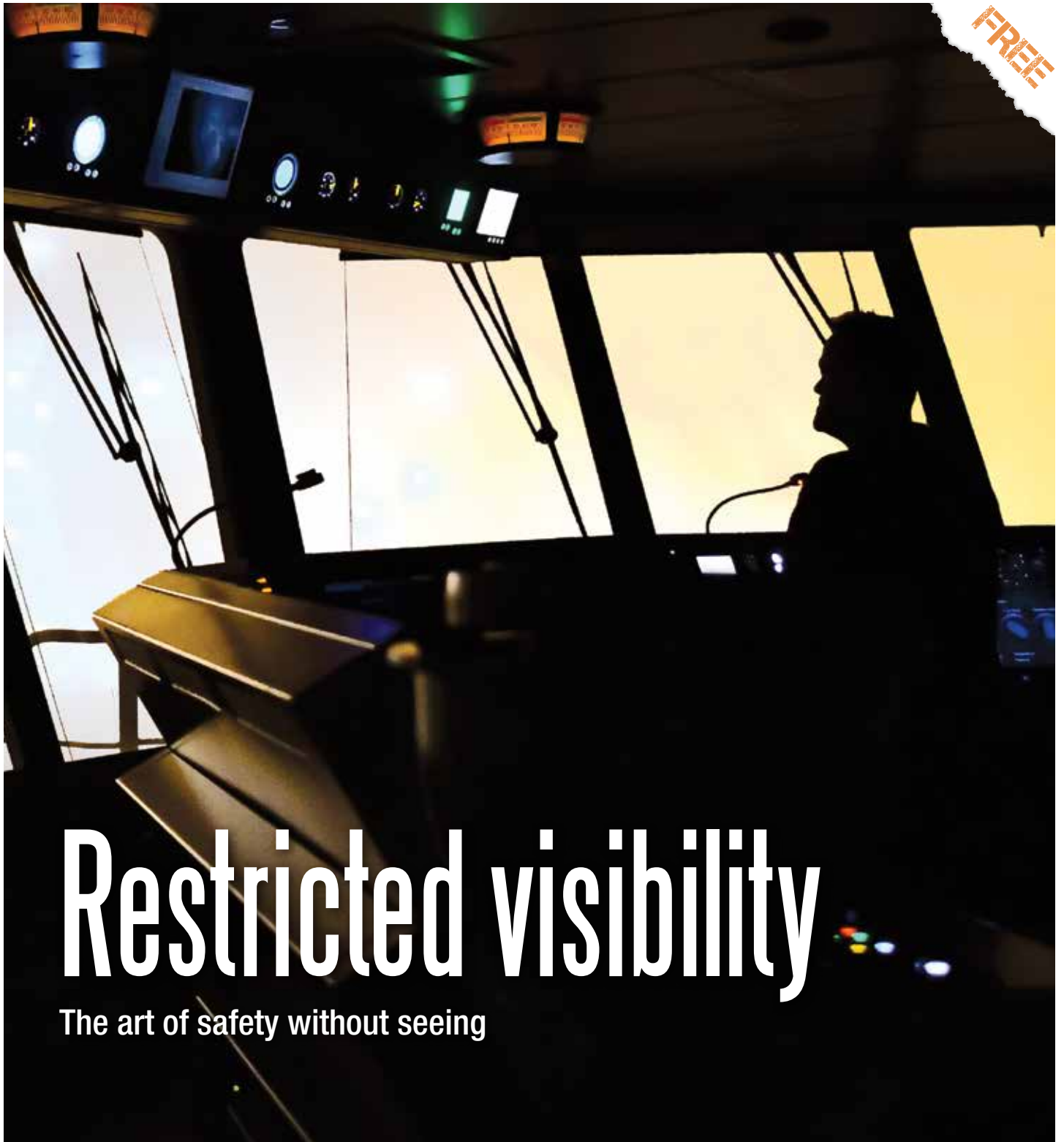


# NAVIGATOR

THE

Inspiring professionalism in marine navigators

FREE



# Restricted visibility

The art of safety without seeing



A free publication by **The Nautical Institute** in association with the **Royal Institute of Navigation**

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## Clear vision

Navigation in restricted visibility is never fun, but it happens and is something that professional navigators must be prepared for. Navigators must be able to spot or even predict restricted visibility and know how to maintain safe navigation in and near it.

