UNITED STATES COAST GUARD

U.S. Department of Homeland Security

MARINE SAFETY ALERT

Inspections and Compliance Directorate

March 3, 2015
Washington, DC

Safety Alert 2-15

Ultra Low Sulfur Fuel Oil & Compliance with MARPOL Requirements

Before entering and while operating within Emission Control Areas

This safety alert is a reminder to vessel owners and operators about the importance of establishing effective fuel oil changeover procedures to comply with MARPOL Annex VI emission regulations. Recently, there have been several reported incidents involving substantial machinery space fuel leakages while vessels were switching fuel oil to ensure compliance. Although such leakages were contained, fuel releases of any kind may result in pollution, injury or death of personnel and shipboard engine room fires. Moreover, many losses of propulsion have occurred in different ports and have been associated with changeover processes and procedures.

On January 1, 2015, the new fuel oil sulfur limit authorized by MARPOL Annex VI, Regulation 14.3.4 came into effect, lowering fuel sulfur content from 1.0% to 0.10%.[1] The 0.10% fuel sulfur content must be used the entire time the vessel is operating in the North American and U.S. Caribbean Sea Emission Control Areas (ECA). As a result, vessels using higher sulfur content fuels must change to ultra low sulfur (ULS) fuel oil to comply. The vessels must use the ULS fuel oil on inbound and outbound transits, at the dock, and anytime within the ECA. Meeting this requirement requires planning and analysis before any changeover from higher sulfur content fuel oil to ECA compliant fuel oil and vice-versa. Each ship which uses higher sulfur content fuel oil is required to develop and implement changeover procedures for switching between residual and distillate fuels in accordance with MARPOL Annex VI, Regulation 14.6.

In some cases vessels may require fuel oil service or day tank modifications and fuel oil service piping modifications to facilitate safe procedures and compliant fuel operations within the ECAs. The management and oversight of any fuel oil mixing that may be part of a changeover process including, proper control and reduction of the operating temperature of fuel supplied, varying ratios of the mixed fuels and control of mixed fuel viscosity to the engines must take place before the vessel enters the ECAs or after the vessel leaves the ECAs. The amounts of ULS fuel oil onboard must be enough to satisfy the vessel's fuel demand at all times while the vessel operates within the ECAs or efforts should be made to take on additional ULSF while in port.

There are many other important technical issues associated with the use of ultra low sulfur fuel oils and fuel oil switching addressed in documents produced by class societies, insurers, engine manufacturers and industry associations. A few of these documents are presented as links at the bottom of the next page.

[1] Vessels that have an accepted exemption under Marpol Annex VI, Regulation 3 or an equivalency under Regulation 4 may not need to switch fuel depending on the requirements of their exemption or equivalency.

The Coast Guard **strongly recommends** that vessel owners and operators:

- Ensure fuel oil switching is accomplished outside of busy traffic lanes and the ECA. Generally the ECA is 200 nm from the North American Coast and 50 miles from the U.S. Caribbean coast (e.g., the Commonwealth of Puerto Rico and the U.S. Virgin Islands);
- Utilize their technical resources to develop safe operations and maintain full compliance with emission requirements;
- Consult with engine and boiler manufacturers for fuel oil changeover guidance and to determine if system modifications or additional safeguards are necessary;
- Consult fuel suppliers for proper fuel selection;
- Ensure all sensors, controls and alarms – pressure, temperature, viscosity, differential pressure, flow indicators, etc., are operational and function as designed;
- Ensure system piping, seals, gaskets, flanges, fittings, brackets, etc., are maintained.
- Ensure detailed system schematics are available;
- Review and update fuel oil changeover procedures as needed;
- Establish a fuel oil system inspection and maintenance schedule;
- Review and update fuel changeover procedures based on lessons learned;
- Provide initial and periodic crew training for accomplishing safe, effective and leak-free fuel switching;
- Remember that the energy content of a given volume of ULS fuel oil may differ from residual fuel, such that existing throttle settings may not give the desired propeller shaft RPM or generator loads and performance/speed trials on ULS fuel oil may need to be conducted and;
- Anticipate that there may be many technical challenges for operators when beginning to use ULS fuel oil as a matter of routine and compliance. These range from excessive leakages of fuel system components, increased wear and tear on these components, lack of lubricity of the fuels and the need for possible changes in maintenance schedules, operational methods, etc. The links below provide additional information on these topics.

