



# United States Coast Guard

## MISLE Incident Investigation Report For

GOLDEN RAY - Capsizing

On 08Sep2019 01:30:00 L



MISLE Activity Number: 6807910  
MISLE Case Number: 1191160



16732  
SEP 12 2019

## MEMORANDUM

From: [REDACTED]  
J. A. Passarelli, CAPT  
CGD SEVEN (des)

To: B. E. Welborn, CAPT  
CGD Eight (Dw)

Subj: FORMAL MARINE CASUALTY INVESTIGATION CONCERNING THE CAPSIZING AND  
FIRE OF THE RO/RO GOLDEN RAY WHILE TRANSITING ST. SIMONS SOUND,  
GEORGIA ON 08 SEPTEMBER 2019.

Ref: (a) Title 46 United States Code, Chapter 63  
(b) Title 46 Code of Federal Regulations, Part 4  
(c) COMDINST M16000.10, Volume V

1. Pursuant to the authority contained in reference (a) and the regulations promulgated under reference (b), you shall commence, as soon as practicable, a formal marine casualty investigation into the capsizing and fire of the RO/RO GOLDEN RAY while transiting St. Simons Sound, Georgia on 08 September 2019.

2. Representatives from the Marshall Islands government and the Korean Maritime Safety Tribunal have requested to participate in this investigation as Substantially Interested States, and are authorized to do so. LCDR Salomee Briggs and LT Peter Link are assigned as legal counsel for this investigation. LT Stephanie Moore is assigned as Recorder. In addition, the following Coast Guard personnel are assigned to assist you:

- a. Mr. [REDACTED] CG INV NCOE
- b. Mr. [REDACTED] MSU Savannah

3. The National Transportation Safety Board (NTSB) is also charged with the responsibility of determining the cause or probable cause of this casualty by the Independent Safety Board Act of 1974 (49 U.S.C. 1901, et. seq.) and may designate representative(s) to participate in this investigation. The NTSB representative(s) may make recommendations regarding the scope of the inquiry, may identify and examine witnesses, and/or submit or request additional evidence.

4. You will thoroughly investigate the matter in accordance with the provisions found in references (a) through (c), and you shall engage technical subject matter experts from the Investigations National Center of Expertise (INCOE), Marine Safety Center, NTSB, and other agencies as appropriate. More specifically, you will determine the following:

- a. The cause of the marine casualty.
- b. The adequacy of response resources including rescue, salvage and pollution.

Subj: FORMAL MARINE CASUALTY INVESTIGATION  
CONCERNING THE CAPSIZING AND FIRE OF THE  
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- c. The adequacy of Aids to Navigation and other waterway factors.
- d. The effectiveness of the Safety Management System.
- e. Whether there is evidence that any failure of material (either physical or design) was involved or contributed to the casualty, so that proper recommendations for the prevention of the recurrence of similar casualties may be made.
- f. Whether there is evidence that any act of misconduct, inattention to duty, negligence or willful violation of the law on the part of any person holding a Coast Guard credential contributed to the casualty, so that appropriate proceedings against the credential of such person may be recommended.
- g. Whether there is evidence that any Coast Guard personnel or any representative or employee of any other government agency or any other person caused or contributed to the cause of the casualty.
- h. Whether the present regulatory framework, as applied to this and similar vessels, provides an adequate measure of safety.

5. Upon conclusion of the investigation, you will submit your completed investigative report to the Commander, Seventh Coast Guard District with the collected evidence, established facts, conclusions and recommendations within 12 months of the convening date and provide monthly progress reports. You are encouraged to submit interim recommendations intended to prevent similar casualties, if appropriate, during the course of your investigation. Your report will be submitted to Commandant (CG-INV) through the Seventh Coast Guard District Prevention Division (dp) and Commander, Seventh Coast Guard District.

6. District Seven will arrange funding, technical assistance, and administrative support, as may be required and within the scope of this investigation. When deemed appropriate for the proper and orderly functioning of this formal investigation, the District Commander is authorized to negotiate for commercial court reporting services pursuant to 10 USC 2304(a)(4). This authorization satisfies the requirements of USCG Procurement Regulations 11-3.204(b)(1) for Commandant (CG-85) approval prior to negotiation of contracts for personal and professional services. If district funds are not available, comply with the Manual of Budgetary Administration, COMDTINST M7100.3.

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Copy: MSU Savannah (S) Sp)  
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CGD Seven (dp) (dl)  
CGD Eight (dcs)  
LANTAREA (LANT-54)  
COMDT (CG-INV)  
COMDT (CG-0941)

U.S. Department of  
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16732/IIA # 6807910  
02 Jul 24

## THE CAPSIZING OF THE MARSHALL ISLANDS FLAGGED ROLL ON - ROLL OFF VESSEL GOLDEN RAY (IMO 9775816) WHILE OUTBOUND ON THE BRUNSWICK RIVER IN ST. SIMONS SOUND, GEORGIA ON SEPTEMBER 8, 2019

### ACTION BY THE COMMANDANT

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations, are approved subject to the following comments. This marine casualty investigation is closed.

### ACTION ON RECOMMENDATIONS

**Recommendation 1:** Recommend Commandant work with the International Maritime Organization (IMO) to amend Safety of Life at Sea (SOLAS) II-2/13.4.2.1 to require the two means of escape from the engine room to be on opposite sides and ends of the space. This will reduce the possibility of both means being blocked at the same time, as was the case in this incident.

Further, recommend Commandant review 46 Code of Federal Regulations (CFR) § 116.500 for a similar requirement on U.S.-flagged vessels.

**Action:** I concur with the intent of this recommendation. The SOLAS regulations and Title 46 CFR adequately address means of escape from fires. However, whenever feasible, and with careful consideration to subdivision and stability, the locations of means of escape should be considered to be situated on opposite sides of the vessel to reduce the risk of entrapment. The Coast Guard Office of Office of Design and Engineering Standards (CG-ENG) will work with the Coast Guard's Marine Safety Center (MSC) to consider issuing recommendations and guidance to vessel designers.

**Administrative Recommendation 1:** Recommend that Commandant concur with the recommendations surrounding the search and rescue for this incident included in Section 5 of Appendix A (SAR Study) and those entities identified for action should consider their implementation.

**Action:** In consultation with the Assistant Commandant for Response Policy (CG-5R), I partially concur with this recommendation. The Office of Search and Rescue (CG-SAR) reviews all case studies that are submitted. All recommendations made in Appendix A of

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the report of investigation will be reviewed and adjudicated in accordance with COMDTINST 16130.2(series). A final action memorandum will be drafted to address each specific recommendation.

**Administrative Recommendation 2:** Recommend that the Commandant concur with the recommendations surrounding the initial pollution response and salvage included in Section 6 of Appendix B and those entities identified for action should consider their implementation.

**Action:** Appendix B refers to the Pollution and Salvage study. This study resulted in 11 recommendations which are individually answered below:

**Pollution & Salvage Study Recommendation 1:** The Office of Emergency Management and Disaster Response (CG-OEM) should work with (CG-SAR) and the Office of Marine Environmental Response Policy (CG-MER) to use this case to further refine the organizational structure in complex cases using Incident Command Systems (ICS). CG-OEM should also work with the Coast Guard's Incident Response, Emergency and Disaster Management, and the Marine Environmental Response Schools to use this and other cases where there is overlapping jurisdiction for the SAR response and pollution and salvage response, to refine and clarify training that will assist in implementing a Unified Command (UC) that unifies all operations under the umbrella of one UC. In a case like this incident, it could be done by creating a SAR Branch so they could operate independently within the construct of the UC. This would have aided in showing if there were any true resource gaps and encouraged the ordering of additional resources to begin coordinating salvage with pollution response as opposed to in isolation. This also gives a clear chain of command to all people involved in the response which avoids confusion.

**Action:** In consultation with CG-5R, I do not concur with this recommendation. A separate SAR cell is not needed since SAR Groups already exist in the ICS structure. Specifically, SAR Groups already have a presence in the Incident Management Handbook (IMH) and go into more detail in the Mass Rescue situations section. Additionally, creating a separate SAR Cell in ICS outside of the current SAR functions would conflict with standing SAR policies.

**Pollution & Salvage Study Recommendation 2:** CG-OEM should work with Command Cadre Training courses and the Emergency and Disaster Management School to improve the training and clarify expectations for each Sector to have and update a watch quarter station bill (WQSB). Coast Guard District (CGD) Seven Planning and Force Readiness (dx) should work with each unit to ensure they have a WQSB that details expectations for establishing an Incident Management Team (IMT) in the event of catastrophic incidents. There should be multiple scenarios considered when developing a WQSB to ensure the appropriate personnel are in the right positions and not pulled away from something in their expertise to fill a command staff position. Personnel should be trained to fill multiple positions in the IMT to allow maximum flexibility when staffing an IMT. Combining local knowledge with strike team and other specialized deployable forces creates the

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highest percentage for success. Often relationships are built at the local level, and it is important to have local representation throughout the UC. CG-OEM should work with CG-MER to determine the best way to address Coast Guard pollution response administrative functions in an ICS setting. A dedicated, trained Federal On Scene Coordinator Representative (FOSCR) should be identified to conduct all United States Coast Guard (USCG) administrative functions during a response of this magnitude to appropriately document all USCG actions and decisions. Additionally, this person can review the operations and make recommendations to the USCG UC member as their direct representative. This position should be allowed to review all IMT actions, documents, and processes but should be focused on addressing all administrative functions pertaining to USCG support to pollution response operations. This can be done in a variety of ways but will ensure Marine Information for Safety and Law Enforcement (MISLE) database and other documentation is completed appropriately.

**Action:** In consultation with CG-5R, I do not concur with this recommendation. CG-OEM has already promulgated clear guidance for units to establish WQSBs for multiple types of incidents.

**Pollution & Salvage Study Recommendation 3:** CG-OEM should work to establish training and guidance on cases that can create an incident within an incident. CG-OEM should work with LANT and PAC Area to ensure District dx staff work with units to modify Heavy Weather plans during storm season to address ongoing response activities. A storm during a hurricane season is a potential challenge to many responses and Heavy Weather plans should be in place when appropriate. In all instances of this magnitude that could be impacted by heavy weather, a Heavy Weather plan should be created as early as possible and updated as needed. Specific modifications to the plan can be made on a case by case basis but having a good foundation of a plan in place early will keep responders safe and maximize response efforts.

**Action:** In consultation with CG-5R, I do not concur with this recommendation. The Emergency Management Manual Volume I, COMDTINST 3010.11 (series) establishes the required contingencies and update frequency for heavy weather plans.

**Pollution & Salvage Study Recommendation 4:** The Office of Maritime and International Law (CG-LMI) should provide a thorough legal review following the litigation of this case to CG-MER to inform Federal On-scene Coordinators (FOSC) on the outcomes of this case and how they pertain to the FOSC ability to grant Non-tank Vessel Response Plan (NTVRP) deviations. In cases involving complex salvage, it is recommended the UC create a decision point to discuss the change in salvage operations or contractors so they can be alerted to any potential deviations well in advance of contractual end dates. Additionally, if the above mentioned FOSCR position is implemented, they can assist in ensuring that the response adheres to the NTVRP and works to help address any needs to deviate from the plan.

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**Action:** In consultation with CG-5R, I partially concur with this recommendation. A review by CG-LMI may be beneficial in providing insight FOSCs on information to review when considering authorizing a deviation from a vessel response plan.

**Pollution & Salvage Study Recommendation 5:** CGD Seven should work with CG-MER and the Coast Guard Marine Environmental Response School to create a case study regarding the impact of using an Administrative Order in this incident. The use of an Administrative Order is a useful tool in the FOSC's toolbox. It is recommended that these be considered whenever there is hesitation to institute any of the FOSC or their associated staff's recommendations. The use of an Administrative Order should be realistic in the timeframe it recommends and as was exemplified in this response should be willing to consider alternatives that meet the intent of the issuance of the order.

**Action:** In consultation with CG-5R, I concur with this recommendation. Administrative Orders are valuable tools to use by an FOSC. CG-MER will work with the Marine Environmental Response School to develop a case study for the FOSC course and the On-Scene Crisis Communication course.

**Pollution & Salvage Study Recommendation 6:** CG-OEM should work with the Coast Guard Emergency and Disaster Management School to create more thorough debrief process and develop specific training. It is apparent in this case that Coast Guard field personnel had information that was not readily conveyed up to the Marine Safety Unit (MSU) FOSC and in some instances that information could have been used to enact a more efficient response. In ICS training, debriefing is only slightly mentioned and there is a skill to conducting a good debrief, so more training and time spent on this will help all future responses. It is imperative that we do not wait until the end of response to learn lessons and implement improvements.

**Action:** In consultation with CG-5R, I partially concur with this recommendation. CG-OEM works with Coast Guard Training Center (TRACEN) Yorktown and Force Readiness Command (FORCECOM) to conduct reviews of course material and the debriefing process will be reviewed during the course review timelines. Additionally, the CG-IMH is currently undergoing a revision which will improve the debrief and demobilization information provided to responders.

**Pollution & Salvage Study Recommendation 7:** Region 4 Regional Response Team (RRT-4) should work with CGD Seven District Response Advisory Team (DRAT) to document the use of Sphag Sorb in this response. This should provide a foundation of lessons learned to be studied to assist in future responses where this is recommended as a response strategy. RRT-4 and CGD Seven DRAT should review processes and make appropriate modifications to ensure all appropriate response strategies are considered. All response strategies should be considered even if negative political ramifications exist. It does not mean they have to be implemented, but it is the duty of the FOSC to ensure all efforts possible are expended. Decisions not to use a response

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strategy should be appropriately documented in the same manner decisions to use a debated response strategy are documented.

**Action:** In consultation with CG-5R, I concur with this recommendation. No action is required from the Commandant's level for implementation.

**Pollution & Salvage Study Recommendation 8:** CG-OEM should work with the Coast Guard's Incident Response and Emergency Management Schools to improve the function of Air Operations within ICS. Air Operations and the IMT need to have good communications and the information needs to be used in a timely and appropriate manner and this incident provides lessons on why improvement is necessary. There is a variety of advanced technology available to facilitate this process and make it more timely and useful to response operations.

**Action:** In consultation with CG-5R, I partially concur with this recommendation. CG-OEM currently works with TRACEN Yorktown and FORCECOM to conduct reviews of course material and the Air Operations Branch will be reviewed during the course review timelines. Additionally, the CG-IMH is undergoing a revision which will improve the Air Operations Branch information provided to responders.

**Pollution & Salvage Study Recommendation 9:** CGD Seven should work with LANT Area, CG-OEM, and CG-MER to use this incident as a case study to evaluate ways to better integrate salvage operations into IMT and update any appropriate training and policy. Salvage should be integrated in the operations section as soon as possible. Lightering operations should always be considered in the beginning of a response and the actions that remove the threat of pollution should be taken as soon as safe to do so. When we consider these as different and distinct operations it can slow down the operations and keep the pollution threat present longer than needed. It is important for the USCG UC member to emphasize the need to remove the pollution threat as they advocate for UC objectives and help partner agencies understand that this can be done through lightering before salvage operations or in conjunction with salvage operations if deemed safe to do so. One of our primary focuses in regards to salvage should be mitigating the threat of pollution and it is our responsibility to ensure that is communicated. This case shows, that it can be and often is necessary to use administrative tools like an Administrative Order to get all parties moving in the same direction.

**Action:** In consultation with CG-5R, I concur with this recommendation. While the CG-IMH does illustrate a salvage group in the Operations Section, the timing of when to establish it as well as a lightering group is not discussed. There is often a pollution and emergency management nexus in a salvage response and coordination is key within the UC. CG-MER believes a case study may be beneficial to provide a better understanding how and when to integrate salvage and lightering for the benefit of a response. A front-end analysis is being conducted for the possibility of a salvage and marine firefighting course. This incident could be useful when incorporated as a case study if the course creation is approved.



The CG-IMH is currently undergoing a revision, CG-OEM will leverage this case to evaluate existing CG-IMH guidance regarding salvage operations, and ensure any appropriate clarifications are made. Additionally, CG-OEM recommends this case be used as a training tool for exercises, to include testing salvage-related capabilities and authorities and internal/external communications at units prior to being in dire response situations. CG-OEM-4 (Exercise Support Team) actively supports exercise development to focus on areas of consideration to address complex situations including salvage situations with units throughout the Coast Guard and response.

