Forum

What's Lookout About at Sea?

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Traditionally, the duties of a lookout include maintaining situational awareness and providing warning of the risk of collision, stranding and other dangers to navigation. Therefore, in addition to the use of both eyesight and hearing, the effective use of available instruments and equipment are essential to the purpose of proper lookout; this applies particularly to radar. The aim of this paper is to emphasise the need for the correct practice and method of lookout.

KEY WORDS

1. Seamanship. 2. Safety. 3. Human Factors.

1. INTRODUCTION. The collision between the container ship *Ever Decent* and the cruise vessel *Norwegian Dream* in the English Channel in August 1999 not only attracted justifiable debate on the safety of navigation in a busy waterway but also heightened public awareness on the practice of lookout. Obviously, this disaster can be attributed to some visibility or seamanship aspects. Traditionally, the duties of a lookout include maintaining situational awareness and providing warning of the risk of collision, stranding and other dangers to navigation. Therefore, in addition to the use of both eyesight and hearing, the effective use of available instruments and equipment are essential to the purpose of proper lookout; this applies particularly to radar. The aim of this paper is to emphasise the need for correct practice and method of lookout.

2. MILITARY SERVICES. The doctrine from a typical army textbook states that: 'The basis of lookout is visual distance measurement.' Lookout in the navy may be, or should we say must be, exercised by radar or laser equipment for the detection of long-range anti-ship missiles. Navies fight with electronic targets only because in modern warfare there is actually little chance that any enemy will come within visible range. But armies do not have such equipment with them all the time, and they frequently have to fight at very close range; thus their lookout often relies on just a pair of eyes.

3. MERCHANT MARINERS. Merchant seafarers live like the navy but must fight like the army. Why? The following are the more unfortunate aspects of marine radar use:

(a) Small targets cannot be detected at long range.
(b) The radar scanner is often not installed in an ideal location.

(c) The number of targets frequently exceeds the ARPA's capacity.
(d) Radar resolution is not good enough to distinguish a small target from a big one.
(e) Sea clutter swamps a small target at close range.

Consequently, those who attempt to rely on radar lookout alone find their life miserable in the merchant fleet.

3. BEARING AND DISTANCE. Suppose that a soldier is assigned the lookout job. When he sees targets, he has to inform his colleagues about what he can see, including the target's bearing and distance, etc. The bearing is easy for anybody to locate if the lookout relates the target to a conspicuous spot in the landscape, but what about the distance? The lookout can only judge by his experience. Sometimes this can be a matter of life or death, and so it is for the mariner.

The COLREGs give us the rules of ascertaining collision risk by a target's bearing that we can easily take from an azimuth circle. But who can remember the bearings of two or three targets, not to mention the fact that you need to remember a further two or three sets of previous bearings to compare with them? Most people have problems with the eight or more figures of a phone number. If we have to pick up a target's bearing and distance visually, how can we do it correctly and keep the values in our memory?

3.1. *Using Visual Bearings*. The most precise way to ascertain the risk of collision is always to take true bearings from a gyro repeater. Sometimes relative bearings can also serve this purpose if the ship's heading is steady. In the case of vessels without deck cargoes, deck fittings are always the same. For instance, the foremast's relative bearing is always zero if we take it from the ship's centreline gyro repeater as are mostly found on Japanese-made vessels. The break of the forecastle may be 10 degrees to each side, and the pilot boarding station's stanchion may be 30 degrees to each side, etc. However, the point is that, while the precise bearings of reference points on deck is not crucial, their relative bearing is always fixed, and they can be used as reference points to ascertain the risk of collision.

Once a target's bearing line moves ahead of the reference point (relative bearing getting smaller), we can say this target may be passing by the ship's bow. When the bearing line moves aft of the reference point, it is probable that the target may be passing astern. When the bearing line remains over the reference point or does not move very much, a risk of collision shall be deemed to exist. Clearly, it is important to maintain the observation position on the bridge to avoid any parallax of the reference point, and due allowance must be taken for heading yaw when the sea is rough.

For those ships with deck cargo, the deck cargo's shape, colour, ends etc. may serve the same purpose as reference points. For example, a container positioned in the outer row of a certain bay may be coloured orange, one foot lower than the row next to it, and the target is located on its fore-end direction. The characteristics of colour (orange), gap (different height between boxes), and position (fore-end of the box) comprise a vivid and compound visual impressions of the target's bearing which is easier to remember and check later.

