Situational Awareness and the Error Chain in the Maritime Industry

Today, many vessels are equipped with the latest technologically advanced navigation and communication gadgets, and the mariners using this equipment are better trained than their seafaring forefathers. And yet navigation incidents still occur. Investigations reveal that despite all the training and hardware available, human error continues to be the leading factor in many marine incidents. Technology and training alone cannot prevent incidents.

Internationally, the maritime industry has adopted Bridge Resource Management (BRM) as a management approach to reduce the human-error chain that frequently leads to a collision, grounding or other navigational incident. The approach is created around the concept of situational awareness, error-chain recognition and error correction. To be effective, BRM requires open communication and proper use of all available resources.

Situational awareness is the accurate perception of factors and conditions that affect the vessel during a specified period of time. The level of situational awareness needed increases proportionally with risk to the vessel's safety and demands on the mariner. Generally, the closer to land you are, the greater the risks and demands, and thus the greater the need for situational awareness. Not surprisingly, most maritime incidents occur in or near coastal waters.

Loss of situational awareness by mariners during critical moments of navigation has let to a host of marine incidents. Navigation watch standers lost track of the events going on around them. They failed to assess the importance and consequences of these events and did not take corrective action in time to save the vessel from peril.

The collision of a cruise ship and a container vessel in August 1999 illustrates the error chain. A recent report issued by the Bahamian Flag Administration describes how, during the period immediately before the collision, the officer of the watch on the cruise ship "became confused about the exact situation around him." Whether or not he was impaired from fatigue or was experiencing an excessive workload, his level of situational awareness was compromised and led to the collision.

The area where the collision took place was heavily congested, with 10 other vessels in a narrow section of the English Channel. Another vessel had been on a collision course with the cruise ship until 12 minutes before the collision with the container vessel.

Only one officer was on watch on the cruise ship at the time of the collision and during the earlier scare. According to the report, company procedures call for the watch to be doubled in areas of heavy traffic, but this was not implemented.

The watch officer was burdened with routine clerical tasks while being the sole officer on watch in a highly congested waterway. He apparently relied heavily on the use of radar and did few visual checks. However, he did not use his radar in the most effective way, using the Automatic Radar Plotting Aids (ARPA) out put on both radars in use. He used ARPA manual speed inputs based on estimated speed over the ground rather than speed through the water.

The lookout reported ships throughout the period before the collision, telling the officer on watch when other ships were coming close, including the container vessel. How the lookout's reports were acted upon is not clear in the post-incident report.

About four or five minutes before the collision, the container vessel called the cruise ship on the VHF radio and asked her to pass around her stern. This call distracted the officer's attention from his radar plot. At this time a second ship being overtaken by the container vessel altered course to port to pass around its stern. The second ship was not visible from the bridge of the cruise ship. At the very least, the action of the second ship complicated an already hazardous situation.

Incidents and near-missed are not the result of a single event but rather of a sequence or chain of events that climax in a mishap. This is known as the error chain. Error chains can occur in any event that involves human activity. Clues to identify the presence of an error chain include:

- Failure to meet targets, milestones – Failure of the navigation team to attain or maintain targets, including ETAs, vessel speed, or passage plant.
- Using undocumented procedures – The use of procedures to deal with abnormal or emergency conditions that are not prescribed in any approved company operations manuals, such as encountering sudden bad weather or unusual traffic situations.
- Departing from standard operating procedures or "winging it" – An intentional or inadvertent departure from standard operation procedures, such as the failure, for whatever reason, to adhere to a passage plan.
- Violating minimum operating conditions or limitations – Intentional violation of minimum operating conditions or specifications as defined by regulation, Master's instructions, or company standards, such as excessive speed in reduced visibility, or not observing minimum closest point of approach (CPA) orders.
- Not "minding the store" – The bridge team is not monitoring the vessel's navigation.
- Incomplete or ineffective communication – This problem results when information is withheld and there is a failure to seek resolution of misunderstandings, confusion, or disagreements.
- Ambiguity or confusion – Independent sources of necessary information (instruments, manuals and people) are confusing or unclear. A sense of uncertainty, anxiety, or bafflement about a situation exists.
- Fixation or preoccupation with distractions – Focus of attention on one item or event to the exclusion of all others can include any number of distractions that draw a watch-stander's attention away from his/her duties. Distractions may result from heavy momentary workload, inclement weather, or abnormal or emergency situations. They can be caused by personal problems, inattention, complacency, fatigue, or an operational practice that requires the watch-stander to engage in activities not essential to safe navigation.

The presence of one or more of the above clues constitutes a likelihood that an error chain exists. Identifying the error chain alone may not eliminate the possibility of an incident. Error-chain identification is a warning that immediate action is required to avoid an incident. The key to successful error-chain breaking is the alertness of the navigation watch-standers to the error-chain clues listed above and development of strategies to break the chain in a timely manner.

Situational awareness is accomplished when you have an accurate perception of the events internal and external to your vessel. In other words, you are able to recognize a change in the situation. You understand the full impact of the change and you are able to accurately predict or project your situation in the near future.

A higher level of situational awareness results in a lower level of risk. A low level of situational awareness is a key factor in the development of an error chain. The bottom line is the navigation officer

must continually observe what is going on in and around the vessel. The officer must analyze these observations, recognize developments, recognize developing problems, assess their severity, determine an appropriate remedy, take action to rectify the problem and, finally, monitor the results.

- Lawrence B. Russell
Marine Transport Lines, Inc.
Marine Section Member

*Copyright 2002 *National Safety Council * All Rights Reserved. Reviewed 5/05.*

Content from the National Safety Council Members-Only Website is available for you to re-use for educational purposes through your internal employee communications. We do ask that the National Safety Council is credited as follows, "Permission to reprint granted by the National Safety Council, a membership organization dedicated to protecting life and promoting health" or "Copyright National Safety Council, All Rights Reserved"