

Subject Follow up to recommendations *Safe container transport north of the Wadden Islands. Lessons learned following the loss of containers from MSC ZOE.*

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1. About this report

In the night of 1 to 2 January 2019, the Panamanian container ship MSC ZOE lost 342 containers on the North Sea, north of the Dutch Wadden area. The beaches of the Wadden Islands and the coastline of Friesland and Groningen were strewn with the contents of the containers.

The investigation into the course of events leading up to the occurrence involving the MSC ZOE was undertaken in accordance with the regulations of the International Maritime Organization (IMO) and EU Directive 2009/18/EC. The investigation bodies of the affected States Panama, Germany and the Netherlands carried out the investigation jointly. The results and recommendations of this investigation appear in the international report into the course of events.

The loss of containers from the MSC ZOE led to large-scale (plastic) pollution in the North Sea and the Wadden area in the Netherlands (and Germany). The question emerged what the Netherlands can do to prevent accidents of this kind. In response, in addition to the international investigation, the Dutch Safety Board launched an investigation into the risks of large-scale loss of containers from large container ships like the MSC ZOE on the international shipping routes north of the Dutch Wadden Islands.

The Safety Board concluded that the Wadden area requires better protection against the loss of containers on the shipping routes that pass the islands, to the north. The investigation also showed that large and wide container ships operating in storm-force northwesterly winds run the risk of failure of the lashing systems and containers, and that as a consequence the ships can lose containers, on both the northern and southern shipping route.

This risk is the consequence of a combination of a number of hydrodynamic phenomena. In storm-force northwesterly winds, vessels are confronted with high athwartships waves. As a consequence, large, wide container ships make extreme rolling movements. On the relatively shallow southern shipping route, there is also a risk of seabed contact due to the combination of vertical and horizontal ship movements. In addition, waves can slam against the ship, and seawater from waves can spray upward at high speed along the side of the ship, against the containers (a phenomenon known as green water). Individually and in combination, these phenomena cause extreme forces to act on the ship, the containers and the lashing systems with which the containers are secured. As a consequence, containers can break free and be washed overboard.

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Interim warning

When it became clear during the investigation that wide large container ships sailing in severe weather conditions run the risk of bottom contact on the southern shipping route above the Wadden Islands, the Dutch Safety Board issued an interim warning in October 2019. The warning referred to the risk of ships of comparable dimensions to the MSC ZOE coming into contact or near contact with the seabed on the southern shipping route in specific wind and wave conditions.

Immediately following the issuing of the warning, the Dutch Minister of Infrastructure and Water Management called upon the Netherlands Coastguard to announce the warning in the form of a note on the electronic sea charts and in the event of specific wind and wave conditions and tide situations, to broadcast a report to shipping. Since 1 November 2019, the Netherlands Coastguard has been transmitting navigation reports to shipping informing vessels about the warning. These notices to shipping have been further extended, since that time. Depending on the actual wave height, via VHF marine radio, container ships of a specific type are actively contacted and the Netherlands Coastguard advises those vessels travelling from the Dutch side (sailing in an easterly direction) and wishing to follow either the northern or southern shipping route, on the shipping route to be followed.

International approach to prevent the loss of containers

In its report, the Dutch Safety Board concluded that minimizing the risk of loss of containers on the two shipping routes north of the Wadden Islands required an integrated approach from all parties involved, the container shipping sector, the IMO and the Dutch government, where necessary in collaboration with the Wadden States Germany and Denmark. In the international investigation into the course of events of the occurrence involving the MSC ZOE, and the investigation by the Dutch Safety Board into the risks on the shipping routes north of the Wadden Islands, recommendations were issued to prevent the loss of containers near the Wadden area. The recommendations from both investigations must be considered in combination.

In its report, the Dutch Safety Board issued six recommendations: five to the Dutch Minister of Infrastructure and Water Management and one to Maritime by Holland (Nederland Maritiem Land) and the Royal Association of Netherlands Shipowners (KVNR). The recommendations relate to the international approach for preventing the loss of containers, the approach in the Netherlands in the short term and an improvement of the understanding of the route-specific risks north of the Wadden Islands.

On 26 November 2020, the Dutch Minister of Infrastructure and Water Management responded to the recommendations. The Royal Association of Netherlands Shipowners responded on 8 June 2021. Maritime by Holland has not published a position in response. The full text of the reactions is available on the website of the Dutch Safety Board.

