NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF MARINE SAFETY
WASHINGTON, D.C.

ENGINEERING GROUP CHAIRMAN'S FACTUAL REPORT

A. ACCIDENT INFORMATION

NTSB Accident No.:	**DCA15MM017**
Accident Type:	Collision
Location:	Houston Ship Channel, Upper Galveston Bay at buoys 89 & 90 in the vicinity of Morgan's Point. Lat 29-40.35N, Long 94-58.74 W 51.6′ N
Vessel No. 1:	Liberian-registered bulk carrier *Conti Peridot,* IMO No. 9452634
Owners, No. 1:	Conti Peridot Shipping Ltd.
Vessel No. 2:	Danish-registered chemical tanker *Carla Maersk,* IMO No. 9171503
Owners No. 2:	A.P. Moller – Maersk A/S
Date:	March 9, 2015
Time:	12:30:45 Central Daylight Time (CDT)

B. ENGINEERING GROUP

Group Chairman:	Luke Wisniewski, Marine Engineer Investigator NTSB Office of Marine Safety 490 L'Enfant Plaza East, S.W. Washington, DC 20594
Coast Guard	[redacted] Investigator USCG Sector Houston 13411 Hillard Street Houston TX 77034USCG
Coast Guard	[redacted], Investigator, USCG Sector Houston 13411 Hillard Street Houston TX 77034
Conti Peridot	Henning Pulmer Designated Management Representative hbv

	Fleet Safety/ Security Officer /Senior DPA/CSO
	Bremer Bereederungsgesellschaft mbH & Co.
Conti Peridot	David Betts
	Liberia Flag
	16703 Galewood Way
	Houston, TX 77058
Carla Maersk	Andy Cross, Marine Superintendent
	Mærsk Tankers
	A.P. Moller – Maersk A/S
	Esplanaden 50
	1098 Copenhagen Denmark

C. ACCIDENT SUMMARY

For a summary of the crash, refer to the *Accident Summary Report* in the docket for this investigation.

D. DETAILS OF THE ENGINEERING INVESTIGATION

The Engineering Group Interviewed

Conti Peridot

Position	Date and Location of Interview
Chief Engineer	March 13th, 2015 onboard vessel
2nd Engineer	March 13th, 2015 onboard vessel
3rd Engineer	March 13th, 2015 onboard vessel
Oiler	March 13th, 2015 onboard vessel

Carla Maersk

Position	Date and Location of Interview
Master	March 18th, 2015 onboard vessel
Chief Officer	March 18th, 2015 onboard vessel
Chief Engineer	March 14th, 2015 onboard vessel
2nd Engineer	March 14th, 2015 onboard vessel
4th Engineer	March 14th, 2015 onboard vessel

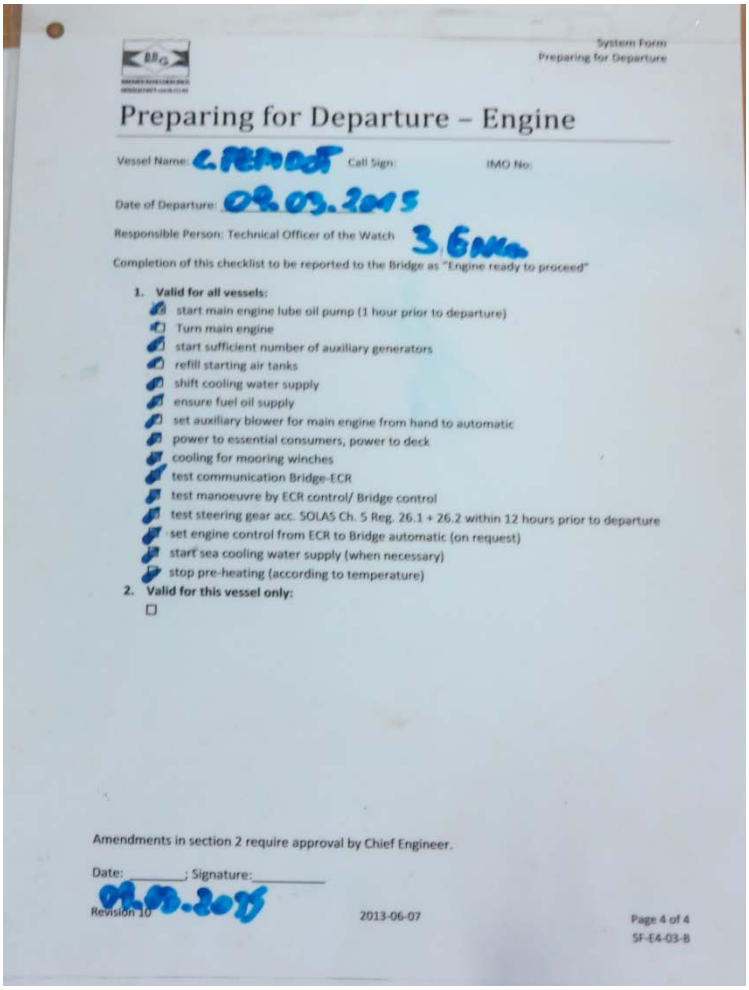
Note: Interview transcripts are available at NTSB Docket No. DCA-15-MM-017

1. Engineering Accident Narrative

1.1. Aboard the *Conti Peridot*

The *Conti Peridot* arrived at Houston's Fairway Anchorage from Manzanillo, Mexico via Panama Canal on March 4th at 09:12. The vessel remained at the anchorage for five days. The morning of the accident, the 3rd Engineer on watch received the one hour notice from the bridge at 07:05. The 3rd engineer prepared the main engine for departure in accordance with Safety Management System procedure, Preparing for Departure - Engine to SF E4-03-B.[1]

The procedure included turning the main engine, testing communication with Bridge and Engine Control Room (ECR), testing mauoeuver by ECR control / Bridge control and testing the steering gear in accordance with SOLAS Ch. 5 Reg. 26.1 & 26.2 within 12 hours prior to departure. Figure 1, photograph of the completed Preparing for Departure checklist performed by 3rd Engineer on March 9th.



System Form
Preparing for Departure

Preparing for Departure – Engine

Vessel Name: Conti Peridot Call Sign: IMO No:

Date of Departure: 09.03.2015

Responsible Person: Technical Officer of the Watch 3.6Nm

Completion of this checklist to be reported to the Bridge as "Engine ready to proceed"

1. **Valid for all vessels:**
   - ☑ start main engine lube oil pump (1 hour prior to departure)
   - ☐ Turn main engine
   - ☑ start sufficient number of auxiliary generators
   - ☑ refill starting air tanks
   - ☑ shift cooling water supply
   - ☑ ensure fuel oil supply
   - ☑ set auxiliary blower for main engine from hand to automatic
   - ☑ power to essential consumers, power to deck
   - ☑ cooling for mooring winches
   - ☑ test communication Bridge-ECR
   - ☑ test manoeuvre by ECR control/ Bridge control
   - ☑ test steering gear acc. SOLAS Ch. 5 Reg. 26.1 + 26.2 within 12 hours prior to departure
   - ☑ set engine control from ECR to Bridge automatic (on request)
   - ☑ start sea cooling water supply (when necessary)
   - ☑ stop pre-heating (according to temperature)
2. **Valid for this vessel only:**
   - ☐

Amendments in section 2 require approval by Chief Engineer.

Date: 09.03.2015; Signature:_____

Revision 10 2013-06-07 Page 4 of 4
SF-E4-03-B

Figure 1, *Conti Peridot* Preparing for Departure - Engine to SF E4-03-B (NTSB)

At 07:30 the main engine, STX MAN-B&W 6S50MC-C, a slow speed diesel, was tested ahead and astern.[2] Standby engine was recorded in the engineering log book at 07:36.[3] The anchor was hauled out of the water at 08:06.

[1] MV *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 38 & Conti Peridot Preparing for Departure Engine Checklist 03-09-2015.
[2] MV *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 38.
[3] MV *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 38.

The Chief Engineer, Second Engineer, 3rd Engineer on-watch and the Oiler were interviewed regarding the accident on March 13th at City Docks, Pier 21, Houston, TX. All the engineering interviewees stated that the propulsion and steering systems were functioning normally during the transit up to the collision and after it. The main engine was utilizing marine gas oil (MGO). Fuel change over from Heavy Fuel Oil (HFO) to MGO occurred on March 3rd at 10:55.[4] The *Conti Peridot's* main engine could be controlled at the bridge, the ERC or locally at the engine side. The Chief Engineer and 2nd Assistant engineer informally told NTSB & Coast Guard investigators that the vessel was in "bridge" control during the time of the accident. There were no reported deficiencies listed in the Engine Room Log Book for propulsion and steering systems..[5] There were no recorded entries in Engine Room Log Book for main engine, propulsion, or steering systems from March 2nd to March 12th.[6]

During the inbound transit No. 3 generator (auxiliary engine) and steering gear pumps 1 & 2 were in service. The engine room alarm readout noted several alarms from 08:16 hours to 15:52, however none were associated with the steering or propulsion systems during the inbound transit or while meeting *Carla Maersk* on one whistle, port to port meeting arrangement, figure 2.

The Chief Engineer's Order Book with Standing Orders for March 9th, "Shifting to alongside" was initialed by the engineering watch officers. The engineering watch officers were instructed not to leave the Engine Room (E/R) control room while in the channel during maneuvering.[7] USCG and NTSB reviewed the Order Book with Standing Orders entries as far back as January 21st. There were no special instructions or entries in the Chief Engineer's Order Book with Standing Orders relating to main engine, propulsion, or steering systems, other than to always monitor main engine temperature and pressures to normal condition, which was routinely part of the chief's standing orders.[8]

[4] *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 33.
[5] *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 38.
[6] *Conti Peridot* Engine Log Book No 17, commencing January 31st, 2015. March 9th 2015 remarks section pg 32-42
[7] *Conti Peridot.* Order Book with Standing Orders commenced November 08, 2014, March 9th 2015.
[8] *Conti Peridot.* Order Book with Standing Orders commenced November 08, 2014, January 21st - March 9th 2015.