This Safety Alert is provided for informational purposes only and does not relieve any domestic or international safety, operational or material requirement. Questions regarding this should be forwarded to the Coast Guard Office of Commercial Vessel Compliance, Foreign and Offshore Vessel Division (CG-CVC-2) at **202-372-1218** or by email at **CGCVC@uscg.mil**.

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Note: ***The Coast Guard has collected the following links from open internet sources and re-posted them for informational purposes only. Their inclusion here is not an endorsement or expression of preference of any kind towards any specific publication or organization.***

- **MAN B&W Operation on Low Sulphur Fuels**
- **Wartsila Low Sulphur Fuel Guidelines**
- **Steamship Mutual – Risk Alert: ECAs Low Sulphur Fuel Oil Changeover Procedures**
- **International Council on Combustion Engines - Guidelines for the Operation of Marine Engines on Low Sulphur Fuel**
- **ABS Fuel Switching Advisory Notice**
- **DNVGL – Sulphur Limits 2015 Guidelines on Compliance**
- **Intertanko/OCIMF Recommendations on the Hazard Assessment of Fuel Changeover Processes**

January 26, 2016

Hon. Christopher A. Hart
Chairman
National Transportation Safety Board
Office of Marine Safety
490 L'Enfant Plaza East, SW
Washington, DC 20594-2000

via email: rob.jones@ntsb.gov

Re: Proposed Findings, Probable Causes, and Safety Recommendations
Collision between Bulk Carrier *Conti Peridot* and the chemical tanker *Carla Maersk*, on March 9, 2015 in the Houston Ship Channel, Texas
DCA15MM017

Dear Chairman Hart:

In accordance with National Transportation Safety Board Rule 49 C.F.R. § 831.14 and in support of its ongoing commitment to prevent future incidents and near misses in the Houston Ship Channel, the Houston Pilots Association submits the following proposed findings, probable causes, and safety recommendations for the March 9, 2015 collision between the *Conti Peridot* and the *Carla Maersk*. We appreciate this opportunity to assist in making our waterway safer.

Proposed Findings:

Visibility/Fog Conditions

1. Fog was present at the time of the collision, and visibility had dropped to zero. This was a sudden and unpredicted development. The fog was not present when the *Conti Peridot* got underway from sea or when the *Carla Maersk* left the dock for her outbound transit. Prior to getting underway, both pilots checked the weather forecasts for fog. At that time, fog was not forecasted for March 9, 2015. The pilots aboard both vessels testified that they would not board a vessel or leave a dock in zero visibility.

2. Due to the sudden loss of visibility, the pilot aboard the *Conti Peridot* was deprived of the ability to visually observe the swing of the *Conti Peridot's* bow against fixed navigation aids, other ships, and adjacent land features. This required the pilot onboard to rely solely upon electronic navigation aids including his Portable Pilot Unit (PPU), the ship's radar, and the ship's gyro. While these electronic aids to navigation are good tools, determining a ship's rate of turn solely using these electronic aids without visibility is extremely difficult.

3. After the fog rolled in, the bar was closed, and no new vessels were boarded until fog conditions had abated.

The Sluggish *Conti Peridot*

4. When the pilot boarded the *Conti Peridot* (LOA 189.99m; B 32.26m; Deep Draft 9.56m), he knew that she exhibited poor handling characteristics and slow rudder response. The Master of the *Conti Peridot* likewise testified that *Conti Peridot* would "react quite slower" than the other ships that he had worked on.[1] Before getting underway, the pilot onboard the *Conti Peridot* took the ship's poor handling characteristics into account and planned to continuously monitor how the ship responded as he brought the vessel in from sea, negotiating a series of turns that would give him a "feel" for the ship as well as an overtaking maneuver with one vessel and a meeting with another. If he encountered any problems with the ship during these initial turns and meetings his plan was to abort or extremely modify the transit. They were all uneventful, and occurred in full visibility. The pilot therefore continued with the transit.

5. After clearing the Inner Bar Channel and Bolivar Roads, the ship made the turn at Buoys 25/26 to head across Galveston Bay. The *Conti Peridot* next successfully met the deeply laden vessel *BW Kyoto* at about 11:12:45 in the vicinity of lighted beacons 45/46 without incident in full visibility.