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For the purposes of this memorandum, the following documents were also consulted:

- Cabinet response to Dutch Safety Board report MSC ZOE (26 November 2020);
- progress letter to the Dutch House of Representatives on implementation of recommendations from the Dutch Safety Board report MSC ZOE (26 May 2021);
- minutes of the Dutch House of Representatives 'Maritime' committee debate on 2 June 2021;
- letter of introduction to the Minister of Infrastructure and Water Management accompanying the investigation by MARIN into the hydrodynamic effects that can play a role on Panamax and feeder container ships (26 October 2020).

This memorandum contains a general conclusion about the follow-up to the recommendations, followed by a short summary of the responses received to each recommendation and a conclusion about the follow-up of that recommendation.

The report concludes with a brief consideration of the recommendations from the international investigation.

2. General conclusion about follow-up

The primary objective of the recommendations is to minimize the risks of loss of containers on the two shipping routes north of the Wadden Islands. The Dutch Safety Board focused its attention on what parties in the Netherlands can do to achieve this objective, both at national and international level.

The response from the Dutch Minister of Infrastructure and Water Management to the recommendations and the related documents (progress letter, investigation reports) show clearly that the Minister has already followed up or intends to follow up on the majority of elements of the recommendations.

The international approach required to better manage the risks of loss of containers based on measures via the IMO will be a process of years, as noted by the Safety Board in its report. This is also reflected in the response from the Minister. In collaboration with Germany, Denmark and other EU Member States, the Minister has taken a series of international actions and initiatives aimed at preventing the loss of containers near the Wadden Islands, but many of the proposed measures can only be implemented in 2022 or 2023. A broader analysis of the extent to which international regulations may have lagged behind the process of upscaling in container shipping will in all probability require even longer to implement.

In appealing to the PSSA¹ status of the Wadden area in proposals for protective measures within the IMO, the reaction from the Minister reveals a relatively limited view as concerns possible measures for protecting a PSSA area as put forward in the recommendation. The guidelines from the IMO for PSSAs do offer possibilities for further types of measures, beyond

¹ PSSA stands for Particularly Sensitive Sea Area. This is a sea area designated by the IMO as particularly sensitive. This kind of international recognition of an area as PSSA represents a vital basis for arriving at additional protective measures, via the IMO.

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merely adjusting technical standards. One of the protective measures referred to as a possibility is: 'adoption of ships' routeing and reporting systems near or in the area'.² The Safety Board suggests that the Minister should consider reinforcing the proposals on this point, within the IMO.

In line with the recommendations, at national level, the Minister has initiated various actions. Shipping companies and masters of large container ships are for example now informed of the four hydrodynamic phenomena that emerged in the investigation, on the two shipping routes near the Wadden Islands. The same applies to route-specific risks for other types of container ships (Panamax and feeder vessels) which were revealed by the MARIN investigation commissioned by the Ministry. The Netherlands Coastguard informs container ships of the wave period and wave direction during stormy conditions and actively contacts certain types of container ships. Within that process, masters of large container ships are advised to take the northern route. In addition, the Minister has commissioned and is continuing to commission further investigations into other as yet unrecognized risks of loss of containers on the northern and southern shipping routes north of the Wadden Islands.

Because it will certainly take several more years before a number of concrete results are achieved, the Safety Board encourages the Minister over the coming years to remain active in realizing the objectives of the recommendations at both national and international level. In that connection, it is important to not lose sight of the relationship with the follow-up to the recommendations from the international investigation.

At national level, one key point for attention in the short term is to both formally and financially reinforce the position of the additional Coastguard tasks with regard to informing and advising shipping with a view to minimizing the risks of loss of containers.

The recommendation to the Royal Association of Netherlands Shipowners (KNVR) has been actively followed up on with regard to initiatives on an international level. However, before they deliver the intended results in the form of international regulations, further time will be required. The Safety Board continues to encourage the KVNR to employ its leading role in its attempts alongside all other stakeholders to arrive at principles and industry standards ahead of the introduction of international regulations, that promote the safety of container transport.