**Pollution & Salvage Study Recommendation 10:** CG-MER should work with the National Oceanic and Atmospheric Administration (NOAA) to make Shoreline Clean-up Assessment Techniques (SCAT) training more widely available and required throughout the Coast Guard. SCAT should be set up and begin operating as soon as possible. SCAT is best accomplished when there is adequate representation from industry, state, and federal participants. It is also important to work with the environmental unit to ensure vital information is passed up and down the chain of command. NOAA offers good SCAT training and there are various applications that allow technology to synchronize the data. It is recommended that the USCG devote more time and resources to making this training more readily available and streamlining the ability to purchase and use best available technology for these efforts to better protect the environment.

**Action:** In consultation with CG-5R, I concur with this recommendation. SCAT training is a highly valuable training for USCG response personnel. CG-MER will collaborate with NOAA, who has historically provided this training, to enhance additional SCAT training opportunities for USCG responders.

**Pollution & Salvage Study Recommendation 11:** CGD Seven should work with Sector Charleston and MSU Savannah to update the Area Contingency Plan (ACP) used in this incident to make it easier for field personnel to reference and utilize in future incidents. CGD Seven should also work to ensure their units are forward leaning when initially requesting resources and then demobilize resources as necessary as things start to slow down. Some units try to take on complex response with minimal outside support and this is not a best practice. Our response is better when we pool our resources and stand up a robust IMT that includes local area knowledge and specialized personnel to ensure all federal equities are well represented. In a response of this scale there is often additional administrative burden to make sure all of our partner agencies, the public and the entire USCG chain of command have adequate information. This means you will need additional staff to make sure the IMT is adequately supported and we can provide the best support to our customers.

**Action:** In consultation with CG-5R, I concur with this recommendation. No action is required from the Commandant level for implementation. However, CG-MER's

current ACP revitalization efforts support this recommendation.

**Administrative Recommendation 3:** Recommend the Office of Investigations and Casualty Analysis (CG-INV) alert Investigating Officers of the benefits of employing the services of the MSC staff during the interview of relevant crewmembers at the onset of technical investigations. Had MSC been present or involved in the preliminary interviews of witnesses, they would have additional questions based on professional qualifications that could have identified causal factors earlier post-fact-finding. This is a best practice for consideration in any technical investigation.

**Action:** I concur with this recommendation. The Marine Safety Center Salvage and Engineering Response Team (SERT) provide technical assistance during marine casualties focusing on casualties that involve grounding, sinking, capsizing, collision, allision, fire, and structural damage. The SERT on-call duty officer is already available 24 hours a day, 7 days a week. The addition of supporting Investigating Officers during interviews is a capability they will provide when needed. Since this casualty occurred, MSC investigators are actively supporting marine casualty investigations, including an ongoing Marine Board, by participating in interviews with technical witnesses. CG-INV will add contacting the SERT when conducting technical investigations to the program's standard procedures.

**Administrative Recommendation 4:** Recommend CG-INV develop a list of USCG translators who have marine safety experience for use in investigations. As all crewmembers were not native English speakers, speaking either Korean or Filipino, the lack of competent translators who understood maritime terminology plagued the investigation throughout. Although a certified Korean translator was utilized for the formal hearing, some witnesses complained of misrepresentation of their testimony. Based on this situation, the Lead Investigating Officer took extra time with these witnesses to ensure that their testimony was clarified and clearly understood by all parties prior to moving to the next question or witness. Additionally, attorneys representing the non-native English speakers were provided the hearing transcripts to review and give feedback. The official documents were then amended to reflect a true and accurate record of the testimony. Had a translator possessing a maritime background been readily available, this situation could have been avoided.

**Action:** I partially concur with this recommendation. The Office of Auxiliary & Boating Safety (CG-BSX) already has access to a large pool of interpreters through the Auxiliary International Affairs Directorate. This service is readily available to Marine Casualty Investigations and is routinely used by the USCG worldwide.

This service is composed of nearly 400 volunteer interpreters who are qualified to translate documents or interpret verbally in 55 foreign languages. Many missions are remotely supported by email, phone, or by document review and translation. Other missions include deploying domestically and internationally to provide on-scene support to USCG Sectors, Stations, cutters and air assets.

**Administrative Recommendation 5:** Recommend CG-INV, in consultation with the Investigations National Center of Expertise (INCOE), develop a just-in-time training program for

Judge Advocates assigned to formal investigations as attorney advisors. The attorney advisors for this case were instrumental in obtaining evidence, authoring unique subpoenas and associated cover letters, fostering strong collaborative relationships with Party In Interest attorneys, and negotiating agreements when objections were raised. This investigation was fortunate to have a legal advisor for the hearing with an extensive maritime law background, which proved crucial to success. Without this background, the legal advisor would have had minimal guidance to complete this undertaking.

**Action:** I concur with the intent of this recommendation. Attorney advisors are an invaluable member of the formal investigative team. However, the addition of a just-in-time training would divert a critical resource during the critical initial phase of an investigation. Instead of providing just-in-time training, the Coast Guard will develop best practices and guidance for attorneys assigned to formal investigations.

**Administrative Recommendation 6:** Recommend CG-INV, in consultation with the INCOE develop best practices for investigators who have foreign nationals as witnesses, flag states, owners, or operators involved in the investigation. The process for gathering evidence and compelling appearances are different than United States citizens but not captured in any guiding documents. The Marine Safety Manual Volume 5, Chapter A3/E.3.b. does not adequately address how to liaise with foreign nationals who serve as witnesses for formal hearings after they leave the United States. This is problematic if these witnesses leave the United States and do not return to testify at formal proceedings.

**Action:** I concur with this recommendation. Investigations involving foreign mariners and international partners are significantly more complicated than domestic investigations due to overlapping jurisdiction for witness interviews, evidence gathering, and appearances of witnesses at the formal hearing. The Coast Guard will develop best practices and guidance for international investigations involving foreign mariners and flag administrations.

**Administrative Recommendation 7:** Recommend CG-INV review the conditions met for the level four Investigating Officer Specialty Code and add completion of a formal investigation as a requirement. There is a unique set of skills required to complete an investigation of this level. Consideration should be given to separating the formal investigation and hearing process, with the hearing process as a separate addendum to the marine casualty investigator personnel qualification standard (PQS), just as the hearing qualification is separate from the suspension and revocation officer qualification.

**Action:** I partially concur with this recommendation. The Coast Guard does not agree that a formal hearing should be a mandatory requirement to attain Level 4 for the Investigating Officer Specialty Code. While a formal hearing is certainly a valuable experience, there are a variety of skills and duties that contribute to being an expert in investigations. The current Level 4 requirements ensure that an officer has a wide breadth of investigations experience by requiring an officer to meet two of the following criteria: participation in a formal investigation, service in an investigation leadership position, and development of investigative policy. A formal hearing is a unique event and opportunity

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that may not be available to all investigators seeking to attain Level 4. CG-INV will evaluate the effectiveness of creating a Formal Hearing Addendum to the Marine Investigator PQS. However, creation of a separate TRACEN Yorktown course, which is in place for the suspension and revocation training process, will not be pursued at this time.

**Administrative Recommendation 8:** Recommend USCG FORCECOM, in concert with USCG TRACEN Yorktown, review the Sector Commander, Incident Commander, and Prevention Department Head course curriculum for content regarding investigations. Specifically, how the investigation interacts with the response. It was noted on several occasions throughout the investigation that the response and investigation were duplicating efforts, which slowed both processes down. In previous iterations of guidance for Incident Management, the Investigating Officer served in an advisory role to the UC.

**Action:** In consultation with CG-5R, I concur with the intent of this recommendation. The Coast Guard will update the Investigations Section of the CG-IMH to include the interaction between the response operations and the investigation section.

**Administrative Recommendation 9:** Recommend CGD Seven issue letters of appreciation or public service awards to the Brunswick Bar Pilots Association and Moran Towing for their critical role in facilitating communications during the SAR of this incident. The calm, collective nature of the Pilot on the GOLDEN RAY and the availability of his handheld VHF radio proved essential to communicating the location and status of those in need of rescue. Further, Moran Towing being on-scene in close proximity to receive the transmissions from the Pilot and relay the information to all response assets most certainly expedited the rescue of those onboard the GOLDEN RAY.

**Action:** This Administrative Recommendation was issued to CGD Seven for consideration and appropriate action.



W. R. ARGUIN

Rear Admiral, U.S. Coast Guard  
Assistant Commandant for Prevention Policy (CG-5P)



16732  
10 January 2023

**CAPSIZING OF THE MOTOR VESSEL GOLDEN RAY (IMO 9775816)  
WHILE OUTBOUND ON THE BRUNSWICK RIVER  
IN ST. SIMONS SOUND, GEORGIA, UNITED STATES OF AMERICA  
WITH ONE INJURY AND NO LOSS OF LIFE  
ON SEPTEMBER 08, 2019**

**ENDORSEMENT BY DISTRICT COMMANDER**

The record and the report of the investigation convened for the subject marine casualty have been reviewed, including the findings of fact, analyses, conclusions, and recommendations. It is recommended that this marine casualty investigation be closed.

**ENDORSEMENT ON RECOMMENDATIONS**

- I. **Safety Recommendation #1: Two Means of Escape on Opposite Sides of Engine Room.** Recommend Commandant engage the IMO to recommend they amend SOLAS II-2/13.4.2.1 to require two means of escape from the engine room, on opposite sides and ends of the space. This will reduce the possibility of both means of escape being blocked at the same time, as was the case in this incident. Further, recommend Commandant review 46 C.F.R. §116.500 for a similar requirement on U.S. vessels.

**Endorsements:** **Concur;** however, recommend review of 46 C.F.R. § 92.10-5 (subchapter I) which is more applicable due to the size of the GOLDEN RAY. This C.F.R. site currently requires two means of escape from general areas where passengers and crew have access or are normally employed; however, it does not specify the location of the two means of escape (opposite sides), nor does it specify engine room spaces. Recommend CG-INV review other major marine casualties to determine if the current construction regulations are adequate, or whether the regulations should be amended per this recommendation.

- II. **Administrative Recommendation #1: Search and Rescue (SAR).** The recommendations surrounding the SAR phase of this incident are included in Section 5 of Appendix A.

**Endorsements:** **(5.a) Personnel with SAR qualifications within the Incident Management Team (IMT).** **Concur;** depending on the circumstances of each case, an Incident Management Team

should be staffed with SAR/Command Center-centric experience for marine casualty cases or incidents involving SAR. In addition, a designated SAR Mission Coordinator (SMC) should be incorporated within the IMT.

(5.b) Regional cache of Salvage Equipment. **Do not concur;** requirements for salvage equipment already exist under the auspices of the Vessel Response Plan and Title 33 C.F.R.

(5.c) Requirement for all Aviators to attend the Advanced Helicopter Rescue Course (AHRs). **Do not concur;** the current FORCECOM training requirements were met and were adequate for this response. The pilots involved in this response made decisions in accordance with the proper Operational Risk Management (ORM) processes. The AHRs curriculum did not apply to the circumstances of this case.

(5.d) Standardization of communications equipment for the Aviation community. **Concur;** Recommend CG-711 review and ensure standardization of rescue swimmer communications equipment across the aviation fleet. Emerging communication technology should be evaluated and implemented.

(5.e) Requirement for senior officers to attend the Coast Guard's On-scene Coordinator Crisis Management Course. **Concur;** senior officers with other than Operations Ashore Response backgrounds should be required to attend the On-scene Coordinator Crisis Management course. This training would assist in coordinating with external agency partners and enhance the Coast Guard's actions during a response to similar casualties. Recommend CG-1 evaluate course and include in Officer Specialty Codes for other specialties, such as Operations Ashore Prevention.

(5. f) Incorporate Training Materials within SMC Supervisor Course related to Vessel Response Plans (VRPs). **Concur;** this would allow future SMCs to understand the salvage resources available during a response of this nature. Recommend CG-SAR consider incorporation of Vessel Response Plan requirements in the SMC Course.

### III. **Administrative Recommendation #2: Pollution Response and Salvage.**

Recommendations surrounding the initial pollution response and salvage are included in Section 6 of Appendix B.

**Endorsements:** (6.a) Development of a Case Study. **Concur;** complex cases such as these involve several authorities and require internal and external communications. Breakdown in authorities and communications need to be reviewed by CG-OEM and CG-MER, with validation by CG-LMI.

(6.b) Updating of Watch Quarter Station Bill (WQSB). **Do not concur;** CG-OEM promulgates clear guidance for units to establish WQSBs for multiple types of incidents.

(6.c) Modification of Heavy Weather Plans for Incident Management Activities. **Do not concur;** Emergency Management Manual Volume I establishes the required contingencies and update frequency for heavy weather plans.

(6.d) Deviation from the Non-Tank Vessel Response Plan (NTVRP). **Concur;** CG-LMI should conduct a legal review due to the deviation that occurred from the approved NTVRP. During a response of this magnitude, additional resources to those listed in the NTVRP may be necessary. Policy guidance should be updated to provide a decision matrix to assist the FOSC in determining the FOSC's ability to grant deviations from the NTVRP or approve amendments to the Plan during the response phase.

(6.e) Use of Administrative Orders. **Concur;** the use of Administrative Orders is a recognized best practice.

(6.f) Develop Specific Training to Improve the Debriefing process. **Concur;** a more thorough debriefing process would improve efficiency of communications during response actions.

(6.g) Documentation of Response strategies. **Do not concur;** all strategies were considered to ensure implementation of the best response options available. Documentation of all considered strategies is not practicable or feasible during an active response of this magnitude. We recommend robust documentation via a decision memo for those strategies that are implemented.

(6.h) Improve the function of Air Operations within the Incident Command System. **Concur;** this should be a priority for CG-OEM to improve coordination between SAR resources and the Incident Command Post. A SAR Cell should be created as well to improve communications.

(6.i) Integration of Salvage Operations into the Incident Management Team. **Concur;** while salvage is not a Coast Guard mission, there is often a pollution nexus and coordination is necessary as witnessed during this casualty response.

(6.j) Incorporation of NOAA Shoreline Cleanup and Assessment Technique (SCAT) Training for Coast Guard Personnel, and utilization of SCAT within the Incident Command Post. **Concur;** SCAT training provided by NOAA should be a priority for all IMD personnel, and CG-MER should ensure adequate funding is provided for the SCAT training.

(6.k.) Update Area Contingency Plan (ACP). **Concur;** the ACP is the primary plan for oil spills. For the ACP to be useful it must be maintained and operationally focused. We fully support CG-MER's modernization efforts and would like to see programmatic support, funding, and dedicated billets for the ACP to remain a useful response and planning document.

IV. **Administrative Recommendation #3:** Employ Marine Safety Center (MSC) Staff at the Beginning of Marine Casualty Investigations. Recommend CG-INV alert investigators of the benefits of employing the services of the MSC staff during the interview of relevant crewmembers at the onset of technical investigations. Had MSC been present or involved in the preliminary interviews of witnesses, they could have assisted and identified causal factors earlier, based on the professional qualifications and experience of personnel assigned to the MSC. This is a best practice for consideration in any technical investigation.

**Endorsement: Concur;** MSC staff bring a level of technical expertise that is vital in any marine casualty investigation, and especially one as technically complex as the GOLDEN RAY marine casualty investigation.

V. **Administrative Recommendation #4:** *List of USCG Translators.* Recommend CG-INV develop a list of USCG translators who have marine safety experience and can assist in marine casualty investigations with foreign nationals involved. As none of the crewmembers were English speakers, and were of either Korean or Filipino nationality, the lack of competent translators who understood maritime terminology plagued the investigation throughout. Although a certified Korean translator was utilized for the formal hearing, some witnesses complained of misrepresentation and misinterpretation of their testimony. Based on this situation, the Lead Investigating Officer took extra time with these witnesses to ensure their testimony was clarified and clearly understood by all parties prior to moving on to the next question or witness. Additionally, attorneys representing the non-native English speakers were provided the hearing transcripts to review and give feedback. The official documents were then amended to reflect a true and accurate record of the testimony. Had a translator possessing a maritime background been readily available, this situation could have been avoided.

**Endorsement: Concur, as a best practice.** CG Auxiliary members are also available to assist as interpreters and should be engaged at the onset of an investigation with foreign crewmembers.