6. Visibility began to decrease, when the pilot onboard the *Conti Peridot* was passing Redfish Island. He notified Vessel Traffic Service (VTS) of this decrease in visibility. As the visibility decreased, the *Conti Peridot* met a series of ships before the collision with the *Carla Maersk*. The first meeting was with the *Karoline N*, a vessel with substantial draft in the vicinity of lighted beacons 59/60 at about 11:34:00. Due to bank effect and the hydrodynamic effects of the water moving around the two ships, the *Conti Peridot* dove into the void (or area of lower pressure) behind the stern of the *Karoline N*. Although the *Conti Peridot* was experiencing maximum bank effect, the pilot was able to get the ship steadied back on the centerline using full left and right rudder and full ahead.

7. The *Conti Peridot* next met the tank vessel *Stolt Span* in the vicinity of Beacons 61/62 at about 11:39:30. Prior to this meeting, the pilot onboard the *Conti Peridot* advised the pilot onboard the *Stolt Span* that he was experiencing sluggish handling and, because of this warning, the *Stolt Span* provided extra room to the *Conti Peridot* to effect the meeting. The pilot onboard the *Conti Peridot*was able to carry out this meeting successfully through the use of full rudder commands and full ahead.

8. Prior to meeting the next ship, *Gaia Leader*, the *Conti Peridot* reduced speed to increase the spacing between the *Conti Peridot* and the tow *Lincoln L*.[2] When the *Conti Peridot*

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[1] DCA15MM017 Document #75 (7 – Interview – Ops – Conti – Master) at 9:6–7.

[2] The *Lincoln L* was inbound ahead of the *Conti Peridot* and, by slowing the ship, the *Lincoln L* was able to get further down the Channel so that the *Conti Peridot, Carla Maersk, and Lincoln L* would not meet three abreast in the Channel. The pilot onboard the *Conti Peridot* also spoke with the captain of the *Lincoln L* to discuss this and the *Lincoln L* accordingly increased her speed to further increase the separation between vessels. This maneuver worked. (*See* Finding No. 16 below).

met the *Gaia Leader*, the *Conti Peridot* maintained as much of the centerline of the channel as possible while the *Gaia Leader* moved well over to the green side of the channel to give the *Conti Peridot* as much room as possible. Again, as the *Gaia Leader* passed, the *Conti Peridot* dove into the low pressure area behind her and began experiencing significant bank effect. The pilot immediately began attempting to steady up the *Conti Peridot* in order to get into position to meet the *Carla Maersk.*

9. Shortly before the collision, the *Conti Peridot* came away from the red bank of the Houston Ship Channel and sheared to the left toward the *Carla Maersk.* The pilot onboard the *Conti Peridot* ordered hard right rudder and "full ahead" engines to maximize the rudder effectiveness. As the *Conti Peridot* sheared left toward the *Carla Maersk*, the pilot testified that he felt no response from his ship to these orders. The pilot had thought that these maneuvers would result in the rudder "catching" and giving the *Conti Peridot* some rate of turn to starboard. Only at the last seconds before impact, did it seem as if the *Conti Peridot* was finally beginning to respond to the hard over right rudder.

10. At about 12:31 local time, the *Conti Peridot*'s bow collided with the port side of the *Carla Maersk* in the vicinity of lighted beacons 89 and 90 in the Houston Ship Channel.

The *Carla Maersk–Conti Peridot* Meeting Agreement

11. The pilots onboard the *Conti Peridot* and the *Carla Maersk* agreed to a port-to-port or "one whistle" meeting arrangement. Just before the collision, when it became apparent that the *Conti Peridot* was unable to steer to the proper position for this meeting, the pilot onboard the *Conti Peridot* proposed a starboard-to-starboard or "two whistle" meeting, but the *Carla Maersk* was already committed, and there was insufficient time to act on this last-second *in extremis* proposal.

