GAS DETECTION IN MARINE APPLICATIONS

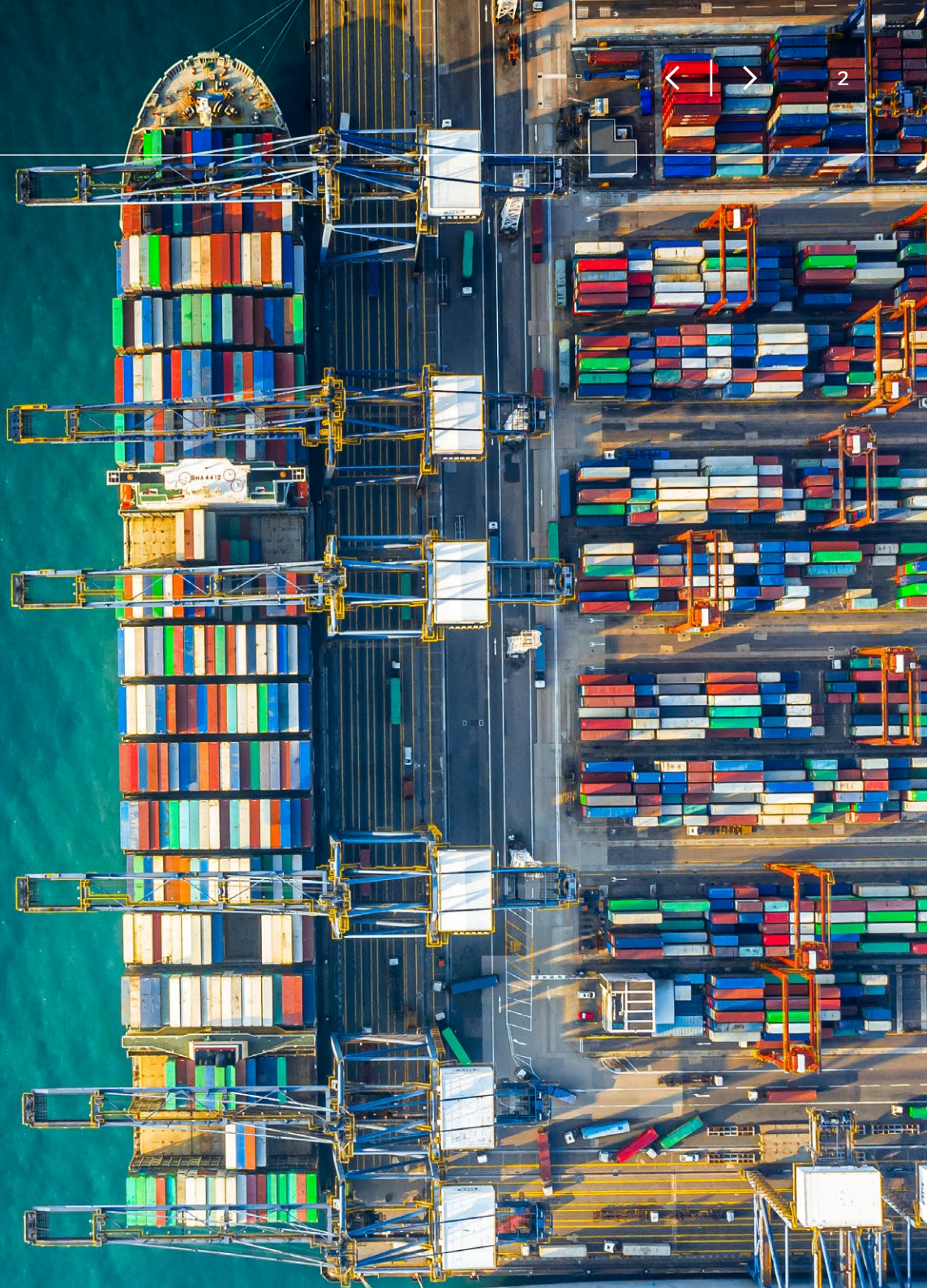
How to Optimize Reliability and Reduce the Total Cost of Ownership

Honeywell

INTRODUCTION

The marine industry is a significant contributor to the world economy, with 55,000 vessels that carry 80% of global trade . Protecting this critical sector and its workers is paramount. This is where gas detection comes in.

Toxic and flammable gases pose a real threat to workers and assets in the marine industry, mainly due to hazardous and flammable cargo combined with confined spaces. A gas-related incident can have far-reaching consequences. This e-guide examines the main risks, standards, and regulations and looks at how to optimize the effectiveness of gas detection systems, enhance safety, and reduce the total cost of ownership (TCO).



