CASUALTY REPORT

Collision on 29 March 2001

between the Tanker BALTIC CARRIER, registered on Marshall Island

And

The Bulk Carrier TERN, registered on Cyprus
The draft of this report has been submitted to Bundesoberseeamt in Germany, The coordinator of the investigation for the Marshall Islands and Department of Merchant Shipping – Cyprus.

The Bundesoberseeamt fully agree with the facts stated in the report and its conclusions.

The Marine Safety department of the Marshall Islands has reviewed the report and have no comments to make on the report. The Marshall Islands Maritime Administration will be issuing a report on its investigation into this collision.

The Department of Merchant Shipping – Cyprus do agree with the principal conclusions in the report and have some comments to the report. See the comments in annex 2.

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1. The Casualty

Type of casualty: Collision

Location of casualty: The Baltic Sea, in the 17 m DW route, 54°43,2 N 012°35,0 E. This position is based on the track from the GPS plotter of BALTIC CARRIER.

Date and time: 29 March 2001, at about 00.15 hrs (UTC +2) local Danish time.

Injuries: None

2. Summary

The tanker BALTIC CARRIER was on a voyage from Estonia to United Kingdom with a cargo of fuel oil. The bulk carrier TERN was on a voyage from Cuba to Latvia with a cargo of sugar.

Around midnight between 28th and 29th of March 2001 the vessels were proceeding on reciprocal courses in the DW (deep water) route northeast of the Kadet Renden between Germany and Denmark.

On the bridge of TERN were the 2nd officer and a helmsman. On the bridge of BALTIC CARRIER were the master, the 3rd officer and a helmsman. On board both vessels the other vessel was observed. The vessels were going to pass each other port side to port side at a distance of approx. 0,5 nm.

Few minutes before 00.15 (UTC+2), when the distance between the vessels was approx. 1,2 nm., the helmsman on board BALTIC CARRIER told the master that it was not possible to steer the vessel and that the vessel was altering course to port. The Master ordered the rudder hard to starboard, but according to the rudder indicator the rudder remained approximately amidships.

After shifting to the other steering system on the steering stand it was possible to steer again. The distance between the vessels was now approx. 0,75 nm. and TERN was almost right ahead of BALTIC CARRIER. The master of BALTIC CARRIER estimated that it was too late to turn to starboard and therefore ordered the rudder hard to port attempting to pass ahead of TERN.

At approx. 00.15 the stem of TERN ran into the starboard tank No. 6 of BALTIC CARRIER, which contained 2700 tons fuel oil. The collision angle was approx. 50°.
3. Ship Particulars

<table>
<thead>
<tr>
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<th>BALTIC CARRIER</th>
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<tr>
<td>Registration No:</td>
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<td>185.5/26.0/11.1</td>
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<td>Crew:</td>
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<td>22</td>
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<td>Owner:</td>
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<td>Ranger Marine S.A., Piraeus</td>
</tr>
<tr>
<td>Classification Society:</td>
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<td>American Bureau of Shipping</td>
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</table>

**BALTIC CARRIER**

BALTIC CARRIER had valid certificates.

The vessel was equipped with two ARPA radars, GPS, autopilot, gyrocompass and GMDSS radio equipment incl. 2 VHF radios.

BALTIC CARRIER is a double hull tanker.

BALTIC CARRIER has an unmanned engine room. The ship has a fixed propeller and is manoeuvred from the bridge. Nobody was in the engine room, when the collision occurred.

**TERN**

TERN had valid certificates.

The vessel was equipped with two radars, the port being a 10 cm radar and the starboard a 3 cm radar fitted with ARPA, both operational. There were three VHF’s on the bridge. One was always on
channel 16, one normally on channel 70 and one on stand by. There was GPS and gyrocompass. An ordinary telegraph was used for engine orders and there was no automatic bridge control. The vessel was fitted with autopilot, but hand steering was used during the passage in Route T, south of Gedser, and also at the time of the collision. Both steering pumps were always in use when navigating in channels and fairways.

### 4. The Crew

**BALTIC CARRIER**

BALTIC CARRIER had 19 crewmembers.

**Master:** He started as 3rd officer in 1984. In 1987 he became 2nd officer. From 1993 to 1999 he was chief officer on tankers of more than 40,000 BT. In March 2000 he started as chief officer in Interorient Navigation. He finished his master licence degree in December 2000.

The master signed on BALTIC CARRIER on February 23, 2001. He took command as master on 7 March 2001. The former master stayed on board until March 10.

On board the master had his master licence from Latvia and the application for master licence from the Marshall Islands. The master licence from the Marshall Islands was issued, but it had not arrived on board, when the collision occurred.

The master had passed Gedser Rev many times.

**3rd officer:** He was attending the cadet academy from 1993-99. Went to sea in 1995. Completed study for the civil navy in 1998 and for the naval navy in 1999. Went to sea again in April 1999. He was 3rd officer on BALTIC COMMANDER from April to October 2000. He signed on BALTIC CARRIER on 8 December 2000.

The 3rd officer had passed Gedser Rev before.

**Helmsman:** Ordinary seaman. He went to sea first time in April 2000. He signed on BALTIC CARRIER on 8 December 2000. BALTIC CARRIER was his second ship. Before he went to sea, he had been working as an electrician. He had been helmsman on many watches before.

**TERN**

TERN had a crew of 22.

At the time of the collision the 2nd officer was OOW on the bridge. He has a certificate of competence as Chief Mate issued in the Philippines January 2000. He came on board TERN on 13 February 2001 and it was his first assignment on board TERN.

On board TERN the watch system at sea was the ordinary 4/4 shift, the 2nd officer doing the 00-04 and the 12-16 watches. On 28 March following his 12-16 watch he relaxed in his cabin, went to dinner and slept from about 20.00 to 23.30.
At the time of the collision an AB was on duty as helmsman. He had about 5 years practice at sea and signed on TERN on 13 February in his first assignment at this vessel.

5. Narratives

BALTIC CARRIER

The following is based on the statements from the master, the 3rd officer and the helmsman.

BALTIC CARRIER departed from Muga (Tallin) on 27 March 2001 in the morning, on a voyage to Milford Haven, UK. The draft was 10.6 meters in fresh water and the ship was on even keel. The ship had loaded 33,000 tons of fuel oil in Muga. The vessel was going to bunker on the roads at Göteborg.