VI. **Administrative Recommendation #5:** *Training for Judge Advocates.* Recommend CG-INV, in consultation with INV-NCOE, develop a just-in-time training program for Judge Advocates assigned to formal investigations as attorney advisors. The attorney advisors for this case were instrumental in obtaining evidence, authoring unique subpoenas and associated cover letters, fostering strong collaborative relationships with PII attorneys, and negotiating agreements when objections were raised. This investigation was fortunate to have a legal advisor for the hearing with an extensive maritime law background, which proved crucial to the success of the case. Without this background, the legal advisor would have had minimal guidance to complete this undertaking.

**Endorsement: Concur;** lessons-learned and best practices gleaned from this marine casualty investigation can be used to develop training materials and serve as a training opportunity for future attorney advisors.

VII. **Administrative Recommendation #6:** *Best Practices for Investigations Involving Foreign Nationals.* Recommend CG-INV, in consultation with the INV-NCOE, develop best practices for investigations involving foreign nationals, foreign flag states, owners, or operators as witnesses. The process for gathering evidence and compelling appearances in court hearings are different than those for U.S. citizens but are not captured in any guiding documents. Marine Safety Manual Volume 5, Chapter A3/E.3.b.



does not adequately address how to liaise with foreign nationals who serve as witnesses for formal hearings after they depart the U.S. This is problematic if these witnesses depart the U.S. and do not return to testify at formal proceedings.

**Endorsement: Concur;** it is important that best practices are identified and shared with the field on how to liaise with foreign nationals during investigations. Marine Safety Manual Volume V should be updated to include relevant information and processes for administrative proceedings involving foreign nationals.

VIII. **Administrative Recommendation #7:** *Additions to Officer Specialty Code.*

Recommend CG-INV review the conditions met for the level four Investigations Officer Specialty Code and add completion of a formal investigation as an option for obtaining the OAP12, Level IV designation. Consideration should be given to separating the formal investigation and hearing process, with the hearing process as a separate addendum to the Marine Casualty Investigator PQS, just as the hearing qualification is separate from the Suspension and Revocation Officer qualification.

**Endorsement: Concur;** Investigating Officers assigned to formal investigations/ hearings develop a unique skill that should be documented appropriately within the Officer Specialty Codes. However, steps should be taken to avoid requiring the conduct of a formal investigation in order to obtain the Level IV OSC for these investigations. An Investigating Officer's level of experience should be considered when assignment for formal investigations is necessary.

IX. **Administrative Recommendation #8:** *Review of Training Course Curriculum.*

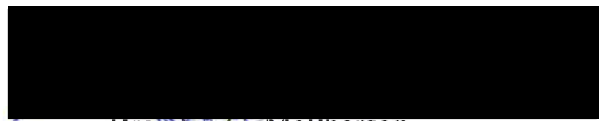
Recommend USCG FORCECOM, in concert with USCG Training Center Yorktown, review the Sector Commander, Incident Commander, and Prevention Department Head course curriculum for content regarding marine casualty investigations. Specifically, the curriculum should address how the marine casualty investigation correlates with ongoing response efforts. It was noted on several occasions throughout the marine casualty investigation that the response and investigation personnel were duplicating efforts, which slowed both processes down. In previous iterations of guidance for Incident Management, the investigator served in an advisory role to the Unified Command.

**Endorsement: Concur;** this casualty highlighted unique challenges when it comes to marine casualty investigations and active response efforts. Higher levels of coordination are necessary to improve efficiency and prevent duplication of efforts.

X. **Administrative Recommendation #9:** *Letters of Appreciation or Public Service Awards.* Recommend USCG District Seven issue letters of appreciation or public service awards to the Brunswick Bar Pilots Association and Moran Towing for their critical role

in facilitating communications during the SAR phase of this incident. The calm, collective nature of the Pilot on board the GOLDEN RAY at the time of the incident, and the availability of his handheld VHF radio proved essential to communicating the location and status of those in need of rescue. Further, Moran Towing's presence on-scene allowed them to receive the transmissions from the Pilot and relay the information to all response assets. This most certainly expedited the rescue of those onboard the GOLDEN RAY.

**Endorsement:** **Concur;** recognition of all involved parties is well deserved for this incident. Marine Safety Unit Savannah has been coordinating with those involved to ensure appropriate recognition for their actions during this incident.



Brendan C. McPherson  
Rear Admiral, U.S. Coast Guard  
Commander, Seventh Coast Guard District



**CAPSIZING OF THE MOTOR VESSEL GOLDEN RAY (IMO 9775816)  
WHILE OUTBOUND ON THE BRUNSWICK RIVER  
IN ST. SIMONS SOUND, GEORGIA, UNITED STATES OF AMERICA  
WITH ONE INJURY AND NO LOSS OF LIFE  
ON SEPTEMBER 08, 2019**

**LEAD INVESTIGATING OFFICER'S REPORT**

**1. Preliminary Statement**

1.1. This marine casualty investigation was conducted, and this report is submitted, in accordance with Title 46, Code of Federal Regulations (C.F.R.), Chapter I, Subchapter A, Part 4, Subpart 4.07, and under the authority of Title 46, U.S. Code (U.S.C.) Chapter 63. Pursuant to 46 U.S.C. § 6308, no part of this marine casualty investigation report, including the findings of fact, opinions, recommendations, deliberations, or conclusions, shall be admissible as evidence or subject to discovery in any civil or administrative proceeding, other than an administrative proceeding initiated by the U.S.

1.1.1. The U.S. is not signatory to the Casualty Investigation Code.<sup>1</sup> However, the guidance in the Casualty Investigation Code is used as a common framework and was utilized in this marine casualty investigation.

1.1.2. In incidents such as this, the Casualty Investigation Code states that a vessel's flag State and an affected coastal State, should agree as to which will serve as the Marine Safety Investigating State (MSIS). On September 8, 2019, after being notified of the incident, the USCG Investigation and Casualty Analysis Program Office (CG-INV) and representatives of The Republic of the Marshall Islands (RMI) agreed that the USCG would serve as the MSIS, with the RMI designated as a Substantially Interested State (SIS). Subsequently, the Korean Maritime Safety Tribunal (KMST) was also designated as an SIS based on the nationality of some crewmembers. The U.S. National Transportation Safety Board (NTSB) also conducted its own investigation under its authorities, but in conjunction with the USCG investigation.

1.1.3. On September 12, 2019, the USCG District Seven District Commander convened a formal marine casualty investigation, designating the Lead Investigating Officer (LIO) and supporting personnel.

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<sup>1</sup> IMO Resolution MSC.255(84), Adoption of the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code) (adopted 16 May 2008).

1.1.4. As a result of COVID-19 impacts and travel restrictions, the formal investigation and hearing were delayed several months. Once travel restrictions eased, the multi-agency/flag investigation team reconvened in-person to resume the investigation process and ultimately conduct the USCG's first virtual formal hearing. KMST and NTSB investigators were unable to physically attend the hearing due to continued travel restrictions, however, investigators from all SISs had access to entire administrative record. The hearing commenced on September 14, 2020, in Brunswick, Georgia. All witnesses, except one, appeared as requested and Party-in-Interest (PII) representatives participated throughout the hearing.<sup>2</sup>

1.1.5. *Investigation Complicating Factors of Note.* The following factors impacted the completion of the investigation.

1.1.6. *SMS.* Despite repeated requests of the approving classification society and vessel's owners, USCG and SIS investigators have not received a full copy of the Company's SMS to date. Only excerpts of the SMS were provided for investigators. Lack of the full system manual prohibited the investigators from conducting a full review of this shipboard operations guiding document.

1.1.7. *Availability of Information.* During the course of the investigation, the SMS-required records generated on board the GOLDEN RAY were not able to be safely accessed due to the condition of the vessel following the capsizing. Additionally, many of the records relevant to the investigation were destroyed by prolonged submergence in saltwater. This limited the documentation pertaining to the onboard implementation of the SMS that were available for review. Furthermore, the sections of the Company's SMS that were made available during the investigation did not include specific procedures for the following: how and when stability is calculated; ballast water management; watertight openings in the vessel's hull; and the cargo stowage planning.

1.1.8. *Stability Instrument.* The GOLDEN RAY's loading and stability instrument, the LOADMATE, was maintained in the vessel's office on the port side of the vessel. Once the vessel came to rest on its port side, this compartment quickly flooded. In the initial days of the salvage operations, salvors were able to recover several computers from the vessel, including the LOADMATE. The LOADMATE was analyzed by several labs but the information contained in the spinning disk hard drive was ultimately determined unrecoverable. As the stability information contained on the LOADMATE was never submitted to vessel shore-based personnel, any stability information contained on the LOADMATE was forever lost.

1.1.9. Similar to the stability instrument, paper records maintained in the vessel's office or on the Bridge were destroyed either by water egress into the specific compartment or decomposition of the paper.

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<sup>2</sup> See Section 1.1.5. of this report for Investigation Complicating Factors of Note.

1.2. The following organizations and individuals were designated as PII's by the LIO, in accordance with 46 U.S.C. § 6303 and 46 C.F.R. § 4.03-10: GL NV24 Shipping, Inc., as the owner of the GOLDEN RAY; G-Marine Services Co., Ltd., as the operator of the vessel; Liberty Global Logistics, as the Slot Charterers for the vessel; and the Brunswick Bar Pilots Association, including Mr. Jonathan Tennant, as the Pilot onboard the GOLDEN RAY at the time of the incident, and Mr. Bruce Fendig, as a local pilot with expertise relevant to the investigation. On September 15, 2020, the LIO removed the Slot Charterers' designation at their request.

1.3. The USCG was the lead agency for all evidence collection activities involving this investigation. Other members of the investigation team included individuals from the NTSB, the RMI, and the KMST. No other persons or organizations assisted in this investigation.

1.4. Unless otherwise noted, all times listed in this report are in time local to the incident (Eastern Daylight Time, Coordinated Universal Time offset minus four hours) using a 24-hour format, and are approximate.

## 2. Vessel Involved in the Incident



Figure 1. Pre-incident photograph of the GOLDEN RAY taken on December 13, 2018 by the RMI Maritime Administrator

Official Name:	GOLDEN RAY
Identification Number:	IMO 9775816
Flag:	The Republic of the Marshall Islands
Vessel Class/Type/Sub-Type	Vehicle Carrier
Build Year:	2017
Gross Tonnage:	71178 GT
Length:	191.57 M
Beam/Width:	35.4 M
Draft/Depth:	21.15 M
Main/Primary Propulsion: (Configuration/System Type, Ahead Horse Power)	Direct Drive Diesel (1) at 17322 ahead hp
Owner:	GL NV24 Shipping, Inc. Ajeltake Island, The Republic of the Marshall Islands
Operator:	G-Marine Services Co., Ltd.

### 3. Deceased, Missing, and/or Injured Persons

Relationship to Vessel	Sex	Age	Status
Crewmember 1	Female	22	Injured

### 4. Findings of Fact

#### 4.1. *The Incident.*

4.1.1. The GOLDEN RAY was a RO-RO vessel flagged in the RMI, designed to carry a maximum of 7,742 vehicles. It frequented ports around the world since its delivery date in 2017. The vessel had no history of marine casualties and was in compliance with all applicable certificates. Figure 2 depicts the overall route of the vessel for this voyage.

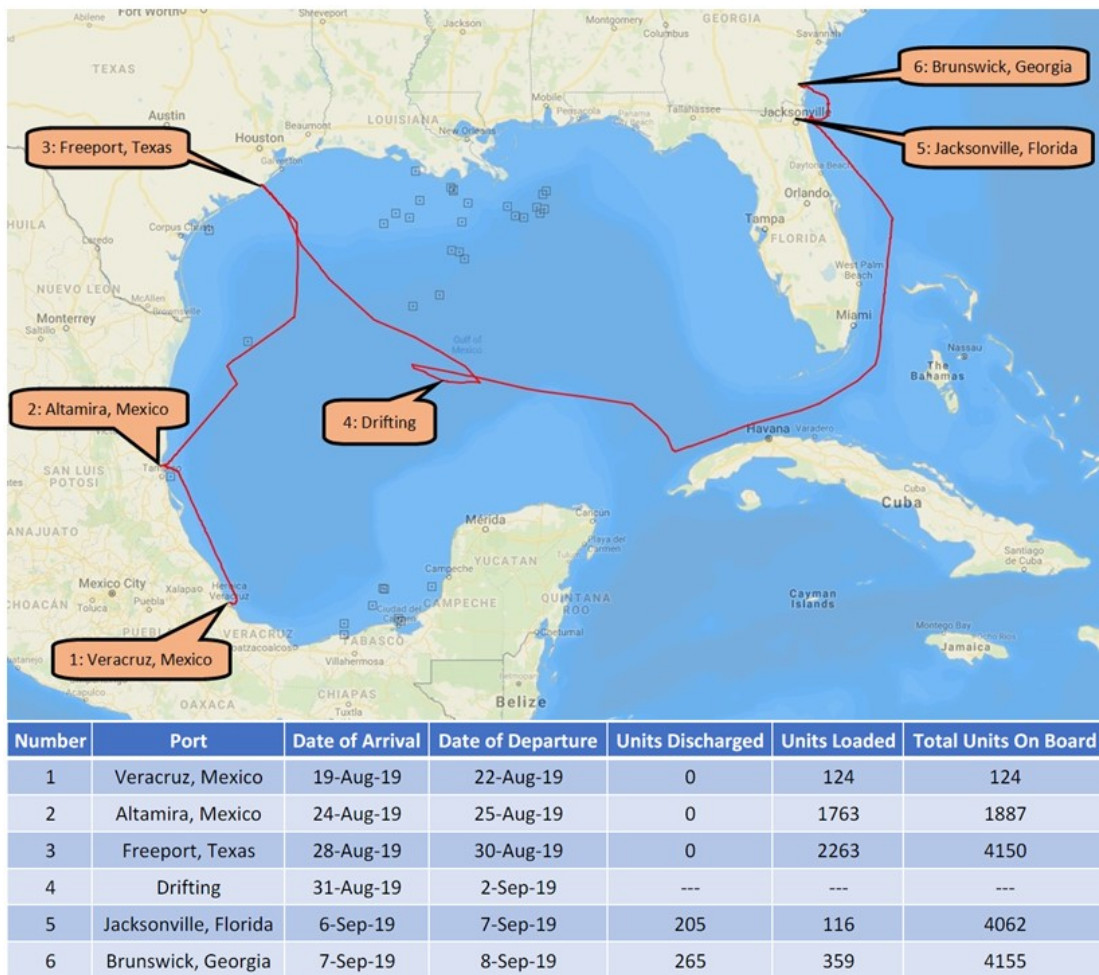


Figure 2. Summary of GOLDEN RAY voyage generated from VDR data by RMI

4.1.2. On September 8, 2019 at 0053, the GOLDEN RAY departed the Port of Brunswick, Georgia, from Colonel’s Island Terminal Berth 1, assisted by two towing vessels. The weather was 76°F, clear skies, visibility of 10 miles, and a maximum wind speed of 16 mph. Sunset occurred at 1943. There were 23 crewmembers and a Pilot on board. The Master, Second Officer, Able Seafarer-Deck (Helmsman), and Pilot were

located on the Bridge as the vessel departed. Other crewmembers proceeded to their assigned posts for standby positions.

4.1.3. The following sequence of maneuvers depicted in Figure 3 summarize the voyage from Brunswick, Georgia. Records from the vessel’s computer listed the following doors as “open” during these maneuvers: Deck 5, Door 0 (access to aft stairtower) and Door 47 (entrance to stairtower that accessed the Engine Control Room (ECR)). The locations of these doors are depicted in Figure 4.