It may sound strange but it is not always clear (pun intended) when a vessel is actually in or near an area of restricted visibility. Once confirmed, or even suspected, the processes to be followed must align with the company's Safety Management System (SMS), Master's orders and good seamanship. Issues that lead to restricted visibility are largely environmental and can include fog, mist, snow, heavy rain, sandstorms and even smoke. It is also not just a question of what you can see, but also what other vessels can see. Your ship might be in perfect weather but sailing near a fog bank that could obstruct another vessel – this also counts as restricted visibility.

One of the key aspects of restricted visibility is that it fundamentally changes the application of the Colregs. The Colregs are divided into the actions taken when vessels are in sight of each other, and those when they are not. We highlight some of these differences in this issue.

For example, when vessels are in sight of each other in normal conditions, one ship will be 'stand on' and the other 'give way'. When in restricted visibility, however, both (or all) vessels must take action to reduce the risk of collision.

Some fundamentals do stay the same, notably Rule 5: 'Lookout' by ALL available means. Rule 6 covers 'Safe Speed' and the ability to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

A professional navigator needs to be prepared at all times for restricted visibility and must be ready to respond immediately. However, you are not alone

and one of the first actions when time allows will be to call the Captain. Other critical decisions will be to post extra lookouts, the use of technology (lookout by all available means) and ensuring that engines are available for immediate manoeuvre (safe speed).

Individual navigators and bridge teams should not leave decisions and reactions to chance. The bridge team must be familiar with all company procedures and Master's orders for dealing with restricted visibility. Everyone should understand the manoeuvring characteristics of the vessel, anticipate risks of restricted visibility within the passage plan and know about the use and limitation of technology for detecting risk of collision, perhaps consolidating their knowledge and experience by carrying out appropriate drills.

The perfect starting point for all this preparation is to plan ahead, discuss as a team and mentor each other.

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200B Lambeth Road, London SE1 7JY, UK  
Tel: +44 (0)20 7928 1351 Fax: +44 (0)20 7401 2817  
navigator@nautinst.org www.nautinst.org

With support from: 1 Kensington Gore, London, SW7 2AT, UK  
Tel: +44 (0)20 7591 3134 Fax: +44 (0)20 7591 3131  
www.rin.org.uk

#### Editorial committee:

**Editor** Emma Ward  
**Design** Phil McAllister

**For The Nautical Institute**  
Steven Gosling AFNI, Lucy Budd,  
Aly Elsayed AFNI, David Patraiko FNI  
**For the RIN** George Shaw FRIN

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We welcome your news, comments and opinions on the topics covered in *The Navigator*. We reserve the right to edit letters for space reasons if necessary. Views expressed by letter contributors do not necessarily reflect those held by The Nautical Institute

## Access all areas

Restricted visibility affects most, if not all navigators at one point or another. Here are some useful websites and online resources to help you increase your knowledge and skills.

If you spot any broken links, or would like to suggest resources that we have not included here, please do get in touch!

### Scanning from screen to scene

It can be all too easy for watchkeepers to 'look' without 'seeing'. In this free online article from *Seaways*, Abdul Khaliq and Alan Bury from Liverpool John Moores University explore how vision works, and outline a method for keeping an effective lookout.

<https://www.nautinst.org/resources-page/scanning-from-screen-to-scene.html>

### Looking and seeing

Continuing the theme, Captain Aly Elsayed discusses visual perception and situational awareness for navigators in a free online article for *Seaways*. He explains how to interpret the visual scene and improve situational awareness by building mental pictures and using visual cues to identify hazards and make decisions.

<https://www.nautinst.org/resources-page/free-article-looking-and-seeing.html>

Or watch the video at: <https://tinyurl.com/NIVisualPerception>

### MAIB accident reports

There have been numerous accidents involving restricted visibility, poor lookout procedures and non-compliance with the Colregs reported to the UK's MAIB in recent years. Here are a few that are worth a look – maybe something to discuss in a safety meeting?