A voyage plan was made. The waypoints from the plan were entered into the GPS navigator. The route was planned to go through Kadet Renden and Storebælt (Great Belt).

The ship’s watch was on UTC (+1) when the collision occurred. However, hours below are UTC (+2).

On 28 March 2001 the 3rd officer and an ordinary seaman took over watch at 21.00 hours. The OS was at 21.00 hours ordered to be helmsman. He was steering until the collision took place, except for 5 minutes some time before the ship entered the DW 17 route.

The master came on bridge at 22.00 hours to send at telex. The master stayed on the bridge after he had sent the fax. The master called the boatswain, and asked him to make the anchors ready. This was done because the ship was approaching narrow waters. Approx. 23.00 hours the boatswain reported, that this had been done. The boatswain communicated with the bridge by a portable VHF radio.

The master took over the command on the bridge at approx. 23.30 hours, which was before the vessel entered the DW route. The 3rd officer and the helmsman stayed on the bridge.

The wind was SSE 13-15 m/s. Visibility was 8-10 miles. It was partly clouded.

At 23.30 hours the master put the engine program on manoeuvring speed. This means that the main engine has a little fewer revolutions. The speed was reduced from approx. 13 knots to approx. 12.9 knots. The chief engineer was informed that the engine was on manoeuvring speed.

At 23.33 just before entering the DW 17 route the course of BALTIC CARRIER was altered from 244° to 237° in order to follow the route (see annex).

Lyngby Radio was informed as required, when the vessel entered the DW 17 route.

The master chose to follow the DW 17 route, because of the grounds near Gedser Rev in the Kadet Renden. There was much traffic outside the DW route. Two ferries passed on starboard side at a distance of approx. 2 nm.
Both radars were in use. The 3 cm radar was set on distance 6 nm and off centre. The 10 cm radar was set on distance 12 nm. The radars were on north up.

Another vessel was approaching on an opposite course in the DW 17 M route. The master and the 3rd officer first observed the oncoming vessel on the radar at distance approx. 8-10 nm. The oncoming vessel was observed visual at distance 8 nm.

The oncoming vessel was plotted on the radar. CPA was 0,5 nm. The speed of the oncoming vessel was approx. 13 knots. The course was opposite BALTIC CARRIER’s course. BALTIC CARRIER’s course was 237°. The oncoming vessel’s course was approx. 057°.

On the left radar the alarm on CPA was set to 0,5 nm. The master acknowledged an alarm on the radar from plot of the other vessel, so the audible alarm was cancelled.

The vessels were going to pass each other port to port at an appropriate distance.

When the distance to the oncoming vessel was approx. 4 nm., the master switched the 3 cm radar to distance 3 nm.

The oncoming vessel was still following the DW route on a opposite course.

BALTIC CARRIER kept to the red buoy side of the DW route. The oncoming vessel was first observed in the middle of the DW route, but then manoeuvred to the green buoy side of the DW route.

BALTIC CARRIER passed north of the yellow buoy no. S78 - Fl(4)y 10s.

The wind was increasing while BALTIC CARRIER was proceeding in the DW route, and the approx. last 15 minutes before the collision it became more difficult to steer because of gusts of wind. The helmsman was ordered by the master to steer 235-236° because of the wind.

The helmsman has explained, that because of the wind and gusts of wind he had to keep the rudder 5-10° to starboard during the last 10-15 minutes before the collision to hold the vessel on the course.

On the oncoming vessel the master saw 2 masthead lights and a red sidelight.

Everything was normal and all instruments were in function without any problem. Navigation lights were switched on. The navigation lights have alarms, but all lights were in order.

No other vessels were disturbing the navigation of BALTIC CARRIER, when sailing in the DW route.

Besides the above mentioned effect of the wind the helmsman had not during the watch experienced any steering problems until few minutes before the collision. The helmsman had behaved perfectly normal on the watch.

Approx. 3 minutes before the collision, the helmsman said, that he could not steer the vessel and that the vessel was coming to port. The helmsman tried to keep the vessel on the ordered course. The master saw that BALTIC CARRIER was coming to port, and he observed visually that the bearing to
the oncoming vessel was changing. The master read the distance and bearing on the other vessel on the radar display. As the master recall it the distance was 1,2 nm and the bearing was 208° to the oncoming vessel, when BALTIC CARRIER started to turn to port.

The master ordered hard starboard on the wheel. He was standing by the radar. The 3rd officer was in the chart room. The master saw that the rudder indicator did not go to starboard and the vessel continued to go to port. The rudder indicator stayed approx. on zero / amidships.

The alarms on the steering stand began to sound and flash. The steering stand was on system 2. The master told the 3rd officer to change to steering system 1 on the steering stand. The master ordered the helmsman to put the wheel in amidships position, while the 3rd officer was switching from system 2 to system 1. After switching to system 1 on the steering stand the alarms disappeared. It only took a few seconds from the alarm came until they had shifted to system 1.

The distance read on the radar display was then approx. 0,75 nm to the oncoming vessel and BALTIC CARRIER was heading almost at the other vessel. The red sidelight was visible on the other vessel.

BALTIC CARRIER was still turning to port. The master found it difficult to decide, whether he should go to starboard or to port. He decided to continue to go to port because he considered it the best chance to avoid a collision.

Shortly after switching to steering system 1 the master therefore ordered the rudder hard to port. He estimated, that it was too late to turn to starboard. He saw on the rudder indicator, that the rudder went hard to port. When full port rudder was given BALTIC CARRIER came faster to port.

The master ordered the 3rd officer to call out on VHF channel 16, saying that BALTIC CARRIER was not under command and that BALTIC CARRIER was coming to port and the 3rd officer did so. The 3rd officer heard a vessel answer that it would turn to port but he did not know, which vessel it was. The master did not hear any reply, but he was very busy at the moment.

At the same time as the master ordered the VHF call, he ordered the 3rd officer to switch on the “Not under command” lights (NUC) and the 3rd officer did this. They did not switch off the sidelights. They did not gave warning signals by sound or light.

The master could not see weather the oncoming vessel changed course.