MARINE: A GROWING INDUSTRY

The marine industry is a huge sector that comprises the construction, transportation, inspection, maintenance, and decommissioning of vessels. The market was valued at $171 billion in 2021 and is expected to grow to $189 by 2028. Asia Pacific has the largest market share, with its shipbuilding industry representing almost 93% of new vessel deliveries in 2019. The European shipbuilding industry is a leader in innovation. A diverse fleet of commercial vessels in this region contributes $165 billion to the EU's annual GDP growth[1].

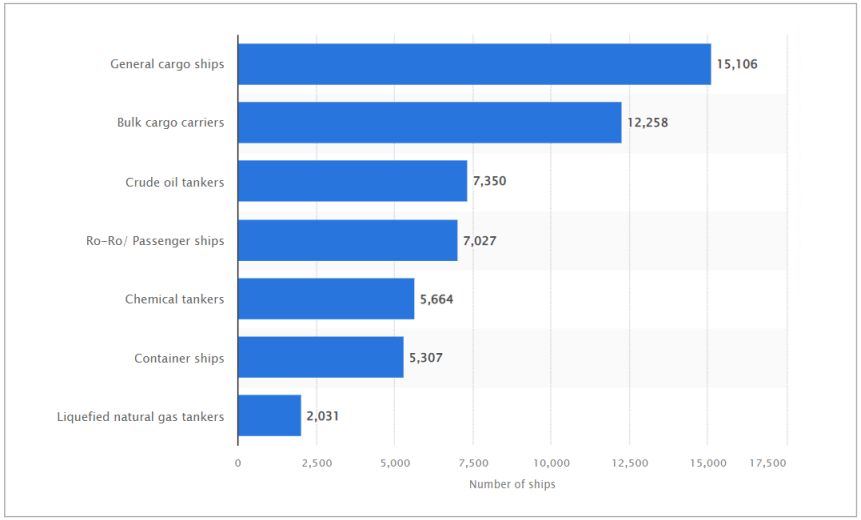


Figure 1: Number of ships in the world merchant fleet as of January 1, 2021, by type, January, 2021 [Accessed August 21, 2022][2]

Figure 1 shows the breakdown of the number of vessels per usage in the global merchant fleet.

Many of these vessels could expose marine workers to hazardous gases and, as such, require a reliable gas detection program. Typical marine applications where toxic and flammable gases may be present are:

- Tanks protected by inert gas purges;
- Cargo areas that may have chemical or gas leaks;
- Tank investigations or inspections to verify their integrity;
- Ballast water treatment chemical exposure;
- Cargo pump room exposure to leaks;
- General leak detection;
- Tank cleaning where the previous cargo was hazardous; and
- Testing the atmosphere of enclosed spaces before entry.

GAS: A POTENTIALLY OMNIPRESENT THREAT TO MARINE WORKERS AND ASSETS

Transportation and inspection are the most regulated sectors of the marine industry due to the hazardous nature of the products in transport. Some products emit flammable gases, which can create an explosive mixture unless safely managed.

Tankers that carry crude oil, petroleum products, liquefied petroleum gas, liquefied natural gas, and chemicals have holds fitted with engine exhaust, N_2, or CO_2 to create an inert blanket and prevent the build-up of an explosive mixture. But flammable gases are not the only challenge in the marine industry. Container ships and bulk carriers can contain fumigants and gases that ripen fruits. These products can be toxic to humans and create a risk for marine workers.

Table 1 illustrates the most common gases, potential sources, and consequences.

CATEGORY	GAS	SOURCES	POTENTIAL RISK
TOXIC	H_2S - Hydrogen sulfide	Crude oil and petroleum products	Toxic to humans
	CO - Carbon monoxide	Exhaust gases	Toxic to humans
	O_2 - Oxygen		Need a minimum level for breathing
	CO_2 - Carbon dioxide	Exhaust gases	Toxic to humans
	HCN - Hydrogen cyanide	Fumigation	Toxic to humans
	PH_3 - Phosphine	Insecticide	Toxic to humans
FLAMMABLE	Flammable gases	LPG, Natural Gas, Solvents	Fire or explosion
TOXIC AND FLAMMABLE	VOCs - Volatile organic compounds	Crude oil and petroleum products	Fire or explosion Toxic to humans

Table 1: Toxic Gases in the marine industry

An everyday activity that exposes marine workers to the risk of toxic and flammable gases is confined space entry. Workers enter confined spaces to perform routine tasks like inspection and cleaning. During this activity, they could be exposed to any of the gases listed above.