3. Follow-up per recommendation

Recommendation 1

To the Minister of Infrastructure and Water Management

In collaboration with the Wadden States Germany and Denmark, take the initiative for a specific proposal to the IMO with measures for international container shipping to prevent

² International Maritime Organization, *Resolution A.982(24), Revised Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas*, i.e. section 6, 6 February 2006.

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the loss of containers on both shipping routes north of the Wadden Islands. This can for example take the form of a review of technical standards, the introduction of restrictions, recommended routes, precautionary areas, traffic control and/or information provision. Make particular use of the status of the Wadden Sea as a Particularly Sensitive Sea Area (PSSA) and the possibilities within the IMO standards for taking measures to protect a PSSA. Make use of the outcomes of this investigation and other investigations into route-specific risks (see also recommendation 5).

Response

The Minister of Infrastructure and Water Management is working alongside Germany and Denmark on a proposal to the IMO on an adjustment of the existing routing measures north of the Wadden Islands. The recording of shipping routes will be supplemented with a recommendation from the Maritime Safety Committee of the IMO on the risk of loss of containers. This recommendation will then be published in the form of an IMO circular and included in the IMO's Ships' Routing Guide, an international nautical publication used by crews in route preparation. According to the Minister, experience has shown that IMO recommendations of this kind tend to be well complied with. The earliest date for discussion of the proposal within the IMO is the spring of 2022, and according to the Minister, it could become effective at the start of 2023.

With regard to the use of the PSSA status of the Wadden area, the Minister has pointed out that in identifying protective measures, the status of the Wadden area as a PSSA can only be used if the measure relates directly to this area, and if it can be linked to existing IMO standards. According to the Minister, this is not the case for a measure aimed at altering general technical IMO standards for container ships.

In May 2021, together with Germany, the Minister submitted a proposal to the IMO for an obligation on all container ships to install equipment that makes it possible to determine the precise angle of inclination during stormy conditions. This will improve the information position of the crew. The proposal will be discussed by the IMO in October 2021.

With regard to international regulations on the design of large container ships, the Minister has expressed his willingness to urge a broader analysis of the extent to which international regulations may have lagged behind the increase in scale in container shipping. Following the accident involving the MSC ZOE, a series of incidents have occurred around the world involving large-scale loss of containers, which justify just such a discussion. To help move this discussion forward, in October 2021, the Netherlands will be submitting an information document to the IMO. In addition, within the IMO, supplementary criteria focused among others on stability problems of large ships were approved during the meeting of the Maritime Safety Committee in November 2020. These criteria promote a uniform international level of safety for ships that experience stability problems. The Minister has expressed his intention to call for these criteria to be made obligatory, in the IMO.

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During an IMO meeting in May 2021, a proposal submitted by the Minister (together with other EU Member States) for the development of measures for the detection and reporting of lost containers, was approved. This will be further elaborated within the IMO over the next two years.

Moreover, according to the Minister, the European Commission has announced its intention (in collaboration with the Netherlands and other interested Member States) to investigate whether a type inspection for twist locks and lashing rods could bring about an improvement. Discussions will be held on this subject with other Member States, in the Autumn of 2021.

In 2020, the Minister commissioned MARIN to carry out a further investigation into the hydrodynamic effects that can play a role in respect of two smaller types of container ships (Panamax and feeder) than the large container ships such as the MSC ZOE. According to the Minister, the investigation will provide a better insight into the behaviour of different types of container ships on the routes north of the Wadden Islands in adverse weather conditions. The results of the investigation will among others be used for initiatives submitted by the Netherlands to the IMO (see also recommendation 2 below) and for issuing advice to the Netherlands Coastguard (recommendation 3 below).

Conclusion on follow-up

The recommendation is broadly being followed up on. Whether the initiatives within the IMO will actually contribute to minimizing the risks of loss of containers will only become clear once the presented proposals have been adopted and implemented.

In appealing to the PSSA status of the Wadden area in proposals for protective measures within the IMO, the response from the Minister reveals a relatively restricted view of the possible measures. The recommendation is not only aimed at adjusting general technical IMO standards for container ships. For other types of measures, such as imposing restrictions, recommended routes, traffic control and/or information provision, the PSSA status of the Wadden area could also be used. The IMO guidelines for the designation and protection of a PSSA expressly offer the necessary opportunities. One of the protective measures referred to as a possibility is: 'adoption of ships' routing and reporting systems near or in the area'.³ The Safety Board recommends considerably reinforcing the proposals from the Netherlands to the IMO, on this point.