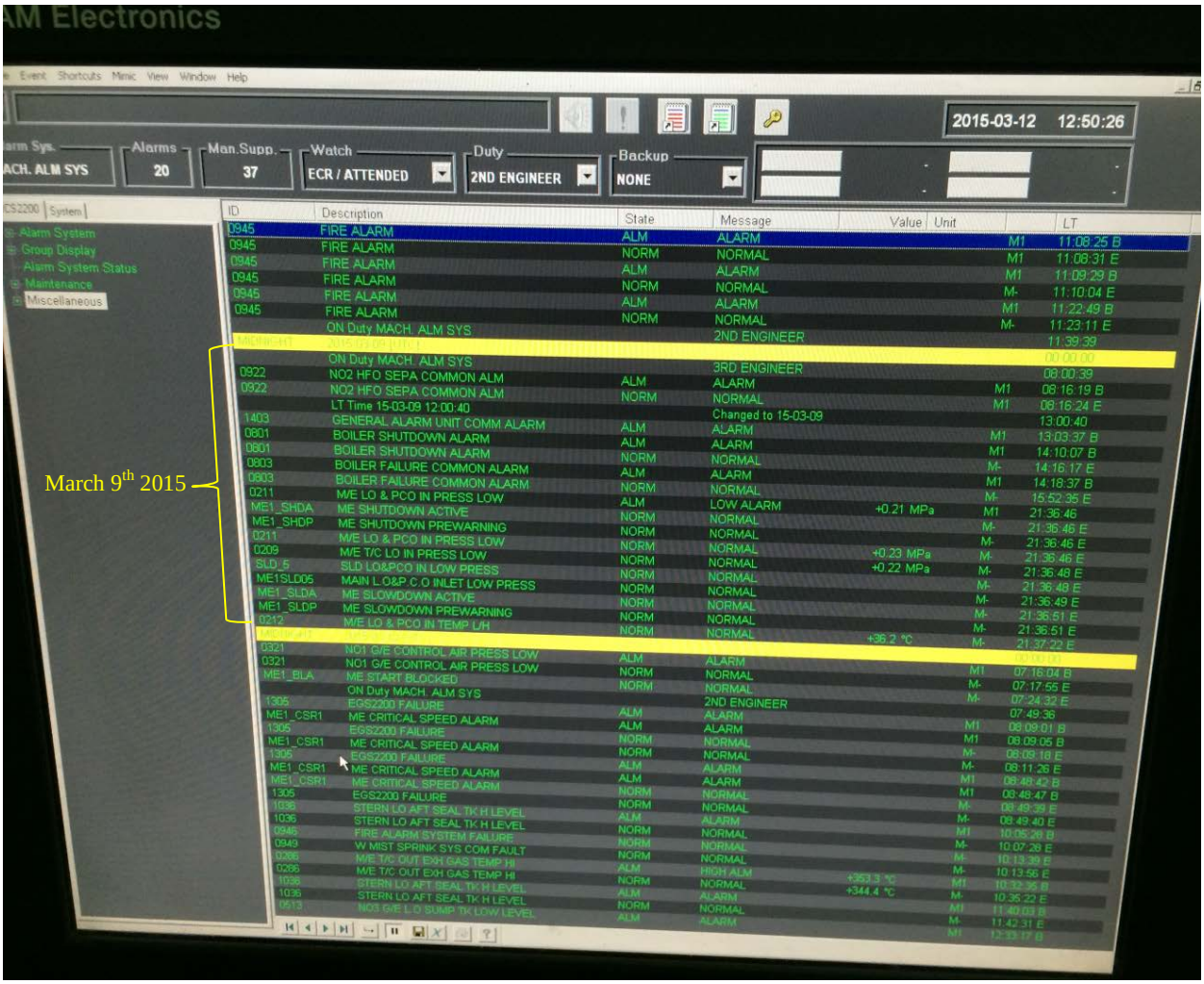


Figure 2, *Conti Peridot* Machinery Alarm System display history, March 9th 2015 (NTSB)

1.2. Aboard the *Carla Maersk*

The *Carla Maersk* arrived at Texas Petrochem, Houston on March 7th at 20:40, finish with engines (FWE) was recorded in the engineers' log.[9] The vessel loaded 33,000 barrels (bbls) of MTBE from Kinder Morgan Liquids Terminal and remained at the terminal until March 9th. On the morning of March 9th an engineering safety briefing was conducted in the engine control room at 0800, voyage 15502.[10] The steering gear room and engine room were checked and no leakage reported. The change of duty checklist was completed and recorded in the log. At 08:00, 1hr departure notice was provided to engine control room from bridge. *Carla Maersk's* Safety Management System Checklist, Before Departure-Engine Room, SHIPNET ID E40, was completed

[9] MT *Carla Maersk* Engineers' Logbook, Started using date 25 December 2014. March 7th 2015, work and special incidents section pg 73.
[10] MT *Carla Maersk* Engineers' Logbook, Started using date 25 December 2014. March 9th 2015, work and special incidents section pg 75.

by the 4th Engineer and signed by the Chief Engineer, figure 6.[11] The checklist included the following: turning the main engine, testing the telephone to bridge, and testing the telegraph and emergency telegraph. The steering gear was tested in conjunction with the officer of the watch. The rudder angle indicators were verified in relation to actual rudder position.

Maneuvering was agreed with the master to be carried out from the Bridge.[12] About 08:30, auxiliary engineer #3 was started. At 09:00 the steering gear was tested, and two steering pumps were running. At 09:00 the Pilot was on board (POB).[13] The Master / Pilot information exchange occurred at 09:15 as recorded in the ship movement book.[14]

At 09:20 control of the main engine, Hyunda MAN-B&W,6S50MC MK6, slow speed diesel was transferred to the bridge & engine was tested. The vessel started unmooring at 09:25. Cast off / all clear was recorded in the movement log at 09:50 am.[15]

The Chief Engineer, Second Engineer, and 4th Engineer on-watch were interviewed regarding the accident on March 14th onboard the vessel at Barbours Cut Terminal temporary anchorage La Porte, TX. All the engineering interviewees stated that the propulsion and steering systems were functioning normally during the transit up to the collision and after it.

The general alarm sounded after the collision. Engineering crew members reported to the engine control room. Muster was taken and the chief engineer instructed personal to conduct soundings of fuel, oil, and slop tanks. No damage or intake of water reported. The chief engineer stated the vessel listed 10^{o} to the port side, shortly after the collision.

There were no reported deficiencies listed in the Engine Room Log Book for propulsion and steering systems. There were no recorded entries in Engine Room Log Book for main engine, propulsion, or steering systems listed in the work or special instruction sections from March 3nd to March 13th.

The Chief Engineer's standing orders, SHIPNET ID E44, were signed by engineering staff on January 8th 2015. USCG and NTSB reviewed the standing orders. There were no special

[11] MT *Carla Maersk* Engineers' Logbook, Started using date 25 December 2014. March 9th 2015, work and special incidents section pg 75.
[12] *Carla Maersk* Checklist-Before Departure-Engine Room, signed by C/E March 9th 2015 at 08:00. Shipnet ID E40, Revision 0, 20-Nov-2012.
[13] MT *Carla Maersk* Movement Log, IMG1008, March 11th 2015.
[14] MT *Carla Maersk* Movement Log, IMG1008 & IMG 1009, March 11th 2015.
[15] MT *Carla Maersk* Movement Log, IMG1008 & IMG 1009, March 11th 2015.

instructions, outstanding issues or entries in the Chief Engineer's standing orders relating to main engine, propulsion, or steering systems.

A review of the Engine Control Room, Kongsberg Norcontrol Automation alarm system history reveals no main engine or steering system alarms during the outbound transit or while meeting *Conti Peridot's* on one whistle, port to port agreed upon passing arrangement. Figure 3, displays the alarms history during the morning of the accident.

Figure 3, *Carla Maersk* Kongsberg Norcontrol Automation Alarm History March 9th 2015 (NTSB)

2.0 Engineering Plant Description

2.1 The *Conti Peridot's* main propulsion system was comprised of a single centerline-mounted slow-speed, two-stroke, crosshead type STX MAN B&W 6S50MC diesel engine directly connected to a fixed-pitch, 4 bladed, 6 meter diameter propeller. The engine was described by its manufacturer as "super long stroke and had 6 cylinders, each with 500 millimeter diameter bores. Due to the slow rotational speed of the engine, the propulsion system does not require a reduction gear between the engine and propeller.

Figure 4, Bridge console Engine telegraph (NTSB)

The system does not use a clutch to engage or disengage the engine from the propeller, or a shaft brake to stop it. The engine must be brought to a stop to secure the propeller and then must be started in either the ahead or astern direction to meet the ordered speed command. Changes in direction must be separated by an engine "stop" command.

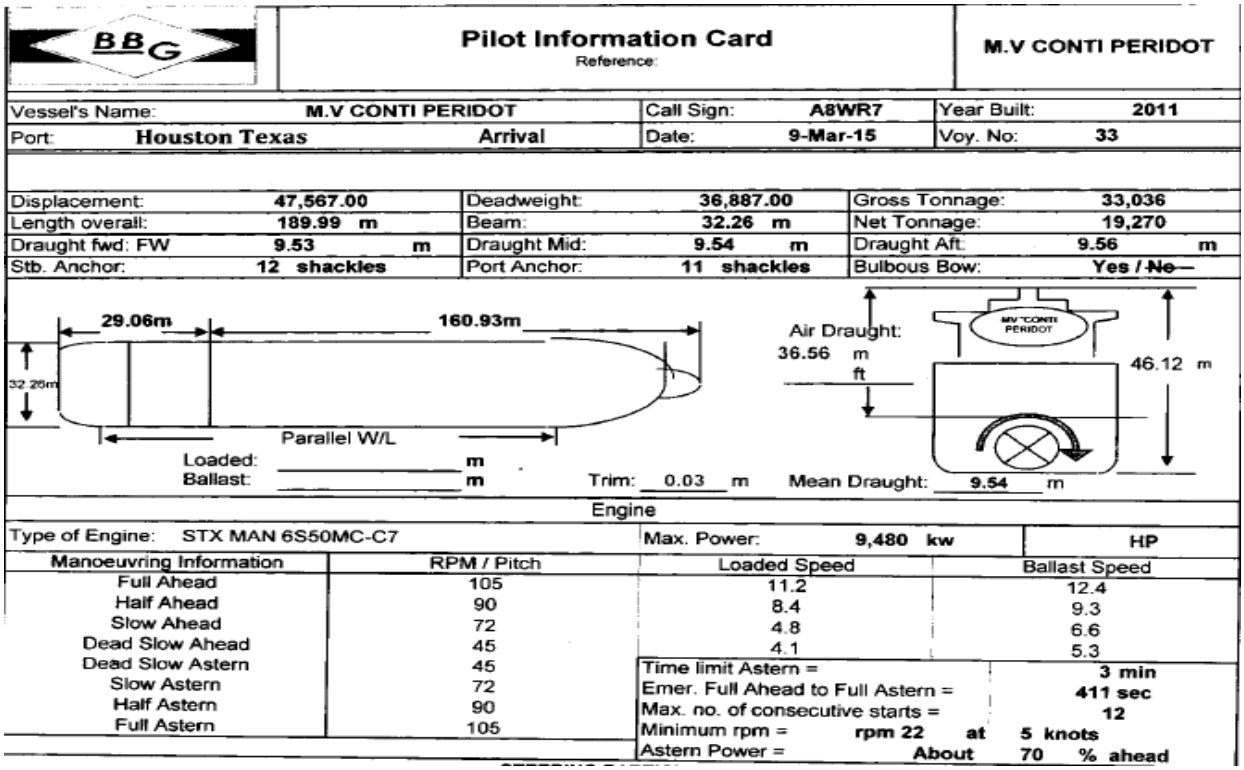
The vessel has remote telegraph controls on the Bridge and in the Engine Control Room (ECR). The telegraph system is an independent system. This system enables the navigator to transfer the commands of engine speed and direction of rotation from the bridge and the engine control room. Figure 10 displays the telegraph located on the bridge. When in "bridge control" the telegraph directly controls the engine. Maneuvering lever commands and associated rpm and speed tables were found on metal placards near the engine control stations in both the bridge and ECR. All engine throttle placards corresponded to information found on the Pilot Card as illustrated in, figure 4,5.