Engine/RPM Issues Onboard *Conti Peridot*

12. The *Conti Peridot's* Pilot Card provides that an engine order of "Full Ahead" would correspond with 105 RPMs. The Master of the *Conti Peridot*, however, testified that he intentionally limited the RPMs to 100.[3] At the time of the transit, this information was not passed on to the pilot onboard the *Conti Peridot*, who understandably relied upon the information given to him on the Pilot Card and during the Master–Pilot Exchange. *See* Annotated *Conti Peridot* Pilot Card below:[4]

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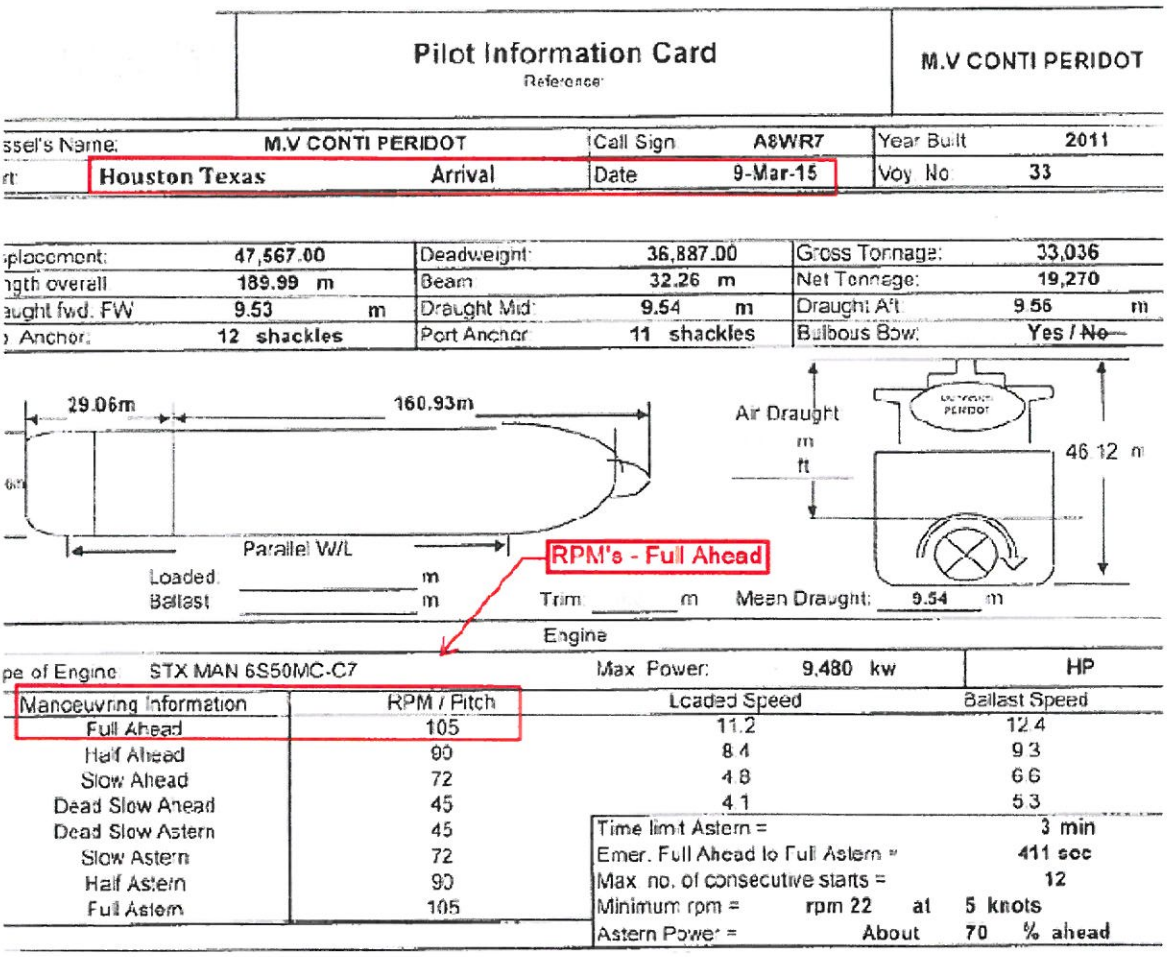
[3] DCA15MM017 Document #75 (7 – Interview – Ops – Conti – Master) at 15:14–19.

[4] DCA15MM017 Document #12 (2 – Ops – Conti – Pilot Card).