Recommendation 2

To the Minister of Infrastructure and Water Management

Inform shipping operators and masters of large container ships in a structural manner about the four hydrodynamic phenomena that emerged from this investigation, which can occur in

³ International Maritime Organization, *Resolution A.982(24), Revised Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas*, i.e. section 6, 6 February 2006.

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the even of athwartships high waves on both shipping routes north of the Wadden Islands. In providing this information, also make it clear that these phenomena and combinations of these phenomena can generate forces on large, wide and stable container ships which can result in the loss of containers. If further route-specific risks emerge from other investigations, operators and captains should also be immediately informed of those outcomes.

Response

In her response, the Minister indicated that shipping companies and masters are currently informed of the four hydrodynamic phenomena, via various channels. Since 31 October 2019, the Netherlands Coastguard has been issuing advice to large container ships in specific weather conditions, on the basis of the interim warning from the Safety Board. Since the start of November 2020, the Netherlands Coastguard has been advising container ships of the type Panamax and feeder⁴ on the basis of the supplementary MARIN investigation commissioned by the Minister. The Coastguard has also included a warning on the risks of loss of containers in sea charts and nautical publications.

The Minister will also be disseminating the outcome of the supplementary MARIN investigation via the Royal Association of Netherlands Shipowners (KNVR), the Netherlands Association of Merchant Shipmasters, the International Chamber of Shipping and the International Federation of Shipmasters' Association, to the shipping companies operating (large) container ships. Finally, in collaboration with Germany and Denmark, the Netherlands will be preparing an abstract of the outcomes of the supplementary MARIN investigation for a number of leading international nautical publications, and the results of the supplementary MARIN investigation will be published within the IMO.

Conclusion on follow-up

The recommendation is being followed up on.

Recommendation 3

To the Minister of Infrastructure and Water Management

Grant the Coastguard the tasks, authorities and resources it needs to monitor container ships so that ships can sail safely past the Wadden Islands in all wave and weather conditions. With this in mind, investigate the possibilities for traffic control of container ships, such as establishing a VTS area, actively disseminating warnings to shipping about prevailing weather and wave conditions in the Dutch part of the North Sea and innovate the way such information is provided. Involve the Coastguard and Rijkswaterstaat in defining

⁴ Panamax: typical length 278 metres, width 32 metres; feeder: typical length 163 metres, width 27 metres. By way of comparison: the MSC ZOE is 395 metres long and 59 metres wide.

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this role and responsibility. Also seek cooperation and/or harmonization with Germany on the intended tasks.

Response

The Minister has indicated that the Coastguard has improved the provision of information to container shipping. See also the response to recommendation 2. According to the Minister, the advice from the Coastguard is well complied with. Since October 2020, the Coastguard has been sending specific information to shipping via NAVTEX⁵, regarding wave period and direction in adverse weather conditions.

Since the interim warning from the Dutch Safety Board regarding seabed contact by large container ships on the southern route above the Wadden islands, if wave heights exceed five metres, the Dutch Coastguard has been actively contacting large container ships. Within that process, masters of large container ships are advised to take the northern route. In response to the supplementary report by MARIN (see also recommendations 1, 2 and 5), which also considered container ships of the type Panamax and feeder, these recommendations have been further tightened up and extended, on the basis of the initial restrictive wave heights derived by MARIN, in its report.

According to the Minister, the warning of container ships is a new and additional task for the Coastguard, which for the time being must be undertaken within the existing capacity. At present within the restraints of the existing capacity, the Coastguard is working hard to actively warn feeders sailing in an easterly direction, as far as possible.

In consultation with the Netherlands Coastguard and Rijkswaterstaat, the Minister has commissioned an investigation into the possibilities of traffic control for container ships. Harmonization with the methods employed in Germany and Denmark will also be considered. The investigation is also aimed at other parts of the North Sea area, also given the rise in the number of wind farms on an increasingly busy North Sea. The investigation is still currently underway. The Minister will issue a statement on the results, at the end of 2021.