In order to warn the crew the master now ordered the 3rd officer to start the general alarm on board. The 3rd officer had in fact earlier on his own initiative pressed the general alarm for a short moment, when the master ordered him to switch to system 1 on the steering stand. At that time the master had asked him to stop because at that time the master was not sure that it was needed.

On BALTIC CARRIER they did not hear or see sound or light signals from the oncoming vessel before the collision.

Just before the collision the master ordered the rudder hard to starboard, but the ship did not begin to turn to starboard before the collision.
5 seconds before the collision the master set the engine control to zero/stop. Until then he wanted to have as much speed as possible, so the vessel was able to manoeuvre and to pass the oncoming vessel.

It took less than 3 minutes from BALTIC CARRIER lost steering to the collision occurred.

The course of BALTIC CARRIER was approx. 185° just before the collision. The oncoming vessel hit BALTIC CARRIER in starboard side and the bow of the vessel penetrated the starboard tank No. 6, which contained approximately 2,700 tons of fuel oil. The angle of collision was approx. 50° from the stem of BALTIC CARRIER. After the collision the angle between the two vessels increased to approx. 80°.

Nobody was hurt when the collision occurred.

Time of collision was 00.15 UTC+2 (23.15 UTC +1). The master read the time on the ship’s watch and wrote it on the course recorder.

The 3rd officer called Lyngby Radio 1-2 minutes after the collision to inform about the collision.

Everything was prepared for fire fighting, but no fire broke out on board.

The master ordered the chief officer to fill ballast in port side to give the vessel a port list, in order to limit the oil pollution from the tank. There was no ballast on board BALTIC CARRIER before the collision.

The two vessels were drifting together for 30 minutes. The master of BALTIC CARRIER asked the other vessel, which now turned out to be TERN, not to reverse out of the hole before the situation was under control.

BALTIC CARRIER anchored north of the route after the collision.

Steering system
The Master and the 3rd officer are of the opinion that the collision occurred because of a defect in the steering system.

The master and the crew members on board at the time of the collision did not experience problems with the steering system before the collision.

Alarms on the steering stand
The master explained, that there was alarm on the steering stand just before they shifted to system 1. One alarm was marked 2SG CNT. There was another alarm on the steering stand, but the master can not tell which. When they switched to system 1 on the steering stand the alarms disappeared.

The alarms on the steering are not printed.

The electrician went to the bridge 10-12 minutes after the collision. The master or 3rd officer told him which alarm lamps had been on. The electrician pushed the lamp test and read, that the alarm which had been on were “2SG CNT” and SYS FAIL”.


Steering gear pumps
Nobody was in the engine room, when the collision occurred.

The master and the 3rd officer did not start or stop the steering gear pumps shortly after the collision. They did not see or hear any alarm on the ULSTEIN steering pumps panel on the bridge before the collision.

The chief engineer and the 2nd engineer went to the control room, when they heard the general alarm. At that time they did not know what kind of emergency situation it was. The collision took place approx. 20-25 seconds after they arrived to the control room. They did not see or hear any alarms in the control room. After the collision they inspected the engine room and the steering gear room. The 2nd engineer saw, that both steering gear pumps were running.

The electrician went to the control room after the collision. He then went to the steering gear room, where he saw that the two green lights for the steering gear pumps, which means that the pumps are running.

Manœuvring information
The master has told, that stopping time is approx. 10 minutes, when the engine is taken from full ahead to full astern. He has also told, that the manœuvring information on the bridge is not correct. The ship had received new manœuvring tables from the owners before the collision. The master tested the new tables before arriving to the loading port Muga, but the figures was still too low.

If the engine control was set on full astern, when the ship started to turn to port, the master estimates that the speed would only have been reduced 1-2 knots.

Other
An alcohol test was made after the collision. They have an instrument on board. The result was written in the logbook. Nobody had been drinking alcohol. It is not allowed to drink alcohol on board.

The master was well rested when the collision occurred. Between March 27 and 28 he slept all night and woke up at 08.00. He did some paperwork during the day and was first on the bridge for a longer period after 22.00 hours.

The 3rd officer and the ordinary seaman, who was at the helm, had watch from 08-12 and 20-24 (UTC +1). On March 28 they were off duty from 00-08 and from 12-20 (UTC +1).

TERN
TERN departed Cienfuegos on Cuba on 10 March destined for Ventpils in Latvia loaded with a full bulk load of about 20,000 tons raw sugar.

After an uneventful crossing of the Atlantic the vessel anchored at the Skaw Road for bunkering on 27 March at 17.05. The bunkering was completed at 20.20 and TERN bunkered in total 300 MT fuel oil and 50 MT diesel oil.

At 21.00 the voyage continued south through Kattegat.
On 28 March at 11.20 TERN took a pilot on board north of Sprogoe for the Great Belt passage. The pilot disembarked off Spodsbjerg about 4 hours later.

The ship’s watch was on UTC (+2) when the collision occurred. Hours below are UTC (+2).

The following is based on the statements from the 2nd officer and the helmsman.

The 2nd officer went to the bridge at 23.50 feeling rested and otherwise good. On the bridge the 3rd officer and the helmsman were present. The normal hand-over procedure was carried out, during which the 3rd officer told about vessels in the vicinity, the present position, which was in Route T just before the green buoy DW 75. The hand-steered course was 057° and the speed was full sea speed 11.5 knots. The telegraph was placed at full ahead. Chart BA 2365 was in use. Both radars were operating well, both set at head up, relative motion and – to the best of the recollection of the 2nd officer – the port radar set at range 3 miles and the starboard radar at 6 miles. One VHF was at channel 16, one at channel 70 and the third at channel 64 ready for the reporting to Moen Traffic Control after exiting the fairway. The vessel was showing the normal navigational lights.

The wind was SE, 5 Bf., the sea moderate and good visibility, at least 7 – 8 miles. There was a rather strong SW current.

The 2nd officer took over as officer on watch at 24.00 – the watch then adjusted to local time. The vessel had just passed DW 75 on its starboard side (see annex). The 3rd officer left the bridge shortly after.

To the best of the recollection of the 2nd officer there were 3 vessels on reciprocal courses when he took over as officer on watch. All of them were showing red and white lights and were observed on TERN’s port bow, apparently proceeding in Route T. He was not sure when he first observed the vessel which later turned out to be BALTIC CARRIER but he was quite certain that it was showing red and two white lights as the other vessels at reciprocal courses.