- > <https://www.gov.uk/maib-reports/collision-between-ro-ro-passenger-ferry-red-falcon-and-moored-yacht-greylag>
- > <https://www.gov.uk/maib-reports/grounding-of-ro-ro-freight-ferry-arrow>
- > <https://www.gov.uk/maib-reports/collision-between-container-vessel-anlwyong-and-gas-carrier-king-arthur>

### Look back at *The Navigator*

Don't forget to revisit previous issues of *The Navigator* for information about collision avoidance (issue 2, February 2013), lookout (issue 19, October 2018) and weather (issue 21, June 2019)

Access past issues of *The Navigator* here:

<https://www.nautinst.org/technical-resources/navigator.html>

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# What rule when?

Twenty years ago, The Nautical Institute published a survey that showed that there is often confusion over the sections of the Collision Regulations (Colregs) that apply in restricted visibility. The answer may seem straightforward enough – Rules 4-10, which always apply, plus Rule 19. However, the introduction of modern technology and autonomous vessels has added further layers to the question. The Nautical Institute has recently worked with the UK MCA to update their guidance. Here are some of the key points

‘Restricted visibility’ is broadly defined as when what you can see by eye is obstructed by any meteorological condition.

It does not mean simply that it is dark – it means that visibility is restricted in some other way. Fog is perhaps the most obvious condition, but it is not the only one.

Causes of restricted visibility include:

- > Fog
- > Mist
- > Falling snow
- > Sandstorms
- > ‘Similar causes’ (e.g. smoke)

## Applying the rules

Rule 19 applies when a vessel is in or near an area of restricted visibility. If you are aware of a fog bank up ahead but have not yet entered it – the rule still applies! Rules 1-10, which include requirements for safe speed, lookouts, etc. apply at all times.

The Colregs themselves do not state at what distance visibility should be considered to be restricted. This may vary from vessel to vessel. Your Safety Management System (SMS) should provide guidance on this. If there is nothing in the SMS, and you believe that visibility is restricted, then you should behave as if it is. You can also find more advice on how to judge visibility below.

## Eyes up

It can be easy to assume that with modern aids to navigation, including radar and AIS, navigating in restricted visibility should not be a problem – but it still requires great caution. Yachts and other small vessels may not show up on radar and may not have AIS, so it is important to keep a good lookout by all available means.

## Speed

The Rules require the vessel be at a ‘safe speed’ but offer little specific guidance. There is no obligation to slow down, unless you hear a fog signal forward of your beam – in which case you should reduce speed

to the minimum. The SMS should provide guidance on suitable speed, but if in doubt, remember that the slower you are going, the more time you will have to react.

## Lights and sounds

You should always show navigation lights in restricted visibility, no matter what time of day. Likewise, you should always sound the appropriate sound signals when navigating in or near an area of restricted visibility. In this situation, only fog signals can be sounded.

In restricted visibility, fishing vessels and those that are restricted in their ability to manoeuvre sound the same signal (one prolonged, two short blasts) whether underway or at anchor.