STANDARDS AND REGULATIONS

The shipping industry is regulated by strict safety protocols, especially for transportation and inspection. Because of the regular need to enter confined spaces, regulations specify a minimum requirement of appropriate Confined Space Entry (CSE) gas detectors on board.

The E.U.'s Marine Equipment Directive (MED) demands that these portable detectors be certified as EX meaning they are protected for use in hazardous areas.

It is not only marine workers who are at risk from flammable and toxic gases. Classification societies must conduct inspections before a ship goes to sea. Coast Guards and customs personnel inspect vessels when searching for contraband. Inspectors must enter the same confined spaces and adhere to the same regulations as marine workers.

Key regulators and standards governing the shipping industry include but are not limited to:

- The International Maritime Organization (IMO)[3];
- ISO 19891-1:2017[4] specifies suitable portable gas detectors for compliance with SOLAS regulation XI-1/7[5];
- NOTE 1 SOLAS regulation XI-1/7[5] requires portable gas testing equipment onboard ships for O_2, flammable gases, H_2S, and CO to test confined spaces before entry;
- On all tankers system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted[6];
- The MED mark that confirms a product or piece of equipment is approved for use on ships of EU Member States and countries applying the Marine Equipment Directive[7].
- Classification societies, such as Lloyds Register[8], Det Norske Veritas[9], Bureau Veritas[10].

HOW TO REDUCE RISK WITH GAS DETECTION

Gas detection is critical to keeping marine workers safe by warning them of toxic or flammable gas mixtures. Both portable and fixed gas detection systems have their place in the marine environment.

PORTABLE GAS DETECTION

Workers can use portable gas detectors to check the atmosphere of a confined space before entry. During work, the confined space should be continually monitored to ensure the atmosphere remains safe. Honeywell produces several portable gas detectors that can be paired with a smartphone using Safety Communicator App which can relay real time reading from the environment. Each device has features relevant to its use, including:

- Honeywell BW™ Ultra tests for five gases, including O_2, LEL, CO, VOCs, and H_2S. It has a one-button operation for ease of use and can relay a signal for remote monitoring;
- Honeywell BW™ Flex tests for four gases simultaneously with the flexibility of choosing from 15 different sensors; and
- Honeywell BW™ RigRat has up to six gas sensors allowing users to choose from 23 variant gas types. The units can be placed at intervals to create a wireless safety perimeter around the hazardous area.

FIXED GAS DETECTION

Fixed gas detection continuously monitors an area and warns marine workers of a gas release. These units detect leaks from tanks or pipelines that could endanger workers nearby or create a fire risk. Some of the latest solutions include:

- Sensepoint XCD has remote monitoring capabilities for O_2 and toxic sensors. The sensor and transmitter can be separated for use in areas where the point of detection is not easily accessible;
- The XNX™ universal transmitter features a variety of sensor modules that can connect to the transmitter;
- Searchpoint Optima Plus is an infrared point Hydrocarbon gas detector certified for use in potentially explosive atmospheres. Infrared offers the fastest speed of response and fail-safe operation;
- Searchzone Sonik™ detects the ultrasonic sound pressure level produced by pressurized gas leaks;
- The Searchline Excel™ Plus is a short and medium-range gas detector and Searchline Excel™ Edge is designed for long-range perimeters; both with a fast response to flammable hydrocarbon gas even in low visibility.