Pilot Information Card
Reference

M.V CONTI PERIDOT

ssel's Name:	M.V CONTI PERIDOT	Call Sign	A8WR7	Year Built	2011
rt:	Houston Texas	Arrival	Date	9-Mar-15	Voy No 33

placement:	47,567.00	Deadweight:	36,887.00	Gross Tonnage:	33,036
ngth overall	189.99 m	Beam	32.26 m	Net Tonnage:	19,270
aught fwd. FW	9.53 m	Draught Mid:	9.54 m	Draught A't	9.56 m
Anchor:	12 shackles	Port Anchor	11 shackles	Bulbous Bow:	Yes / No

29.06m 160.93m

Parallel W/L

Loaded m
Ballast m

Air Draught
m
ft

46.12 m

RPM's - Full Ahead

Trim m Mean Draught: 9.54 m

Engine

pe of Engine: STX MAN 6S50MC-C7 Max Power: 9,480 kw HP

Manoeuvring Information	RPM / Pitch	Loaded Speed	Ballast Speed
Full Ahead	105	11.2	12.4
Half Ahead	90	8.4	9.3
Slow Ahead	72	4.8	6.6
Dead Slow Ahead	45	4.1	5.3
Dead Slow Astern	45		
Slow Astern	72		
Half Astern	90		
Full Astern	105		

Time limit Astern =	3 min
Emer. Full Ahead to Full Astern =	411 sec
Max. no. of consecutive starts =	12
Minimum rpm = rpm 22 at	5 knots
Astern Power = About	70 % ahead

13. The Bell Tape from the *Conti Peridot* reveals that the bridge setpoint for a "Full Ahead" order was actually 100.3 RPMs.[5] In addition, in the fateful moments before the collision, the pilot onboard the *Conti Peridot* gave a "Full Ahead" order in an effort to put more water over the rudder and avoid a collision. Alarmingly, in the moment when the pilot onboard the *Conti Peridot* needed additional revolutions the most, he only received 80.9 RPMs or 77% of the rated 105 RPMs as noted on the Pilot Card. Although the pilot and captain aboard the *Conti Peridot* engaged in a full Master–Pilot Exchange, the pilot was never informed of the fact that he would not receive the full rated RPMs listed on the Pilot Card. *See* Annotated *Conti Peridot* Bell Tape below:[6]