In the event of a failure of the normal pneumatic/electric remote operating system from these locations, the engine can be operated locally at the Engine Side Console in emergencies. Commands from these three control locations are transmitted to the engine via pneumatic / electric maneuvering

and fuel oil regulating systems, allowing for starts, stops, ahead and astern direction and speed variations.

Starts are accomplished by admitting high pressure compressed air from the starting air system via a separate lower pressure pneumatic control air system through a start air distributor. Twelve (12) is the maximum number of consecutive starts and or changing the engine from forward to astern, that was listed on the pilot information card. The engine is based on a mechanical camshaft system for activation of the fuel injection and the exhaust valves. The engine is provided with a pneumatic / electric maneuvering system and the engine speed is controlled by an electronic/hydraulic type governor. Each cylinder on the engine is equipped with a starting air valve that is opened by control air from the starting air distributor and closed by a spring. The control air supply is timed by the distributor so individual starting air valves deliver air to the cylinders in the correct firing order. The maneuvering control system stops the engine by ending fuel injection to the cylinders through a puncture valve in the fuel pumps being activated independent of engine speed control.

Figure 5, *Conti Peridot* Pilot Information Card March 9th 2015 (NTSB)



BBG

Pilot Information Card
Reference:

M.V CONTI PERIDOT

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

Displacement:	47,567.00	Deadweight:	36,887.00	Gross Tonnage:	33,036
Length overall:	189.99 m	Beam:	32.26 m	Net Tonnage:	19,270
Draught fwd: FW	9.53 m	Draught Mid:	9.54 m	Draught Aft:	9.56 m
Stb. Anchor:	12 shackles	Port Anchor:	11 shackles	Bulbous Bow:	Yes / ~~No~~

Engine

Type 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	Time limit Astern =	3 min
Slow Astern	72	Emer. Full Ahead to Full Astern =	411 sec
Half Astern	90	Max. no. of consecutive starts =	12
Full Astern	105	Minimum rpm = rpm 22 at 5 knots	
		Astern Power = About 70 % ahead	

The STX Engine Bridge Telegraph Printer, figure 6, recorded engine speed correlation to the telegraph (throttle position) set point.[16] This information, set point and actual RPM, is also recorded on the Voyage Data Recorder.

NTSB & USCG investigators requested and received *Conti Peridot's* last 7 months of preventative maintenance and executed maintenance performed on the main engine, MAN B&W, 6S50MC-C and Steering System, Yoonwon Rotary Vane, YVS-500/2 as record in their IMECS Fleet Management System, September 6th 2014 to April 16 2015.[17] A review of the records indicates main engine, propulsion, and steering systems inspections, checks, cleanings, tests, and overhauls were conducted in accordance with prescribed maintenance schedule.

Figure 6, *Conti Peridot* Bridge Telegraph Printer

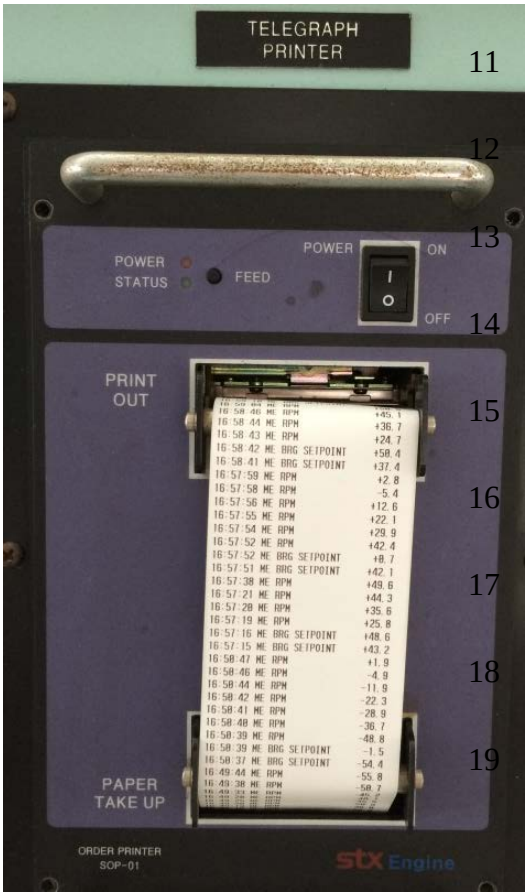
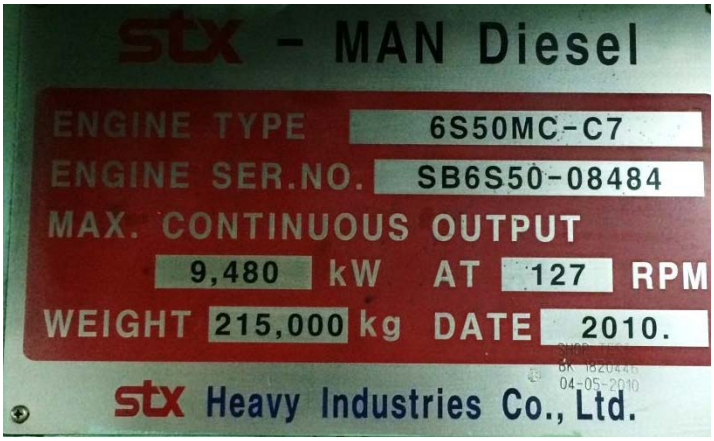


Figure 7, *Conti Peridot Main Engine Nameplate* (NTSB)



[16] MAN B&W S50MC-C7 Project Guide, 6th Edition, 1/2009.
[17] *Conti Peridot* IMECS Fleet Management System, Executed Maintenance from Sept 6th 2014 to April 16th 2015.

2.2 The *Carla Maersk's* main propulsion system is comprised of a single centerline-mounted slow-speed, two-stroke, crosshead type Hyundai MAN-B&W,6S50MC MK6,8,561kW(10,480bhp) @123 RPM, Single speed diesel engine, 6 cylinder directly driven, fixed 4.00 meter pitch propeller, with 4 blades, and a 5.80 meter diameter. Due to the slow rotational speed of the engine, the propulsion system did not require a reduction gear between the engine and propeller.

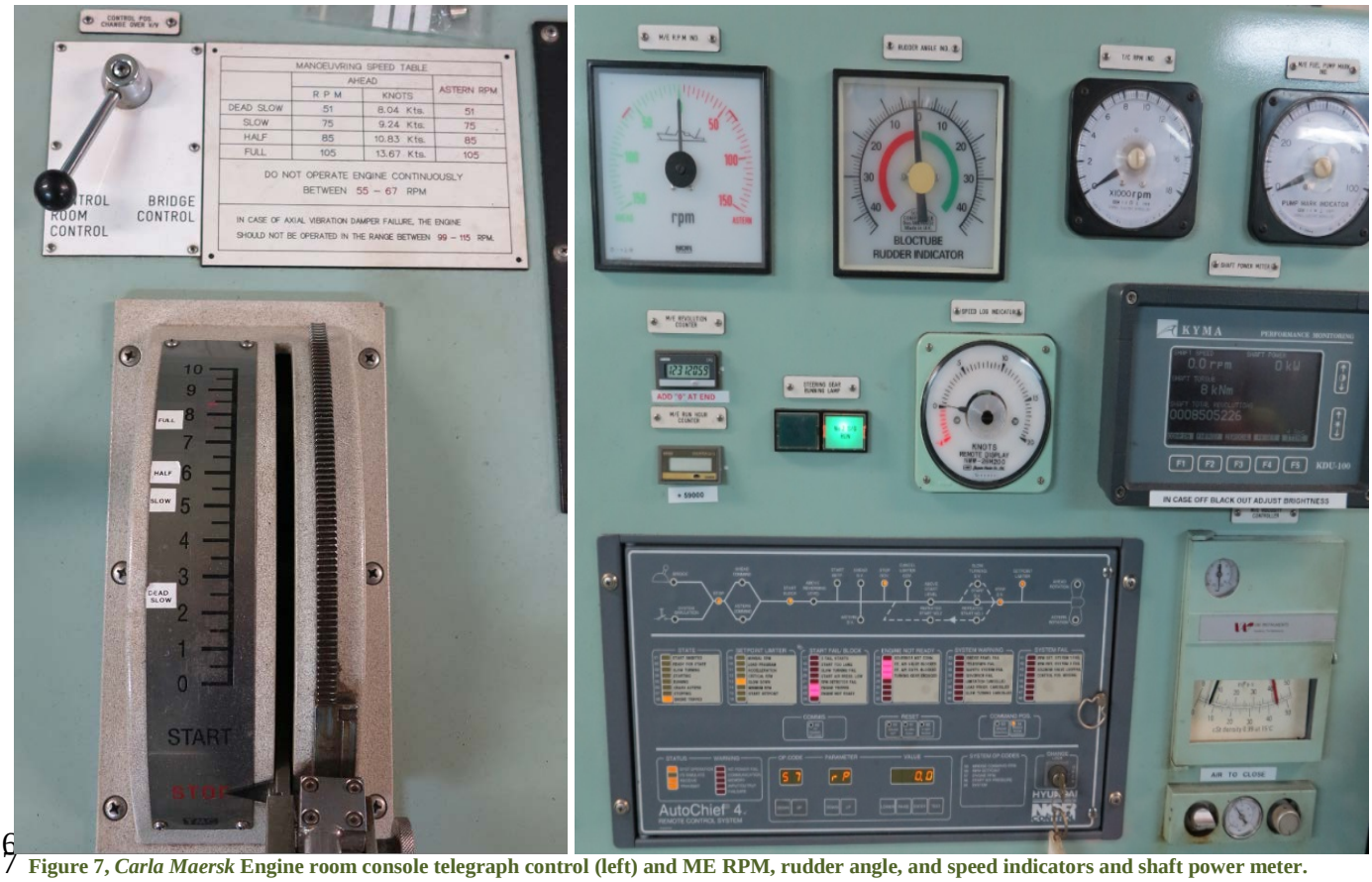


Figure 7, *Carla Maersk* Engine room console telegraph control (left) and ME RPM, rudder angle, and speed indicators and shaft power meter.