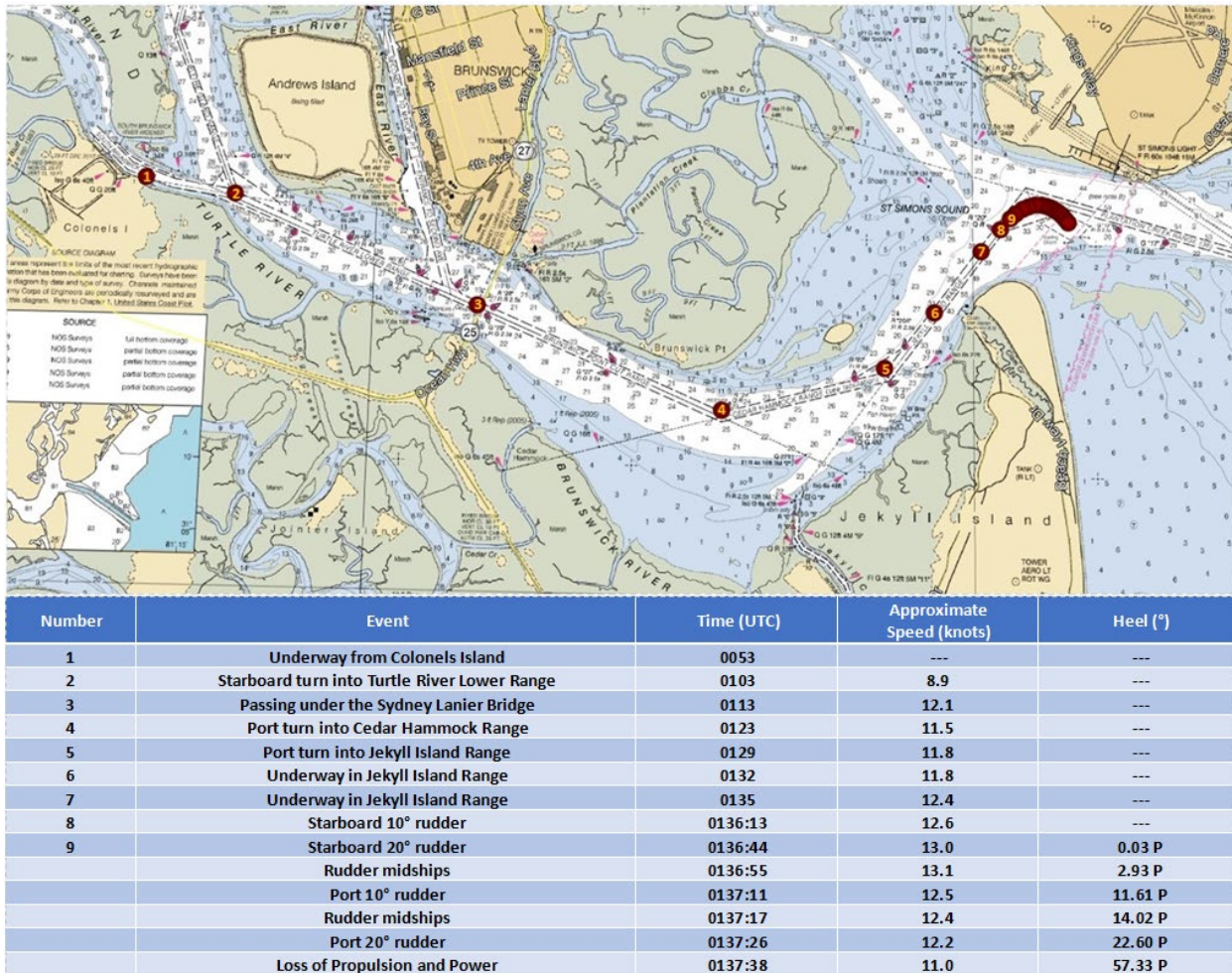


Figure 3. Summary of maneuvers during outbound transit generated from VDR and PPU data by RMI

4.1.4. Shortly after departing the berth while underway on the Turtle River in the vicinity of the Lower Range, the Master gave the order to open the Pilot Door (port side, Deck 5). Records show the Pilot Door uncleaned and opened at this point. This was his routine practice while inbound or outbound with a pilot onboard. The location of the Pilot Door is depicted in Figure 4.

4.1.5. As the GOLDEN RAY went under the Sidney Lanier Bridge, the Master released the crew from their standby positions.





4.1.6. Figure 5 summarizes the commands given by the Pilot on board during the outbound transit. The Helmsman responded quickly and appropriately to each command given.

Time	Helm Command
0136:08	10° starboard rudder ordered by Pilot
0136:13	Quartermaster reports rudder at starboard 10°
0136:39	20° starboard rudder ordered by Pilot
0136:44	Quartermaster reports rudder at starboard 20°
0136:47	Midships ordered by Pilot
0136:55	Quartermaster reports rudder midships
0137:05	10° port rudder ordered by Pilot
0137:11	Quartermaster reports rudder at port 10°
0137:13	Midships ordered by Pilot
0137:17	Quartermaster reports rudder midships
0137:22	20° port rudder ordered by Pilot
0137:26	Quartermaster reports rudder at port 20°
0137:29	Hard port rudder ordered by Master
0137:38	Midships ordered by Pilot / Propulsion and power lost

Figure 5. Table of commands and responses for outbound transit gathered from VDR audio

4.1.7. At 0136, the GOLDEN RAY entered Widener 11 near the St. Simons Fishing Pier. A “widener” is defined as an area in which a vessel can maneuver between two channels that is wider than the channel. This area is depicted in Figure 6 by the red triangle. As the vessel transited Widener 11, the crew experienced a sudden unexpected heeling to port. The Pilot asked the Master, “Captain, what’s the GM on this thing?” No response was recorded on bridge audio. GM is the metacentric height and a factor in the overall stability of the vessel. In making the turn through Widener 11, the Pilot ordered 20 degrees starboard rudder at 0136 and then midships, but the vessel continued to make a starboard turn. The Master ordered a hard port rudder.

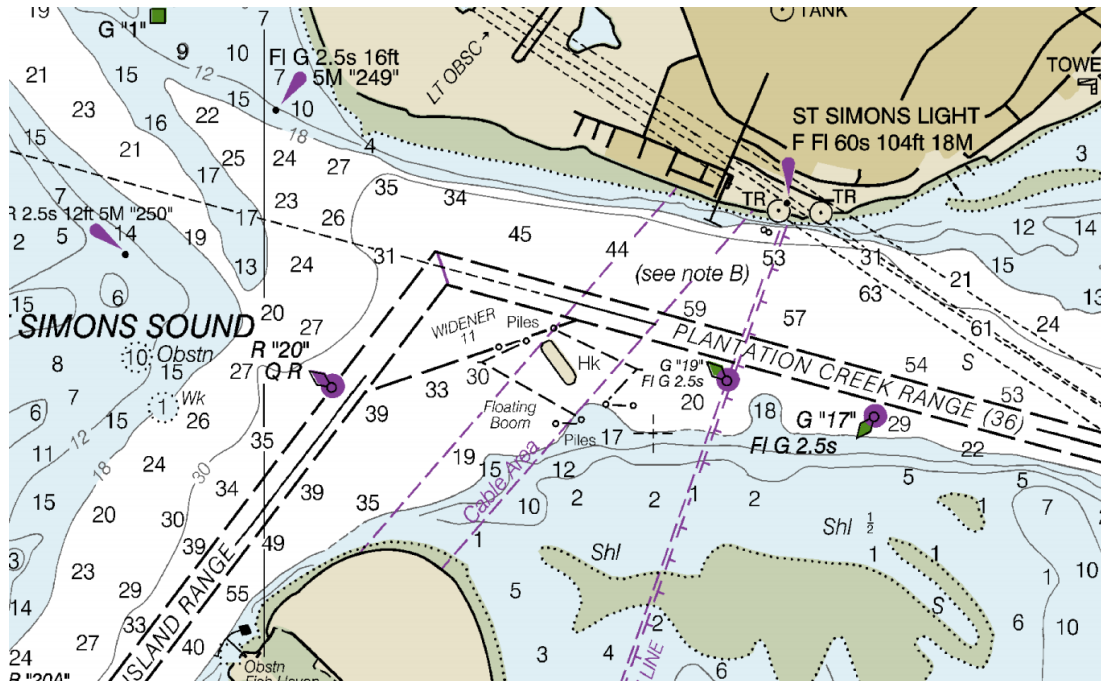


Figure 6. Widener 11 on NOAA Chart 11506

4.1.8. Engine room crew observed water ingress through the midship stairtower, which connected the ECR to Deck 5. An additional stairtower was located aft, leading to Deck 5 for access to the engine room.

4.1.9. At 0137, the GOLDEN RAY began to heel to port while in an uncontrolled turn to starboard. The Pilot onboard another inbound deep draft vessel (M/V EMERALD ACE) observed the GOLDEN RAY at approximately 45 degree heel, based on the orientation of the vessel's forward mooring station lights. The location of these lights are pictured in Figure 1 on the bow of the vessel. Eventually, the vessel's IMACS indicated approximately a 60 degree port heel at which time the GOLDEN RAY was considered capsized.

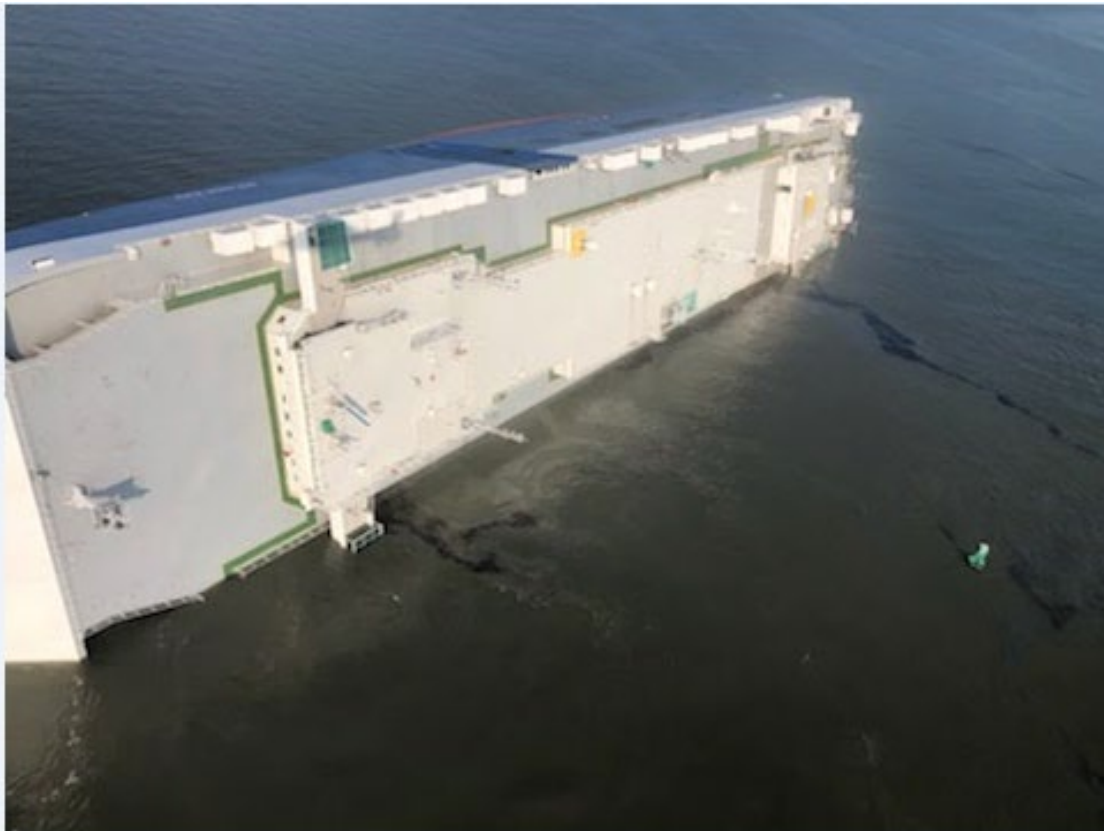
4.1.10. Speed over ground abruptly stopped and the assist tug on scene, DOROTHY MORAN, reported pushing on the capsized GOLDEN RAY at the request of the Pilot, but not being able to move it. The vessel was located just outside Widener 11.

4.1.11. The vessel lost all power on board within seconds when the main engine shut down due to low lube oil pressure. The emergency generator reportedly came online for a matter of minutes then shut down.

4.1.12. All crewmembers reported the vessel had no lighting after capsizing and they were unable to retrieve personal flashlights or access their lifejackets. Three crewmembers and the Pilot were located on the Bridge; two crewmembers were located in the ECR; two additional crewmembers were in the engine room; and the remainder of the crewmembers were in their staterooms or crew common areas. While evacuating the capsized vessel, a Cadet sustained minor injuries.

4.1.13. The Pilot from the M/V EMERALD ACE reported back to his dispatcher to give notification of the incident, and the dispatcher notified the USCG. See Appendix A for details regarding the notification.

4.1.14. After daylight, a responding airborne USCG asset observed a sheen in the vicinity of the GOLDEN RAY, captured in Figure 7.



*Figure 7. Photo of sheen taken by USCG post incident*

4.1.15. On-scene assist vessels and USCG assets rescued all 23 crewmembers and the Pilot. Appendix A of this report contains the details of the Search and Rescue (SAR) operations.

4.1.16. Pollution response and salvage operations commenced during the SAR phase of the response. Appendix B contains the details of these operations.

## 4.2. *Additional/Supporting Information.*

### 4.2.1. *Corporate and Operational Framework.*

4.2.1.1. *Owner and Operator Delineations.* The operator and ISM Manager<sup>3</sup> responsible for the operation of the GOLDEN RAY was G-Marine Co., Ltd. The owner of the vessel (“the Company”) was GL NV24 Shipping Inc. The manager of local operations and scheduling was Hyundai Glovis Co., Ltd. The third-party cargo planner for Hyundai Glovis, which provided agent services to local vessels, was Norton Lilly International.

4.2.1.2. *Crew Composition and Experience.* New crew reported on board the GOLDEN RAY on August 28, 2019, including the Master and eight other crewmembers. The off-going Master departed the vessel after a pass down with the oncoming Master. Shortly after assuming command, the Master conducted drills, as required by regulation.

*Crewmembers.* All crewmembers held the required credentials and appropriate flag State endorsements for their positions on board.

4.2.1.2.1.1. *Master.* The Master had over 39 years of sailing experience. He acquired his first credential in 1980. The Master was issued his Master’s credential for unlimited tonnage in 1995. He sailed on bulk carriers until 2016, when he transitioned to serve as Captain aboard his first RO-RO vessel. In 2017, he started working for G-Marine. The GOLDEN RAY was the third RO-RO vessel he served aboard as a Master. He had no experience as a Chief Officer on RO-RO vessels but served in that capacity on other types of vessels. The GOLDEN RAY’s Master was inexperienced with loading operations specific to RO-RO vessels, as he had never previously served in a position responsible for RO-RO vessel stability calculations or loading/unloading of vehicles on this vessel type.

4.2.1.2.1.2. *Chief Officer.* The Chief Officer had 13 years of overall sailing experience. He served as a Chief Officer for 10 years, six of which were on RO-RO vessels. When he reported aboard the GOLDEN RAY on March 5, 2019, he received training on the stability instrument from the off-going Chief Officer for approximately three to four hours.

4.2.2. *Voyage Plans for the GOLDEN RAY.* Figure 2 provides a visual summary of the port calls for the GOLDEN RAY.

4.2.2.1. *Port of Jacksonville and Outbound Transit.* The Port of Jacksonville, Florida, at Blount Island Terminal is located 12.5 nautical miles from the sea buoy. The GOLDEN RAY called on Berth 22 in Blount Island on September 6, 2019. Figure 8 depicts the trackline for this transit.

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<sup>3</sup> See ISM Code, Part A, Section 4; see also Revised Guidelines for the Operational Implementation of the ISM Code by Companies, MSC-MEPC.7/Circ.8.

