been missed.

B.

A bulk carrier arrived in port to discharge a cargo of grain, which had been treated with fumigants at the beginning of the voyage. A need was established to obtain a sample of the cargo and the 2nd officer was dispatched to the deck to obtain this. The cargo hatch cover was partially opened by the crew and, using a home-made receptacle secured to a long pole, an attempt was made to collect a sample from the hold by leaning over the hatch coaming, but without success. The 2nd officer decided to open the access hatch and take a sample from the top of the Australian ladder within the hold. As the 2nd officer descended the vertical ladder he was seen to pass out. The crewman on deck assisting the 2nd officer followed correct procedure by immediately alerting the bridge by radio. Subsequently a rescue was effected using Self Contained Breathing Apparatus. Fortunately, the 2nd officer made a full recovery in hospital, despite being overcome by the remnants of the fumigant and the reduced levels of oxygen in the hold. The deck officer did not recognise the bulk carrier hold as a space that can become a transient enclosed space, and moreover a space which can become dangerous in many circumstances. The concept of bulk carrier hold atmospheres becoming dangerous through common cargo operations had never been discussed at safety meetings on board the vessel.

C.

A loaded coastal cargo vessel was transiting a familiar route that was regularly repeated in her trading pattern. All deck officers were familiar with the route and, as is often the case, complacency had crept into navigational procedures. The passage was so regular that course lines had been applied in ink on the charts. Deck officers had, amongst other things, fallen into a pattern of neglecting to transfer parallel indexes from the chart to the radar and had no prescribed position fixing interval in the passage plan. This combination of shortcomings proved catastrophic. The voyage as planned required the vessel to pass between two islands off the coastline. However, during the first watch in the early hours a strong current was running across the ship's planned course. The Officer of Watch (OOW) was applying an excessive fixing interval and was also habitually failing to employ the parallel indexing information prepared on the charts. The vessel was set heavily to Port of her planned course line at this critical time. This was not detected and the vessel grounded. The OOW had missed two opportunities to identify the heavy set to Port and avoid the grounding.

The London P&I Club

50 Leman Street
London E1 8HQ - UK
Telephone: +44 (0)20 7772 8000
Email: london@londonpandi.com
www.londonpandi.com

TMC MARINE
A BUREAU VERITAS GROUP COMPANY

Standon House - 21 Mansell Street
London E1 8AA - UK
Telephone: +44 (0)20 7237 2617
Email: info@tmcmarine.com
www.tmcmarine.com

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CS50101 - 92937 La Défense Cedex
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