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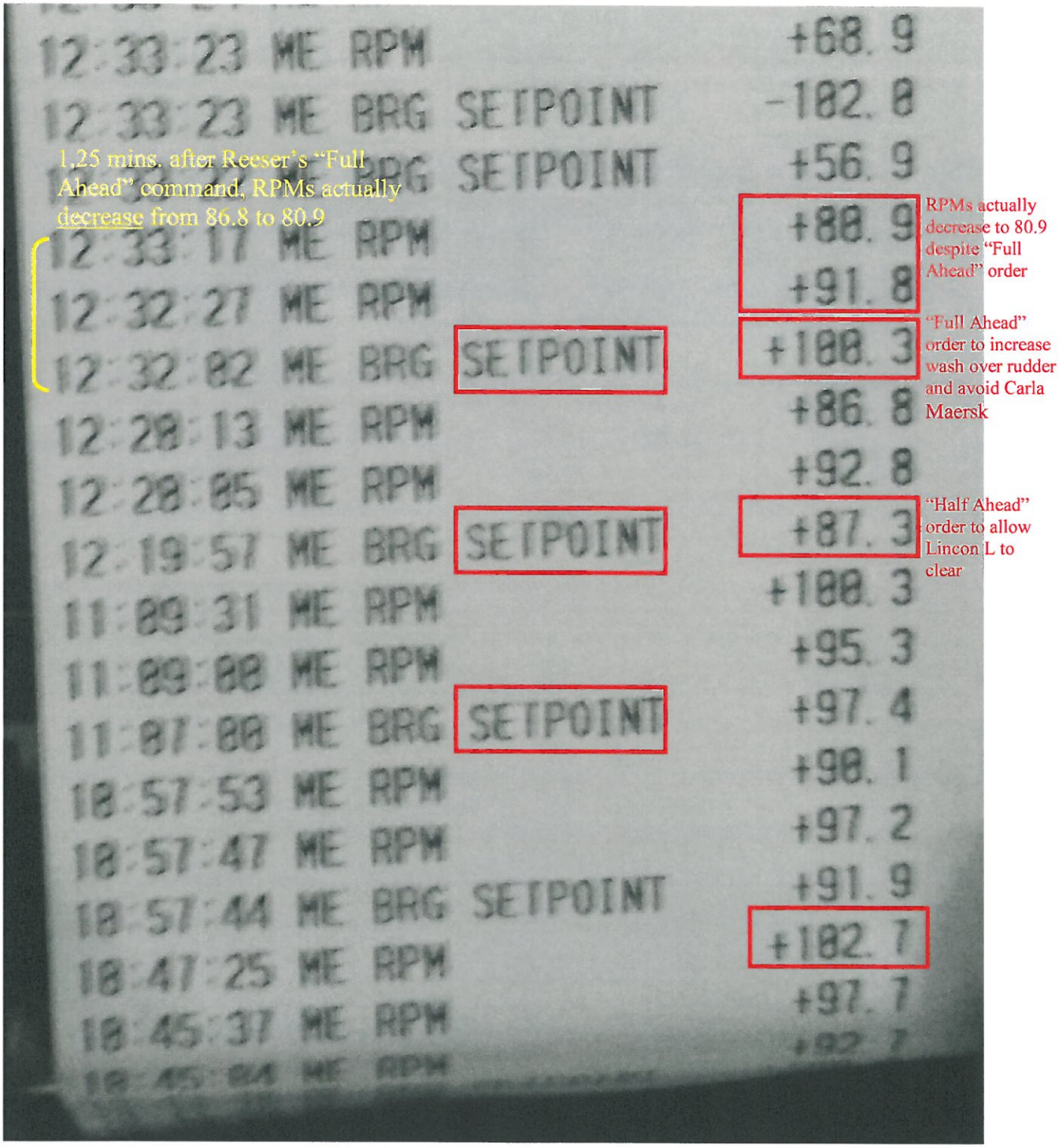
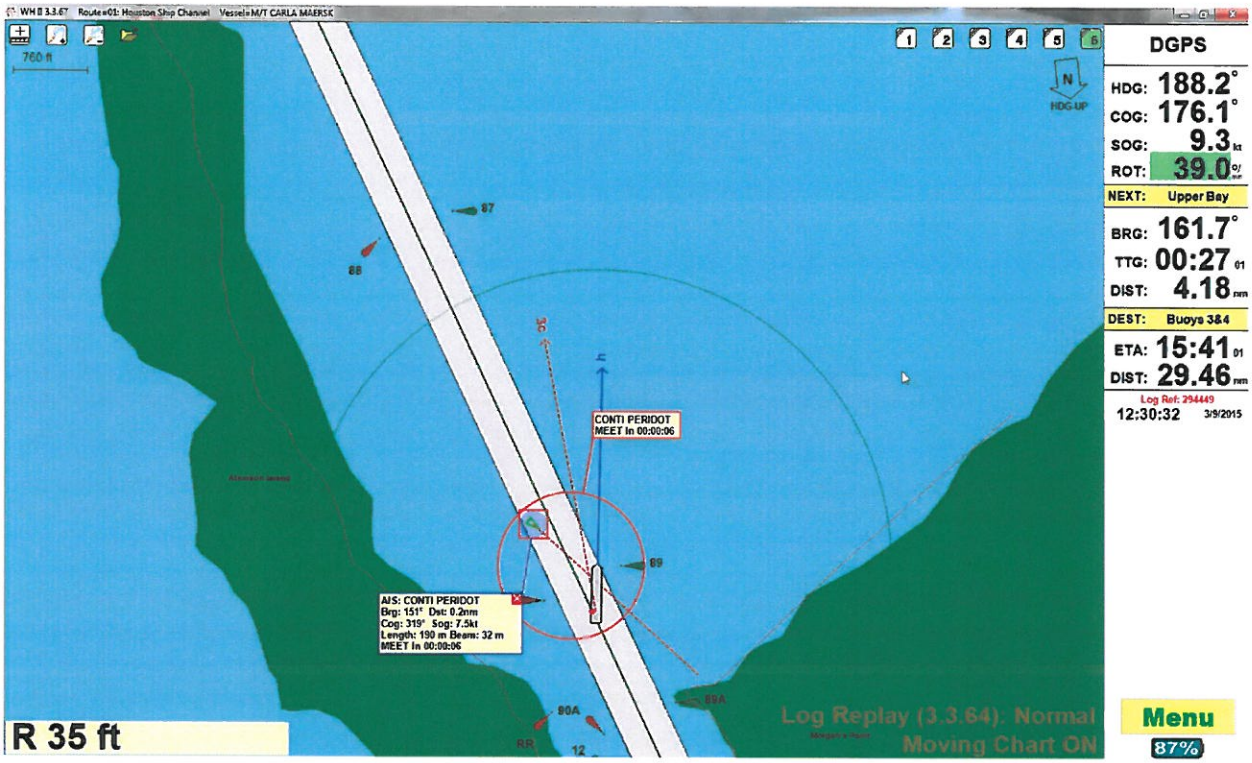
[5] On the *Conti Peridot*'s Bell Log Tape excerpted below, "BRG SETPOINT" refers to the RPMs set by the Master on the bridge of the *Conti Peridot* in response to the pilot's engine orders. This is akin to operating a throttle as to the traditional Engine Order Telegraph. On the tape excerpted below, a "+" setpoint refers to ahead propulsion and "-" refers to astern propulsion. Where there is no "BRG SETPOINT" listed, the Bell Log Tape displays the actual RPMs being turned.