The system did not use a clutch to engage or disengage the engine from the propeller, or a shaft brake to stop it. The engine must be brought to a stop to secure the propeller and then must be started in either the ahead or astern direction to meet the ordered speed command. Changes in direction must be separated by an engine "stop" command.

The vessel has remote telegraph controls on the Bridge and in the Engine Control Room (ECR). The telegraph system is an independent system. The system enables the operator to transfer the commands of engine speed and direction of rotation from the bridge and the engine control room. Figure 7 displays the telegraph control, control position change over and maneuvering speed table ME RPM indicator, rudder angle indicator speed indicator and shaft power meter located on the engine console room.

NTSB & USCG investigators requested and received *Carla Maersk's* last 5 months of preventative maintenance and executed maintenance performed on the main engine, propulsion, and steering systems, as record in their Shipnet Fleet, version 11, system, December 1th 2014 to April 3rd 2015.[18] A review of the records indicates main engine, propulsion, and steering systems inspections, checks, cleanings, tests, and overhauls were conducted in accordance with prescribed maintenance schedule.

3.0 Engineering Crew Information

3.1 The *Conti Peridot* had a crew of twenty-four (24), with seven (7) personnel in the engineering department of Filipino and Polish nationality. Four (4) pipe fitters of Polish and Filipino nationality boarded in Manzanillo, Mexico to carry out ta tank conversion of Heavy Fuel Oil (HFO) transfer system and HFO storage tanks #3 Port and Starboard to a low sulfur Marine Gas Oil (MGO) storage tank. The diesel switching installation and tank conversion would allow the engineering crew greater capacity to store MGO and automated the HFO / MGO fuel change-over procedure and process prior to entering an IMO Emissions Control Areas (ECA)[19], instead of manually changing over the fuels. Engineering officers: Chief Engineer, 2nd Engineer, 3rd Engineer. The department also had one (1) electrician, one (1) oilers and one (1) wiper. The engineering crew on watch at the time of the collision consisted of the Chief Engineer, 2nd Engineer, 3rd Engineer and Oiler. The entire crew submitted samples for drug and alcohol use following the collision. All test results for drug and alcohol were negative. [20]

3.2 The *Carla Maersk* had a crew of twenty-five (25), with six (6) personnel in the engineering department of Bulgarian, Romanian, Ukrainian, and Filipino nationality and two (2) pipe fitters of Filipino nationality. Engineering officers: Chief Engineer, 2nd Engineer, 3rd Engineer. The department also had one (1) electrician, one (1) oiler and one (1) wiper. The engineering crew on watch at the time of the collision consisted of the Chief Engineer, 4th Engineer and Oiler. The Master and Chief Officer administered alcohol testing onboard the vessel after the collision. All engineering crew test results for alcohol were negative.[21] USCG indicated all engineering crew post-accident drug testing were negative.

[18] Carla Maersk's Maintenance Record Shipnet Fleet, version 11, December 1th 2014 to April 3 2015.
[19] International Maritime Organization (IMO) amended the International Convention for the Prevention of Pollution from Ships (MARPOL) designating specific portions waters as an Emission Control Areas (ECA).
[20] *Conti Peridot* Toxicology Final Report, March 12th, 2015. University Services MRO, La Porte, TX.
[21] *Carla Maersk* Master's Drug and Alcohol Report, revision 1/ 21-Nov-2013, signed by Master on March 9th.

4. Vessels Descriptions

4.1 *Conti Peridot* Vessel particulars

Vessel Name	***Conti Peridot***[22]
Owner	Conti Peridot (L) Shipping Ltd. Schifffahrts-GmbH & Co. Bulker KG MS "CONTI PERIDOT"
Operator	Bremer Bereederungsgesellschaft mbH & Co. KG Bremen, Germany
Port of Registry	Monrovia
Flag	Liberia
Type	Handymax Bulk Carrier, Dolphin 57, hull # SF060119
Keel Laid	20 December 2009
Delivered for Service	19 January 2011
IMO Number	9452634
Classification society	American Bureau of Shipping (ABS)
Construction	Welded steel
Draft, summer	12.8 m (42')
Length, overall	189.99 m (623.32')
Breadth, molded	32.26m (105.84')
Depth, molded	18 m (59.06')
Gross tons (GT ITC)	33,036
Deadweight	57,001.1 mt
Displacement, summer	69,224.30 mt
Engine power and type	STX MAN-B&W,6S50MC-C7, 9,480 kW(12,707hp) at 127 RPM Single speed diesel engine, 6 cylinder.
Propulsion	Directly driven, fixed pitch propeller, 4 blades, 6 meter dia.
Auxiliary Engines	Anqing-Daihatsu, 5DK-20, 500kW (760hp)
Rudder Type	Single, semi-balanced, Yoowon Rotary Vane, YVS-840/2

[22] *Conti Peridot* Ship's Particulars, by BBG Gmbh Ship Management, signed copy by Master Hector Isla.

4.2 *Carla Maersk* Vessel particulars

Vessel Name	***Carla Maersk***[23]
Owner	A.P. Moller – Maersk A/S
Operator	Handy Tankers K/S, Commercial
Port of Registry	Copenhagen
Flag	Danish
Type	Chemical Tanker
Keel Laid	22 June 1998
Delivered for Service	23 February 1999
IMO Number	9171503
Classification society	Det Norske Veritas (DNV) Germanischer Lloyd (GL)
Construction	Welded steel
Draft, summer	12.02 m (39' 05'')
Length, overall	182.75 m (599' 07'')
Breadth, molded	32.20m (105' 08'')
Depth, molded	18.60 m (61' 00")
Gross tons (GT ITC)	29,289
Deadweight	44,999 mt
Displacement, summer	55,067.2 mt
Engine power and type	Hyundai MAN-B&W,6S50MC MK6,8,561kW(10,480bhp) @123 RPM, Single speed diesel engine, 6 cylinder
Propulsion	Directly driven, fixed 4.00 meter pitch propeller, 4 blades, 5.80 meter diameter
Rudder Type	Single, balanced, Ulstein FRYDENBÖ, rotary vane actuator, RV 1350

4.3 GPS antenna locations

Investigators measured the location of the AIS GPS antenna's aboard the both vessels and reviewed the antenna drawings to ascertain their relative positions on the vessels.

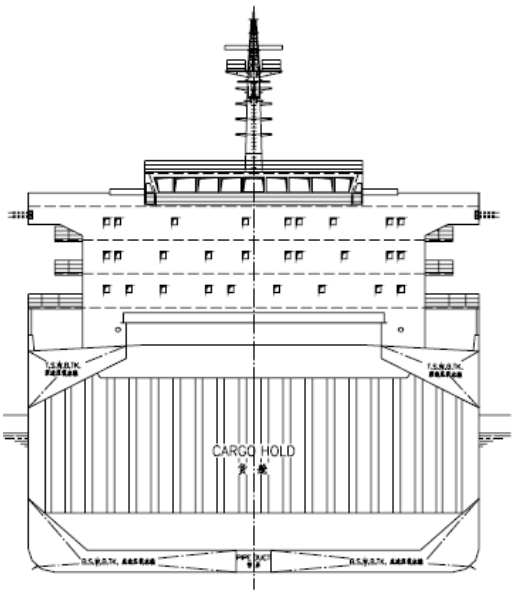
4.3.1 *Conti Peridot* AIS GPS: 162.98 meters from bow, 7.92 meters right of centerline, 20.33 meters above WL, draft 9.243 meters.[24]

[23] *Carla Maersk* Ship's Particulars, Rev 04 / Feb/ 2015.
[24] *Conti Peridot* Arrangement of Antenna.pdf and Conti Peridot General Arrangement.pdf.

4.3.2 *Carla Maersk* AIS GPS: 156.16 meters from bow, 7.32 meters right of centerline, 26.90 meters above WL, draft 10.2 meters.[25]

4.4 General Arrangements

4.4.1 *Conti Peridot* General Arrangement[26]



NAME	FRMIN	FRMAX	FILL	VNET
	#	#		m3
Cargo : Density=1 t/m3				
NO.1 CARGO HOLD	182	217	1.00	13009.86
NO.2 CARGO HOLD	144	183	1.00	15333.25
NO.3 CARGO HOLD	108	145	1.00	14553.08
NO.4 CARGO HOLD	70	109	1.00	15333.27
NO.5 CARGO HOLD	35	71	1.00	13404.64
SUBTOTAL				71634.09

Figure 8 *Conti Peridot's* Midship Section and cargo hold capactities in cubic meters[27]

On the day of the accident, the *Conti Peridot* was in a ballast condition, with 7 of 16 ballast tanks 100% full, and only 5 Port and Starboard (PS) ballast tanks were empty. Total loaded water ballast logged for all tanks was 59.18%.[28] The ship was displacing 47,050 metric tons. Figure 8 exhibits loading conditions on March 8th The forward draft was 9.217 meters, the amidships draft was 9.230 meters and the aft draft was 9.243 meters according to *Conti Peridot's* Floating Condition while in Houston's Fairway Anchorage recorded on March 8th 2105. Heel was recorded at .35 degrees to port, and trim .03 meters. The *Conti Peridot's* pilot information card on March 9th lists the forward draft at 9.53 meters, the amidships draft was 9.54 meters and the aft draft was 9.56 meters.