3.2. *Distance Verification*. What is the most likely scene we see in our daily life at sea when we look out of the bridge windows? It is the horizon when the visibility

is good. Remember, this is the line that inspired the idea that 'the Earth is a sphere'. Because a ship's mast appears first when she comes over the horizon, it serves as a great reference for distance verification. By human nature, we are used to comparing the distance of each target against the foreground and judging the visual size of a target against its known height. This is true, for we neither become taller nor shorter each day when we stand on solid ground and know the height of each object around us. But it may not be so useful when we are on a ship's bridge with the eye height changed by draft or trim and when the target's height is unknown. We cannot be sure what we have in sight.

Let us take the full container ship as an example: in clear weather, with a height of eye of 42 metres, the horizon lies about 13 miles away. If a ship's full silhouette is visible, and the water-line of this ship coincides with the horizon, we might say the distance to this target is 13 miles; in fact, we cannot say this for sure, because nobody's eye can see the water-line that far off. Once the ship comes closer, its water-line will descend under the horizon. We can verify this from the ship's silhouette cutting the horizon line to make sure. By comparing the water-line position of several ships against the horizon, we can pick up the vessel closest to us. A target vessel's water-line will undergo some changes as it approaches. We begin to see some wave form distorted in the bow wave line at about 4 miles away, although this depends on the height of eye of the observer and the target's shape and contrast. When the target's bow wave (or the wake current for a small ship) becomes more vivid, this means it is much closer. Precious time must not be wasted watching the bow wave form; bearings must be taken now. This is our main objective. Lookout is for safety. The dangerous range is when white splashes are seen at the ship's bow, which means that the distance is down to only one or two miles.

If a clear vision of the horizon is lost, we actually lose much of our ability to judge distance. This is when the radar needs to be used to evaluate the horizon distance more carefully. Mariners are often surprised that a vessel whose water-line they thought was on the horizon is much closer than they thought.

3.3. *Nightfall.* During night-time, the horizon may still be visible if some time is taken to achieve the best night vision. Therefore, the following is worth discussing; usually, merchant vessels are constructed according to the class rules, and navigation lights are well separated. We can still compare a target's distance from the horizon to estimate the range. The most dangerous situation for those who rely only on visual lookout is confusing the ocean-going vessel's navigation lights with the fishing boat's station lights. (Lord bless those of you who find your way out of fishing schools!) The possibility of this happening should be detected by skilful use of the radar equipment to determine which are the big vessels in the vicinity by periodically adjusting the gain to eliminate the fishing boat echoes. As well as the navigation lights, if we can see the accommodation light or something else, the distance should be around 4 miles away (the normal visibility range of a household light). This could be the last suitable chance to take avoidance action for a merchant vessel. For a small fishing vessel, the first noticed light usually shows at 7 miles range (normal radar-detectable range). If this first light becomes two or three lights, it means you have come to the normal household light visible range.

When reflections of navigation lights are seen on the water, the target is only one or two miles off and a serious risk of collision is present; bold action is needed. If it proves hard to adjust night vision for the scene outside – and time is limited for a

target at close range – indication lights or the shape of equipment inside the bridge can be used as visual reference points.

4. RUSH TO IT OR TAKE IT CONFIDENTLY? If you are a junior officer on board, there are some situations in which you should call the master. What should the master do when he rushes to the bridge? And, apart from any standard procedures, what should you do when you take over duty on the bridge after some hours' rest?

a. Take a quick look at ship's position as shown on the GPS or ECDIS.
b. Check the horizon outside the windows: is it clear or blurry? If it is blurry, is the radar already in use? If not, it should be turned on immediately.
c. At night-time, look briefly at the ARPA's data, but take some time to get accustomed to the darkness so that a visual check can be made as soon as possible.
d. Verify the closest ship's distance by checking for its bow splashes, wake current or any lights reflecting on the sea.
e. If no targets are at close range, check their position relative to the horizon to determine the most dangerous target and begin taking bearings by reference point.

When called to the bridge in a critical situation, this practice may only take a few seconds and avoidance action can be promptly exercised. The time available for ascertaining the collision risk and taking action depends upon the target's distance. Visual reference points need to be used when time is so limited.

5. CONCLUSIONS. The proper use of radar systems has undeniable value in marine situational awareness. However, better use of human vision can overcome some of the limitations of radar. When a target's echo is immersed or swamped by sea clutter at close range, that is the time that an assessment of its movement is most needed. Some human instincts 'kick in' automatically; however, for the rookie, some things need to be taught, and experience must be accumulated over time. Such experience may be acquired through witnessing good practice, and may also require some kind of wits, if a high heart rate and sweating is not to be associated merely with physical exercise and sport.

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