The Minister has also initiated discussions with Germany and Denmark about the measures needed to improve the safety of container shipping above the Wadden area. In response, Germany has indicated that it issues warnings to shipping travelling in a westerly direction, in line with the warnings issued by the Netherlands Coastguard. Germany has confirmed that these notices have been issued since the end of November 2020. Since the start of 2021, warning notices are not only issued to large container ships like the MSC ZOE and the Panamax type, but also to smaller container ships (feeders).

Conclusion on follow-up

⁵ NAVigational TEXt Messages is an international automatic radio telex service for transmitting maritime safety messages such as navigation and meteorological and weather warnings from coastal stations, to shipping.

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The recommendation has not (yet) been followed up on. The investigation into the possibilities of traffic control for containers ships will in the future indicate to what extent the Coastguard can actually effectively offer guidance to ships, to enable them to sail safely past the Wadden Islands in all wave and weather conditions. It also as yet remains unclear whether the additional tasks of the Netherlands Coastguard have or will be formally confirmed, and to what extent the Coastguard will receive additional resources for implementing those tasks. According to the Minister, the appropriate capacity for the Coastguard will only be determined once the MARIN investigation into the effects of green water on feeders has been concluded.

Recommendation 4

To Maritime by Holland (Nederland Maritiem Land) and the Royal Association of Netherlands Shipowners (KVNR)

Actively communicate the lessons learned from this investigation and the international investigation into the course of events and in your national and international networks, take up a pioneering role in reaching agreement on and disseminating the principles and industry standards that promote the safety of container transport close to the Wadden area.

Response from Maritime by Holland

No position has yet been received in response to the recommendation.

Response from the Royal Association of Netherlands Shipowners (KVNR)

In its letter of response, the KVNR indicated that it has actively communicated and discussed in detail the lessons learned from the investigation by the Dutch Safety Board and the international investigation into the course of events, with the Dutch shipping companies affiliated to the KVNR. The KVNR has also held international discussions with the other shipowners' associations that received a recommendation in the international investigation, namely the International Chamber of Shipping (ICS) and the World Shipping Council (WSC). The KVNR also reported on a number of international initiatives taken with support from the KVNR.

1. A proposal from the WSC in 2019 to the IMO on the need to harmonize the requirements laid down in the international agreement on container safety (CSC Convention) and ISO standard 1496-1 regarding the stacking strength of containers.
2. In 2020, together with the ICS and a number of IMO member states, the WSC submitted a proposal to the IMO on a worldwide compulsory reporting system for containers lost overboard.
3. The ICS and WSC worked alongside the ISO on revising the ISO standard for securing equipment and the corner points of containers.

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4. With the support of the KVNR, in 2021, together with Germany, France and the Netherlands, the ICS submitted a proposal to the IMO regarding an obligation to equip new container ships and others with an electronic inclinometer.
5. The KVNR brought to the attention of and discussed with the ICS and WSC the 'Joint Industry TopTier - Securing container safety at sea', initiated by MARIN. The aim of TopTier is to improve the reliability of the safety of container transport by the existing fleet, and to generate the technical insights necessary for safe designs and innovations, for the future.

Conclusion on follow-up

The recommendation is being followed up on. The response from the KVNR shows that the KVNR has adopted an active role in disseminating the lessons and that international initiatives are being implemented in line with the recommendation. The Dutch Safety Board encourages the KVNR to also fulfil its leading role in ensuring that initiatives are taken at international and national level aimed at reducing the risk of loss of containers in the Wadden area, as far as possible. This could for example be achieved by agreeing on industry standards that contribute to improved safety.

Maritime by Holland has not yet published an official position with regard to the recommendation. Indications from Maritime by Holland following publication of the report that the recommendation would perhaps have been better addressed to the Dutch manufacturing industry in no way detract from the fact that Maritime by Holland could also have played a role. The Dutch Safety Board also refers in that respect to the obligation contained in the Dutch Safety Board Act that requires parties to notify how they intend to follow up on recommendations issued⁶.

Recommendation 5

To the Minister of Infrastructure and Water Management

Investigate the extent to which the route-specific risks of loss of containers on the shipping routes near the Wadden Islands as referred to in this report can occur in different types of container ships and in different meteorological and maritime conditions. In this investigation, include all incidents and other signals which could suggest other as yet unrecognized risks of loss of containers on the specific shipping routes.

Response

The Minister made it known that the following investigations have been or are still to be undertaken:

⁶ Dutch Safety Board Act, Article 74.