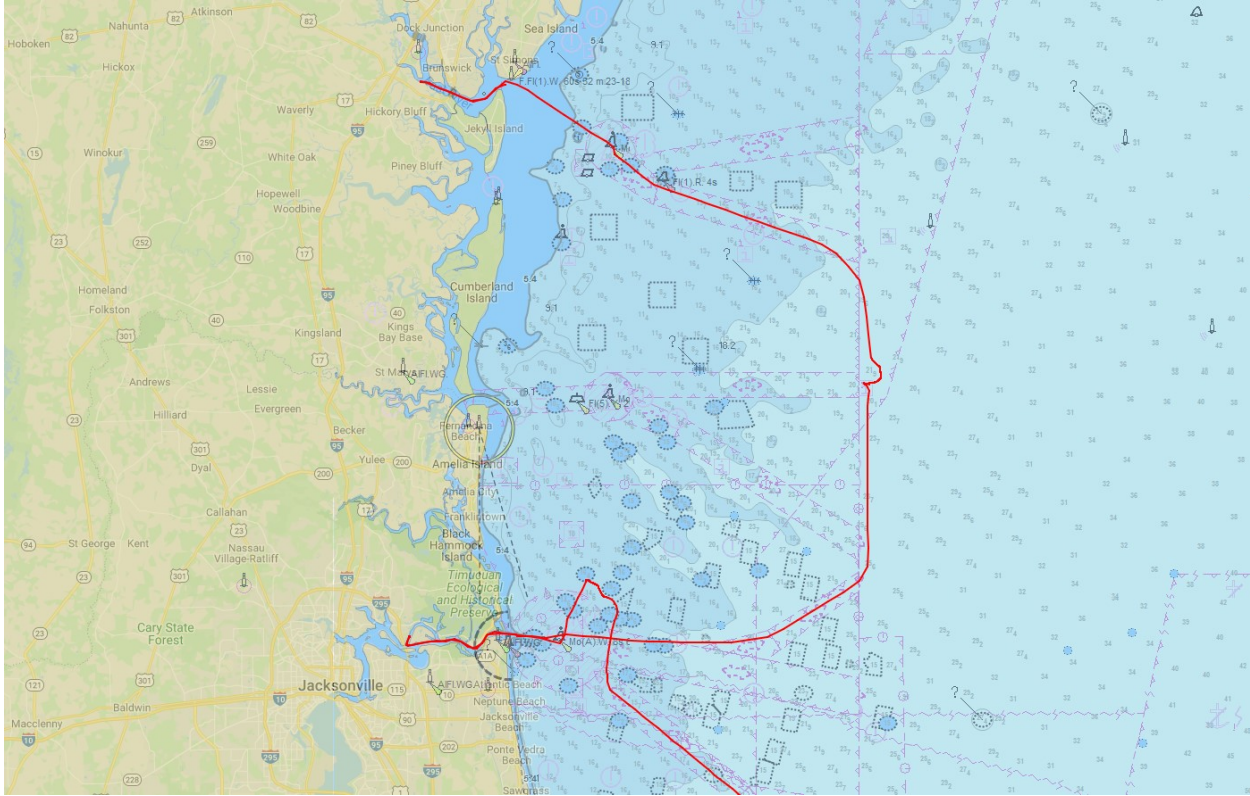


Figure 8. Vessel trackline from Jacksonville to Brunswick derived from LRIT and AIS

4.2.2.1.1. Upon departure from the Port of Jacksonville and until the Jacksonville Pilot disembarked the GOLDEN RAY, the Pilot Door remained open as pictured in Figure 9 below.



Figure 9. Pilot door condition on outbound transit from Jacksonville September 6, 2019 from JAXPORT CCTV footage

4.2.2.1.2. The GOLDEN RAY did not discharge or take on ballast. The vessel had approximately 2924.33 MT of ballast on board upon departure from the Port of Jacksonville.

4.2.2.1.3. The Master sent a departure report to the Company, indicating a GM of 1.91 M, which he obtained from the Chief Officer. The vessel's Safety Management System (SMS) required this report, and the contents consisted of information regarding fuel levels, cargo loading, draft, GM, next port, and other similar information.

4.2.2.1.4. The Chief Officer used a pre-stowage plan in preparation for the voyage to the Port of Brunswick and entered average estimated vehicle weights into the stability instrument. The stability instrument is further explained in Section 4.2.5.2.7.

4.2.2.2. *Transit between Jacksonville and Brunswick.* Figure 2 depicts the track line for this transit. The GOLDEN RAY did not discharge or take on ballast. The vessel did not take on additional fuel and used approximately 17 MT of fuel on its transit from Jacksonville to Brunswick.

4.2.2.3. *Port of Brunswick.* Colonel's Island at the Port of Brunswick, Georgia, is exclusively a RO-RO vessel facility located 15 nautical miles from the sea buoy, and consists of three berths. The channel width is 400 feet and the channel project depth is 36 feet. There is a tidal range of 7.6 feet and a turning basin in the South Brunswick River of 900–1,400 feet. The Port of Brunswick pilots navigate ships through a series of turns through St. Simons Sound and the Brunswick River. The GOLDEN RAY called on Berth 1. This area experiences significant tidal influence. Local pilots developed maximum drafts at which vessels can transit regardless of tidal state; specifically, the draft at the time the GOLDEN RAY was transiting the Port of Brunswick was 9.3 M. State Pilotage is required by Title 52, Official Code of Georgia (Annotated) Chapter 6, Article 2. 52-6-45, as authorized by 46 U.S.C. § 8501. Specifically, it requires foreign-flagged vessels calling on the Port of Brunswick to be under the direction and control of a pilot licensed by the State of Georgia.

4.2.2.4. *Inbound Transit to Brunswick.* Figure 2 depicts the track line for this transit.

4.2.2.4.1. On September 7, 2020 at 1453, the Brunswick Bar Pilots Association Pilot Boat pulled alongside the GOLDEN RAY at the sea buoy for the St. Simons Sound. The Pilot boarded through the open Pilot Door and proceeded to the Bridge. He asked the Captain about the vessel's condition and no issues were reported.

4.2.2.4.2. At 1508, the Pilot and Captain commenced the pilot briefing required by 33 C.F.R. § 164.11(k),<sup>4</sup> during which the Pilot asked about the Pilot Card and they discussed the route, meeting/passing arrangements with another deep draft vessel during the inbound transit, tugs, bridge clearance for the Sidney Lanier Bridge, mooring configuration, and duration of the transit.

4.2.2.4.3. On the inbound transit, the vessel passed another deep draft vessel by lining up outside the channel and arriving at Colonel's Island at 1736, as previously agreed upon between both pilots.

#### 4.2.3. *Loading Operations in Brunswick.*

4.2.3.1. At 1900, the GOLDEN RAY began taking on units. At 2219, the Chief Officer adjusted the anti-heeling tanks (listed as "DWBT5" on the IMACS). The inclinometer started at 1.03 degrees starboard, ended .32 degrees port. Draft started aft 9.61 M forward 9.23 M, ended 9.49 M aft, forward 9.25 M.

4.2.3.2. At 2242, the vessel completed cargo operations and the stevedores departed. Stevedores loaded vehicles on the upper decks of 5, 11, and 12. The total number of vehicles on board prior to departure was 4,155. The total weight of cargo added to the vessel at the Port of Brunswick was 550 MT.

#### 4.2.4. *Weather.*

4.2.4.1. *Hurricane DORIAN.* DORIAN was one of the strongest hurricanes to hit the northwestern Bahamas in modern history, making landfall at Elbow Cay, Great Abaco, on the afternoon of September 1, 2019. A trough in the eastern U.S. caused the storm to swing north-northwest off the coasts of Florida and Georgia, strengthening to a Category 3 status. The Port of Brunswick experienced Tropical Storm Force winds. DORIAN's eye passed over a NOAA sea buoy offshore of South Carolina on the afternoon of September 5, 2019, as it passed the Brunswick area. NOAA conducted a survey of the Brunswick, Georgia, shipping channel on September 6, 2019, and found no anomalies resulting from the storm. As a standard practice, NOAA post-storm surveys do not include wideners. Post-incident surveys of Widener 11 did not reveal any post-storm anomalies in charted depth.

4.2.4.2. *Hurricane Port Conditions.* Captains of the Port, per each unit's hurricane contingency plan in place for 2019, set Port Conditions for

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<sup>4</sup> The pilot briefing is also recommended by Annex 2 of IMO Resolution A.960(23), Recommendations on Training and Certification on Operational Procedures for Maritime Pilots Other Than Deep-Sea Pilots (adopted on 5 December 2003), Section 5.



Hurricane DORIAN based on forecasted wind speed arrival times. Figure 10 summarizes these port conditions.

Port Condition	Date Set by Jacksonville	Date Set by Brunswick
X-Ray	August 29, 2019 at 0800	August 31, 2019 at 0800
Yankee	September 2, 2019 at 0800	September 3, 2019 at 0000
Zulu	September 3, 2019 at 0800	September 3, 2019 at 0800
Open	*September 5, 2019 at 1230	September 5, 2019 at 1805

\* Port opened with restriction of 36 feet draft or less and it resumed normal operating status later that day at 1600.

Figure 10. Port conditions set for Hurricane DORIAN

4.2.4.3. *Itinerary Changes.* On August 29, 2019 at 1552, the Master of the GOLDEN RAY emailed the Port of Jacksonville agent for pre-arrival information. On August 31, 2019, starting at 1630, the vessel drifted in the Gulf of Mexico to avoid Hurricane DORIAN. Although the storm did not directly impact the GOLDEN RAY, one hurricane-related event occurred. According to testimony from the Chief Officer, on direction from the vessel's shore office, the GOLDEN RAY took on approximately 1400 MT of ballast in order to increase stability while drifting in anticipation of heavy weather. On September 3, 2019, the Master reported to the vessel's agent that the draft was 9.9 M. In his response, the vessel's agent asked the vessel to reduce draft to 9.4 M to meet the request of local Pilots. Prior to entry into Jacksonville, Florida, the Chief Officer discharged 1400 MT of ballast to obtain this draft. The vessel arrived in Jacksonville on September 6, 2019.

#### 4.2.5. *Construction.*

4.2.5.1. *Sister Ship.* SOLAS Chapter II-1 defines a sister ship as a ship built by the same yard from the same plans. The GOLDEN RAY is considered a sister ship to the SILVER RAY, as it was built in the same ship yard utilizing the same plans. As a sister ship, the SILVER RAY was used to develop the Trim and Stability Booklet<sup>5</sup> for the GOLDEN RAY (see Appendix C for details).

#### 4.2.5.2. *Openings in the Watertight Envelope of Note.*

4.2.5.2.1. *Pilot Door.* The Pilot Door on the GOLDEN RAY was located port side on Deck 5 at frame 73 (see Figure 4). This 2.2 M by 2 M door remained open throughout the outbound transit from Brunswick, Georgia. No policy or regulation specifically prohibited this practice and it is commonplace among the RO-RO vessel industry to have the Pilot Door open during inbound and outbound

<sup>5</sup> The Trim and Stability Booklet is required by the International Code on Intact Stability, 2008. See IMO Resolution MSC.267(85), Adoption of the International Code on Intact Stability, 2008 (2008 IS Code) (adopted on 4 December 2008).

transits with a pilot onboard. It is considered a watertight door completely open to Deck 5, as pictured on the SILVER RAY in Figure 11 and Figure 12. Deck 5 is considered part of the watertight envelope of the vessel and contained an aft and midship access to stairtowers noted in section 4.1.8.

The GOLDEN RAY departed port on numerous occasions with the Pilot Door open on Deck 5 during inbound and outbound transits requiring a pilot. On departure from the Port of Brunswick, the Master ordered the Pilot Door open and it remained open through the incident. SOLAS II-1/22 requires watertight doors to be closed if not in use while underway, although some discretion is left to masters in limited circumstances.<sup>6</sup>



Figure 11. Photo of the SILVER RAY Pilot Door open taken from inside the vessel by USCG

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<sup>6</sup> SOLAS II-1/22, paragraph 3 states, *inter alia*, “A watertight door may be opened during navigation to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door must be immediately closed when transit through the door is complete or when the task which necessitated it being open is finished.”



Figure 12. Photo of SILVER RAY Pilot Door closed taken from inside vessel by USCG

4.2.5.2.2. Loading Ramps. The GOLDEN RAY was equipped with two loading ramps, one on the starboard side near midships and one on the starboard stern quarter. Both of these ramps were in the closed position and secured for sea at the time of the incident. Following the incident, salvors noted the stern ramp was cleated. Only the stern ramp was used for loading operations in Brunswick.

4.2.5.2.3. Deck Ventilation. The GOLDEN RAY's cargo decks were equipped with a ventilation system, consisting of ventilation ducts that led from each deck upwards through the upper most deck. Each of the ventilation ducts was fitted with an electric exhaust fan and mechanical damper on the upper end. In general, the ventilation system is designed to prevent the buildup of flammable or hazardous vapors from the loaded vehicles. The dampers are designed to seal the ventilation ducts closed in the event of a fire, allowing the low-pressure CO<sub>2</sub> fixed firefighting system to extinguish the fire. The dampers are not designed to create a watertight seal on the ventilation ducts, which is why they terminate above the highest deck.

4.2.5.2.4. *Fire Detection System.* The GOLDEN RAY was equipped with a fire detection system that alarms visually and audibly on the Bridge. Witness testimony indicated that no fire alarms were received prior to the vessel's sudden heel to port. The loss of power resulted in numerous alarms being activated on the Bridge; however, witnesses could not confirm if any originated from the fire detection system. Additionally, the history of fire alarm activations was not able to be recovered from the fire detection system panel. The only facts surrounding the fire were provided by responders, as pictured in Figure 13 and noted during their post-incident statements. No crewmembers witnessed the fire.



Figure 13. Photo of vessel post incident showing smoke after sunrise taken by USCG

4.2.5.2.5. *Fire Suppression System.* The GOLDEN RAY was equipped with a low-pressure CO<sub>2</sub> fire suppression system. This system was not discharged prior to the sudden heel to port.

4.2.5.2.6. *IMACS.* Upon construction, the GOLDEN RAY was fitted with Totem Plus Integrated Monitoring Alarm and Control System (IMACS) software. This system provides real-time monitoring for all automated vessel's engineering systems, watertight door status, tank monitoring, draft readings, and list angles. Generally, the tanks include all ballast, fuel oil, diesel oil, and gas oil tanks. This type of system is used by most modern deep draft vessels to reduce manning requirements in the engine room.

As this system is used to reduce engine room manning, they are approved and certified by classification societies and periodically tested to confirm operation and accuracy. The vessel's IMACS computer was retrieved from the engine room and analyzed for this investigation.

4.2.5.2.7. *Stability Instrument.* The loading program for the GOLDEN RAY was referred to as LOADMATE manufactured by Totem Plus, Ltd. This served as the vessel's approved stability instrument which interfaced on an Optiplex3046 Dell computer. It was approved and certificated by the Classification Society on behalf of the flag Administration on December 5, 2017, in accordance with the 2008 IS Code.<sup>7</sup> The Classification Society verified its accuracy at the last annual survey on December 18, 2018, for the load line certificate. LOADMATE was designed to aid in ascertaining the vessel's compliance with the vessel's Trim and Stability Booklet.

Specifically, LOADMATE calculated metacentric height (GM) and center of gravity (KG), amongst other data points, for comparison against parameters contained within the vessel's Trim and Stability Booklet. The stability instrument interfaced with the IMACS system to obtain liquid tank levels and draft readings. A crewmember typically had to manually enter information into the instrument. After all cargo information was entered, the crewmember would obtain the GM from the stability instrument. If the vessel did not meet one of the parameters from the Trim and Stability Booklet, a red screen would appear stating, "NOT OK," for that parameter. If a parameter, such as the GM, was not correct, the crewmember had the option to move cargo, discharge cargo, shift ballast, discharge ballast, or receive ballast to bring the vessel into compliance with the Trim and Stability Booklet. After corrective actions, the crewmember could then run the stability instrument again to see if the vessel was sufficiently stable.

4.2.5.2.8. *Ballast Tanks.* The GOLDEN RAY had 22 ballast tanks, which had the capacity to receive 9839.8 MT of ballast water. This ballast system was used to adjust the vessel's center of gravity and to adjust draft, heel, and trim. The vessel had multiple

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<sup>7</sup> The 2008 IS Code requires each ship to be provided with a stability booklet, which is approved by the Administration and contains sufficient information to enable the master to operate the ship in compliance with the requirements of the IS Code. In addition, if a stability instrument is used as a supplement to the stability booklet for the purpose of establishing compliance with the relevant stability criteria, the stability instrument is subject to approval by the Administration. See 2008 IS Code, Part A, Section 2.1.6; Annex 2, IMO Resolution MSC.267(85) (adopted on 4 December 2008), Adoption of the International Code on Intact Stability, 2008 (2008 IS Code).

locations to control ballast operations. At the time of the incident, the vessel held 2877.44 MT of ballast on board.

#### 4.2.5.3. *Regulatory Compliance and History.*

4.2.5.3.1. *Inspection and Port State Control History.* The GOLDEN RAY received its last USCG Port State Control exam in Benecia, California, on May 19, 2019, with no deficiencies noted. The vessel also underwent an initial Port State Control exam in Veracruz, Mexico, with no deficiencies noted on August 20, 2019. All required certificates and documentation were current and approved by the appropriate authorities.

4.2.5.3.2. *Drug and Alcohol Testing.* All crewmembers deemed directly involved in the incident were tested for drugs and alcohol. All of those crewmembers tested negative.