CARGOBULK

Tank Name	Spgr (MT/CU.M)	Load (%)	Weight (MT)	LCG (m)	TCG (m)	VCG (m)	Volume (m³)
CARGOHOLD1.C	2.331002	6.51%	1974.9	67.212f	0.000s	2.538	847.2
CARGOHOLD2.C	2.331002	13.24%	4733.0	38.454f	0.000s	3.147	2030.4
CARGOHOLD3.C	2.331002	17.08%	5792.9	8.195f	0.000s	3.521	2485.1
CARGOHOLD4.C	2.331002	24.97%	8926.2	22.027a	0.000s	4.194	3829.3
CARGOHOLD5.C	2.331002	12.76%	3986.2	50.669a	0.000p	3.337	1710.1
Subtotals:		15.22%	25,413.27	1.432a	0.000	3.583	10,902.2

Figure 9 *Conti Peridot's* cargo holds load summaries for March 8th [20]

[25] *Carla Maersk*
[26] *Conti Peridot*
[27] *Conti Peridot* General Arrangment.pdf
[28] *Conti Peridot's*

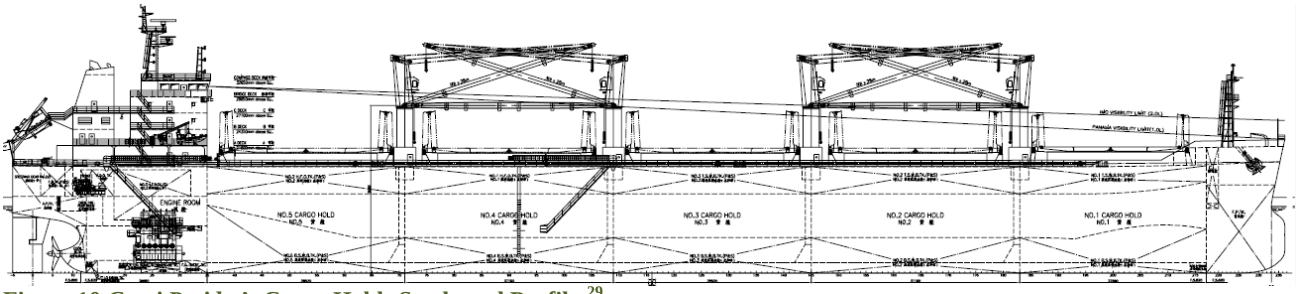


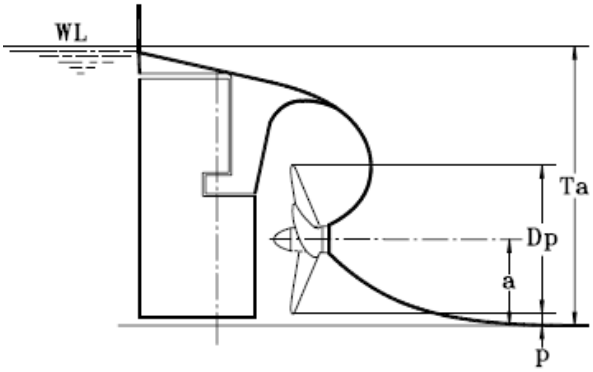
Figure 10 *Conti Peridot's* Cargo Holds Starboard Profile.[29]

4.4.1.a *Conti Peridot* Propeller Immersion ratio

Propeller Immersion ratio was .9905 or 99.05%, where Ta = 9.243, a = 3.30m, Dp = 6.00m based arrival floating conditions.[30] However, propeller Immersion ratio calculated from the pilot card information was 1.0433 or 104.3%.[31]

(3) Propeller immersion

To keep efficiency of propeller, draft aft should be deep enough to take sufficient propeller immersion of more than 100%. Propeller immersion ratio:



Propeller Immersion Ratio:

I/ Dp = (Ta-a) / Dp

Where:

Ta: Draft at A.P. (m)

a: Height of shaft above B.L. (m)

a = 3.30 m

Dp: Propeller Diameter (m)

Dp = 6.00 m

Figure 11 *Conti Perdiot's* Loading Manual, 57000DWT Bulk Carrier, section 2.8.1 Instruction at loading condition[32]

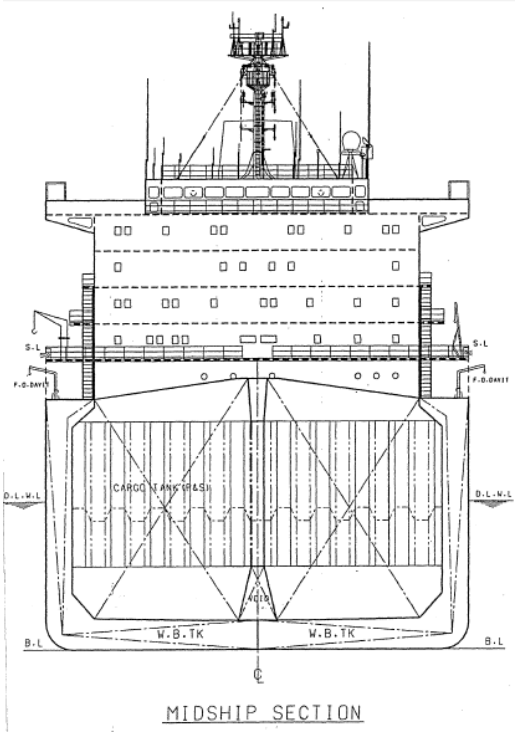
[29] *Conti Peridot* General Arrangment.pdf.

[30] *Conti Peridot's* Floating Condition, Arrvl_Houston_08March2105

[31] *Conti Peridot* Pilot Information Card, March 9th, 2015.

[32] Figure 10 Conti Perdiot's Loading Manual, 57000DWT Bulk Carrier, Detail Design SC4439(SF)G4-101-01JS, Shanghai Merchant Ship Design & Research Institute, CSSC, pg 13.

4.4.2 *Carla Maersk* General Arrangement[33]



CARGO OIL TANKS

COMPARTMENT	FRAME LOCATION	CAPACITY (M3) 100%	98%
NO.1 C. O. TK(P)	82 - 86	1700.3	1666.3
NO.1 C. O. TK(S)	82 - 86	1700.3	1666.3
NO.2 C. O. TK(P)	78 - 82	2379.7	2332.1
NO.2 C. O. TK(S)	78 - 82	2373.1	2325.6
NO.3 C. O. TK(P)	74 - 78	2633.5	2580.8
NO.3 C. O. TK(S)	74 - 78	2626.9	2574.4
NO.4 C. O. TK(P)	70 - 74	2771.4	2716.0
NO.4 C. O. TK(S)	70 - 74	2764.8	2709.5
NO.5 C. O. TK(P)	66 - 70	2812.3	2756.1
NO.5 C. O. TK(S)	66 - 70	2805.7	2749.6
NO.6 C. O. TK(P)	62 - 66	2812.3	2756.1
NO.6 C. O. TK(S)	62 - 66	2805.7	2749.6
NO.7 C. O. TK(P)	58 - 62	2812.3	2756.1
NO.7 C. O. TK(S)	58 - 62	2805.7	2749.6
NO.8 C. O. TK(P)	54 - 58	2812.3	2756.1
NO.8 C. O. TK(S)	54 - 58	2805.7	2749.6
NO.9 C. O. TK(P)	50 - 54	2787.9	2732.1
NO.9 C. O. TK(S)	50 - 54	2781.3	2725.7
NO.10 C. O. TK(P)	46 - 50	2331.4	2284.8
NO.10 C. O. TK(S)	46 - 50	2324.8	2278.3
SLOP TK(P)	45 - 46	544.5	533.6
SLOP TK(S)	45 - 46	544.5	533.6
TOTAL		52736.4	51681.7

Figure 12 *Carla Maersk's* Midship Section and cargo hold capactities in cubic meters[34]

On the day of the accident, the *Carla Maersk* was in a loaded condition, with 14 of 20 cargo tanks each 89% full, and only 1 Port and Starboard (PS), 2 PS, & 10 PS cargo tanks empty. The ship was displacing 43,524 metric tons.[35] The forward draft was 10.2 meters, the aft draft was 10.2 meters, zero trim.[36] Total Observed Volume (TOV) was 217,198.8bbls. Gross observed volume (GOV) was 217,198.8bbls and Gross standard volume (GSV) was 216,519.4.

[33] *Carla Maersk* General Arrangement DWG.pdf
[34] *Carla Maersk* General Arrangement DWG.pdf
[35] *Carla Maersk's* Load Summary March 9th 06:20, Voyage 15502
[36] *Carla Maersk's* Load Summary March 9th 06:20, Voyage 15502

BROSTRÖM
BRO PROMOTION

CARGO REPORT
AFTER LOADING
BRO PROMOTION

File Name:	DEP.COND.HOUSTON	Voyage:	15502	Drafts given by the user	
		Port:	Houston	Draft fwd [m]:	10.20
Date:	09/03/2015	Terminal:	TPC	Draft Aft [m]:	10.20
Time:	06:20	Jetty:	A	Trim [m]:	0.0
				Heel [deg]:	0.0

Parcel	Trade Name	UNNO	DegF	C.T.E	API.60F	Table	TAB13 Heat	Adj
METHYL TERT-.	METHYL TERT-.	2398	64.0	0.000789	58.3	6C	0.11824	

Tank	Parcel	R/M	Ull obs cm	Ull cor cm	TOV barrel	GOV barrel	DEGF	VCF	GSV barrel	TCWL Air t
COT3P	METHYL TERT-.	M	354.000	354.000	14779.2	14779.2	68.4	0.99336	14681.0	1735.9
COT3S	METHYL TERT-.	M	368.000	368.000	14607.5	14607.5	68.0	0.99368	14515.1	1716.3
COT4P	METHYL TERT-.	M	360.000	360.000	15523.3	15523.3	62.4	0.99811	15493.9	1832.0
COT4S	METHYL TERT-.	M	360.000	360.000	15478.6	15478.6	62.2	0.99826	15451.7	1827.0
COT5P	METHYL TERT-.	M	360.000	360.000	15744.7	15744.7	62.2	0.99826	15717.3	1858.4
COT5S	METHYL TERT-.	M	362.000	362.000	15688.0	15688.0	62.2	0.99826	15660.7	1851.7
COT6P	METHYL TERT-.	M	360.000	360.000	15750.9	15750.9	62.1	0.99834	15724.8	1859.3
COT6S	METHYL TERT-.	M	362.000	362.000	15683.0	15683.0	62.8	0.99779	15648.4	1850.3
COT7P	METHYL TERT-.	M	363.000	363.000	15732.1	15732.1	62.6	0.99795	15699.8	1856.3
COT7S	METHYL TERT-.	M	364.000	364.000	15681.1	15681.1	63.0	0.99763	15644.0	1849.7
COT8P	METHYL TERT-.	M	363.000	363.001	15723.6	15723.6	63.1	0.99755	15685.1	1854.6
COT8S	METHYL TERT-.	M	362.000	362.000	15696.2	15696.2	63.0	0.99763	15659.0	1851.5
COT9P	METHYL TERT-.	M	363.000	363.000	15565.4	15565.4	66.2	0.99510	15489.1	1831.4
COT9S	METHYL TERT-.	M	360.000	360.000	15545.3	15545.3	67.8	0.99384	15449.5	1826.7
TOTAL					217198.8	217198.8	64.0	0.99687	216519.4	25601.3

Figure 13 *Carla Maersk*'s cargo holds load summaries for March 9th [27]