## Camera

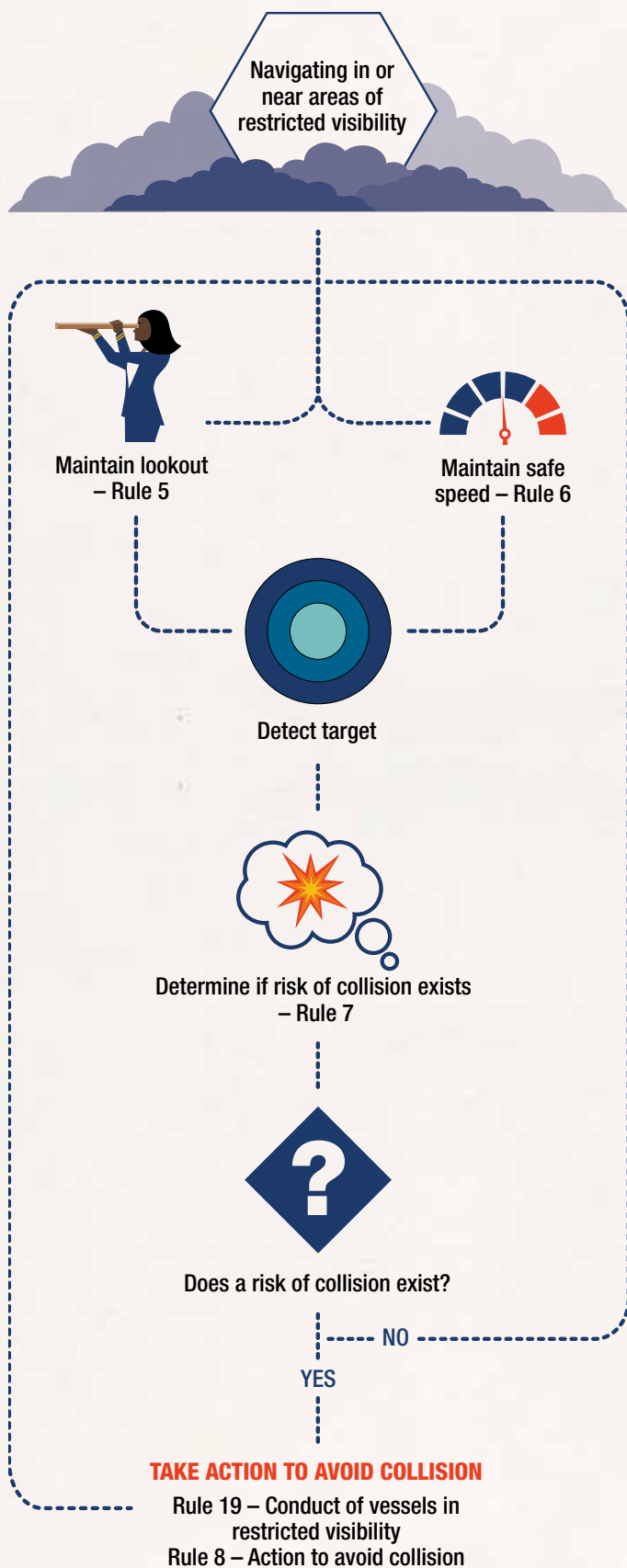
It sounds like a trick question: why might you hear a fog signal in completely clear conditions? An uncrewed vessel with a remote operator where all cameras have failed will sound a fog signal to let other vessels know that it is, effectively, in restricted visibility – it can’t see you, even if you can see it, and will be operating according to Rule 19. This might sound unlikely, but as remotely operated vessels become more common, it is not impossible!

## Determining risk

Determine if there is a risk of collision by carrying out systematic plotting and observations of detected targets. Relative motion trails on a radar provide a basic visual indication of a potential collision risk. However, this visual indication does not remove the requirement for the systematic plotting of targets.

On an ARPA display, a risk of collision with a tracked target exists if the relative vector of the target points at own ship’s position on the screen. Observing the compass bearing of a target is one means of determining whether risk of collision exists. If visibility allows, this should be used to supplement the systematic plotting of targets.

## Application of Colregs in restricted visibility: Decision support tree



In restricted visibility, when use of visual compass bearing assessment is not possible, another method to observe the compass bearing of a target is to use a compass stabilised radar to take bearings of the observed target. An electronic bearing line (EBL) fixed to own ship is a convenient way of observing changes to the compass bearing of a target.

Even if the compass bearing does appreciably change, there may still be a risk of collision when approaching large targets, a tow or targets at close range.

You may already have CPA and TCPA alarms to alert you to the risk of collision, or a potential close-quarters situation with tracked targets. Be aware whether these alerts originate from radar or AIS and the differences between each system, especially if AIS data is being overlaid onto a radar image.

### Take action!

You have determined that a risk of collision is developing – what now?

In restricted visibility there is no ‘stand-on’ or ‘give-way’ vessel. Neither vessel has ‘right of way’ and both vessels are expected to manoeuvre to avoid risk of collision. Take action early and make it obvious – expect the other vessel to act too. A substantial alteration of course will be more readily apparent than a change of speed.

Even in restricted visibility, with both vessels obliged to take avoiding action, vessels shall ‘not impede’ vessels which are restricted to navigating in a narrow channel or following a traffic separation scheme. It is important to take early action and leave sufficient space.

Fishing vessels may look small, but may have trailing nets; bear this in mind when considering what action to take. Similarly, tugs may have another vessel in tow.

### Where to turn?

If the target posing the risk of collision or a close-quarters situation is forward of your beam, try to avoid altering to port for that vessel unless you are overtaking it. If the target posing the risk is abeam or abaft of your beam, try to avoid altering course in a direction that would take you towards that vessel.

