

INTERACTIVE ROOT CAUSE ANALYSIS (IRCA) AS A PRACTICAL TOOL FOR DEVELOPING MANAGEMENT SKILLS (FOR MASTERS IN NAVIGATION)

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Abstract. Most accidents are caused by human error, not technological or mechanical failure, the immediate cause is very often that a person made a disastrous decision. As for the management level **the accident investigation** is the most prominent part of the curriculum for Masters in Navigation for acquiring professional English skills in National University “Odessa Maritime Academy”.

For the teaching strategy the 4-step approach for solving a problem can be effective and useful. The use of all 4 stages can vary and depend on the exact task in the definite field. Masters in navigation should look deeper to figure out the cause of the problem, fix the underlying systems and processes so that it goes away for good.

The technique of **Root Cause Analysis (RCA)** is widely used in accident investigation by shipping companies to prevent recurrence. RCA has proven to be a powerful loss-prevention tool and allows crewmembers to discover the true root cause of a casualty. The purpose is to raise situational awareness of officers about the reason why accidents occur. If the root cause can be established and rectified, the risk of accident reoccurring is substantially reduced.

The problem-solving approach focuses on the analytical ability of Masters to find correct professionally-grounded solution based on theoretical knowledge and practical experience on board the vessel.

INTRODUCTION

As far as we can determine, there is no generally accepted definition of what **Root Cause Analysis (RCA)** is. Therefore, we offer the following as possible definitions, one of them at least communicates what is meant by the concept.

One of the definition is that **Root Cause Analysis (RCA)** is a structured investigation that aims to identify the true cause of a problem and the actions necessary to eliminate it [1, p.11].

The term of **Root Cause Analysis (RCA)** is a comprehensive term encompassing a collection of problem solving methods used to identify the real cause of a non-conformance or quality problem. Root Cause Analysis is the process of defining, understanding and solving a problem. The root cause has also been described as an underlying or fundamental cause of a non-conformance, defect or failure. Furthermore, the term “root cause” can also be referred to as the precise point in the causal chain where applying a corrective action or intervention would prevent the non-conformance from occurring [2].

Root Cause Analysis (RCA) is a popular and often-used technique that helps people answer the questions of **WHY** the problem occurred in the first place. It identifies the origin of a problem using a specific set of steps to find its primary cause. The main things to determine are: what happened; why it happened; what actions to reduce the likelihood that it will happen again.

This technique is widely used in accident investigation by shipping companies to prevent recurrence. RCA has proven to be a powerful loss-prevention tool and allows crewmembers to discover the true root cause of a casualty.

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Having good strong problem-solving skills can make huge difference to future career of an officer. Most of all human error types on ships are caused by making ineffective solutions with sometimes painful consequences [1, p.2-3].

APPROACHES TO ROOT CUASE ANALYSIS (RCA)

Under STCW Code (A-II/2) deck officers and Master must use leadership and managerial skills. The Code emphasizes the necessity to know and be able to apply effective communication on board and ashore; obtain and maintain situational awareness in respect of effective resource management. Special attention is to be paid to applying decision-making techniques such as situation and risk assessment, identifying and generating options, selecting course of action and evaluating of outcome effectiveness [3, p.35].

Situational awareness of every crewmember on board the vessel and safety culture provided by the company and being followed and monitored by Master can guarantee the successful and safe performance of the voyage. It can be illustrated by the results presented by IMO Secretariat Report which states that individual casualties have reduced from 1942 in 2008 up to 1051 in 2012. IMO casualties and incidents database shows that from 2013 up to 2016 the number of cases with vessels have halved from 433 to 206 as shown in Figure 1 and Figure 2. [4]

**IMO Casualties & Incidents Database
Number of Cases (Vessels)**

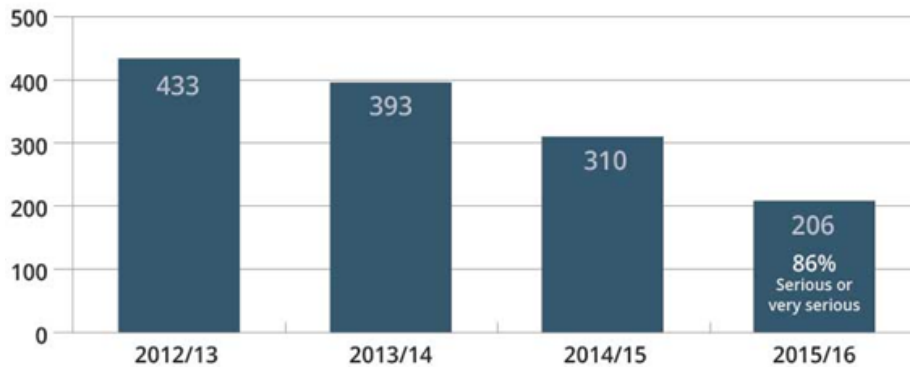


Figure 1: Number of cases (vessels)