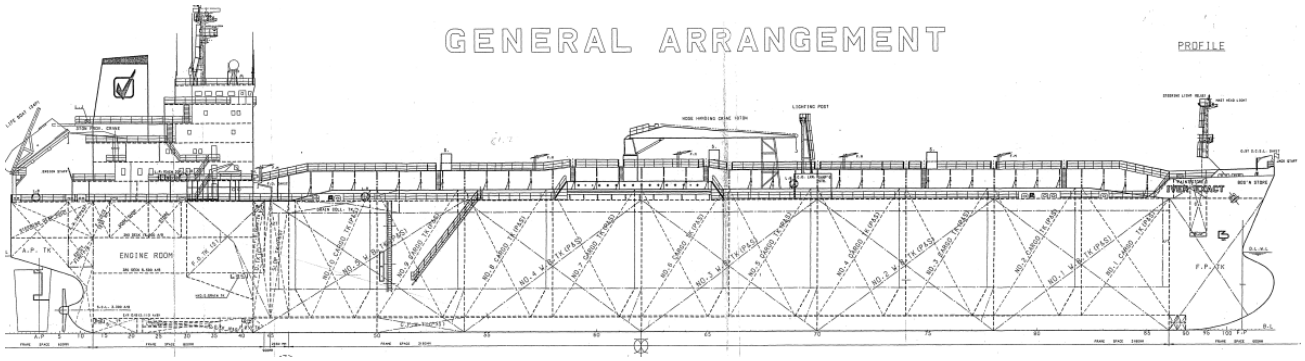


Figure 14 *Carla Maersk*'s cargo holds Starboard profile[28]

5.0 Collision Point of Contact and Vessel Damage

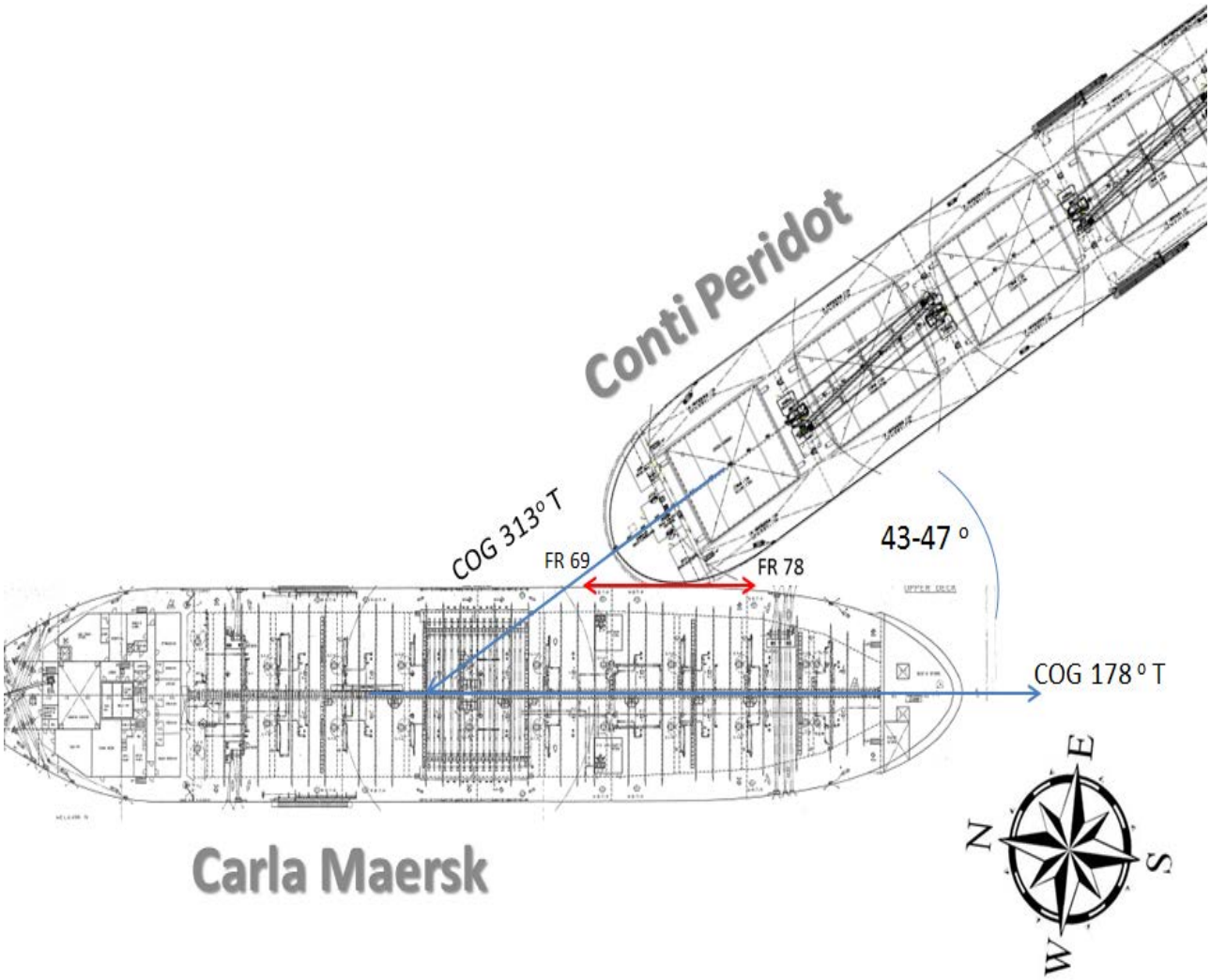


Figure 15, Contact point of *Carla Maersk* and *Conti Peridot,* Houston Ship Channel March 9th 2015.

Initial damage assessment was conducted by the vessel's classification society's attending marine surveyors and a salvage company. NTSB investigators requested and received final damage surveys, closed conditions of class, and statement narratives.

5.1 *Conti Peridot* collision point of contact was the port bow. The *Conti Peridot's* Course Over Ground (COG) was approximately 313 degrees true at the time of the collision.[37]

[37] *Conti Peridot's* course recorder, March 9th 2015 and Port Vision Vessel Event Report for *Conti Peidot* and Playback March 9th 2015.

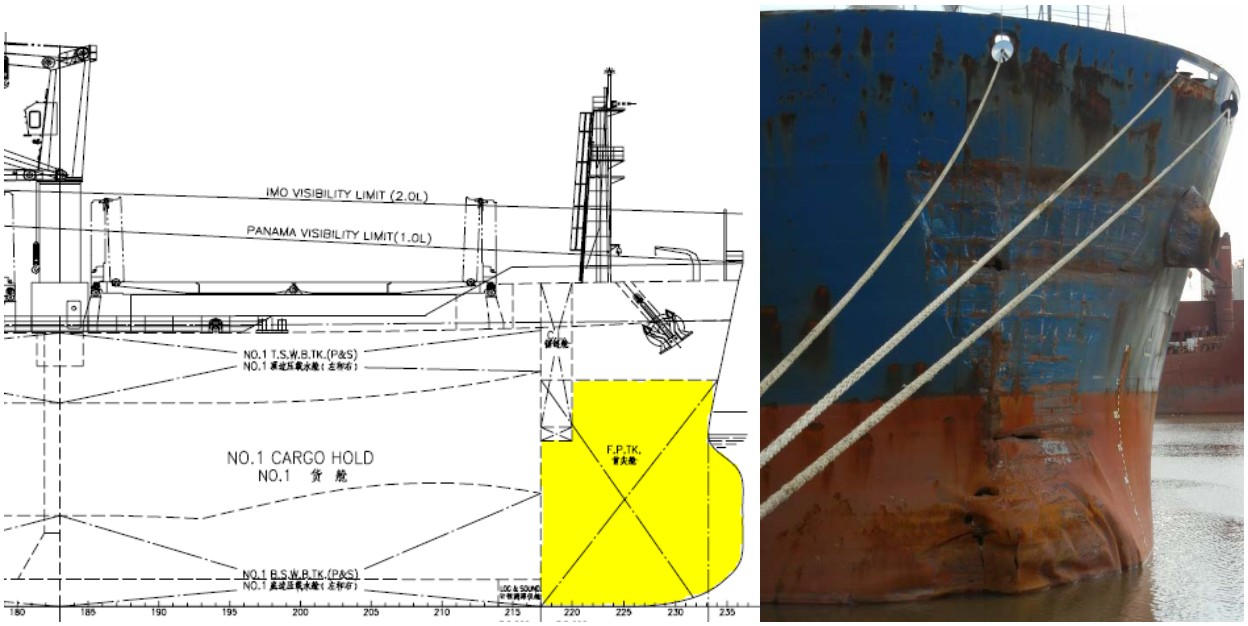


Figure 16, *Conti Peridot* Forepeak Ballast Tank (F.P. TK) and forepeak space void highlighted in yellow and bulbous & side shell damage (NTSB)

Conti Peridot's attending marine surveyor from their Classification Society, American Bureau of Shipping (ABS) conducted initial damage survey and noted the following areas damage found from March 9th to April 17th 2015.[38]

The following areas of the forepeak tank were found damaged as follows: From bottom plate up to platform at level '14900, Port and Starboard (PS) from bulbous area frame 236 to frame 231 PS and Starboard (STBD) platforms 4410 (1st),6910 (2nd),9410(3rd),1 1910(4th) and '14900(5th) and side shell in way of were found buckled and with several fractures. Port side shell longitudinals number 229 and 230 from 1st platform(44'10) up to 5th platform (14900) were found buckled. Side Shell in wav of frames 229 and 230 found set-in.

The following area of the forepeak space void were found damaged as follows: Port and Starboard (PS) from frame 228 to Centerline (CL), Starboard (STBD) from CL to 5th side shell longitudinal from level 14900 up to main deck, the side shell longitudinals and shell plate were found buckled, deformed and with several fractures. Space from main deck up to upper deck. Side longitudinals up to 1 meter from the main deck and lowers brackets on the following areas were found buckled- PS 8 longitudinal counted from CL and STBD 4 longitudinal counted from CL.[39]

[38] *Conti Peridot* ABS Class Survey Report, Class No. 11200632, Report No. HS2853202, Last Visit Date April 17th, 2015.
[39] *Conti Peridot* ABS Class Survey Report, Class No. 11200632, Report No. HS2853202, Last Visit Date April 17th, 2015.

5.2 The initial impact point on the *Carla Maersk* was the port side forward of midship, starting at frame 78 and continuing to frame 69. *Carla Maersk's* COG at the time of collision was approximately 178 degrees true.[40] Water ballast tanks, 2 port & 3 port were affected. Cargo tanks 3 port & 4 port were damaged as well, with the largest damage in way of Cargo Tank 4 port.