According to the helmsman there were several red and white lights on TERN’s port side and also two vessels rather far away on the same course.

The 2nd officer kept a close look at the next fairway buoy, DW 77, and aimed at passing it about 0.3 miles on starboard side. He also kept a close watch of the vessels on reciprocal courses, including the later identified BALTIC CARRIER, which was still showing steady red and two white lights on the port bow.

At 00.12, on 29 March, the 2nd officer went behind the curtains to the chart room to plot the position of the vessel in the chart. In the chart room the 2nd officer heard the helmsman shouting that the other vessel, BALTIC CARRIER, was changing course and he rushed out in the wheel house where he saw that BALTIC CARRIER was turning hard and would not be able to stop its port turn before reaching TERN. He estimated that the distance to BALTIC CARRIER was less than the 0.5 miles.

According to the helmsman the 2nd officer went into the chart room just after the helmsman saw the green buoy just forward the bridge on starboard side. At this time the other vessel, BALTIC CARRIER, was still on a steady reciprocal course showing red and two white lights. Shortly after he observed that BALTIC CARRIER was changing course, the mast lights closed and came almost in line. He immediately shouted ”other vessel changing course” and he then saw the green light
together with the red and added, "now going green". The 2nd officer immediately came out of the chart room and very shortly after BALTIC CARRIER showed full green.

The 2nd officer feared that if he turned to starboard the BALTIC CARRIER would hit TERN midships and he therefore decided to turn to port. He ordered the helmsman to go hard port. The helmsman asked hard port and the 2nd officer confirmed hard to port.

This is confirmed by the helmsman and he observed that the rudder indicator came towards port.

After the wheel was hard port BALTIC CARRIER called on VHF asking TERN to alter course to starboard. The 2nd officer responded that TERN was altering course to port, which was confirmed and accepted by BALTIC CARRIER, which also said that BALTIC CARRIER also turned port. (This communication was registered by Verkehrzentrale Warnemünde, and confirmed by the communication logged by Lyngby Radio).

Very shortly after, between 00.14 – 00.15 (UTC +2), the two ship collided. The bow of TERN ran into the starboard side of BALTIC CARRIER forward of its accommodation in an angle of about $50^\circ$. The 2nd officer stopped the engines few seconds before the collision.

TERN’s master came to the bridge very shortly after the collision. The master took over command and shortly after also the chief officer also attended the bridge.

The 2nd officer heard the master communicate with somebody on board BALTIC CARRIER, who informed that they had had a steering problem.

The two vessels remained connected while TERN was inspected for damages and remained connected until BALTIC CARRIER requested TERN to disconnect.

After communication with the German Coast Guard TERN sailed with reduced speed to anchorage at Rostock Road, where it anchored at 08.40.

According to the helmsman the collision could be felt very strongly. BALTIC CARRIER immediately put on deck lights. The helmsman did not notice the time of the collision neither the heading of TERN at the time of the collision.

Just after the collision the helmsman heard BALTIC CARRIER calling and saying, "don’t go astern".

The master, the chief officer, the chief engineer and others came to the bridge. The master took over command and the helmsman overheard the master exchanging information with BALTIC CARRIER over VHF. He also heard that the person from BALTIC CARRIER told the master that BALTIC CARRIER had "steering gear casualty".
6. Consequences of the Collision

BALTIC CARRIER

BALTIC CARRIER was holed through double hull (side ballast) tank No. 6 starboard into cargo tank No. 6 starboard. The main deck had been opened from the ships side and approx. 5 meters towards the centreline. Tank no. 6 is placed right in front of the accommodation. Double hull (side ballast) tank No. 5 was filled with water and fuel oil after the collision.

The pollution

Cargo tank No. 6 starboard was loaded with approx 2700 tons fuel oil. The main part of this oil escaped into the sea. Because of the wind and current the oil drifted towards the Danish islands Moen and Falster, and into the narrow waters Groensund between the two islands. Some of the oil ran into the forepeak of TERN, while the vessels were drifting together.

The pollution of the coastline was the most severe ever happened in Denmark.

TERN

The stem of TERN was heavily damaged and to a degree which impaired the seaworthiness of the vessel. The forepeak ballast water tank was opened to the sea and a greater amount of fuel oil from BALTIC CARRIER ended up in the forepeak tank and mixed with seawater. The port anchor and the anchor shaft were damaged and the foundation of the anchor winches and mooring winches forward were also affected by the collision. The bulkhead between the forepeak tank and the cargo hold was also affected.
After inspections in the port of Rostoc by the German maritime authorities and also by the classification society and after having emptied and cleaned the forepeak tank TERN was on April 9 under certain strict conditions allowed to sail for Ventspils for discharging and repair.

7. Further Investigations

BALTIC CARRIER

Chart
Admiralty Chart 2365 was used on board BALTIC CARRIER. The chart was corrected to 2001: 985.

The first GPS position after the collision was taken by the 3rd officer on the display of the radar and given to Lyngby Radio. This position was not written down on board. The 3rd officer wrote the position from the GPS down after the collision. In the chart 2365 the first position set out in the chart after the collision is marked 23.25 (UTC +1).
GPS plotter
2 FURUNO GPS Navigator GP-80. One GPS was used as plotter showing the track of the vessel.

The position of the collision was according to the GPS plotter 54°43′2″ N - 012°35′0″ E.

The GPS plotter shows that BALTIC CARRIER started to alter course 3-4 minutes before the collision.

The lines on the GPS plotter is not the DW route, but a line between two way points and guard lines 0.5 nm on both sides.

The positions from the track show that BALTIC CARRIER was proceeding in the northern and appropriate side of the DW route.

Radars
2 radars: FURUNO 28″, Color Display. One radar was repaired on March 16, 2001. On April 2 after the collision, this radar started to smell burned and was turned off. The radar had been running at the time of the accident without problems.

Course recorder
TOKIMEC, type CR-4.

The wind was increasing while BALTIC CARRIER was proceeding in the DW route, and it became more difficult to steer because of gusts of wind. The master and the 3rd officer are of the opinion that this is why the course recorder shows larger deflections the last approx. 15 minutes before the collision.