HOW TO REDUCE GAS DETECTION MAINTENANCE TIME AND COST

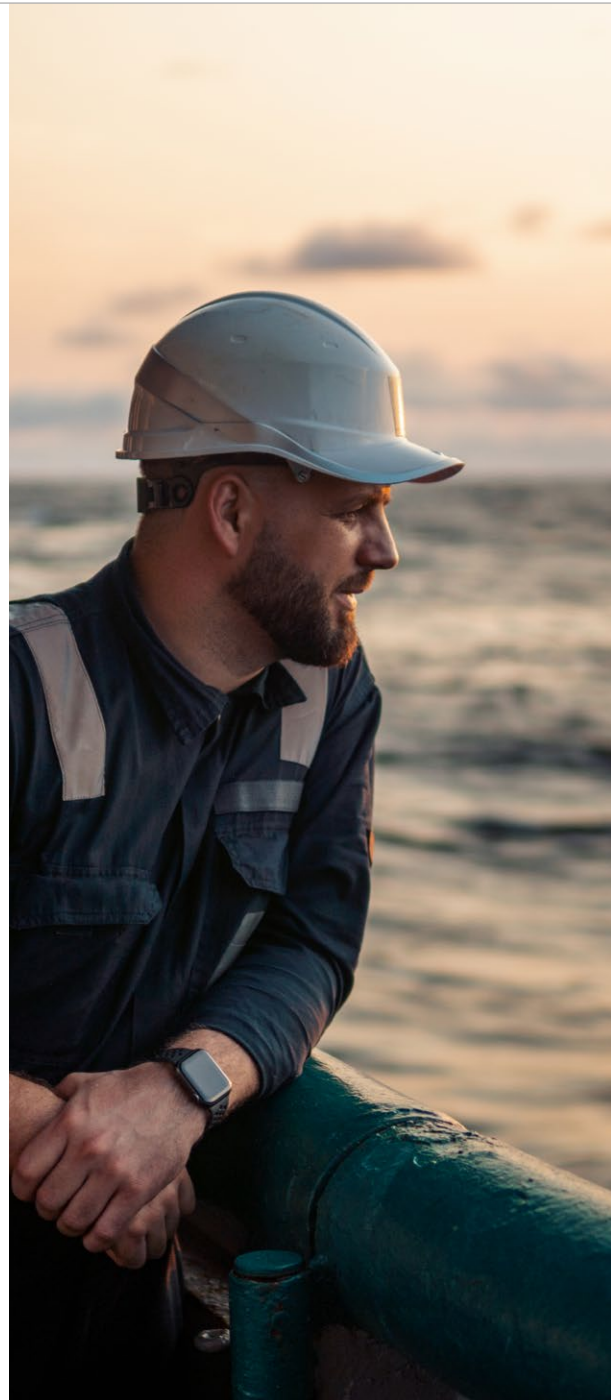
The marine environment is a challenging context. Vessels remain at sea for several weeks at a time with no access to spare parts or service support until their next berthing. As such, marine workers depend on durable and reliable gas detectors to help keep them safe and help prevent incidents on board.

Several features of the Honeywell range of portable and fixed gas detectors are specifically designed to meet the rigorous demands of the shipping industry. These features include a longer sensor life due to poison resistance and a simple maintenance process using smartphone applications. Some features of the Honeywell gas detection range and their contribution to lower maintenance costs are listed on the right in table 2.

Shipping companies need worldwide support for their fixed and portable gas detection systems so that wherever their ships berth, they can access the resources they need. Honeywell offers a global supply and service network that gives marine companies the peace of mind that they can find support when needed.

FEATURE	BENEFIT
Extended battery runtime	Honeywell BW™ Flex and Honeywell BW™ RigRat (with IR Flam) can run up to 2 months on a single charge, reducing downtime.
Remote configuration via smartphone app	Ease of configuration and quick access to data.
Infrared sensors	Fast response and immune to catalytic poisons
Continuous pumping	Internal pumps continuously pull air through a sampling hose for analysis
IP66/68 rating	Ensures protection from water and dust ingress
Inert mode	User is prompted to enter inert mode to activate alarms setpoint when oxygen level drops below 10%