4.2.5.3.3. *SOLAS Stability Determination Requirement.* At the time of the incident, SOLAS II-1/20 required only passenger vessels, upon completion of loading and prior to departure, to determine the vessel's trim and stability.<sup>8</sup>

4.2.5.4. *Safety Management System.* As a result of the 1994 amendments to SOLAS, Chapter IX requires compliance with the ISM Code.<sup>9</sup> The ISM Code requires, *inter alia*, a Company to develop, implement, and maintain an SMS. The SMS should include instructions and procedures ensuring the safe operation of ships, defined levels of authority and lines of communication, procedures for reporting non-conformities, and procedures to prepare for and respond to emergency situations.<sup>10</sup> Once an Administration or Recognized Organization verifies the Company and its shipboard management operate in accordance with the SMS, a Safety Management Certificate (SMC) is issued.<sup>11</sup>

With respect to the GOLDEN RAY, the Company's SMS provided procedures for various shipboard tasks, including the responsibilities of crewmembers, cargo operations, stability management, and emergency training.<sup>12</sup> The Korean Register of Shipping (KRS) approved the Company's

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<sup>8</sup> On January 1, 2020, IMO Resolution MSC.421(98) entered into force, expanding the application of SOLAS II-1/20 to additional types of vessels.

<sup>9</sup> See SOLAS Chapter IX, Regulation 3.

<sup>10</sup> See ISM Code, Part A. Particularly, under Section 6, the Company should ensure the master is properly qualified for command, fully conversant with the SMS, and given the necessary support to safely perform the Master's duties. In addition, the Company should establish procedures to ensure new personnel are given proper familiarization with their duties and provided with essential instructions.

<sup>11</sup> See ISM Code, Part B, Section 13.7.

<sup>12</sup> See Section 8.3 of this ROI, Investigation Complicating Factors of Note.

SMS and subsequently issued an interim SMC.<sup>13</sup> The KRS conducted the most recent external ISM audit of the GOLDEN RAY on May 4, 2018. During the audit, no non-conformities or observations were issued, and the attending auditor determined that the SMS was properly implemented. As a result of the audit, the KRS issued a full-term SMC with an expiration date of May 3, 2023. As such, the Company's SMS at the time of the incident was in compliance with the ISM Code. The most recent internal audit was conducted by the Company on December 13, 2018, where they issued one non-conformity relating to medicine chest contents.

4.2.5.4.1. *Organizational Structure.* The Company's SMS detailed the shipboard organizational structure, as well as the duties and responsibilities of all crewmembers. The Master was the senior most crewmember and was provided overriding authority to make decisions with respect to the safety of the vessel and crew, as well as protection of the environment and cargo.

4.2.5.4.2. *Master's Duties.* The Master's responsibilities included the following: ensuring compliance with relevant rules, regulations, conventions, procedures, and manuals; ensuring the safe navigation of the vessel; ensuring the seaworthiness of the vessel; confirming cargo loading and discharge plans prepared by the Chief Officer; and managing the shipboard training program. Furthermore, although SOLAS II-1/5-1 indicates stability information as the sole responsibility of the Master, the Company's SMS did not require masters to have specific experience in subordinate positions on the same vessel types for which they were taking command.<sup>14</sup> In addition, under the 2010 STCW Code,<sup>15</sup> Part A, Chapter II, Section A-II/2, to obtain a Chief Officer or Master's endorsement, loading and stability knowledge is a requirement. However, the Company's SMS did not provide for training specific to calculating and verifying stability on a RO-RO vessel.

The Master trusted the reports from the Chief Officer regarding the vessel's stability and fully delegated responsibility on this matter to him. Following this communication with the Chief Officer, the Master sent this information as part of the departure report for each port to the Company preceding Brunswick. The GM was not verified beyond the Chief Officer's statement.

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<sup>13</sup> See ISM Code, Part A, Section 14.

<sup>14</sup> The Company's SMS addressed crew embarkation and debarkation in section CRM-04, but did not address pre-embarkation training for masters who lacked subordinate experience on RO-RO vessels.

<sup>15</sup> The International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) (adopted on 7 July 1978), amended by the Manila Amendments (adopted on 25 June 2010).

4.2.5.4.3. *Chief Officer's Duties.* The Chief Officer reported directly to the Master and oversaw the entire Deck Department. The Chief Officer's duties included the following: complying with relevant rules, regulations, conventions, procedures, and manuals; developing cargo loading and discharging plans; supervising the loading and discharging of cargo; confirming the vessel's stability; and managing the loading, transfer, and discharging of ballast. The Company's SMS did not require training for the Chief Officer relating to calculating stability. In addition, although the SMS required the Chief Officer calculate the vessel's stability and ensure compliance with the Trim and Stability Booklet, the SMS did not detail the procedure for calculating and recording the vessel's stability.

4.2.5.4.4. *Cargo Operations.* The Company's SMS had detailed procedures for conducting cargo operations, which included the following: general requirements; operation of ramps; preparations for loading; loading of cargo; lashing of units; monitoring of cargo during voyages; and unloading of cargo. These procedures required the Master to be satisfied that the vessel had sufficient stability at all times.

Additionally, the SMS required that the vessel's stability be calculated using the on-board stability instrument and comply with the required GM for the specific loading condition. The cargo operations procedures also required a pre-loading/discharging meeting be conducted with the stevedore superintendent to review the pre-stowage plan. Furthermore, following completion of cargo operations, the Duty Officer was required to conduct a check of each car deck with the stevedore superintendent to ensure compliance with the stowage plan. In addition, the SMS required that all gastight and watertight doors and hatches be closed following completion of cargo operations on each deck.

However, the SMS lacked specific detail regarding certain safety critical tasks performed on the GOLDEN RAY, particularly, the development of stowage plans.<sup>16</sup> The SMS additionally lacked detailed procedures for the Chief Officer in calculating stability and lacked a clear process for verifying the stability calculations by the Master and shore side personnel, including the LOM and space planner. The SMS also did not include any procedures for pre-embarkation training of the Chief Officer in calculating stability, of the Master in verifying stability, or of the crewmembers in keeping watertight doors closed.

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<sup>16</sup> The development of stowage plans is neither regulated nor required as part of the vessel's SMS. However, the shipper is required to provide accurate information regarding the cargo to the vessel under SOLAS II-1/25-8.



4.2.5.4.5. *Shipboard Emergencies.* Procedures for the response to shipboard emergencies were included in the Company's SMS. The procedures addressed, among other things, the response to fires, flooding, and abandoning vessel. Fire drills and flooding drills were required to be conducted monthly. Abandon vessel muster drills were also required to be conducted monthly, while simulated launching of the free fall lifeboat was required to be incorporated at least every six months. Fire and abandon vessel drills were also required to be conducted whenever 25% or more of the crew changed since the last drill was conducted. The procedures required that drills be conducted in a realistic manner and a debriefing be conducted upon completion. The completion of drills was required to be recorded in the Deck Logbook and sent to the Company.

As the GOLDEN RAY had new crew onboard, the drill was required to be conducted within 24 hours of the vessel's departure. Following crew change in Freeport, Texas, an abandon vessel drill was conducted on the GOLDEN RAY on September 1, 2019. During this drill, the free fall lifeboat and davit launched rescue boat were both lowered to the water and maneuvered.

4.2.5.5. *Development of Stowage Plans and Cargo Loading Operations for Brunswick.* The following process was undocumented. The LOM for Hyundai Glovis took over when the vessel departed Mexico and received a list of "cleared" vehicles from each terminal for U.S. port calls. The LOM sent the list to a third-party cargo planner, who generated a Microsoft Excel spreadsheet, known as the pre-stowage plan, for each U.S. port based on the amount and types of vehicles. The cargo planner used a table of average weights—in lieu of actual weights—based on the type of vehicle, but generally tried to keep heavy vehicles on lower decks and lighter vehicles on higher decks. Actual weights were never identified or verified at any point in the process.

After development of the pre-stowage plan, the cargo planner sent it back to the LOM for verification and adjustment. Once the LOM completed review, he sent it to the Chief Officer, the vessel's local agent, and port stevedores. With respect to the Port of Brunswick, this occurred at 1103 on September 6, 2019. The Chief Officer stated he entered information from the pre-stowage plan into the stability instrument to calculate the GM and overall stability of the vessel.

Each deck was divided into "holds" and these holds were identified in the pre-stowage plan (see Figure 14). Further, the Chief Officer stated he derived individual vehicle weights by dividing the total weight by the number of

vehicles in each hold. If the GM could not be brought within parameters of the vessel's approved Trim and Stability Booklet, the Chief Officer would contact the LOM for adjustments to vehicle locations. The Chief Officer stated he entered the information into the stability instrument for Brunswick and received an acceptable stability condition. Upon arrival to Brunswick, stevedores loaded the GOLDEN RAY in accordance with the pre-stowage plan, which was subsequently verified by the Chief Officer. The Chief Officer typically would note any changes that deviated from the pre-stowage plan, but none occurred for Brunswick. Although it is a common practice in the RO-RO vessel industry, the final stowage plan was not submitted prior to departure. The Chief Officer stated he calculated the stability again using the stability instrument following the loading operations and received an acceptable stability condition, including a GM of 2.45 M, prior to departure.

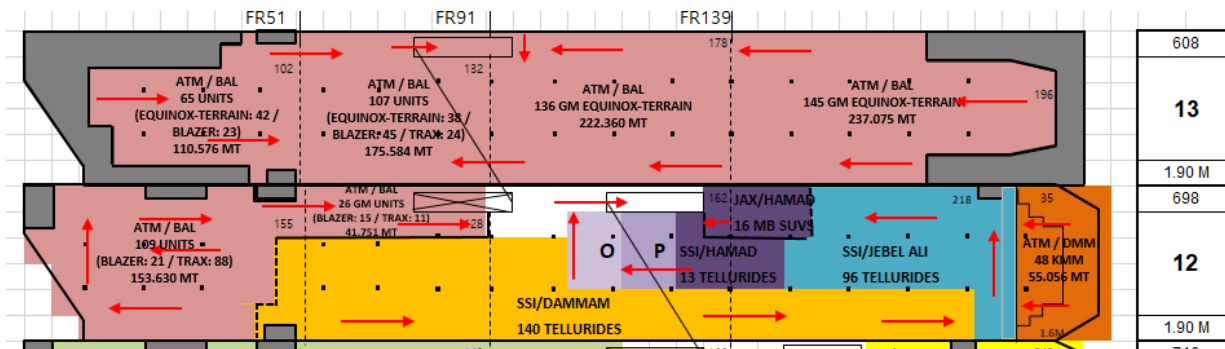


Figure 14. Snapshot of pre-stowage plan for Brunswick provided by Hyundai Glovis

#### 4.2.5.6. Calculated Loading Conditions Upon Departure from Brunswick.

4.2.5.6.1. *MSC Calculated Loading Conditions.* Facts surrounding the values used to complete the stability analysis conducted by the USCG Marine Safety Center (MSC) are captured in Appendix C of this report. Values were derived from the IMACS for all inputs except cargo. Cargo was derived based on the pre-stowage plan and actual vehicle weights from the manufacturers. The difference in weight is contained in Table 3.3 of Appendix C.

The Chief Officer stated he divided the estimated total weight by the number of vehicles loaded to get an average vehicle weight (rather than using the manufacturer-provided actual vehicle weights). This is what he entered into the stability instrument (LOADMATE) to calculate the GM. The MSC's analysis determined the Chief Officer's calculations would have been off by 2.2 percent which was approximately 200.95 MT.

4.2.5.6.2. *SILVER RAY's Stability Instrument.* USCG investigators attended the sister ship, the SILVER RAY, in

Brunswick and observed the Chief Officer's use of the stability instrument. During that visit, the Chief Officer used the final stowage plan to obtain the GM prior to departure. Additionally, he stated he would run the GM before loading with the pre-stowage plan to give him a rough idea of the final GM. He stated the pre-stowage and final stowage plan would occasionally differ if some cargo needed to be moved around at the loading/discharge port. The SILVER RAY's stability instrument computer was located on the port side of the vessel in the vessel's office.

4.2.5.6.3. *Vessel's Owners Calculated Loading Conditions.* Owners of the GOLDEN RAY visited the SILVER RAY post incident as part of the investigation and entered into the SILVER RAY's stability instrument the conditions set forth by the GOLDEN RAY's IMACS and the Brunswick pre-stowage plan. Several criteria regarding the righting arm properties from the 2008 IS Code were not met. The criteria that were not acceptable indicated, "NOT OK," by the system.

4.2.5.7. *Pilot.* The Pilot onboard the GOLDEN RAY at the time of the incident was a 22-year veteran of the Brunswick Bar Pilots Association. He stated he completed "over five thousand" transits in the area. He was a career pilot and earned his full branch pilot's license in 2014.

4.2.5.8. *SAR.* Details concerning the SAR phase of the incident response are captured in Appendix A.

4.2.5.8.1. *Amplifying information regarding SAR.*

4.2.5.8.1.1. The Pilot carried a handheld VHF radio which he communicated to the assist vessels on scene. The assist vessel relayed information to response assets in order to facilitate location of the crewmembers and their subsequent rescue from the Bridge. However, this transmission was not heard beyond these assets and therefore, no MAYDAY call could physically have been issued by the Pilot or anyone on board the GOLDEN RAY.

4.2.5.8.1.2. It is a common practice for crew on RO-RO vessels to receive training using a knotted fire hose as a means of traversing large open spaces within the vessel as the crew did in this case to escape the bridge.

4.2.5.9. *Initial Salvage.* Details concerning the initial salvage phase of the incident response are contained in Appendix B.

4.2.5.10. *Previous Accidents.* The following incidents involving RO-RO vessels losing stability were reviewed and the related facts are included below.

4.2.5.10.1. *HOEGH OSAKA – January 3, 2015.* The vessel lost stability after experiencing a severe starboard list. The cargo began to shift and the vessel suffered subsequent flooding. As the vessel flooded, it lost steering and propulsion. Notable facts from the accident include the following: the heel to starboard was a result of inadequate stability upon departure from port; the shifting cargo was deemed a result of the excessive list and not a causal factor in the incident; the vessel had an itinerary change which affected the loading plan and ballasting plans; and no departure stability calculation occurred prior to the vessel leaving port.

4.2.5.10.2. *RIVERDANCE – January 31, 2008.* The passenger RO-RO vessel grounded while underway. Severe weather impacted the ability of the vessel to be refloated and several circumstances impacted the salvage of the vessel. Notable facts from this accident include the following: the actual weight of vehicles loaded was not part of consideration in the loading plan; no stability calculations were completed (nor required at the time of the incident); and ballast was not adjusted even with anticipated weather conditions.

4.2.5.10.3. *COUGAR ACE – July 23, 2006.* The vessel experienced a significant list while underway. While in the process of a ballast water exchange, the vessel lost stability and listed to 60 degrees. All individuals onboard were successfully evacuated from the vessel. The vessel remained afloat until it was towed closer to shore and eventually, righted. Notable facts from this accident include the following: improper ballast water exchange operations; the failure to ensure stability was maintained during such operations; and inadequate procedures for dictating the completion of ballast water exchanges.

## 5. Analysis

### 5.1. *The GOLDEN RAY Left the Port of Brunswick with Insufficient Stability.*

Appendix C of this report outlines the analysis conducted by the USCG Marine Safety Center (MSC). The results of their analysis indicated that the vessel did not fully meet the requirements of the righting arm criteria due to the limited area under the righting arm curve between 30° and 40° at the time GOLDEN RAY left Brunswick. Further, MSC also used their independently generated computer model to assess compliance with the mandatory Severe Wind and Rolling criteria (Part A, Section 2.3) of the 2008 IMO Intact Stability (IS) Code. Results indicated that the vessel failed this criteria by a significant margin. As the ship began its starboard turn in the vicinity of Widener 11, it experienced a heeling moment due to the resultant centrifugal force. MSC calculated the effect that this turn had on the righting arm curve using a range of turn radii and the speed of the vessel. Results indicated that the maximum righting arm and righting energy were significantly reduced by the turning heeling moment. Lastly, the final area under the righting arm curve which resulted from the combined effects of the way the vessel was loaded in Brunswick, and the heeling moments experienced during that starboard turn created a small fraction of the area under the righting arm curve. This extreme lack of righting area (and corresponding lack of righting energy) indicated that the vessel had little capability of withstanding further adverse static or dynamic heeling effects. Dynamic overshoot, which caused the GOLDEN RAY entering Widener 11 to heel even further away from the direction of that turn, coupled with any cargo shifting or weight shift due to that heel, are likely to have overcome the remaining righting energy and resulted in the capsizing.