**Lives Lost-Reported by the IMO Secretariat
Individual Casualties**

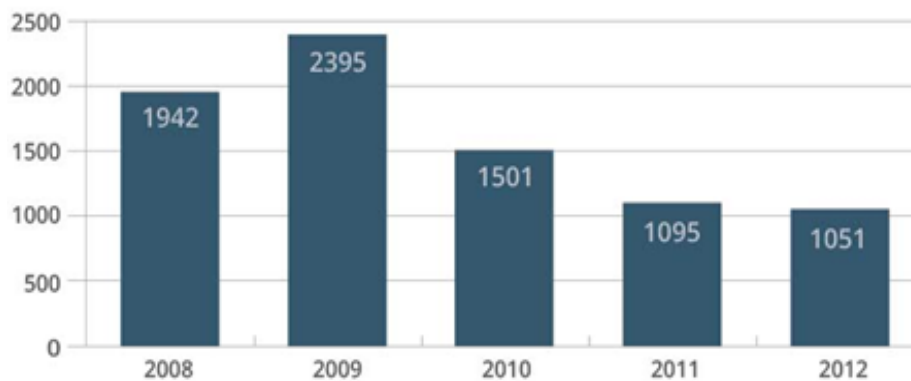


Figure 2: Individual Casualties

The STCW Convention and Code define the minimum standards of competence of seafarers. There are seven functional areas, at three different levels of responsibility provided by STCW Code. The levels of responsibility are: **management level** (applies to senior officers); **operational level** (applies to junior officers); and **support level** (applies to ratings forming part of a navigational or engine watch) [5, p.122]. Master programmes are implemented by universities and academies on the second stage of higher education. These programmes imply the graduates' ability to solve difficult professional tasks in complex. Master programmes additionally imply acquiring knowledge of innovative type and skills of independent research.

WHY DO WE NEED ROOT CAUSE ANALYSIS (RCA)?

Most accidents are caused by human error, not technological or mechanical failure, the immediate cause is very often that a person made a disastrous decision. As for the

management level **the accident investigation** is the most prominent part of the curriculum for Masters in Navigation for acquiring professional skills in National University “Odessa Maritime Academy”.

All accidents, incidents and near misses should be obligatory reported to the office and be investigated, analyzed and discussed afterwards during safety meetings.

Unfortunately, 71% of all human error types on ships are situational awareness related problems. Situation Awareness (SA) acts as team working and effective decision-making aspect. **Situation Awareness** is the ability of an individual to possess a mental model of what is going on at any one time and also to make projections as to how the situation will develop. An often cited definition is; “... the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning, and the projection of their status in the near future” [6, pp. 401-411].

Onboard safety culture is the foundation for safety needs to be established in the company’s culture. The successful implementation of effective safety culture is of primary importance for every seafarer onboard the vessel. That is a must for everybody to understand the relationship between unsafe acts and serious incidents that may result with loss of life.

The **main purpose of accident investigation** is to improve safety performance by:

- 1) exploring the reasons for the event and identifying both the immediate causes and underlying causes;
- 2) identifying the remedial action to improve the safety management system by improving risk control, preventing a recurrence and reducing financial losses.

The mandatory points which are a must for every investigation report are **root cause analysis and preventive or remedial actions**.

The root cause can be defined as the most basic cause that can be reasonably identified that management has control to fix, and when fixed, will prevent, or significantly reduce the likelihood of the problem's recurrence. A root cause is a factor that caused a nonconformance and should be permanently eliminated through process improvement.

WHAT IS THE STRATEGY OF ROOT CAUSE ANALYSIS (RCA)?

This the question we’d like to raise and draw your attention concerning safety of maritime transportation for all parties involved, cut of financial losses, safety of human lives and property.

RCA is a collective term that describes a wide range of approaches, tools, and techniques used to uncover causes of problems. It’s a method of problem solving used for identifying the root causes of faults.

RCA is a popular and often-used technique that helps people answer the question of **WHY** the problem occurred in the first place. It identifies the origin of a problem using a specific set of steps, with associated tools, to find the primary cause of the problem, so that you can:

1. Define what happened;
2. Determine why it happened;
3. Figure out what to do to reduce the likelihood that it will happen again.