[6] DCA15MM017 Document #45 (3 – Engineering – Conti Peridot Bridge STX Main Engine Telegraph Printer 3-9-2015).



14. If the *Conti Peridot* had properly come right, her rate of approach to the *Carla Maersk* would have slowed. Considering the evasive maneuvers of the *Carla Maersk* to her right and her speed of 9.2 knots in the opposite direction, the relative motion of the two ships would likely have resulted in them clearing one another rather than colliding. This is best

demonstrated by the relative positions of the two vessels at the time of the collision. The following is a screenshot from the PPU of the pilot aboard the *Carla Maersk*:



The pilot onboard the *Conti Peridot*'s direct testimony confirms this was the case:

> *. . . I realized that my—that was another factor along with the fog, was my speed wasn't enough to make this happen. And then when I went full ahead, it just didn't move, you know. I didn't get that push that I was looking for on the rudder.*[7]

Implications of Ultra Low-Sulfur Fuel Requirements

15. As a result of new requirements resulting from the adoption of the new International Convention for the Prevention of Pollution from Ships (MARPOL) Annex IV, the *Conti Peridot* was burning an ultra low sulfur content fuel. The United States Coast Guard has issued the following warnings with respect to ultra low-sulfur content fuels:

> *Remember that the energy content of a given volume of ULS fuel oil may differ from residual fuel, such that existing throttle settings may not give the desired propeller shaft RPM or generator loads and performance/speed trials on ULS fuel oil may need to be conducted.* United States Coast Guard Safety Alert 2–15, attached hereto as **Exhibit A**.

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7 DCA15MM017 Document #74 (7 – Interview – Ops – Conti – Houston Pilot) at 21:14–18.

Because many ship engines were originally designed to run on intermediate and heavy residual fuel oils, these new requirements have required certain engine conversions to operate on the light, low sulfur distillate fuels. The acceleration of the main engine of the *Conti Peridot* was likely slowed by the use of a low viscosity distillate fuel as evidenced by the long interval of time elapsed between the engine order set point and when the engines achieved the ordered RPMs (2 ½ minutes from 11:07:00 to 11:09:31 on the bell tape excerpted above) and, in the case of the urgent full ahead order just prior to collision (at 11:32:02 on the bell tape excerpted above), not achieving the ordered RPMs at all.

Proactive Vessel Spacing and Traffic Management

16. Well ahead of the meeting with the *Carla Maersk*, the pilot onboard the *Conti Peridot* reduced speed in order to maximize the spacing between the *Conti Peridot* and an inbound tow *Lincoln L*. If this had not been done, the *Lincoln L*, the *Carla Maersk*, and the *Conti Peridot* would have met three abreast in the channel. The pilot onboard the *Conti Peridot* also called the *Lincoln L* to have the tow increase her speed and thereby open up the space between the three converging vessels even more. This proactive action made it much safer, under the circumstances at the time, to meet the *Carla Maersk* because it removed a potential hazard (the *Lincoln L*) from the equation.

Risks of Anchoring in the Channel Due to Fog

17. When the visibility on the Houston Ship Channel dropped to zero, the possibility of going to anchor was considered by the pilot onboard the *Conti Peridot*. First, it should be noted that Rule 9(g) of the Inland Navigation Rules states "*Every vessel shall, if the circumstances of the case admit, avoid anchoring in a narrow channel.*" Considering the circumstances relevant to this situation, the Houston Ship Channel is a large and dynamic system with multiple moving vessels and interests. In this case, there were multiple ships in two opposing convoys that were all meeting each other. If the *Conti Peridot* initiated an emergency anchoring, all of the other vessels in the opposing convoys would have had to do likewise. Coordinating this requires distance and sufficient time to slow all of the in transit vessels and then safely anchoring. Making all of the vessels in the system aware of the need to slow down and go to anchor and then getting all of the ships moving again itself thus presents numerous dangerous challenges and, under the circumstances at the time, the pilot onboard the *Conti Peridot* felt that going to anchor would be more dangerous than continuing to carefully monitor his meeting arrangements and maneuver the ship to her intended berth. The fact that the *Conti Peridot* had successfully recovered from two other ship meetings in reduced visibility where the Master gave only 100 RPMs for full ahead confirms the pilot's decision.