5.2. *Master Lacked Experience in Subordinate Job Functions.* The GOLDEN RAY's Master was inexperienced with loading operations specific to RO-RO vessels, as he had never previously served in a position responsible for RO-RO vessel stability calculations or loading/unloading of vehicles on this vessel type. While he may have had supervisory experience relating to stability and loading operations, he lacked experience in practical application since he did not serve in these roles firsthand. Two of the three RO-RO vessels for which he was a Master were with this Company. It is not commonplace for a person to become a Master of a RO-RO vessel without having first served as a Chief Officer on this vessel type. According to the Master, he had no specific role in the loading process. However, the SMS noted the Master as possessing the ultimate responsibility for ensuring the vessel met all relevant regulations. Additionally, because the Company's policy did not require masters to have specific experience in any other officer position on similar vessel types in lower capacities prior to serving in that role, particularly specific experience as a Chief Officer on a RO-RO vessel, the Master did not possess firsthand experience calculating RO-RO vessel stability. Furthermore, as the Company's SMS did not address pre-embarkation training for the Master, he could not overcome his inexperience in that role and satisfactorily oversee the Chief Officer in his stability calculations. The Master's lack of knowledge of the stability calculations, inexperience on RO-RO vessels in a subordinate position, and insufficient guidance to minimize the knowledge gap, made him ill-equipped to oversee the Chief Officer in his performance of duties. This ultimately resulted in the Master trusting the Chief Officer's reports regarding stability without verifying the information. If the Master was knowledgeable on the subject, or provided with additional resources, he

could have recognized an error in the calculated GM prior to departure and provided time for correction.

5.3. *Failure of Chief Officer to Recognize Stability Did Not Improve Prior to Departure from Brunswick.* During the investigation, the GM calculated by the MSC using loading conditions from the Brunswick departure was 1.76 M, which is a significantly smaller than the GM reported by the Chief Officer prior to departure. To improve upon the reported Jacksonville departure GM of 1.96, the GOLDEN RAY would have needed to take on additional ballast, remove cargo from the vessel's upper decks, significantly shift cargo, or take on additional fuel; however, none of these events occurred. Nevertheless, the Chief Officer stated the GM at departure from Brunswick had significantly improved to 2.45 M. At the Port of Brunswick, the vessel added 550 MT of cargo to the upper decks of 5, 11, and 12. Additionally, the vessel used approximately 17 MT of fuel on the transit from Jacksonville to Brunswick. With these two changes to the loading condition of the vessel, the GM could have only decreased. As such, the Chief Officer failed to identify there was an error in the increased GM he reported of 2.45 M. Due to the unrecoverable nature of the GOLDEN RAY's loading instrument, the LOADMATE<sup>17</sup>, it cannot be conclusively determined what caused the margin of error. The Chief Officer testified that he conducted the calculations using the LOADMATE and generated a GM of 2.45 M in Brunswick. There was no other evidence available to corroborate his statement and he chose not to testify to clarify this point at the formal proceedings. Initial interviews conducted with the Chief Officer only covered general processes of ballasting and stability calculations but never clarified how these two processes interacted or applied upon departure from Brunswick. Without an opportunity to clarify these points, his specific actions in calculating stability after loading and prior to departure from Brunswick are unknown. Although less likely given approval and verification by the Classification Society, it could also be due to a problem with the stability instrument software. Assuming the Chief Officer's statement is true, then the most likely cause of the margin of error is the Chief Officer incorrectly entering information in the LOADMATE and his failure to recognize that stability could not have improved in Brunswick. Had the Chief Officer noticed the significant difference in GM, he would have been able to verify the calculations were correct using "hand calculations" and the vessel's Trim and Stability Booklet.<sup>18</sup> Additionally, the Chief Officer would have been able to investigate the cause of the discrepancy and discovered a problem with the vessel's stability. This would have allowed him to take corrective actions to avoid the loss of stability.

#### 5.4. *Insufficiency of Written Company Vessel Loading Processes in the SMS.*

5.4.1. *Single Point of Failure for Stability Calculations.* On the GOLDEN RAY and throughout the Company's fleet, there were multiple entities involved in developing and implementing cargo operations. Figure 15 depicts the development of the loading plan for the GOLDEN RAY based on witness testimony.

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<sup>17</sup> See Section 1.1.5 of this ROI for Investigation Complicating Factors of Note.

<sup>18</sup> "Hand calculations" involve comparing the loading conditions and liquid weights (ballast, fuel, etc.) against tables in the Trim and Stability Booklet, rather than the computer generating the output. This process takes an average of 30 minutes to complete.

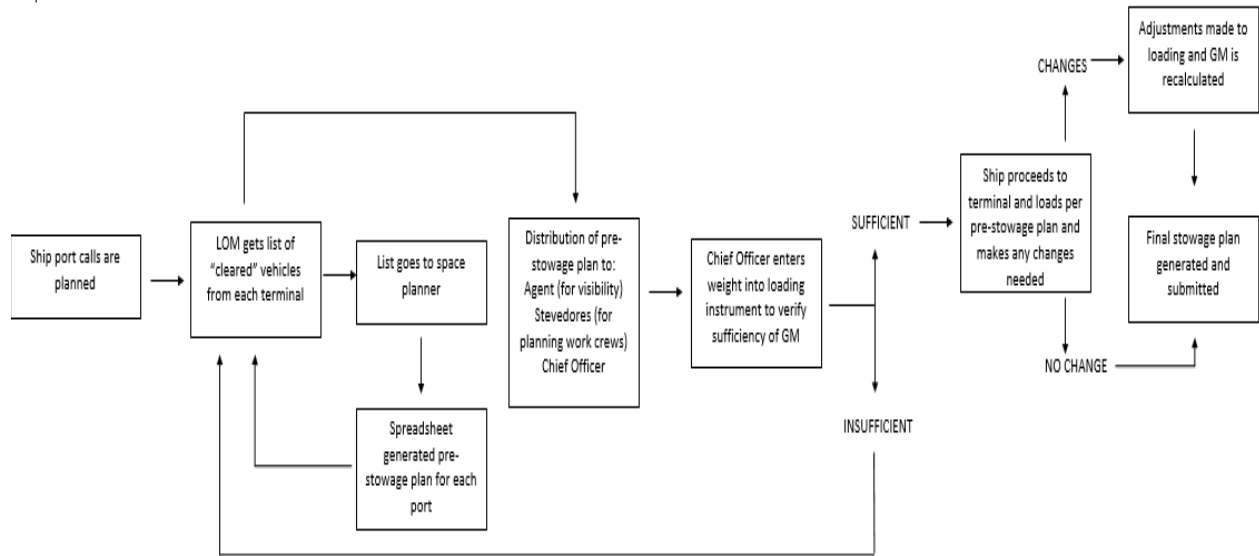


Figure 15. Cargo operations flow generated from witness testimony

While this undocumented process used for development of cargo plans for the GOLDEN RAY is efficient and utilized minimal personnel, there is a single point of failure in having multiple steps for consideration of stability in loading. The Chief Officer singularly considers and calculates stability in the process, based on decisions made by the LOM and space planner. In general, it is ideal that the vessel would receive a copy of the pre-stowage plan ahead of a port call which did happen in this case. Additionally, the Chief Officer received the pre-stowage plan with estimated total weights for each section, rather than individual vehicle weights. Due to unsuccessful attempts to retrieve information off the stability instrument, there is no way to verify the Chief Officer’s testimony that GM was calculated at the steps indicated on the flow chart using the pre-stowage plan. The process in Figure 15 had worked since its inception in the fleet and never resulted in a loss of stability for other vessels. However, this process relied solely on one person to conduct stability calculations. Had the GOLDEN RAY provided feedback to the LOM or space planner, they could have helped adjust the pre-stowage plan to achieve acceptable stability and avoided the subsequent loss of stability. No one in the process noticed visible signs of stability issues or the manner the vessel handled underway in either the Port of Jacksonville or the Port of Brunswick. Based on the departure report from Jacksonville, the LOM or space planner could have intervened at that time to set corrective measures prior to the vessel arriving in Brunswick. During the process of validating the stability based on the pre-stowage plan, if the loading instrument calculated a GM or other parameter that indicated a lack of stability, the stability instrument would have so indicated with a message of, “NOT OK”. If this message appeared, there were three options available to resolve the situation through adjustment of either cargo or ballast. First, the vehicles onboard could have been moved. However, due to limited empty cargo space, movement of vehicles would have provided little positive adjustments to the GM. Second, the vehicles could have been offloaded. In this situation, the implication of the Jones Act would have been a consideration. Lastly, and the most desirable option, the Chief Officer could have taken on ballast to achieve an

acceptable GM. For this option, draft restrictions to remain on the current scheduled departure would have been considered, as the vessel could have made adjustments to the ballast and waited for a more amicable tide for the deeper draft. None of these options were taken by the GOLDEN RAY and due to a refusal of the Chief Officer to testify it is unclear why not.

#### 5.5. *Lack of Specificity in the SMS.*

5.5.1. *Lack of Specificity Regarding Stability Calculations in the SMS.* The Company's SMS lacked specific detail relating to stability calculations on the GOLDEN RAY. The lack of detailed procedure for calculating the vessel's stability, recording the results, and verifying the information contributed to the Chief Officer reporting a GM to the Master that was not representative of the actual GM at the time of departure from the Port of Brunswick. The inaccuracy of the GM reported by the Chief Officer would not have been readily apparent to the Master without a thorough review of the parameters (ballast tank levels, fuel oil tank levels, cargo weights, etc.) entered into the LOADMATE and comparison with the loading conditions in the vessel's Trim and Stability Booklet, which was not a step included in the SMS. The insufficient intact stability of the GOLDEN RAY would have been identified prior to departure had there been procedures in place in the SMS for the Chief Officer to properly calculate the GM, then the Master to independently verify the stability calculations against the Trim and Stability Booklet, and finally a shore side representative, such as the LOM or space planner, to be informed of the stability for any corrective action. This would have prevented the sudden loss of stability and subsequent capsizing of the vessel during the outbound transit.

5.5.2. *Lack of Specificity Regarding Stowage Planning in the SMS.* The Company's SMS did not adequately detail the process for planning the stowage of units on the GOLDEN RAY. Although the SMS required the Chief Officer to review the pre-stowage plan prior to commencing cargo operations, it did not detail the process for reviewing the pre-stowage plan nor did it require that stability calculations be conducted using the cargo weights provided in the plan. Additionally, there was no documented feedback procedure for acceptance or modification of the pre-stowage plan. Clear procedures in the SMS for calculating the anticipated GM of the vessel based on the pre-stowage plan prior to arrival at the Port of Brunswick would have allowed for the identification of the reduced GM as not in compliance with the Trim and Stability Booklet. This would have likely initiated changes to the stowage plan, loading of additional ballast, or a combination of both.

5.5.3. *Lack of Checks and Balances Regarding Stability in the SMS.* The Company's SMS did not provide multiple layers of prevention with respect to the GOLDEN RAY's stability even though it was compliant with the ISM Code. Pursuant to the SMS, the responsibility to calculate the vessel's stability and ensure compliance with the Trim and Stability Booklet rested with the Chief Officer. The Master was also tasked with ensuring the vessel remained in compliance with all applicable regulations and manuals,



including the 2008 IS Code and the Trim and Stability Booklet. There was no requirement in the Company's SMS for shore side review or approval of the vessel's stability prior to departure from port. This created a single point of failure with no active defense mechanism—a failure or error by the Chief Officer could allow the vessel to sail in a non-compliant condition. Inclusion in the SMS of a requirement for the timely review of the vessel's stability by the Master or shore side representative would have identified the non-compliance with the Trim and Stability Booklet and initiated corrective actions.

5.6. *Failure to Maintain Watertight Integrity.*

5.6.1. *Poor Decision to Leave Pilot Door Open.* Leading up to the incident, the Master ordered the Pilot Door open and it remained open throughout the departure from Brunswick. SOLAS II-1/22 requires watertight doors to be closed if not in use while underway, although some discretion is left to masters in limited circumstances. This regulation leaves some discretion to masters and since there were no previous incidents due to this practice the Master likely deemed it a safe one. During the evidence collection and witness testimony, no explanation was given as to why the Pilot Door was left open. However, once the vessel lost stability, as the MSC calculated during the investigation, the Pilot Door was under water at 15-17 degrees of port heel, which allowed an enormous amount of water to enter Deck 5.

5.6.2. *Failure to Close Access Midship and Aft Doors to Stairtowers.* Engineers testified that water ingress through the escape route and the alternate exit to the ECR occurred after the GOLDEN RAY lost stability, resulting in their entrapment in the engine room. The doors to access the engine room on Deck 5, port side were open. This created a potential for water ingress that subsequently impacted the entirety of Deck 5 and the engine room. This water most likely came from the open Pilot Door. Due to the Pilot Door being left open and the rapid loss of stability, expedited downflooding occurred through the access doors being left open, and ultimately contributed to the engineers being trapped in the engine room, as the water blocked their only escape routes. Had these watertight doors been closed, the progressive downflooding may have been less expeditious and allowed the engineers a route to safely escape from the engine room.

5.7. *Inadequate Emergency Lighting.* Inadequate emergency arrangements, including lighting and egress, left crewmembers stranded as the GOLDEN RAY capsized. SOLAS regulations do not require emergency generators to function at heels greater than 22.5 degrees port or starboard or 10 degrees bow or stern. As such, no emergency power or lighting was available for the GOLDEN RAY once it heeled hard to port. Although emergency lighting was unavailable to crewmembers attempting to evacuate the vessel in the dark, all but the four trapped in the engine room made their way out of the vessel and were rescued. However, lack of emergency lighting did not play a role in the injury sustained by the Cadet on board. Once the vessel capsized and the crew was forced to make a nearly vertical exit during SAR, none of the safeguards in place, including emergency lighting and handrails, could have prevented her fall.

5.8. *Isolation of Means of Escape to Port Side from Engine Room.* SOLAS II-2/13.4.2.1 requires two means of escape from the machinery space but does not specify that one should be located on each side of the vessel, just that they should be widely separated. In the GOLDEN RAY's particular vessel design, both means of escape from the engine room opened on the port side at Deck 5. When the GOLDEN RAY reached sufficient list, water entered through the open Pilot Door and proceeded aft to the engine room emergency escape. This, in turn, stranded the crewmembers, as their only means for escape were underwater. Had the vessel been designed with the two required means of escape located on both the port and starboard sides of the vessel, there would have been another option for the crewmembers to leave the engine room once it began flooding.

5.9. *Application of Counter Rudder.* The application of the counter rudder did not play a role in the capsizing, as the capsizing was inevitable based on the circumstances. The sequence of events following the loss of stability happened within seconds. There was no time for the crew to apply any logical correction to the loss of stability or heel that would have prevented the GOLDEN RAY from capsizing. The vessel went from a heel of 17 degrees to 60 degrees within seconds of the crew realizing there was an issue with the stability. Had the vessel remained heeled for a period of time, the crew could likely have applied corrective measures, such as ballasting to attempt to right the vessel. However, because of the rapid downflooding and massive heel to port, the crew had no ability to access the areas to shift ballast and save the vessel from capsizing. Therefore, there was nothing that could have reasonably prevented the capsizing once the vessel heeled to port and the open Pilot Door became submerged. Appendix C further discusses this topic.

5.10. *Fire on Board Undetermined.* Access to the fire-affected portion of the GOLDEN RAY was too dangerous for salvors and investigators to properly conduct a fire investigation. As such, the cause of the fire could not be investigated. Additionally, several other fires were noted throughout the salvage and therefore, the initial fire could not be analyzed. Usually, the fire detection system on board provides a notification that fire is likely to occur by picking up smoldering and alerting the crew before the fire tetrahedron is completed. It is not clear based on the witness testimony and evidence collected whether the fire detection system alarmed during the incident. Even if the fire detection system had alarmed, the crew could not have been able to address the conditions causing the alarm due to the life-endangering situation they were encountering. Additionally, the vessel's low pressure CO<sub>2</sub> system is designed to automatically activate in the event of a fire. However, in this case, once the fire started, the vessel's low pressure CO<sub>2</sub> system did not automatically activate. Evidence during salvage operations indicated no drastic spread of the fire occurred and no firefighting efforts were used; the fire extinguished on its own. This is likely due to vessel fire boundary and compartmentalization requirements during its construction but cannot be confirmed without immediate access to the scene. Therefore, the reasons the CO<sub>2</sub> system did not activate and the cause of the fire cannot be determined.