**This article is based on the UK MCA’s Marine Guidance Note 369 (M&F). It is worth reading the whole note.**

# Looking beyond the fog?

Navigating in fog or other restricted visibility will never be pleasant, but familiarity with the vessel's procedures, capabilities and equipment will help make the process as safe as possible. **Captain Tuuli Messer-Bookman AFNI**, an experienced mariner who has been training and assessing mariners for over 30 years, including 23 years as a professor at the California Maritime Academy in the USA, offers some advice on how to operate when visibility is low



**N**avigating in or near restricted visibility can be stressful for even the most experienced bridge watch officers. Radar and other technologies greatly enhance safety, but not every vessel is radar conspicuous (for instance, fibreglass and wood don't show up well) and many do not broadcast AIS. While technology is a valuable tool, it doesn't replace traditional, diligent watch-keeping.

Colregs Rule 19 addresses vessels operating in or near restricted visibility but offers no guidance as to precautions a watch officer should take. The Master and the vessel's SMS documents should provide instructions as to what '*in or near restricted visibility*' means and what specific precautions should be taken and when.

### Estimating visibility

An important question to ask is, 'How do I know when visibility is restricted?' I recall night orders stating, "Call the Master if the visibility drops below three miles" and wondering how exactly was I to know what three-mile visibility looked like!

If there are radar contacts/land you can see, then the visibility is at least as far as those contacts. If there are contacts you cannot see, then you know the visibility is less than that distance.

Practising estimating distances in clear visibility will enhance your ability to judge visibility as it is deteriorating. Remember that distance to the visible horizon can be found using the formula:  $distance = 1.17 \times \sqrt{height \text{ from the ground to the eye (in feet)}}$ . So, if your height of eye from the ground is 75 feet, the distance to your visible horizon will be approximately 10 nm. Using the metric system, multiply your height in metres above the ground by 13, and take the square root of that. That gives you the distance in kilometres. To find the distance in nautical miles, multiply by 0.54.

Once you know the distance to the horizon, stand in one spot (I stood at the centreline repeater) and see where the horizon lines up with a fixed point on the vessel. This could be the step on a foremast, or perhaps the horizon lies three fingers above the bridge wing rail. If the horizon is 10 miles away and is visually even with the third step of the foremast ladder, you have just established a reference point for 10 miles. If an object or foggy horizon is

below the third step, you know it is closer than 10 miles. With practice, standing in the same spot and using visible objects at known distances compared to shipboard landmarks, you will soon become proficient in estimating distances.

## LOOKOUTS MUST USE ALL THEIR SENSES INCLUDING HEARING - AND SMELL. A LOOKOUT MAY SMELL THE EXHAUST OF A NEARBY VESSEL BEFORE THEY ACTUALLY SEE IT

### Taking precautions

If you are unsure if the visibility is restricted, or if you are 'near' enough to trigger Rule 19, you should assume Rule 19 applies and take precautions. If you are ever in doubt (about anything) it's time to call the Master. Restricted visibility may trigger an increased watch condition, and the Master or other senior officer may come to the wheelhouse.

- > **Notify the Master and engine room:** If you think the visibility is decreasing, or if the vessel is near a fog bank, the Master and engine room must be notified. If the Master cannot be reached, start the fog signals and follow the protocols in the ship's SMS document.
- > **Start sounding fog signals and ensure navigational lights are on:** In restricted visibility, only the fog signals set forth in Rule 35 can be sounded. Manoeuvring signals (including the danger/doubt signal) are only allowed when 'in sight of' another vessel.
- > **Slow down:** The Colregs require vessels to move at a 'safe speed' but offer little specific guidance on what this should be in practice. When in or near restricted visibility, slowing down the ship can be prudent and sometimes required. Some situations require stopping altogether. Slowing down is not always simple. Make sure you understand when and how to slow the ship.

### Immediate manoeuvre

Rule 19 requires engines to be ready for 'immediate manoeuvre'. This can mean different things for different vessels. Officers should understand how their vessel manoeuvres at various speeds and load

conditions. The ship's turning diagram will help you figure out at what speed the vessel's headreach (the distance it takes to stop) is shorter than its advance (the forward distance a ship takes to turn 90°). Most ships going faster than slow ahead can turn 90° in a shorter distance than it takes to stop. Knowing what these distances are at various speeds will help you decide if you should turn or try to stop the ship if collision is imminent.