RCA has proven to be a powerful loss prevention tool and allows crewmembers to discover the true root cause of a casualty. The purpose is to raise situational awareness of officers about the real and true reason **WHY** accidents occur. If the root cause can be established and rectified the risk of the accident reoccurring is substantially reduced.

The problem-solving approach focuses on the analytical ability of masters to find correct professionally-grounded solution based on theoretical knowledge and practical experience on board the vessel.

The highest-level cause of a problem is called the root cause is shown on Figure 3:

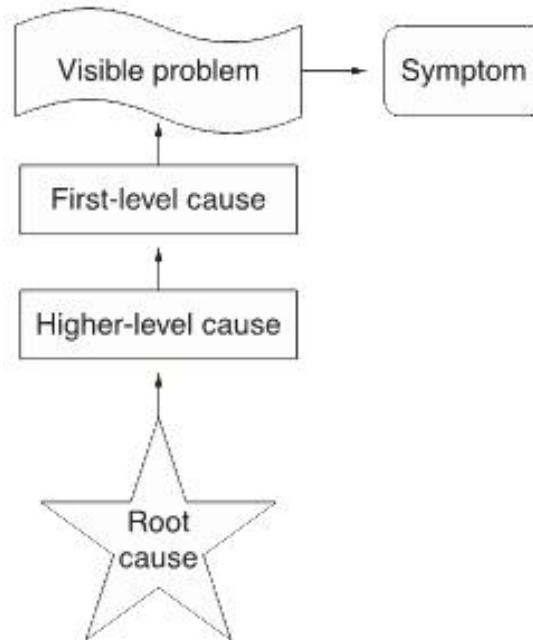


Figure 3: The scheme of the Root Cause

The root cause is “the evil at the bottom” [1, pp.1-19] that sets in motion the entire cause-and-effect chain causing the problems. It’s essentially based on 4 general principles:

1. Define and describe properly the event of the problem (**5 why’s technique**).

5 WHY’s method, in its turn, can be the separate subject for investigation. This is an analytical tool, originally used by the Toyota Motor Corporation, designed to find and identify one or several root causes to a problem. It’s applied nearly in all branches and fields of human life.

The main philosophy of this advanced logical and analytical approach is to teach how to solve a problem by asking “ Why?” Five times successively you move beyond symptoms and delve deep enough to understand the root cause(s). By the time you get to the fourth of fifth “Why?” you will probably be looking directly at management practices. A “Why?” can have several possibilities and each answer has to be looked into for likely root causes.

However, the “ Five Why’s” tool does not provide a resolution to the problem itself, but it is an excellent tool to get an analysis going. The “ Five Why’s” method relies heavily on experience, as it draws on the opinions and observations of the people performing the task.

2. Establish a timeline from normal situation until the final crisis or failure.

3. Distinguish between root causes and causal factor.

4. Once implemented, RCA is transformed into a method of problem prediction.

HOW TO PERFORM ROOT CAUSE ANALYSIS (RCA)?

Let's follow the step sequence based on the case history using 5 Why's analysis.

The vessel was preparing for departure and the mooring parties were standing by forward and aft. The master gave the order to let go all lines and the 2nd officer, who was at the forward mooring station, gave the order to let go both headlines. One of the Abs who was working in front of the mooring winch put the mooring line on a hook on the roller bollard instead of around the roller, which was the normal procedure. An OS was operating the mooring winch but he couldn't see the AB who was handling the line because of the large mooring winch.

For some unknown reason the 2nd officer gave the order to heave in both headlines while one of them was still attached to the shore bollard. It's imperative that the person in charge of the mooring operation has complete situational awareness.

The headline tightened very quickly and it came off the bollard hook and hit the AB hard in the waist. The AB was wearing correct PPE equipment (helmet, safety shoes, coverall and gloves) but this didn't protect him against the snap from the mooring rope. The master believed that the main reason for the accident was because the mooring team wasn't vigilant enough.

Mooring accidents are unfortunately not uncommon but can usually be avoided if the mooring team follows correct procedures and work as a team with clearly defined duties. It is imperative that the mooring team involved is aware of risks which should be defined in the risk assessment [7].