After the collision it was found that the time and the course on the course recorder were not adjusted. The 3rd officer has explained that nobody on board had noticed, that the course on the course recorder was not adjusted.
The course recorder is only a data register device and has no influence on the manoeuvring of the vessel.

Regardless that the course recorder was not adjusted correct, the print shows that the vessel was altering course to port in the few minutes up to the collision. The master wrote the time of the collision on the print and marked in on the line on the print. If the print is corrected from the wrong adjustment, the print shows that BALTIC CARRIER proceeded on course approx. 244° until approx. 42 minutes before the collision, which is approx. 23.33. Then turned 6-7° to port to course approx. 236-237° and followed this course until approx. 3-4 minutes before the collision, when the vessel began to turn to port.

**Steering system**
Steering engine: ULSTEIN.

*Defect on the steering system in August 2000*
BALTIC CARRIER had problems with the steering gear in August 2000 near Rotterdam, where the ship ran aground. According to the report from the classification society the problem then was a loose wire in a junction box at the hydraulic unit.

*Alarms on the steering stand*
If the rudder does not follow the order given by the helm on the steering stand an alarm will start after 35 seconds. For helm orders within 5° starboard to 5° port there are no alarm. The 35 seconds delay of the alarm is reset every time the helm pass zero (amidships).

![Steering stand](image)

As the crew recall it the alarms on the steering stand were marked “SYS FAIL” and “2SG CNT”. After the collision it has been tested that these alarms will start – audible and red light - , if the
rudder after 35 seconds has not followed the order given by the helm, presumed that the helm has not passed amidships or kept within 5° starboard or port.

The alarms on the steering stand are not printed automatically. The alarms are saved in a memory in the steering stand, but the memory has limited capacity and when it is filled the oldest message is deleted.

**Alarms on the steering gear**

The following alarms on the steering gear were printed out in the engine control room. Alarms on the steering stand on the bridge are not printed.

(The time is in UTC+1).

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Alarm ID</th>
<th>Alarm Type</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>001/03/28</td>
<td>23:15:07</td>
<td>1536</td>
<td>NO.2 SG COMM ALARM</td>
<td>XA 2 AL</td>
</tr>
<tr>
<td>001/03/28</td>
<td>23:17:12</td>
<td>1535</td>
<td>NO.1 SG COMM ALARM</td>
<td>XA 2 AL</td>
</tr>
<tr>
<td>001/03/28</td>
<td>23:18:15</td>
<td>1536</td>
<td>NO.2 SG COMM ALARM</td>
<td>XA 2 OK</td>
</tr>
<tr>
<td>001/03/28</td>
<td>23:19:29</td>
<td>1535</td>
<td>NO.1 SG COMM ALARM</td>
<td>XA 2 OK</td>
</tr>
</tbody>
</table>

Line 1 and 2 show failure on steering gear No. 2 and after on No. 1. Line 3 and 4 show that the alarms have been acknowledged and that the failure has disappeared.

The alarm do not tell what the failure was, but can indicate one or more of the following failures:

- Electric motor overload (overload pump).
- Phase failure to electric motor (phase failure pump).
- Power failure to electric motor (power failure).
- Power failure to steering control system (power failure control)
- Low oil level

The alarm print shows that two steering gear pumps has been running until 23.15.07 (UTC +1) and one steering gear pumps has been running until 23.17.12, and that it according to the alarm print has been possible to steer the vessel until then.

The collision took place approx. 23.15 (00.15 UTC+2) and the steering problems on board BALTIC CARRIER arose 3-4 minutes before at approx. 23.11 to 23.12. DIMA therefore finds that the alarms on the steering gear started because of the shock effect at the collision and after the collision possible because of the vibrations from the propeller.

**Examination of the steering system after the collision**

**The Danish Court Surveyors**

On request of the owners of BALTIC CARRIER two Court Surveyors were appointed by the Maritime and Commercial Court (Sø- og Handelsretten) in Copenhagen on 2 April 2001. The appointed Court Surveyors are experts regarding steering systems on board vessels.

The court surveyors were requested to answer the following questions of April 2, 2001 on the basis of inspections:

1. Give a brief description of the steering systems onboard BALTIC CARRIER.
2. Are the steering systems well maintained?
3. Can the likely cause or causes of the failure in or a malfunction of the steering system that occurred on 29 March 2001 be determined?
4. In the event that question number 3 is answered in the affirmative, the nature and cause of the failure(s) or malfunction(s) should be stated.
Additional questionnaire to the court surveyors of May 23, 2001.

5. Is it likely that the steering gear failure the vessel experienced in Rotterdam in August 2000 has been caused by a loose wire as described in a DNV report id no. 22062 dated (erroneously) 22 August 2000?

6. Please give a description of the alarm recording system (memory) of the Tokimec equipment, and
   a) advice if Tokimec’s representative Michael Slachcinski during the first court survey inspection on 2-4 April 2001 was asked if there was such an alarm recording system and what was his reply,
   b) advice under what circumstances the court surveyors learned that such an alarm recording system existed,
   c) advise if it is likely that this alarm recording system had still stored events from the time of the collision at the time of the first court survey inspection, and
   d) advise what was the oldest alarm still kept in this memory system when it was first interrogated in the presence of the court surveyors.

7. Please describe the tests the Danish Maritime Authority have carried out onboard the BALTIC CARRIER on 15-17 May 2001 and the results hereof.

The Investigation Division has received the report from the Danish Court Surveyors. It is concluded in the report that malfunction or failure in the steering system that could cause loss of steering as at the collision time, cannot be re-created.

On the hydraulic system there is no obvious causes for failure and a detailed inspection have been carried out controlling oil, filter and the valves, with no findings to be the cause of the failure in the steering gear.

The alarms on the steering stand are saved in a memory in the steering stand, but the memory has limited capacity and when it is filled the oldest message is deleted. A representative from TOKIMEC, who was present on board 2-4 April 2001 few days after the collision, was asked about possible read out of logged alarms from the TOKIMEC steering stand. He answered that it was not possible to print out any information from the system. The Danish court surveyors did not heard until 18 April, that it actually was possible to read out alarms from the steering stand. At that time it was to late to read, whether any alarms from the time of the collision had been recorded in the memory.