Slowing the vessel:

- > Allows more time to assess the situation and determine if risk of collision exists
- > Has little impact on turning diameters (for most large vessels)
- > Shortens a vessel's headreach
- > Lessens the energy of an impact should there be a collision

Hearing a fog signal forward of the beam may require slowing to bare steerage way.

### Additional lookouts

Sound can become omnidirectional and muffled in fog. When operating in or near restricted visibility, you should post additional lookouts outside and at the bow and the bridge wings. Turn off any music in the wheelhouse and do not use headphones. Lookouts must use all their senses including hearing – and smell. A lookout may smell the exhaust of a nearby vessel before they actually see it. Leaving wheelhouse doors and windows cracked, and posting lookouts in quiet spots will increase the chances of hearing faint sounds. If you think something is amiss, call the Master.

### All available means

If the vessel is equipped with multiple radars, infrared devices, sound reception devices or other technology designed to assist in avoiding collisions, these must be used. All radar contacts must be acquired to generate meaningful information. Long-range radar scanning to determine risk of collision is also required, as is scanning on a low range to detect less conspicuous contacts that may be lost in sea clutter.

If another vessel in the area can be identified easily, perhaps by AIS, call them and make early passing arrangements. In restricted visibility there is no 'stand-on' nor 'give-way' vessel. Remember: in restricted visibility, neither vessel has right of way and both vessels are expected to manoeuvre to avoid risk of collision.

# WATCHOUT

In this series, we take a look at maritime accident reports and the lessons that can be learned

## Close encounter – how inadequate lookouts led to two ships colliding in foggy conditions

### What happened?

A fishing trawler was heading back to port in foggy conditions to land its catch. A new radar had been installed a couple of days previously. As the vessel progressed to port, the skipper had been in the wheelhouse familiarising himself with the new equipment. The deckhand was in the shelter deck, sorting out the fish that had been caught. At some point, the skipper moved to the shelter deck to oversee the deck hand's work, leaving no-one keeping watch or monitoring the radar in the wheelhouse.

Meanwhile, a general cargo ship was approaching the trawler with a chief officer and AB on the bridge. When the two vessels were less than a mile from each other, the chief officer spotted a target on his radar, looked outside and saw the fishing trawler very close by with no-one in the wheelhouse. Despite sounding the whistle and altering course, the two vessels collided. The trawler in particular suffered severe damage and sank while being towed to shore.

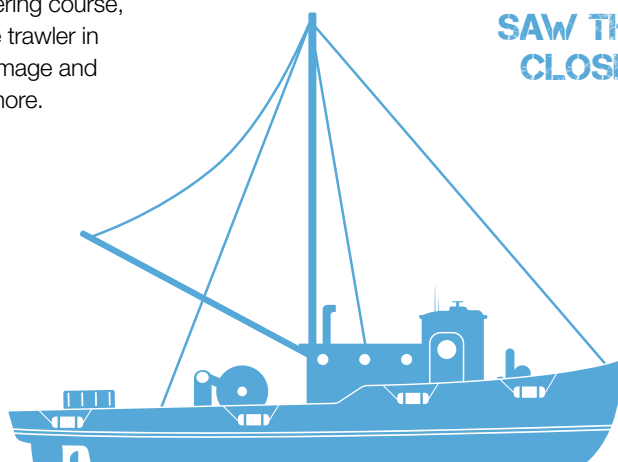
### Why did it happen?

- > The skipper of the fishing trawler left his position in the wheelhouse prior to the collision.
- > Neither vessel was keeping a proper lookout, nor making effective use of their radar, despite the presence of fog.
- > The trawler was sailing with unfamiliar radar equipment and was not equipped with a radar reflector or AIS.
- > Neither vessel sounded its fog signal, which would have given them both valuable prior warning of another ship's presence in the area. Action taken to prevent collision therefore came far too late.

### What changes have been made?

- > The fishing trawler's skipper was urged to put procedures in place to ensure that a proper lookout is maintained at all times. Keeping a lookout by 'all available means' is fundamental to safe navigation, particularly during restricted visibility.
- > The Master and officers of the cargo vessel were reminded of their obligations under the Colregs for navigating in restricted visibility.