5.11. *Inevitability of Grounding.* The GOLDEN RAY lost power and propulsion within seconds of it heeling to port, while making about 12 knots over ground and in an uncontrolled turn to starboard. The vessel's momentum caused the vessel to leave Widener 11 and ground on a sand shoal. With no power or propulsion, and while clinging to various

pieces of equipment on the Bridge, there were no actions that could have been taken by the crew or Pilot to prevent the grounding.

5.12. *Pollution Prevention Measures.* The design of pollution prevention measures do not contemplate vessels capsizing. Safeguards exist, such as closures, one-way valves, and containment, but none of these safeguards would have prevented oil from entering St. Simons Sound once the GOLDEN RAY capsized. Therefore, no reasonable defense against pollution existed.

5.13. *Possibility of Fatigue.* The possibility of fatigue was examined. There is no evidence to suggest that the Pilot or any of the crewmembers were suffering from fatigue. All work-rest requirements were met by crewmembers.

5.14. *Cargo Securing Manual (CSM).* SOLAS Chapters VI and VII require a CSM, approved by the flag Administration, to be provided on all types of vessels engaged in the carriage of cargoes other than solid and liquid bulk cargoes.<sup>19</sup> During this investigation, consideration to cargo securing was given. Evidence did not indicate there was any issue with how vehicles were secured on the GOLDEN RAY. The lashings were provided by the vessel and vehicles were lashed in accordance with the CSM. While the dangerous conditions on board prohibited investigators from confirming that all vehicles were properly secured, it is assumed based on the testimony of the stevedores and crew, that all vehicles were properly secured. Further, salvage of the vessel included 3D scanning of the cargo decks, as pictured in Figure 16. Even after the capsizing and grounding, many of the vehicles on board were held in place by their lashings. This remained the case even as the vessel was salvaged two years later, as pictured in Figure 16.



Figure 16. 3D scanning of vessel post incident by salvors

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<sup>19</sup> See IMO Resolution A.714(17), Code of Safe Practice for Cargo Stowage and Securing (adopted on 6 November 1991).



Figure 16. Photo taken during salvage operations by USCG in 2020

5.15. *Training and Emergency Drills.* Although not specifically queried in crew interviews, it is plausible that training and emergency drills served to prepare the GOLDEN RAY's crew for evacuation. The Master's commitment to safety and insistence that the crew conduct emergency drills in the first few days after his reporting aboard is most certainly a factor contributing to no lives being lost in this incident—the actions required to be taken in the event of an emergency were fresh in the minds of the crewmembers.

## 6. Conclusions

### 6.1. *Determination of Cause.*

6.1.1. The initiating event occurred when the GOLDEN RAY experienced a loss of stability. Contributing factors to this event were:

6.1.1.1. The Master lacked experience in conducting stability calculations on RO-RO vessels.

6.1.1.2. The failure of the Chief Officer to recognize the incorrect result of his reported stability calculations prior to departure from Brunswick.

6.1.1.3. The single point of failure for stability calculations during loading plan development.

6.1.1.4. The lack of specificity of SMS regarding loading plan development and the calculation of stability.

6.1.2. After the vessel lost stability, it began to take on water and experienced its initial flooding. Contributing factors to this event were:

6.1.2.1. The decision to leave the pilot door open.

6.1.3. As the vessel took on water it progressively flooded into other spaces. Contributing factors to this event were:

6.1.3.1. The access doors to the midship and aft stair towers being left open.

6.1.4. The vessel heeled over and capsized. Based on section 5.9 there were no contributing factors to this event.

6.1.5. A fire ensued after the capsizing. The cause and origin of the fire was undetermined as discussed in 5.9, and therefore no causal factors can be identified.

6.1.6. In its capsized position the vessel grounded and came to rest on the southeast edge of Widener 11. There was nothing to prevent the vessel from grounding after it capsized as identified in 5.10.

6.1.7. The vessel lost all power on board. Based on section 5.6, nothing could have prevented this occurrence.

6.1.8. As the vessel capsized a cadet injured her hand. Based on section 5.6, nothing could have prevented this injury.

6.1.9. In its fateful position, the vessel began to discharge oil. There were no contributing factors identified for this event as discussed in 5.11.

6.2. *Unsafe Actions or Conditions that Were Not Causal Factors in this Casualty.*

6.2.1. *Negative Impact of Itinerary Changes and Perceived Requirements.* After the passage of Hurricane DORIAN, the decision was made by Hyundai Glovis to shift the port calls of Brunswick and Jacksonville in order to relieve the time pressures on the terminals. Additionally, a planned port call to Wilmington, North Carolina was cancelled. The Port of Jacksonville reopened with no restrictions prior to the GOLDEN RAY's arrival. Even though neither port is draft restricted by law or regulation, some agents or pilots associations ask that vessels maintain a certain maximum draft in order

to avoid the impact of tidal influence on their arrival/departure plans. Pilots or agents request these draft restrictions because of certain factors, such as channel depth, turn radii, tidal influences, traffic schedules, berth characteristics, anticipated weather conditions, preferred under keel clearance, etc.

In this case, the Master complied with Hyundai Glovis' request to reduce the draft of the GOLDEN RAY prior to arrival in Jacksonville. To achieve this, the vessel discharged 1400 MT of ballast. Witnesses testified that there were no external pressures on the vessel's schedule to expedite port calls due to lost time from Hurricane DORIAN schedule changes and avoidance. Further, the vessel willingly complied with requests made by the agent regarding drafts, which were likely perceived as requirements. This likely prevented the Chief Officer from adding additional ballast or taking additional measures to increase the vessel's GM because the vessel met draft and tidal requirements—however, it was at the cost of the vessel's stability. The Chief Officer chose not to testify at the hearing; therefore, the extent that the agent requesting draft requirements contributed to the incident cannot be determined.

*6.2.2. Potential Insufficient Knowledge of the Chief Officer in Performing Stability Calculations.* Pursuant to the Company's standard practice, during cargo operations, it is the job of the Chief Officer to supervise the loading and unloading of vehicles, confirming the vessel's stability and managing the loading/management/discharge or ballast. The GOLDEN RAY's Chief Officer served on the vessel for approximately six months and served as a Chief Officer on a RO-RO vessel for six years. For the four years prior to that, he served as Chief Officer on other vessel types. He stated the GOLDEN RAY had similar but different software to perform stability calculations than the other RO-RO vessels he served on before. Upon reporting to the GOLDEN RAY, he completed a hand over with the prior Chief Officer. During this time, he received three to four hours of training from the off-going Chief Officer regarding their specific stability instrument's software, the LOADMATE. Based on the unwillingness of the Chief Officer to testify at the hearing to clarify this topic,<sup>20</sup> the inability of the data to be derived from the stability instrument, and the Chief Officer being the sole source of the vessel's stability information, the role his potential lack of knowledge played in the incident cannot be determined.

*6.2.3. Incorrect GM.* The Chief Officer stated he divided the estimated total weight by the number of vehicles loaded to get an average vehicle weight. This is what he entered into the stability instrument to calculate the GM. The MSC's analysis determined the Chief Officer's calculations would have been off by 2.2 percent which was approximately 200.95 MT. This was determined to be insignificant to actual GM of the GOLDEN RAY. In several prior RO-RO vessel incidents, this discrepancy in actual versus estimated weight is highlighted as a casual factor. The exact impact of this 2.2 percent was minimal in this instance; however, the practice of using estimated weights for vehicles rather than manufacturer-provided curb weights should be addressed to prevent future incidents.

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<sup>20</sup> See Section 8.3. of this ROI for Investigation Complicating Factors of Note.

6.3. *Evidence of Act(s) of Misconduct, Incompetence, Negligence, Unskillfulness, or Willful Violation(s) of Law by Any Person Holding a USCG Credential Subject to Action Under 46 U.S.C. Chapter 77.* There was no evidence of any such acts or violations of law by any Coast Guard-credentialed mariner and the USCG does not have jurisdiction over other mariners in this case.

6.4. *Evidence of Act(s) of Misconduct, Incompetence, Negligence, Unskillfulness, or Willful Violation(s) of Law by Any USCG Personnel, Any Representative or Employee of Any Other Government Agency, or Any Other Person.* There was no evidence of any such acts or violations of law by any Coast Guard-credentialed mariner.

6.5. *Evidence of Act(s) Subject to Civil Penalty.* The vessel discharged reportable quantities of oil; however, the pollution investigation is being conducted by the FOSC and therefore, is not addressed in this report. There are no acts or evidence that warrant a civil penalty in this investigation.

6.6. *Evidence of Criminal Act(s).* There was no evidence of criminal activity.

6.7. *Need for New or Amended U.S. or International Law or Regulation.* There is a need to update SOLAS II-2 /13.4.2.1 and 46 C.F.R. § 116.500. This is addressed in Section 8.1.1. of this report.

## **7. Actions Taken Since the Incident**

7.1. *Findings of Concern #1.* A Findings of Concern titled ‘Watertight Envelopes and Open Pilot Doors’ has been recommended for release against leaving watertight doors open for extended periods of time. SOLAS gives discretion to Masters to open these doors when work in or around them is needed but directs them to be closed as soon as that work is completed. Great care should be taken in maintaining the water tight integrity of the vessel and this large opening can prove to be deadly if water ingress occurs. Had the vessel not grounded just outside the widener the progressive down flooding allowed by the open Pilot Door and watertight doors in the engine room would have been much worse.

7.2. *Findings of Concern #2.* A Findings of Concern, titled ‘Development of RO-RO Pre-Stowage Plans’, has been recommended for release. It is recommended that vessel owners and operators document the process for developing pre-stowage plans. During this process, consideration should be given to adding safeguards against a single point of failure for calculation and verifying the vessel will meet all parameters in its Trim and Stability Booklet. This will specifically ensure the requirements of SOLAS VI/2 are met.

7.3. *Findings of Concern #3.* A Findings of Concern, titled ‘Routine Hand Stability Calculations’, has been recommended for release. It is recommended that vessels require chief officers of RO-RO vessels to “hand calculate” stability on a regular basis. This ensures they maintain their ability to complete this task if the stability instrument cannot and it allows the crew to compare their results against the computer-generated results.

7.4. *Actions by the GOLDEN RAY's Owners.* The GOLDEN RAY's owners updated SMS policies that address items in section 5.5. of this report. They implemented a training program for officers to learn the stability instrument software. All masters and chief officers must now receive this training prior to boarding. Further, they developed and implemented a training program for all deck officers, aimed at increasing the overall familiarity and awareness for those serving on board RO-RO vessels. The vessel's owners additionally revised their SMS procedures to require final stowage plan submission prior to vessels departing.

The actions taken by the vessel's owners following the incident did not influence the findings and conclusions of this investigation.

## **8. Recommendations**

### 8.1. *Safety Recommendations.*

8.1.1. *Safety Recommendation #1—Two Means of Escape on Opposite Sides of Engine Room.* Recommend Commandant work with the IMO to amend SOLAS II-2/13.4.2.1 to require the two means of escape from the engine room to be on opposite sides and ends of the space. This will reduce the possibility of both means being blocked at the same time, as was the case in this incident. Further, recommend Commandant review 46 C.F.R. § 116.500 for a similar requirement on U.S.-flagged vessels.

### 8.2. *Administrative Recommendations.*

8.2.1. *Administrative Recommendation #1—SAR.* Concur with the recommendations surrounding the SAR for this incident included in Section 5 of Appendix A and those entities identified for action should consider their implementation.

8.2.2. *Administrative Recommendation #2—Pollution Response and Salvage.* Concur with the recommendations surrounding the initial pollution response and salvage included in Section 6 of Appendix B and those entities identified for action should consider their implementation.

8.2.3. *Administrative Recommendation #3—Employ MSC Staff at Beginning of Investigations.* Recommend CG-INV alert investigators of the benefits of employing the services of the MSC staff during the interview of relevant crewmembers at the onset of technical investigations. Had MSC been present or involved in the preliminary interviews of witnesses, they would have additional questions based on professional qualifications that could have identified causal factors earlier post-fact-finding. This is a best practice for consideration in any technical investigation.

8.2.4. *Administrative Recommendation #4—List of USCG Translators.* Recommend CG-INV develop a list of USCG translators who have marine safety experience for use in investigations. As all crewmembers were not native English



speakers, speaking either Korean or Filipino, the lack of competent translators who understood maritime terminology plagued the investigation throughout. Although a certified Korean translator was utilized for the formal hearing, some witnesses complained of misrepresentation of their testimony. Based on this situation, the LIO took extra time with these witnesses to ensure that their testimony was clarified and clearly understood by all parties prior to moving to the next question or witness. Additionally, attorneys representing the non-native English speakers were provided the hearing transcripts to review and give feedback. The official documents were then amended to reflect a true and accurate record of the testimony. Had a translator possessing a maritime background been readily available, this situation could have been avoided.

8.2.5. *Administrative Recommendation #5—Training for Judge Advocates.* Recommend CG-INV, in consultation with INV-NCOE, develop a just-in-time training program for Judge Advocates assigned to formal investigations as attorney advisors. The attorney advisors for this case were instrumental in obtaining evidence, authoring unique subpoenas and associated cover letters, fostering strong collaborative relationships with PII attorneys, and negotiating agreements when objections were raised. This investigation was fortunate to have a legal advisor for the hearing with an extensive maritime law background, which proved crucial to her success. Without this background, she would have had minimal guidance to complete this undertaking.

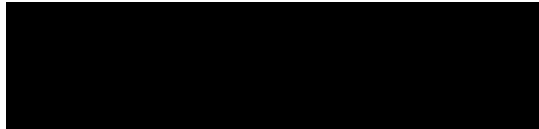
8.2.6. *Administrative Recommendation #6—Best Practices for Investigations Involving Foreign Nationals.* Recommend CG-INV, in consultation with the INV-NCOE, develop best practices for investigators who have foreign nationals as witnesses, flag states, owners, or operators involved in the investigation. The process for gathering evidence and compelling appearances are different than U.S. citizens but not captured in any guiding documents. The Marine Safety Manual Volume 5, Chapter A3/E.3.b. does not adequately address how to liaise with foreign nationals who serve as witnesses for formal hearings after they leave the U.S. This is problematic if these witnesses leave the U.S. and do not return to testify at formal proceedings.

8.2.7. *Administrative Recommendation #7—Additions to Officer Specialty Code.* Recommend CG-INV review the conditions met for the level four investigations Officer Specialty Code and add completion of a formal investigation as a requirement. There is a unique set of skills required to complete an investigation of this level. Consideration should be given to separating the formal investigation and hearing process, with the hearing process as a separate addendum to the marine casualty investigator PQS, just as the hearing qualification is separate from the suspension and revocation officer qualification.

8.2.8. *Administrative Recommendation #8—Review of Training Course Curriculum.* Recommend USCG FORCECOM, in concert with USCG Training Center Yorktown, review the Sector Commander, Incident Commander, and Prevention Department Head course curriculum for content regarding investigations. Specifically, how the investigation interacts with the response. It was noted on several occasions

throughout the investigation that the response and investigation were duplicating efforts, which slowed both processes down. In previous iterations of guidance for Incident Management, the investigator served in an advisory role to the Unified Command.

8.2.9. *Administrative Recommendation #9—Letters of Appreciation or Public Service Awards.* Recommend USCG District Seven issue letters of appreciation or public service awards to the Brunswick Bar Pilots Association and Moran Towing for their critical role in facilitating communications during the SAR of this incident. The calm, collective nature of the Pilot on the GOLDEN RAY and the availability of his handheld VHF radio proved essential to communicating the location and status of those in need of rescue. Further, Moran Towing being on-scene in close proximity to receive the transmissions from the Pilot and relay the information to all response assets most certainly expedited the rescue of those onboard the GOLDEN RAY. Pursuant to the findings of this investigation, the LIO does not recommend any administrative or punitive action against any Coast Guard or other personnel. The LIO does not recommend any suspension or revocation action against any USCG credentialed mariner. The LIO does not recommend criminal prosecution against any person or entity. It is recommended this investigation be closed.



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