<p><u>Step 1. Define the problem</u> What do you see happening? What are the specific symptoms?</p>	<p>AB hit by mooring rope during departure.</p>
<p><u>Step 2. Collect Data</u> What proof do you have that the problem exists? How long has the problem existed? What is the impact of the problem?</p>	<p>The vessel was preparing for departure and the mooring parties were standing by forward and aft. The AB received injuries to his back and is unlikely to be able to resume sea duties.</p>
<p><u>Step 3. Identify possible causal factors</u> What sequence of events leads to the problem? What conditions allow the problem to occur? What other problems surround the occurrence of the central problem?</p>	<p>The master gave the order to let go all lines. 2nd officer gave the order to let go both headlines. AB put the mooring line on a hook on the roller bollard instead of around the roller. 2nd officer gave the order to heave in both headlines. OS can't see AB because of a big mooring winch. The headline tightened very quickly and it came off the bollard hook and hit the AB hard in the waist.</p>
<p><u>Step 4. Identify the Root Cause(s)</u> Why does the causal factor exist? What is the real reason why the problem occurred?</p>	

<p>To pass step 4 we can use 5 Why's method.</p> <p>1 WHY? The mooring line was still on the shore side bollard when the order to heave in was given by the 2nd officer, causing the line to snap and hit the AB in the waist.</p> <p>2 WHY? AB had put the mooring line on the hook of the roller bollard instead of around the roller bollard.</p> <p>3 WHY? The mooring party had poor situational awareness as no party member recognized the risk of the mooring line on the hook.</p> <p>4 WHY? The mooring party didn't follow the company's risk assessment and mooring procedures.</p> <p>5 WHY? The company hasn't been able to implement a safety culture onboard the vessel which follows risk assessment and procedures.</p>	
<p><u>Step 5. Recommend and implement solutions</u></p> <p>What can you do to prevent the problem from happening again? How will the solution be implemented? Who will be responsible for it? What are the risks of implementing the solution?</p>	<p>Mooring team follows correct procedures and work as a team with duties clarification and correct supervision.</p>

As a result, we can conclude that **direct and root causes** stem from the **failure of the management** control system and leads to necessity of following SMS on board the vessel for all ranks.

To sum it up, accident investigation can only be fully effective if:

- action is taken to implement recommendations;
- the corrective action is monitored and measured;
- monitoring corrective action means documenting, tracking and validating;
- training is often identified as a solution to preventing the recurrence of a problem.

CONCLUSION

Coming up straight to the main strategies in teaching Professional English for Masters in Navigation and basing on the above-mentioned compulsory concepts for management level for junior officers we'd like to focus on one of the most life-important issue as «Accident Investigation». The purpose of accident investigation is to determine circumstances and causes to improve safety of life at sea and avoid future accidents.

This table incorporates 4 language skills, main content areas and task descriptions which are applicable for teaching the topic "Accident investigation" for Masters in Navigation.

To achieve sufficient results, it's effective to base the development of all language skills on **Presentation and Videofilms** on PPP (Presentation and Practice stages and Production) stage relatively.

"Real life" situations are visualized and have real authentic background. Presentations and videofilms contain ships' particulars, description of the situation, schemes of ships' movement, etc., which result in COLREGs analysis, implementation of safety culture on board by Master, OOW, pilot and crew.

LANGUAGE SKILLS		TASK DESCRIPTIONS AND FOCUS	CONTENT AREAS
	Reading	Reading for specific information; Reading for detailed and global understanding;	MARS reports; IRCA (Interactive Root Cause Analysis) based on 5 Why's method; International Regulations for Preventing Collision at Sea.
	Listening	Understanding gist, main points, detail, function; Speech recording (e.g. SMCP, acting out in professional situations); Note-taking.	VHF in transmitting or receiving distress, emergency and safety communications, communications with Vessel Traffic Service (VTS) and port control, communications with other ships in collision preventing, communications with shore authorities for port entry, berthing, pilot and tug arrangement, and cargo handling.
	Speaking	Professional discussion on COLREGs violation; Solving professional problems (possible ways of avoiding close quarters, contacts, grounding, etc.); Analysis of the situation by the injured party; Assessment of types of losses (Actual Total Loss, Constructive Total Loss, Particular Average, General Average).	External communications: communication with other ships, shore authorities by means of VHF, face-to-face communication with inspectors or surveyors, shipping agents, cargo chandlers, shipyards or ship owners by telephone in some inspections and making phone calls, face-to face communication with pilot.
	Writing	Drawing up a scheme of ships' movement; Completing reports; Business correspondence.	Sea protests, letters of protest; Different types of claims; Cargo damage reports; Near miss reports; Accident/incident reports.

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