**THE CHIEF OFFICER SPOTTED A TARGET ON HIS RADAR... AND SAW THE FISHING TRAWLER VERY CLOSE BY WITH NO-ONE IN THE WHEELHOUSE**



Read the full report at <https://tinyurl.com/Nav36watchout>



The Nautical Institute's Mariners' Alerting and Reporting Scheme (MARS) - <https://www.nautinst.org/resource-library/mars.html> - comprises a fully searchable database of incident reports and lessons, updated every month. If you have witnessed an accident or seen a problem, email Captain Paul Drouin at [mars@nautinst.org](mailto:mars@nautinst.org) and help others learn from your experience. All reports are confidential – we will never identify you or your ship.



## Adventure and aspiration at sea

Chief Officer **Sarker Mohiuddin Hasnat Lenin MNI** shares how an early love of adventure stories inspired him to follow a career at sea

### Why did you decide to pursue a career at sea?

During my childhood I used to read a lot of novels, including works by the French novelist Jules Verne. Since then I always wanted to travel around the world. Nothing can be better than a seafarers' career. I now work as a Chief Officer for Pacific International Lines Pte Ltd, Singapore.

### What do you find most interesting or challenging about your current role?

I find it challenging every day, but I enjoy the challenges associates with my role. I find crew training and handling the most interesting. You have to deal with so many different nationalities and people at the same time. You also have to supervise their day-to-day jobs, vessel maintenance, cargo stowage and vessel stability throughout the voyage.

### Where do you see yourself in five years' time? Ten?

I dream about taking command of a vessel as Captain and have been preparing myself for such a role. I obtained my Master Unlimited Licence from MCA, UK in 2022 and am now awaiting the golden opportunity. I want to see myself as a maritime policy maker, to assist with creating maritime policies for the future of autonomous shipping. I believe that will be a game changer for the future of shipping in 10 years' time.

### Who has been your inspiration in the shipping world and why?

Captain Kate McCue, who has been phenomenal ever since she took over command of *Celebrity Beyond* with Celebrity Cruises in the USA. She is very inspiring and lots of new generation seafarers want to make a mark in their sea career like her. I would love to meet her one day and sail alongside her.



**Name:** Sarker Mohiuddin Hasnat Lenin MNI

**Current position:** Chief Officer, Pacific International Lines Pte Ltd, Singapore

### How do you tackle the challenge of navigating during low visibility?

No one wants to find themselves in low visibility, but as seafarers sometimes we have to deal with it. We maintain a lookout by all available means, approach with safe speed and keep our engine on standby all the time. Additionally, we keep the radar operational, warn others of our location by using sound signals, keep navigation lights on, have both anchors ready for emergency and plot the vessel's position at more frequent intervals.



# Looking into a future of one hundred eyes

**George Shaw** from the Royal Institute of Navigation looks into his crystal ball to explore how innovations in ‘panoptic vision’ and artificial intelligence might support mariners in the future in navigating areas of restricted visibility

The mythological giant, Argus, was an all-seeing ‘watchkeeper’ blessed with one hundred eyes. Human mariners only have two, but it is not impossible to imagine that technological advances could ultimately offer them their own version of all-weather, panoptic vision. Enhanced and synthetic vision concepts, historically used for landing aircraft in reduced visibility, are developing rapidly, with multispectral sensing and machine vision now being explored for autonomous vehicles.

## Sensor innovation

By comparison, navigating the marine environment in fog is more challenging. Aids for future maritime all-weather navigation and collision avoidance place greater demands on innovations in sensors, artificial intelligence (AI) image processing and pattern recognition. Such powerful techniques should aim to provide all-round ‘vision’ and alerts, improving safety if mariners remain vigilant and mindful of their limitations, but ultimately also benefiting autonomous vessels.

Whilst light is dispersed by fog, other key maritime transmissions remain effective in conditions of restricted visibility. Radar, GPS and AIS/VHF continue to provide good positional and situational awareness, subject to their own inherent limitations and vulnerabilities. Radar is fundamental to collision avoidance, supported by AIS (when used cautiously for general awareness). In poor weather, appropriate choice of vessel speed and diligent lookout within visibility limits will remain vital, since no sensor combination is likely to offer complete capability for the foreseeable future, even with the help of AI.

