Man Overboard Detection

*Cruise Ship Safety*

PureTech Systems
MAN OVERBOARD DETECTION FOR CRUISE SHIP SAFETY

Most of us have gone on a cruise vacation or know of a close friend or relative who has done so. Cruising is a popular vacation option enjoyed by families and individuals throughout the world. What is not so well known, though, is the fact that man overboard events continue to be a common occurrence within the cruise industry. Since 2005,

- 268 Man Overboard Events have been reported.
- On average, 22 people fall off a cruise ship every year.
- 86% of those victims do not survive, or are never found.

Man overboard events (MOB) can happen at any time during the day or night, in all types of weather and sea conditions, and from almost any location on the ship, ranging from a few tens of feet above the water, to over 180 feet. Falls from these heights can injure, render unconscious, or even kill the victim. Likewise, falls from ships operating along northern routes can expose the victim to extreme water temperatures, which can result in hypothermia and death.

Given these scenarios, one approach to increasing the survival rate of MOB events is to ensure accurate timely detection, followed by a rapid response protocol. However, few cruise ships in operation today have any form of man overboard detection system. Although they may have cameras and imaging systems to monitor activity on board the ship, these camera systems are primarily used for basic surveillance or evidential activities and are not designed to actively notify the ship’s crew in the instance of a man falling overboard. In most cases, MOB events are reported by someone who happens to notice the fall, or by a member of the person’s party who reports the person missing. This information must all be verified by the crew before taking action, which can take a considerable amount of time.

Consider these facts:

- The typical stopping distance of a cruise ship is 1 mile.
- If it takes 15 minutes to confirm an MOB event, a ship may have moved 7 miles from the original fall location.
- A typical man overboard detection system can report a MOB event in under 1 second.
Detection Using Intelligent Video

Accurately detecting a human falling from a moving cruise ship is not an easy problem. An object falling from the top level of a large cruise ship can reach speeds of 70 mph. A MOB system must be able to detect objects moving at these speeds, while mounted on the ship itself, which is in a constant state of pitch, roll and yaw. Cruise ships are also very busy environments, with people moving about, blowing debris and a variety of normal operational activities that may involve the movement of items along the side of the ship (ladder deployments, crew boarding, water spray from decks, etc.). And although most cruises tend to target fair weather locations, they still experience all types of weather conditions and sea states. A reliable man overboard detection system must accurately detect human falls in all these situations, while avoiding false alarms and providing the crew with actionable data to react to the situation. Although a challenging problem, numerous companies currently deploy MOB solutions.

One company, PureTech Systems, recently announced the approval of a patent addressing the use of video technology for man overboard detection. Its MOB system captures images using thermal cameras surrounding the ship’s perimeter, extending from the lowest passenger deck to the waterline. Thermal video is a logical choice for maritime situations, as it is less susceptible to harsh lighting scenarios, such as sunrise and sunset. It can also provide clear images day or night and in most weather conditions. High resolution thermal sensors can therefore deliver clear visual indications of a human target to the crew for confirmation.

The use of geospatial video further enhances the detection capabilities of this type of MOB solution. Geospatial video is the understanding of where each video pixel resides in “real” space – meaning latitude, longitude and elevation. This adds another dimension to video analysis by allowing the software to not only understand the physical location of the object, but also the real size, the real speed and the real acceleration. Therefore, although an object may be falling at the same expected speed of a human, a geospatial video solution can understand that this same object is too big or too small to be a human, and suppress the alarm.

Accurately detecting a human falling from a moving ship is not an easy problem to solve, but it is now achievable with recent technology efforts, including advancements in video analytics.
Finally, the use of opposing cameras provides a means by which the video analytics can further confirm the event is happening on the ship itself, and is not something occurring in the background, such as on the water, in the sky or on the dock. In addition to actually being detected in both images, a detection occurring between two camera pairs must pass several additional tests for the duration of the fall; including time stamp, object size, object location, object speed, object type and fall trajectory on both cameras within the pair before being considered an alarm. This further ensures that the crew receives minimal false alarms.