Table 2: Features of Honeywell Gas Detectors

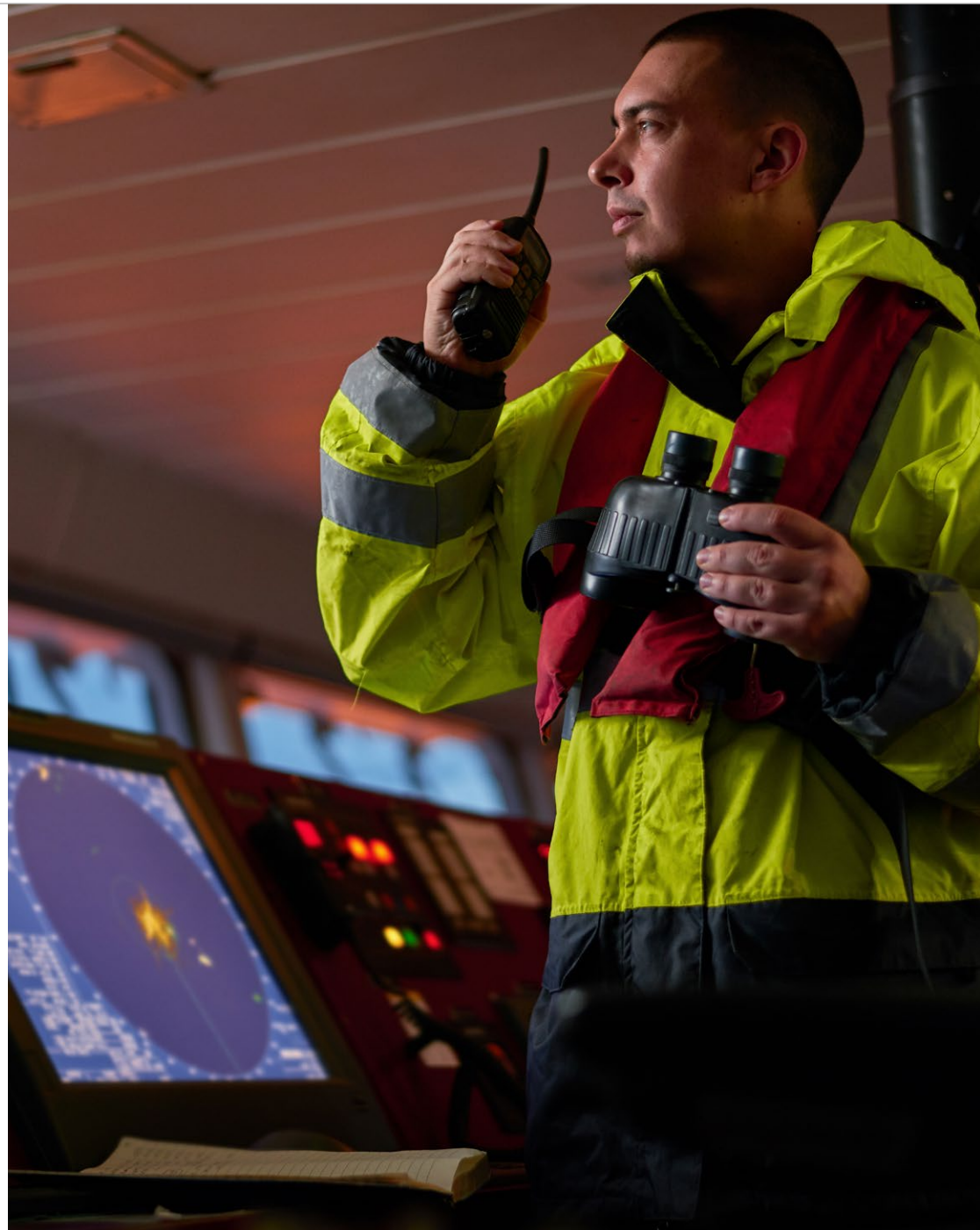


CONCLUSION

The marine industry is growing as more vessels enter the market every year. These ships transport vast quantities of hazardous materials, including fumigation and insecticides for food products. Stringent safety standards govern the industry, and marine workers need portable and fixed gas detection systems to help protect them from toxic and flammable gases.

Honeywell's range of gas detection products meets the robust requirement of the industry. Their sensor technology is robust and offers long life, while installation and maintenance processes are simple and cost-effective. They link to smartphone apps, making calibration and diagnostics simple.

To learn more about how Honeywell can help you optimize your gas detection system **click here**



1 Fortune Business Insights, Marine Vessel Market Size, Share, and COVID-19 Impact Analysis, July, 2021 [Accessed August 15, 2022]
2 Statista, Number of ships in the world merchant fleet as of January 1, 2021, by type, January, 2021 [Accessed August 21, 2022]
3 IMO, International Maritime Organization, 2022 [Accessed October 12, 2022]
4 ISO, ISO 19891-1:2017 [Accessed October 12, 2022]
5 IMORULES, Chapter XI-1 - Special measures to enhance maritime safety [Accessed October 17, 2022]
6 IMO, History of SOLAS fire protection requirements, 2022 [Accessed October 17, 2022]
7 Official Journal of the European Union, DIRECTIVE 2014/90/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 July 2014 on marine equipment and repealing Council Directive 96/98/EC, August 28, 2014 [Accessed October 12, 2022]
8 LR, Lloyd's Register, 2022 [Accessed October 12, 2022]
9 DNV, Det Norske Veritas, 2022 [Accessed October 27, 2022]
10 Bureau Veritas, Bureau Veritas, 2022 [Accessed October 27, 2022]

For more information
https://honeywell.com

Honeywell_Marine_eGuide | 11/22