**A FUTURE PANOPTIC CAPABILITY FOR MARINERS IS FEASIBLE, BUT ALL-WEATHER VISION CAPABILITY WILL REMAIN VARIABLE**

## Infrared imaging

Infrared (IR) sensors, mostly associated with night vision, do have some capability to ‘see’ through some fogs (though not when the fog is too dense). The enhanced vision of such thermal imaging has its own benefits, especially around offshore infrastructure. Due to how they sense temperature differences, the ranges of IR detectors can vary greatly according to the weather conditions. Vessels with distinct heat signatures may be conspicuous in fog at a much greater distance than visual range, but then disappear completely in rain or thicker fog. Not all obstacle surfaces exhibit sufficient temperature differences to be identified in this manner – for example, large mammals are unlikely to be detected.

## Advances in AI

AI is already able to portray compelling digital representations of surroundings by combining and analysing optical images and extracting information from other sensors to complete the picture. This type of synthetic vision may one day be used to overlay computer-generated images on the real-world visual scene via head-up displays or



helmet-mounted devices. A circular ‘staring array’ of optical sensors (potentially enhanced with IR sensing) and AI image processing could offer cohesive 360° panoramic views with embedded virtual cues. This would greatly assist mariners in highlighting key dangers and alerting them to possible interventions.

A future panoptic capability for mariners is feasible and would be particularly effective in good visibility and complex sea spaces containing multiple obstacles and heavy traffic. All-weather vision capability will, nevertheless, remain variable and limited, even with the possibility of AI integrating sensor images and data to reveal as much underlying information as possible.

## A word of caution

Mariners must use AI and enhanced or synthetic vision aids with great care. No sensors are perfect. They can all suffer occasional missed detections, false alarms and measurement errors. AI can mitigate some effects, but its very nature (learning from experience and with big data sets) means that it will inevitably make mistakes while it learns. No single navigation source can be trusted absolutely – and neither can any combination of AI.

Mariners must frequently cross-check all available sources of navigational information, both individually and in combination. Keeping a vigilant visual lookout and selecting appropriate vessel speeds will remain essential, even with the most technologically advanced ‘AI navigators’ supporting and learning by the mariner’s side.

# TAKE TOP 10

## Ten tips for handling restricted visibility at sea, maintaining a good lookout and operating within the relevant Colregs

### 1

#### Professional approach

Restricted visibility is a challenge to navigation, requiring a professional approach. Make sure you know how to assess whether visibility is restricted.

### 2

#### Fog factor

Restricted visibility can be caused by a number of factors, including fog, mist, snow and sandstorms. Some of these circumstances come slowly, others more quickly. Either way, the professional navigator must be ready to react.

### 3

#### Planning ahead

Many sources of restricted visibility can be anticipated and should be part of the risk assessment during passage planning.

### 4

#### In or nearby

Areas of restricted visibility can affect you both when you are in one and when you are nearby. It can obscure collision risks, such as multiple vessels in an approaching squall.

### 5

#### All available means

A good lookout should always be maintained. In restricted visibility, 'all available means' includes all appropriate technology along with extra lookouts.

### 6

#### Safe speed

The key to safety in restricted visibility is to ensure that your speed is appropriate to the circumstances so that you can avoid collision or stop the vessel more easily.

### 7

#### Colregs

Responsibilities of vessels under Colregs change in restricted visibility. When 'in sight', there are rules for 'stand on' and 'give way' vessels. During restricted visibility, all vessels should take action to avoid collision.

### 8

#### Procedures matter

Every vessel should have procedures to ensure that safety is maintained in restricted visibility. These will include SMS procedures, Master's orders and practising good seamanship.

### 9

#### Drills

Restricted visibility drills can be useful to help bridge teams prepare to adapt to this situation.

### 10

#### Mentoring

Learning how to deal with restricted visibility comes with experience; mentor others in your team to be able to recognise the situation and react positively to it.

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## #NavInspire



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## AND THE WINNER THIS ISSUE IS...

Congratulations to this issue's Navsnap winner Tiago Jo Planes Conde, who sent us this snap from on board the car carrier *Trans Future 8*, en route from New Zealand to Japan. We hope you enjoy your new iPad!

We love seeing all the places *The Navigator* gets to and the seafarers who read it (lots from Japanese ports this time!). Send us your photo with your copy of *The Navigator* on Facebook or insta to be in with a chance of winning



Tiago Jo Planes Conde  
**NAVIGATOR CHAMPION**

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