**System Integration and Crew Notification**

In the event of a man overboard situation, accurate detection is only part of the problem. Systems must also provide a high level of situational awareness to help the ship’s crew gain a full understanding of the event as quickly as possible. MOB systems deployed with geospatially video analytics have several unique features to address this need:

**Image Data** – As humans, we inherently rely on vision as one of our primary senses; the human mind will rely on its sense of sight as a means to confirm any other data received. Using video analytics for detection means data preferred for validation by a first responder – still images and looping video – is instantly available to reduce the time required to confirm the event. To further ensure rapid verification, video analytic systems highlight the potential target with graphical “bounding boxes” on both still images and full motion video clips in order to quickly communicate what event raised the alarm.

**Location Data** – In addition to logging the GPS location of the ship at the exact time of the event, video solutions leveraging geospatial data also provide insight as to the location the event took place on the vessel itself. Including location information with each alarm allows first responders to more quickly reach the incident location and begin MOB procedures without the loss of valuable time typically required to confirm an event and its point of origin.
Industry Response and Regulations

Technology providers are not the only institutions taking actions around the need for MOB detection and the deployment of solutions. The United States government identified a need for increased measures to detect MOB situations in 2010 when it released the Cruise Vessel Security and Safety Act (CVSSA). The act applies to cruise ships carrying more 250 passengers on international voyages in which passengers embark or disembark in any US port. It calls for automatic man-overboard detection/monitoring systems within 18 months of the technology becoming available. Since the first release of the act, several companies have stepped forward to prove their detection capabilities, prompting the current revision of the act and the development of an international standard for these man-overboard systems by the International Organization for Standardization (ISO).

Various cruise lines are also proactively testing the new technology ahead of the formal release of the ISO standards and the CVSSA requirements to ensure they understand how to most effectively incorporate this technology as an integral part of their safety systems.

Other Industries

In addition to having tremendous potential to cater to the current requirements of the marine industry in detecting, recording and reporting man-overboard events in real-time, this technology is directly applicable to the broader safety category of “long fall events.” In addition to other maritime industries, including ferry operators, oil platforms, commercial shipping and military vessels, these types of falls can be a safety concern to other non-maritime industries, such as bridges.

Conclusion

The cruise line industry has recognized the need for man overboard detection systems and many manufacturers have invested research and development to create technology which results in accurate detection and notification, including systems based on the use of geospatial video analytics. These video-based systems monitor thermal images, process them using intelligent video algorithms and combine this data with geospatial techniques. This results in not only highly accurate detection capabilities, but also a complete solution which supplies crew members with critical event location data to reduce the delay between the time of the event and the deployment of rescue procedures.
NEXT STEPS FROM PURETECH SYSTEMS

Combining Sensors for More Efficient Perimeter Protection: Fence Intrusion Detection Systems and Video Analytics are both effective perimeter systems. This white paper looks at some of the attributes of each and explores how the combination can result in a more efficient and effective system.

PTZ Auto Follow Tutorial: In most cases, detecting the intrusion is only part of the problem. The key is maintaining surveillance to understanding the intruder’s actions and path. Enabling cameras with PTZ Auto Follow allows the camera to automatically follow the intruder so your security personnel can coordinate a response. Check out this narrated video of PTZ Auto Follow.

8 Things to Consider When Designing a Camera Perimeter: There are many guidelines that have been released that provide information as to the type of security measures that should be considered when protecting these facilities. However, the details involved with making these measures a reality are often missing. This paper presents 8 things to consider when designing a camera-based security system, or when reviewing your existing one.

Types of Camera Auto Follow: Camera Auto Follow, the ability to track an intrusion hands-free, is a very powerful feature to consider as an addition to your security arsenal. This white paper addresses the various auto follow terms that exist in the marketplace today and helps to educate on the varied functionality.

About PureTech Systems

PureTech Systems Inc. is a manufacturer of wide-area perimeter surveillance software solutions including internally developed outdoor video analytics, PTZ Auto Follow, multi-sensor integration and a map-based (real object size) command and control. It is offered to fortune 1000 firms, military, petro-chemical, water and electric utilities, seaports, airports and federal, state and local governments. With headquarters in Phoenix Arizona, PureTech Systems serves national and international markets. To find out more about PureTech Systems Inc. visit our website at www.puretechsystems.com, follow us on Twitter @PureTechSystems or sign up for our email list.

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