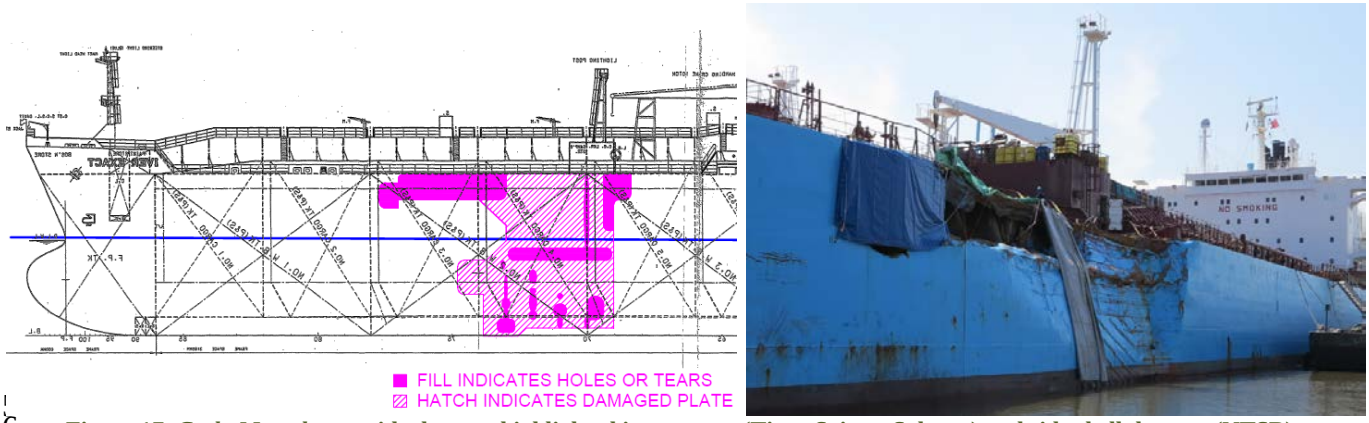


Figure 17, *Carla Maersk* port side damage highlighted in magenta (Titan-Svitzer Salvage) and side shell damage (NTSB)

Carla Maersk's Classification Society, Det Norske Veritas - Germanischer Lloyd (DNV - GL) Hull and Damage Repair survey completed on July 13th 2015 indicates repairs completed in Grand Bahama Shipyard in Freeport, Grand Bahamas.

> *Between frames 69 to 78 and between the main deck down to the 1st horizontal side stringer, the side shell plating has been severely indented, with an open gash visible between frs 72 to 78. In this area the main deck has been indented with a maximum deformation inboard of approximately 2.0m… The longitudinal bulkhead between Water Ballast Tank 2(P) and Cargo Tank 4(P) was renewed at approximately 90%. Corrugated bulkheads between Cargo Tank 3(P) and 4(P) as well as between 4(P)and 5(P) were partly inserted with newly fabricated corrugations. Bilge keel side shell plates as well as internals, between frames 69 and 76 were complete renewed.*[41]

[40] Port Vision Vessel Event Report for Carla Maersk's and Playback March 9th 2015.
[41] DNV-GL Survey Statement, *Carla Maersk*, ID No. 27084, Job ID: 644709, Survey completed July 13th, 2015, pg 2.

Figure 18, View of Ballast Water Tank # 2 Port after removal of damage side shell (left) and fabricated hull block inserted (right) photographs from DNV-GL Survey.[42]

6.0 Post-accident testing of steering gear systems

6.1 *Conti Peridot's* steering gear test.

On March 13th NTSB investigators, with assistance from the Coast Guard, party representative, and shipboard deck & engineering personnel, tested the Yoowon Rotary Vane, YVS-840/2 steering system of the *Conti Peridot* while berthed at the Port of Houston Authority, City Docks Turning Basin, Wharf 21. These tests were conducted with two hydraulic pumps on-line in order to simulate the actual pump arrangements at the time of the accident. The tests consisted of two parts. The first test was to determine if the rudder angle indicator on the bridge matched the actual rudder angle as mechanically indicated on the rudder post itself in the steering gear room. The second test was to determine the time to swing the rudder from 30^{o} port to 30^{o} starboard at the dock. The test was conducted by swinging the rudder from 35 ^{o} to 35 ^{o} while noting the time to travel through 30^{o} to 30^{o}. This test was performed to indicate the approximate response of the rudder relative to standard SOLAS and Coast Guard requirements as well as providing rough comparisons for future VDR or other analyses. Per the results shown in the table below, the tests showed the rudder angle indicators were accurate and that the rudder could travel 60^{o} in about 13 seconds.

[42] DNV-GL Survey Statement, *Carla Maersk*, ID No. 27084, Job ID: 644709-1, Survey Statement Narrative Annex, Revision No: a completed on July 13th , 2015, pg 2.

***Conti Peridot*: Steering Tests 2015/03/13**		
Helm Order	**Bridge Angle Indicator** (degrees)	**Rudder Stock Angle Indicator** (degrees)
Midship	0	0
15° STBD	15	15
35° STBD	35	35
Midship	0	0
15° Port	15	13
35° Port	35	35
Swing Tests: Order 35 deg. to 35 deg.; approx. time to swing from 30 deg. to 30 deg.		
30 Stbd to 30 Port	13 seconds – 2 pumps on line	
30 Port to 30 Stbd	12 seconds – 2 pumps on line	

6.2 *Carla Maersk's* steering gear test.

Carla Maersk steering system, Ulstein FRYDENBÖ, rotary vane actuator, RV 1350 type was tested on March 17 while pier side at Oiltanking terminal Houston, TX with assistance from the Coast Guard, party representatives, shipboard deck & engineering personnel. The tests were conducted in the same manner as the *Conti Peridot* testsPer the results in the table below, the rudder angle indicators were accurate and the rudder could travel 60° in about 12 seconds.

***Carla Maersk*: Steering Tests 2015/03/13**		
Helm Order	**Bridge Angle Indicator** (degrees)	**Rudder Stock Angle Indicator** (degrees)
Midship	0	0
15° STBD	15	14
35° STBD	35	35
Midship	0	0
15° Port	15	15
35° Port	35	35
Swing Tests: Order 35 deg. to 35 deg.; approx. time to swing from 30 deg. to 30 deg.		
30 Stbd to 30 Port	11 seconds – 2 pumps on line	
30 Port to 30 Stbd	12 seconds – 2 pumps on line	

7.0 Inert Gas Requirements for Tankers

7.1 Background- The requirements for tankers to be fitted with an inert gas system were developed by IMO and adopted in November 1973. This Resolution was incorporated into SOLAS

1974 and applied to tankers >100,000 metric tons deadweight (tdwt).[43] Progressively over the years, the applicability threshold has reduced to encompass crude and product tankers of lesser deadweights. SOLAS 1978 protocol contained the requirement for all new oil tankers of 20,000 tdwt and above and chemical and gas carriers with tanks exceeding 3,000 cubic meters (m3) to have an inert gas system. In May 2014, amendments to SOLAS will require Tankers of 8,000 tdwt and above constructed on or after 1st January 2016, when carrying flammable cargoes shall be fitted with a fixed inert gas system in accordance with the requirements of the Fire Safety Systems Code or other equivalent system. The new statutory requirements for fixed inert gas systems enter into force on 1 January, 2016, as a result of changes to SOLAS, the Fire Safety Systems (FSS) Code and the International Bulk Chemical (IBC) Code.

Carriage of chemicals in bulk is covered by regulations in SOLAS Chapter VII - Carriage of dangerous goods and MARPOL Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.

Both Conventions require chemical tankers built after 1 July 1986 to comply with the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code).

The IBC Code provides an international standard for the safe carriage in bulk by sea of dangerous chemicals and noxious liquid substances listed in chapter 17 of the Code. To minimize the risks to ships, their crews and the environment, the Code prescribes the design and construction standards of ships and the equipment they should carry, with due regard to the nature of the products involved. In December 1985, by resolution MEPC.19(22), the Code was extended to cover marine pollution aspects and applies to ships built after 1 July 1986.

In October 2004, IMO adopted revised MARPOL Annex II Regulations for the control of pollution by noxious liquid substances in bulk. This incorporated a four-category categorization system for noxious and liquid substances and it entered into force on 1 January 2007.

Consequential amendments to the International Bulk Chemical Code (IBC Code) were also adopted in October 2004, reflecting the changes to MARPOL Annex II. The amendments incorporated revisions to the categorization of certain products relating to their properties as

[43] Tons deadweight is a measure of how much mass a ship is carrying or can safely carry, it does not include the weight of the ship. DWT is the sum of the weights of cargo, fuel, fresh water, ballast water, provisions, passengers, and crew.

potential marine pollutants as well as revisions to ship type and carriage requirements following their evaluation by the Evaluation of Hazardous Substances Working Group. The Marine Environment Protection Committee on its fifty-sixth session update IBC Code with Resolution MEPC.166(56) adopted on 13 July 2007, enter into force on 1 January 2009. The update code does not require inerting of Methyl Tertiary Butyl Ether (MTBE).[44] Inerting requirements are based sole on the vessel's deadweight not the flammability of the cargo.

In considering the application of IGS requirements to chemical tankers, it was argued that chemical tanker should be given special consideration. Primarily because the inert gas from - shipboard IGS and impurities in the inert gas can contaminate chemical cargoes. For example, the carbon dioxide produced as an inerting agent can drive certain cargoes off specification. Additionally, there are other chemical cargoes which are shipped with inhibitors that react with the oxygen in the tank to prevent the cargo from undergoing unwanted reactions. Therefore, the displacement of oxygen through inerting by any means (bottled nitrogen, inert gas generator, flue gas systems, etc.) can cause breakdown of inhibitors required to prevent these reactions.

The Carriage of dangerous goods and marine pollutants in sea-going ships is respectively regulated in the International Convention for the Safety of the Life at Sea (SOLAS) and the International Convention for the Prevention of pollution from Ships (MARPOL).

Relevant parts of both SOLAS and MARPOL have been worked out in great detail and are included in the International Maritime Dangerous Goods (IMDG) Code, thus making IMDG Code the legal instrument for maritime transport of dangerous goods and marine pollutants. IMDG Code became a mandatory requirement on the 1st of January 2004. Figure 27, lists the Safety Data Sheet for MTBE from TPC Group, Houston TX.[45]

[44] RESOLUTION MEPC.166(56) 2007 AMENDMENTS TO THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (IBC CODE). MEPC 56/23/Add.1

[45] Safety Data Sheet for MTBE from TPC Group, Houston TX. www.tpcgrp.com Version 1.0 4-06-2015.

Figure 19, Safety Data Sheet for MTBE from TPC Group, Houston TX Version 1.0 4-06-2015

TPC Group

SAFETY DATA SHEET

MTBE

Section 1. Identification

GHS product identifier : MTBE

Product use : Fuel component

Supplier's details : TPC Group
One Allen Center, Suite 1000
Houston, TX, 77002, USA
T 713-627-7474

company web address : www.tpcgrp.com

Emergency telephone number (with hours of operation) : 800-424-9300 (Chemtrec - U.S.)
+1-793-527-3887 (Chemtrec - International)

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
ASPIRATION HAZARD - Category 1
Percentage of the mixture consisting of ingredient(s) of unknown toxicity: 1%

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
Causes serious eye irritation.
Causes skin irritation.
May be fatal if swallowed and enters airways.
May cause respiratory irritation.