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- supplementary investigation by MARIN into how container ships with smaller dimensions than the type of the MSC ZOE respond in storm conditions north of the Wadden Islands (September 2020);
- a risk analysis by Rijkswaterstaat of the loss of containers on the North Sea (September 2020);
- investigation into the effect of green water on feeders (investigation still currently underway).

In her progress letter dated 26 May 2021, the Minister also announced that in its supplementary investigation, MARIN had made it known that it had already derived initial restrictive wave heights. Further research will be needed to determine definitive restrictive wave heights. Once all the definitive restrictive wave heights have been determined, according to the Minister, the recommendations to shipping will be reconsidered.

Conclusion on follow-up

The recommendation is being followed up on.

Recommendation 6

To the Minister of Infrastructure and Water Management

Make a periodic risk analysis of the route-specific risks that can lead to loss of containers on the shipping routes close to the Wadden Islands, with a view to the safety of shipping and protection of the North Sea and the Wadden area, and include this analysis as a fixed element of North Sea policy. Under all circumstances, make use of a system of monitoring and analysis of sea shipping occurrences and near occurrences on these shipping routes. Also include developments in shipping such as economies of scale, changes in the picture of shipping traffic and (future) changes to infrastructure and area activities on the North Sea.

Response

The Minister has made it known that following the accident with the MSC ZOE, she instructed Rijkswaterstaat to carry out an additional risk analysis specifically with regard to the loss of containers on the North Sea and the routes above the Wadden Islands (see recommendation 5). This analysis will also consider various incidents involving loss of containers worldwide, and the effects of increasing the size of container ships. According to the Minister, the container transport risk analysis will be repeated every five years, to ensure that developments in container shipping and in other (spatial) developments that could result in possible changes to the outcome of the risk analysis are identified in good time. With regard to the effects of (future) changes to infrastructure and area activities on the North Sea, see recommendation 3.

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The Minister also reported that she will encourage the IMO to analyse more broadly the extent to which international regulations may have lagged behind the upscaling of container shipping. According to the Minister, in particular the report of the international investigation raised questions as to whether over the past 20 years these requirements (as laid down by the IMO) have kept up with the expansion of the scale of container transport by sea. Following the accident involving the MSC ZOE, a series of incidents have occurred around the world involving large-scale loss of containers, which according to the Minister justify such a discussion. To help move this discussion forward, in October 2021, the Netherlands will be submitting an information document to the IMO.

Conclusion on follow-up

The recommendation is being followed up on.

4. Recommendations from the international investigation into the occurrence involving the MSC ZOE

In the international report⁷, recommendations were made to the Panamanian, German and Dutch governments, to revise the technical requirements imposed on container ships, within the IMO. More specifically the requirements relating to:

1. the design limits imposed on cargo securing equipment and containers;
2. the requirements relating to loading and stability of container ships;
3. obligations relating to the instruments that offer an insight into accelerations and oscillations;
4. the technical possibilities for detecting loss of containers.

The investigation also issued recommendations to the German and Dutch governments to join Denmark in investigating the necessity for additional measures on the shipping routes north of the Wadden Islands, or changes to the routes, and on that basis submitting a proposal to the IMO.

The shipping company of the MSC ZOE was also instructed to explicitly draw the attention of crews sailing in this area to the route-specific risks, and to equip and load their ships in such a way that the loss of containers is prevented.

Finally, the international maritime sector was called upon via the World Shipping Council and the International Chamber of Shipping to actively communicate the safety lessons from the investigation and to take the lead in drafting safety requirements and in the innovation of ship design and container transport, in order to minimize the risk of loss of containers, also in conditions such as those occurring near the Wadden area.

⁷ The recommendations appear in the report into the course of events that was produced by the international investigation. The full report is available on the websites of the Dutch Safety Board and the Federal Bureau of Maritime Casualty Investigation (BSU).

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For the complete text of the recommendations, see appendix 1.

Compliance with the recommendations

At the start of 2021, the governments of Germany and the Netherlands, MSC, the World Shipping Council and the International Chamber of Shipping responded to the recommendations issued to them. The Dutch Safety Board will join the Federal Bureau of Maritime Casualty Investigation (BSU) and the Panama Maritime Authority in analysing the follow-up of the recommendations, and will duly be issuing a separate publication.