Other investigations
The steering system of BALTIC CARRIER has also been investigated by the company, the classification society, representatives from the shipyard HYUNDAI, where the ship was build, representatives from TOKIMEC – manufacturer of the steering stand and representatives from the insurance companies, which have an interest in the matter.

None of these investigations have shown any defect in the steering system that could explain a loss of steering as explained by the master and the two crewmembers on the bridge.

Division for Investigation of Maritime Accidents (DIMA) and Naval Material Command Denmark (NMC)
Approx. 2 weeks after the collision DIMA was informed by a Danish pilot that another vessel on 11 April 2001 had had problems with the steering system in the same area. DIMA contacted the company and was informed about the problems from the master of the vessel. While the vessel was steering with autopilot the rudder suddenly went hard to port. They immediately shifted to hand
steering and when they returned to autopilot steering the problem was disappeared. The problem arose when the vessel was proceeding west over approx. 9 nm. northeast from where BALTIC CARRIER and TERN collided.

At that time the other investigations on the steering system on board BALTIC CARRIER had found no defects. DIMA decided therefore to have the magnetic conditions in the area investigated. Several sub sea cables crosses the area, but neither the problems on board BALTIC CARRIER nor on the other ship were arisen right over a cable.

DIMA asked NMC to participate in an investigation as consultants in order to find out if the magnetic conditions in the area could have any influence on the steering system on board ships. At the same time if was decided that it should be investigated if the steering system on board BALTIC CARRIER could be sensitive to other electric equipment, e.g. a portable VHF radio. This is called Electromagnetic Compatibility (EMC) and an expert in this field was also asked to participate.

The investigations included measuring of magnetic fields in the area of the collision and tests on board BALTIC CARRIER. The ship was at that time in a shipyard in Poland.

The magnetic field in the DW route was measured in the beginning of May. The survey and tests on board BALTIC CARRIER were performed at the shipyard in Szczecin, Poland, on May 15-16, 2001.

The result of investigation test concerning Magnetic Disturbances and Electromagnetic Compatibility (EMC)

The mandate of the investigation was: Evaluate if the build state of the steering gear system on board BALTIC CARRIER has any weakness with respect to Magnetic Disturbances or Electromagnetic Compatibility (EMC), and demonstrate the weakness by selected on-site checks.

The magnetic field in the DW route and further west to the area of the collision was measured by the NMC. No unusual large magnetic field was found – that is no more than it should be because of the cable.

Magnetic Disturbance: BALTIC CARRIER passed the power cable on the seabed approx. 11 minutes before the collision. It was checked if the magnetic field from the cable could have had any influence on the steering system. At the test on board BALTIC CARRIER the steering stand was exposed to a magnetic field, which was larger than measured over the cables in the area of the collision.

Electromagnetic Compatibility (EMC) is the ability of equipment and systems to function as intended without degradation or malfunction in their intended operational electronic environment. Further, the equipment or system should not adversely affect the operation of, or be adversely affected by, any other equipment or system.

It was checked if other equipment could have had any influence on the steering system.

The investigations and tests on magnetism and EMC must be considered as informative. The tests must not be considered as a reconstruction of the situation at the time of the collision. The steering system was not tested over a longer period. During the tests it was also necessary to ensure that the test were not destructive and this put some limitations on the tests.
The selected checks did not expose any weakness in the steering system on board BALTIC CARRIER with respect to Magnetic Disturbances or Electromagnetic Compatibility (EMC) that could be correlated to the occurrence at the moment of the collision.

Conclusions

- It has not been possible to show that the steering gear could have been jammed and thus causing the problem that leads to the collision. It has not been possible to reconstruct the event, and long-term tests with the equipment have not been performed.
- Based on the checks performed it can be concluded that the problem most unlikely could have been caused by a magnetic field from the power cable connection between Sweden and Germany.
- The visual inspections show that the steering equipment could be EMC vulnerable.
- The findings indicate that the shipbuilder has EMC as a target in the design.
- The selected solutions with respect to EMC are probably the quality level that the free market presents.
- The selected solutions are not appropriate for more complex vessels, such as military vessels with a high degree of integration.
- The selected checks did not expose any EMC weakness in the system that could be correlated to the occurrence at the moment of the collision.

Electromagnetic compatibility (EMC) - SOLAS

A new regulation in SOLAS, chapter V, provides that all electronic equipment on the bridge or in the vicinity of the bridge, on ships constructed on or after 1 July 2002, is tested for EMC.

Coming investigations

The owners of BALTIC CARRIER have decided to install new steering stand equipment of another manufacturer on the bridge of BALTIC CARRIER.

DIMA has received the steering stand and equipment, which were on board at the time of the collision. DIMA will now consider if it is possible to make further examinations of the steering stand equipment, e.g. the software of the equipment.

Calculations from the Danish Maritime Institute

The company of BALTIC CARRIER asked the Danish Maritime Institute to calculate on the steering, if the ship had steering problems as explained by the master and crew and under the conditions, which were present at the time of the collision. The calculations from a simulator at the Danish Maritime Institute show that if BALTIC CARRIER has a steering system fault while the ship is steering course 236°, having speed 12.6 knots and having the rudder in amidships position the ship will alter course to port, if wind is SSE 15 m/s.

These calculations support the explanations that the ship altered course to port although the rudder according to the rudder indicator was in approx. amidships position. It also helps to explain why the helmsman before the problems arose had to keep the helm 5-10° to starboard.

TERN

The Investigation Division has obtained a report from the Danish pilot who served TERN on March 28 between 11.20 and 15.20.
According to this report the pilotage, during which the master was present at the bridge, was quite uneventful. The pilot was impressed by the maintenance of the vessel and its equipment. The navigation and communication equipment were fully operative and the master and the navigators acted very competently.

8. Comments made by the Division for Investigation of Maritime Accidents (DIMA)

BALTIC CARRIER

BALTIC CARRIER is a new well equipped and fully certificated vessel. It was crewed in accordance with international regulations.

A voyage plan for the actual voyage from Muga to Milford Haven was prepared and waypoints were loaded into the GPS navigator.

For the passage east and south of Gedser the voyage plan was prepared for using the 1 mile wide 17 m DW route, although the draft of BALTIC CARRIER was only 10.6 metres and a note in the chart in use (BA 2365) reserve this route for use by ships which because of their draft are unable to navigate safely in areas outside.