<u>Probable Cause #1</u>: The National Transportation Safety Board finds that a probable cause of the collision was the compounding effect of numerous factors that made it exponentially more difficult to control the *Conti Peridot*. These factors are (1) the sudden and unpredicted onset of fog with zero visibility and (2) the failure of the *Conti Peridot*'s Master

to provide the full ahead RPMs ordered by the pilot onboard the *Conti Peridot* as the pilot was attempting to maneuver the vessel away from a collision.

These two factors compounded with the *Conti Peridot*'s slow rudder response and steering and with the hydrodynamic effects experienced when two vessels meet in a narrow channel and caused the collision. The sudden and unpredicted fog deprived the pilot onboard the *Conti Peridot* of the visual component one relies upon to observe the vessel's rate of turn making it much more difficult to control the vessel. The failure of the *Conti Peridot*'s crew to carry out the engine orders given by the pilot in the moments just before the collision also contributed because it diminished the effectiveness of the hard right rudder. Had these RPMs been provided, the *Conti Peridot* would have likely turned away from the *Carla Maersk* and a collision would have been avoided.

In addition to the *Conti Peridot*'s Master not giving the pilot the full 105 RPMs noted on the Pilot Card, it is also highly probable that the use of low sulfur content also likely played a role in robbing the ship of the immediate burst of energy that would have aided this ship in responding to the hard right helm command and steering away from the *Carla Maersk*.

Probable Cause #2: The National Transportation Safety Board finds that a probable cause of the collision was the diminution in power created by the use of ultra low sulfur fuel onboard the *Conti Peridot*, which deprived the ship of a prompt and customary response to the full ahead bell ordered by the pilot of the *Conti Peridot* as he attempted to put additional water over the hard right rudder and steer away from the *Carla Maersk*.

It is well recognized that the use of ultra low sulfur ("ULS") oftentimes results in diminished engine performance. The use of ULS was the most likely cause of why the *Conti Peridot* only achieved 80.9 RPMs when the "full ahead" order was given just before the collision. This is the only explanation for why the *Conti Peridot* only achieved 77% of her rated engine capacity in the moments leading up to the collision; the moments when the full engine capacity was most critical for the hard right rudder to "catch" and steer the ship away from collision.

Since January 1, 2015, the Houston Pilots—along with all mariners—have observed many engine performance variances caused by the use of ULS.

Safety Recommendations:

Safety Recommendation #1: The National Transportation Safety Board recommends that all mariners and crewmembers operating vessels in less than optimal weather conditions should be especially vigilant to account for the loss of helpful visual navigational aids.

Safety Recommendation #2: In this case, inaccurate information about the *Conti Peridot*'s maneuvering capabilities was passed to the pilot. The National Transportation Safety Board recommends that all vessels operating within the waters of the United States should fully comply with all internationally accepted best practices for exchanging complete and accurate information about a ship's maneuvering capabilities during the Master–Pilot Exchange.

Safety Recommendation #3: The National Transportation Safety Board adopts the United States Coast Guard's recommendation and recommends that new performance tests or sea trials be conducted for ships transiting in the United States in order to obtain updated and accurate information about those vessels' maneuvering capabilities when burning light, low sulfur distillate fuels.

Safety Recommendation #4: The National Transportation Safety Board recommends requiring the discussion of low sulfur fuel and any implications for engine performance as a part of the mandatory Master–Pilot Exchange.

We would like to thank you and the National Transportation Safety Board for this opportunity to allow the Houston Pilots Association to provide these proposed findings, probable causes, and recommendations. If any of the above items require clarification or additional information please do not hesitate to contact us.

Respectfully,

[redacted]

Capt. Michael Morris
Houston Pilots Association

[redacted]

Capt. Robert Shearon
Presiding Officer
Houston Pilots Association