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APPENDIX 1 Recommendations international investigation occurrence MSC ZOE

Loss of containers overboard from MSC ZOE - 1-2 January 2019 (publication 25 June 2020)

Recommendations

The Merchant Marine General Directorate, Panama, the Dutch Safety Board, Netherlands, and the German Federal Bureau of Maritime Casualty Investigation (BSU), Germany, make the following recommendation to **their responsible administrations** in their capacity as representative of the flag states in the various committees of the IMO:

1.1. Revise the existing technical and legal regulations for container ships regarding the design limits of cargo securing equipment, approved loading and stability conditions and the consideration of shallow water effects and speed on ship motions and resulting accelerations and forces. In doing so, especially the following provisions and aspects are to be taken into account:

- IS-Code (Off-design stability conditions for very large containerships and Second Generation Intact Stability started in May 2020)
- Code of Safe Practice for Cargo Stowage and Securing for very large containerships Container safety convention (CSC) and ISO 1496-1 Freight containers - Specification and testing respectively
- IMO Circular MSC.1/Circ. 1228 dated 11 January 2007, Revised guidance to the master for avoiding dangerous situations in adverse weather and sea conditions whether it works at all sea conditions.
- Stability booklet, include that all loading conditions should be checked on high accelerations/forces.
- Cargo securing manual, include design limits of the cargo securing equipment in accordance to the design accelerations.

In doing so, the aforementioned authorities should act in such a way that results attained by existing international working groups are incorporated.

1.2. Generate an obligation on all container ships

1.2.1. to install electronic inclinometers or similar (inertia) systems to measure and display this information in real-time to the captain/crew, and

1.2.2. to install sensors on critical locations on the ship in order to measure accelerations and to provide this information in real-time to the captain/crew in order to allow them to monitor these;

1.2.3. and for ships with mandatory equipped VDR to record actual roll angle, roll period and accelerations for the purpose of safety investigations.

1.3. Evaluate and assess possible technical solutions that can assist the captain/crew in the detection of the loss of containers and propose international standards for implementation of such solutions.

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2. The Merchant Marine General Directorate, Panama, the Dutch Safety Board, the Netherlands, and the Federal Bureau of Maritime Casualty Investigation (BSU), Germany, make the following recommendation to **the responsible administrations of The Netherlands and Germany**, in their capacity as responsible authorities for the conservation and protection of the Wadden Sea to, in cooperation with the Trilateral Wadden Sea Cooperation:

- Ascertain whether the existing tracks of the German Bight Traffic Separation Schemes north of the Wadden Sea have to be adapted, or measures have to be taken particularly for large containerhips to maximize the safety of the voyage on the sailing routes. In doing so, the following aspects and hydrodynamic phenomena have to be taken into account:
 - Extreme ship motions and accelerations;
 - Ships speed;
 - Green water effects;
 - Slamming;
 - Possibility of contact with the seabed;
 - Status of the Wadden Sea as Particularly Sensitive Sea Area (PSSA).

If determined that adaptation is necessary or measures have to be taken, the responsible administrations in their capacity as representative of the flag states in the various committees of the IMO, should propose an amendment and/or measures for the above mentioned existing tracks.

3. The Merchant Marine General Directorate, Panama, the Dutch Safety Board, Netherlands, and the Federal Bureau of Maritime Casualty Investigation (BSU), Germany, make the following recommendation to **the ship owning company MSC**:

- In the construction and operation of ships, reduce high acceleration forces, which can cause damage to crew, passengers and cargo, by installing e.g. bilge keels or anti-roll tanks or stabilizers or setting operational stability limits e.g. by limiting the operational GM.
- Raise awareness and develop guidelines to the Masters and Navigational Officers on sailing with a high stability and the hydrodynamic phenomena that may be encountered in the sailing routes north of the Wadden Sea.

4. The Merchant Marine General Directorate, Panama, the Dutch Safety Board, Netherlands, and the Federal Bureau of Maritime Casualty Investigation (BSU), Germany, make the following recommendation to **the World Shipping Council and the International Chamber of Shipping**:

- Communicate actively the lessons from this safety investigation;
- Propagate industry standards and principles that will increase the safety of container transport;
- Start an initiative for innovation in ship design, to work towards hull and/or lashing system designs that are better suited for the conditions as described in this report.