The master has claimed, that he decided to use the DW route, because of the shoals near Gedser Rev in Kadet Renden.

The DW route ends before the above mentioned shoals and by following the recommended direction of traffic flow in the route north of the DW route BALTIC CARRIER would also have passed safely east of the shoals.

The Division for Investigation of Maritime Accidents (DIMA) is of the opinion, that although it is not forbidden to use the DW route with a draft of 10.6 metres BALTIC CARRIER ought to have used the recommended direction of traffic flow north of the DW route, whereby the distance to the north east going traffic would have been considerably greater, as intended by the recommendation.

During the navigation in the DW route the bridge was manned with the master, who took over command at 23.30 when the ship entered the DW route, the 3rd officer and a helmsman.

DIMA is of the opinion that under the circumstances the bridge watch keeping arrangement was in accordance with the international standards.

It appears that the helmsman was at the helm for more than 3 hours up to the collision only intermitted by one short break.

DIMA finds, that 3 hours more or less continuous at the helm is a too long period that gives possibility for inattention during the steering.

DIMA, however, finds it unlikely that the unintended port turn shortly before the collision was caused by inattention by the helmsman. The increasing wind before the collision demanded continuous handling of the helm, which also is shown on the course recorder.

DIMA is of the opinion, that the navigation in the DW route was fully controlled and DIMA is also of the opinion that the bridge watch all the times was fully aware of the position of the vessel in the route.
TERN was observed on radar at a distance of 8-10 miles and was observed visual at a distance of 8 miles. The echo was duly plotted and its course and speed calculated. The CPA was determined as 0.5 miles, port to port. During the period where the 2 vessels approached each other and until the collision TERN was kept under continuous watch.

DIMA is of the opinion that up to the moment of the unintended port turn, approximately 3 minutes before the collision, everything was quite normal and all instruments and the helm were in function without any problems.

At the moment when the helmsman reported that he was unable to steer and that the ship was going port, TERN was approximately 30° on the port bow at a distance of approximately 1.2 miles. The master ordered hard to starboard, but the rudder did not follow the helm, verified by the rudder indicator. Shortly after the steering stand alarm sounded and the master ordered the steering stand to be shifted from system 2 to system 1. The alarm stopped. The vessel was still turning to port and TERN was now almost right ahead at a distance of approximately 0.75 miles.

Under these circumstances the master concluded that the best chance to avoid a collision was to continue the port turn and he ordered the helm hard to port. According to the rudder indicator the rudder went to port. This was less than 2 minutes before the collision.

DIMA of the opinion, that the normal evasive action in this situation would have been to order a hard turn to starboard, away from the other ship, which was also what the master did before the shift of the steering system and therefore with no result.

By ordering a port turn and by continuing at full speed ahead the master estimated, that there was a chance to pass ahead of TERN. He missed it by approximately 40 meters or approximately 10 seconds.

DIMA understands that the master in this very close quarters situation took actions that he estimated best to avoid the collision, and under the circumstances DIMA can not with certainty claim, that by ordering a starboard turn the collision could have been avoided or the consequences minimized.

According to the master the course was approximately 185° just before the collision and the angle of collision was approximately 50°. This corresponds with the GPS plotter.

DIMA is of the opinion, that the unintended port turn was approximately 50°.

As mentioned earlier in this Report the steering stand alarm has a build in delay of 35 seconds, extended under certain circumstances. It is the opinion of the Investigation Division, that due to these circumstances it is very likely that the time between the failure of the steering gear and until the alarm sounded was more that 35 seconds.

DIMA is of the opinion that the possibility of avoiding the collision would have increased, if the master had ordered the shift to system 1 on the steering stand immediately after the helmsman reported that he was unable to steer the vessel, which was before the alarm started, or if an automatic shift had been build into the steering stand.

As described under Section 8. Further Investigations the Investigation Division and others have initiated a full range of investigations in order to try to establish the cause of the steering gear failure. As also concluded in Section 8 it has up to now not been possible to establish a certain cause of the steering gear failure.
According to the statements the master ordered the 3rd officer to call out on channel 16 that BALTIC CARRIER was not under command and was coming to port.

According to Verkehrszentrale Warnemünde and Lyngby Radio the first message from BALTIC CARRIER was send close to 00.13 and before 00.14 as a request to "ship above me" to "alter course to starboard now" and "I am not under command". TERN responded with the message "I am altering hard port hard port", which was acknowledged by BALTIC CARRIER.

The collision was reported by BALTIC CARRIER on channel 16 very close to 00.16.

DIMA is of the opinion that BALTIC CARRIER’s 3rd officer did not identify his ship properly, however, understandable due to the very close quarters situation.
DIMA is also of the opinion, that due to the very close quarters situation and the fact that TERN actually had observed BALTIC CARRIER turning port and had itself initiated a hard port turn before the call out on channel 16, the communication on channel 16 had no influence on the evasive actions of the two vessels.

It is on basis of the logged communication on channel 16, that DIMA has set the time of the collision to 00.15, which is also the time written by the master on the course recorder.

**TERN**

Although an elder vessel DIMA is of the opinion, that TERN was well kept well equipped and fully certificated. It was crewed in accordance with international regulations.

The voyage from Cuba until a few minutes before the collision must be described as quite normal and uneventful with equipment and machinery in function without any problems.

According to the chart in use, BA 2365, TERN followed the east and north east going lane in the Traffic Separation Scheme South Of Gedser. At 23.12 the GPS position recorded in the log book was 57°36,7’ N 012°18,3’ Ø. In that position the course was altered from 013° to 057°. Accordingly TERN has entered the 17 m DW route at 23.07.

TERN’s draft was only 10.4 metres and there is no explanation to the effect why the OOW choose to use the DW route irrespectively of the draft of the vessel and the note in the chart about the recommended restricted use of the DW route.

DIMA is of the opinion, that although it is not forbidden to use the DW route with a draft of 10.4 metres TERN ought to have used the recommended direction of traffic flow south of the DW route, whereby the distance to the south west going traffic would have been considerably greater, as intended by the recommendation.

During the passage of the traffic separation scheme and in the DW route the bridge was manned with the 2nd officer and a helmsman.