1

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Clear.

Odor : Not available.

Odor threshold : Not available.

pH : Not available.

Melting/Freezing point : -110°C (-166°F)/-108.6°C (-163.48°F)

Boiling point : 55 to 56°C (131 to 132.8°F)

Flash point : Closed cup: -26°C (-14.8°F) [ASTMD93]

Evaporation rate : 1 (Ether=1.0)

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: heat.

Lower and upper explosive (flammable) limits : Lower: 1.6%
Upper: 8.5%

Vapor pressure : 4.05 psi (20°C)

Vapor density : 3.1 [Air = 1]

Specific gravity : 0.74 (25°C)

Solubility : Not available.

Solubility in water : 51 g/L (20°C)

Partition coefficient: n-octanol/water : 1.24

Auto-ignition temperature : 374°C (705.2°F)

Decomposition temperature : Not available.

Viscosity : Kinematic (room temperature): 0.0047 cm^2/s (0.47 cSt)

Molecular weight : 88.15

Henry's law constant : 5.510^-4 (EPA)

Bioaccumulation factor : 5.69 (ACS)

2

Nitrogen has been in use for many years on chemical tankers to reduce the oxygen content in empty tank spaces (and even occasionally adjacent void spaces) when carrying certain chemicals, which can be adversely affected by Oxygen. This is done either for safety reasons, such as to prevent a flammable atmosphere from developing for cargo quality reasons or and for other uses on the vessel (e.g. cargo handling, or inerting void spaces).

7.2 Maersk Tanker A/S policy as described in their Safety Management System procedures aim to inert all low flashpoint cargoes. The *Carla Maersk* was specifically retrofitted with an N2 generator for chemical trade, methanol products explicitly. The retrofits were carried on the *Bro Promotion* (previous vessel name) by then owners Broström for the trade.[46] On August 27th 2008, the Maersk Group announced a public offer for all shares in Broström and in January 2009 the European Union sanctioned the merger.[47]

The inerting of *Carla Maersk's* cargo tanks was based on the requirements of the charter party / voyage fixture notice and the suitability of the vessel for the cargo and trade.[48] *Carla Maersk's* voyage also stated in the voyage fixture, "Vessel is to arrive fully inerted, clean, and suitable to load the above nominated cargo."[49]

7.2.1 Investigators reviewed the following Maersk Tankers provided procedures.

- Directions for Inerting of Chemical Cargoes, SHIPNET ID: 06.520.01
- Inerting with Nitrogen Prior To Loading Chemicals SHIPNET ID: 06.510.01
- Nitrogen Blanketing after Loading of Chemicals SHIPNET ID: 06.518.01

Objective evidence the operator carried out the procedure in accordance with the instruction.

[46] Correspondence with Maersk Tanker A/S Vetting & Marine Operations Manager on11/3/2015.
[47] Brostrom website. –About Us,Still going strong after 145 years. www.brostrom.com
[48] Correspondence with Maersk Tanker A/S Vetting & Marine Operations Manager on11/3/2015.
[49] Correspondence with Maersk Tanker A/S Vetting & Marine Operations Manager on11/3/2015.

8.0 *Carla Maersk* Classification and Notations

Figure 20, *Carla Maersk* bridge. *Iver Example* Lloyd's Register Plaque (NTSB).

8.1 Orignially named *Iver Example* the keel was laid on 22 June 1998. She was built by Halla Engineering & Heavy Industry LTD in South Korea. [50] The double hull chemical tanker was built to Lloyd's Register classfication rules, layouts, and notations. Classification societies play a fundamental rold in the marine industry with the vast majority of commercial ships built to a standard. The society acts on behalf of the ship owner and builder to ensure quality and safety of a ship's main structural components. *Iver Example* was delivered for service 23 February 1999 At the time of delivery the vessel had the following notations.

✠1001A Chemical Tanker, Ship Type 2, in association with a list of defined cargoes, ESP, *IWS, LI, Ice Class 1D with descriptive notes, ShipRight (SDA, FDA, CM, PCWBT) and PT HT steel, LMC, SCM, UMS, IGS, COW

- ✠100A1 Chemical Tanker, Ship Type 2 - Sea-going ships complying with the IBC Code as a Type 2 ship and where the ship is registered with a Flag Administration which supports the issuance and maintenance of dual certification for both Ship Type 2 and where the Flag Administration has agreed to the issuance of dual Certificates of Fitness.[51] A type 2 ship is a chemical tanker intended to transport chapter 17 products with appreciably severe environmental and safety hazards which require significant preventive measures to preclude an escape of such cargo.[52]

[50] Hyundai Samho Heavy Industries Co. LTD http://eng.hshi.co.kr/main/main.asp
[51] Lloyd's Register Rulefinder 2015 – Version 9.24.
[52] IMO. The International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code) http://www.imo.org/en/OurWork/Safety/Cargoes/CargoesInBulk/Pages/IBC-Code.aspx

- *IWS - protection of the underwater portion of the hull is to be provided by means of a suitable high resistant paint applied in accordance with the manufacturer's requirements.[44]
- LI - This notation will be assigned where an approved loading instrument has been installed as a classification requirement.
- Ice Class 1D - Hull strengthening in forward region only. Light and very light ice conditions. [44]
- ShipRight SDA - This ShipRight notation (Structural Design Assessment) assigned when direct calculations in accordance with the relevant ShipRight procedures have been applied. The ShipRight notation SDA is mandatory upon application of any of the following ShipRight notations: FDA, FDA, FDA ICE, FDA SPR and WDA. [44]
- CM - Construction Monitoring complements the SDA and FDA notations and will be assigned when the controls in construction tolerances have been applied and verified. [44]
- PCWBT - Protective Coating in Water Ballast Tanks[44]
- HT steel - Higher Tensile steel[44]
- LMC - This notation (without ✠) will be assigned to existing self-propelled units that will be accepted or transferred into LR class[44]
- SCM - Screwshaft Condition Monitoring[44]
- UMS - Where it is proposed to operate the following machinery in an unattended space, no matter what period is envisaged[44]
- IGS - This notation will be assigned, when a unit having facilities for the storage of crude oil in bulk is fitted with an approved system for producing gas for inerting the crude oil storage tanks. [44]
- COW - Crude oil washing[44]

8.2 The vessel is currently classed under Det Norske Veritas (DNV) and has the following notations.

1A1, ICE-C, Tanker for Chemicals ESP E0 BIS.

- 1A1 - Vessel for which periodical surveys are stipulated in relation to special (main) periodical survey intervals of 5 years.[53]
- ICE-C - Vessel which may operate in light ice conditions[39]
- Tanker for Chemicals ESP - Tanker with enhanced survey programme[39]
- E0 - Machinery of craft fitted with instrumentation and automation equipment[39]
- BIS -Ships built for in-water survey of the ship's bottom and related items[39]

8.4 *Carla Maersk* Additional inspection regimes carried out on the vessel.

Det Norske Veritas AS (DNV) carried out a condition assessment of the hull structure, machinery, and cargo system onboard the *Carla Maersk* and received a Condition Assessment Programme (CAP) overall rating for Hull Structure of 1and Machinery & Cargo System of "in progress" on November 27, 2013. Vessel was awarded CAP 1 Hull, and CAP 2 for M & C on 19-6-2014.[54]

8.4.1 Background, CAP is a voluntary, thorough verification of the condition of the vessel at the time of inspection. The main purpose is to document the quality of aged vessels and to make it possible to judge the vessel based on its current condition rather than its age. CAP is a consultancy service and is independent yet complementary to class. CAP consists of two optional modules, CAP Hull, CAP Machinery and Cargo Systems (CAP MC). Deliveries include a CAP Declaration with an

[53] DNV Class Notation - Description of class notations as of January 2000. https://exchange.dnv.com/Exchange/en/MainClass.html
[54] *Carla Maersk* Condition Assessment Programme Declaration, November 27, 2013.

overall rating of the vessel and technical reports containing descriptions, observations, analysis, ratings and photos of typical condition and of defects and repairs.

8.4.2 Ship Inspection Report Programme (SIRE)

The SIRE system is a very large database of up-to-date information about tankers and barges. SIRE has focused tanker industry awareness on the importance of meeting satisfactory tanker quality and ship safety standards. Since its introduction, the SIRE Programme has received industry-wide acceptance and participation by both Oil Companies International Marine Forum OCIMF Members, Programme recipients and by ship Operators. The expansion of Barges and small vessels into SIRE was inaugurated in late 2004.

Since its introduction, more than 180,000 inspection reports have been submitted to SIRE. Currently there are over 22,500 reports on over 8,000 vessels for inspections that have been conducted in the last 12 months. On average Programme Recipients access the SIRE database at a rate of more than 8000 reports per month.

One of the most significant safety initiatives introduced by OCIMF is the Ship Inspection Report Programme (SIRE). This programme was originally launched in 1993 to specifically address concerns about sub-standard shipping. The SIRE Programme is a unique tanker risk assessment tool of value to charterers, ship operators, terminal operators and government bodies concerned with ship safety.The SIRE programme requires a uniform inspection protocol that is predicated by the following: Vessel Inspection Questionnaire (VIQ), Barges Inspection Questionnaire (BIQ),Uniform SIRE Inspection Report, Vessels Particulars Questionnaire (VPQ),Barge Particulars Questionnaire (BPQ),SIRE Enhanced Report Manager (WebSERM)[55]

8.4.3 Examination of foreign-flag chemical tankers in US waters are conducted by Coast Guard's Port State Control. As a port state responsibility, port state control officers verify that the vessel and their crews are in compliance with international conventions and applicable US laws. The depth and scope of the examinations are determined by the port state control officers based on their observations. Foreign flagged vessels subject to the requirements of SOLAS and other international

[55] Oil Companies International Marine Forum (OCIMF) Ship Inspection Report Programme (SIRE) http://www.ocimf.org/sire/about-sire/

conventions must undergo Port State Control boardings unless specifically exempt. All vessels get boarded once a year for their annual examination. Some vessels get an additional boarding at six months known as a re-exam. Frequency of boardings is dependent on factors such as flag state, class society, owner/operator, and vessel history. Examination areas include:

- International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended
- International Code for Fire Safety Systems (FSS Code), 2007
- NVIC 02-88 Inerting Requirements for Chemical Tankers and Gas Carriers

The last USCG port state inspection 22 December 2014 and 29 December 2013. No outstanding deficiencies or findings reported.[56]

END OF REPORT

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[56] USCG Vessel Critical Profile 3-10-15.