DIMA is of the opinion, that the bridge watch keeping arrangements were not in accordance with international standards, the STCW Convention, in which it is stated, "the duties of the look-out and helmsperson are separate and the helmsperson shall not be considered to be look-out while steering ……..".

According to the statement of the helmsman, however, he observed the change of course of BALTIC CARRIER and the following change from red to green.
DIMA is of the opinion, that the 2nd officer had full control over the navigation in the DW route and that he at all times was fully aware of the position of the vessel in the route.

3 vessels on reciprocal courses were observed by the 2nd officer, when he took over as OOW. All 3 vessels were showing red and were observed on TERN’s port bow. He was not sure which of the 3 vessels was the one, which turned out to be BALTIC CARRIER. The 2nd officer went into the chart room shortly before TERN would be passing one of the vessels on reciprocal course at a distance of less than 0.5 miles. DIMA is of the opinion, that the 2nd officer was well aware of the movements of the other vessels in the route and that it was a very unfortunate moment for the 2nd officer to leave the bridge, in particular when no dedicated look-out was established. It is quite possible that a continuous close attention on BALTIC CARRIER from the 2nd officer could have prolonged the very short time available for evasive actions.

Under the present circumstances the 2nd officer choose to initiate a hard turn to port, as he feared that the consequences of a starboard turn would be, that BALTIC CARRIER would hid TERN midships. The 2nd officer stopped the engines few second before the collision.

DIMA understands, that the 2nd officer in this very close quarters situation took actions that he estimated best to avoid collision and to minimize as much as possible the effect on TERN in case of a collision.

According to the 2nd officer the angle of collision was approximately 50°.

This statement corresponds with the statement of the master of BALTIC CARRIER.

Neither the 2nd officer nor the helmsman could tell TERN’s course when the collision occurred. Founded on the statement by the master of BALTIC CARRIER and the GPS plotter, that the course was approximately 185° just before the collision, DIMA is of the opinion, that TERN’s port turn has only been a few degrees before the collision occurred and that the turn therefore has been initiated very shortly before the collision.

9. Conclusions

The Division for Investigation of Maritime Accidents (DIMA) is of the opinion that the primary cause of the collision between BALTIC CARRIER and TERN was an unintended port turn in BALTIC CARRIER.

The unintended port turn happened at the most unfortunate moment during the two vessels passing of each other on reciprocal courses at a CPA of 0.5 miles at the most.

DIMA is further more of the opinion that the unintended port turn in BALTIC CARRIER was caused by a technical error in the steering system.

It has not been possible, up to now, to establish a certain cause of the technical error in the steering system.

Based on the measurements of the magnetic fields in the DW route over the power cables and the test performed on board BALTIC CARRIER, DIMA is of opinion that the steering problems have not been caused by a magnetic field from the power cables.
The tests performed on board BALTIC CARRIER in Poland were only informative and the opinion of DIMA is therefore, that it is still possible that the steering problems could have been caused, because equipment on board were EMC vulnerable. Another possibility, which is not yet investigated thorough, could be weakness in the software of the steering stand.

A new regulation in SOLAS, chapter V, provides that all electronic equipment on the bridge or in the vicinity of the bridge, on ships constructed on or after 1 July 2002, is tested for EMC.

DIMA is also of the opinion that it is a contributing factor to the collision, that both BALTIC CARRIER and TERN choose to navigate in the 1 mile wide 17 m DW route, although their drafts were only 10.6 and 10.4 metres respectively and although a note in the chart used in both vessels, BA 2365, recommends the DW route to be used only by ships which because of their draft are unable to navigate safely outside.

By using the DW route the CPA between the two vessels was considerably less than if they had used the recommended direction of traffic flow and the available time for evasive actions therefore considerably reduced.

DIMA is finally of the opinion, that it may have been a contributing factor to the collision, that TERN’s 2nd officer, as officer on watch and with no dedicated look-out, went into the chart room at the moment, when TERN was about to pass BALTIC CARRIER at a distance of 0.5 miles at the most. The very critical and very short time for evasive actions was hereby further reduced.

10. Annex

Annex 1: Chart with the approximate routes of BALTIC CARRIER and TERN in the DW route until the collision.

Annex 2: Comments to the report from Department of Merchant Shipping – Cyprus.
Division for Investigation of Maritime Accidents

Knud Skaareberg Eriksen  Niels Mogensen  Lars Gerhard Nielsen
Head of Division          Deputy Chief          Ship Surveyor
ANNEX 2

REPUBLIC OF CYPRUS

MINISTRY OF COMMUNICATIONS AND WORKS
DEPARTMENT OF MERCHANT SHIPPING
LEMESOS

12th July 2001

To: DANISH MARITIME AUTHORITY
INVESTIGATION DIVISION
Fax No.: 4339174416

Cc: CONSULATE GENERAL HAMBURG
Attention: Consul Nicos Atlas

Collision between BALTIC CARRIER and TERN on 29 March 2001

Thanks for sending us the draft to the report on the above collision. Kindly please consider the following comments.

1. According to STCW Section A-VIII/2 part 3-1, Performing the navigational watch paragraph 24: "During the watch, the course steered position and speed shall be checked at sufficiently frequent intervals, using any available navigational aids necessary, to ensure that the ship follows the planned course. Consequently the 2nd officer being officer on watch, had to plot the ship's position at frequent intervals, remaining in the chart room for the least necessary time. The fact that the 2nd officer went in the chart room to plot the ship's position cannot be considered as a contributing factor to the collision, because when the "BALTIC CARRIER" showed her red navigation light, was called immediately by the A.B. on watch, left the chart room and took immediately evasive action. The collision was unavoidable due to very short distance between the two vessels when the wheel of the "BALTIC CARRIER" jammed.

2. We agree that the duties of the look-out person and helmsperson are separate. Although it is common practice when the visibility is good and the steering of the vessel is not continuously on manual, only one A.B. to be on watch.

3. As far as the use of the DW 17m route is concerned, it is enough to mention that both vessels had been using the DW 17m which is considered safe by shipmasters of most passing ships although BA 2365 recommends the DW route to be used only by ships of deep draft.

4. We are not going to make public any report.

5. A copy of the final report, which was sent to IMO, it is hereby attached.

K. Orfanos
For Director

KO/ED

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