

Report 2017-02 on the investigation into the capsizing and subsequent  
rescue mission of the sailing vessel

# CAPELLA



Off the Belgian coast with the loss of three lives on July 1<sup>st</sup> 2017



***Federal Bureau for the Investigation of Maritime Accidents (FEBIMA)***

Vooruitgangstraat 56

B - 1210 Brussels

## **Extract from the European Directive 2009/18/EC**

(26) Since the aim of the technical safety investigation is the prevention of marine casualties and incidents, the conclusions and the safety recommendations should under no circumstances determine liability or apportion blame.

*Febima Copyright. You may re-use this publication, excluding the bureau logos, free of charge in any format or medium. It can only be used accurately and in not-misleading context. The material must be acknowledged as Febima copyright and must be given the title of the source publication. Where third party copyrights have been identified in the report, permission from the third party copyright holders need to be obtained.*

## Contents:

1	List Of Illustrations	5
2	List Of Abbreviations	7
3	Synopsis	8
4	Part 1 – Factual Information	16
4.1	The Lightvessel Race	16
4.1.1	The Legal framework	16
4.1.2	Applicable rules and legislation	17
4.2	The actual track of the race	18
4.3	Meteorological conditions during sail regatta	19
4.3.1	Meteorological Forecasts	19
4.3.2	Meteorological observations	20
4.4	Particulars of sy CAPELLA	21
4.4.1	Construction	21
4.4.2	Equipment	23
5	Part 2 – Analyses	25
5.1	Time and position of capsizing	25
5.2	Investigation of the wreck of sy CAPELLA	27
5.3	Forensic Analyses of the broken off keel bolts	29
5.4	Composition of the broken off keel bolts	30
5.5	Fracture surface analysis of the broken off keel bolts	31
5.5.1	Fracture surface analysis of bolt 2	31
5.5.2	Fracture surface analysis of bolt 4	32
5.5.3	Fracture surface analysis of bolt 5	35
5.5.4	Conclusions of the forensic analyses of the broken off keel bolts	36
5.5.5	Origin of the fracturing of the keel bolts	37
5.5.6	Forces that act upon the keel bolts during grounding	39
5.5.7	Forces acting upon sailing vessels when not running free	39

5.6	The search for survivors	41
5.6.1	Number of crew on board	41
5.6.2	Rescue as proposed by organisers	41
5.6.3	The interval between capsizing and rescue	42
5.7	Cause of the capsizing	43
5.7.1	Contributing factors	43
5.7.2	The cause for the interval between incident and rescue of the survivors	43
6	Recommendations	45
7	List of Appendixes	46

# 1 List Of Illustrations

Figure 1 - Approximate position of the capsizing of the sy CAPELLA	8
Figure 2 –Search Box Prediction Software screenshot	12
Figure 3 - sy CAPELLA at the start of the sailing regatta	14
Figure 4 – Area within which all sailing regatta’s would have taken place	17
Figure 5 - Course 6 of the Lightvessel Race 2017	18
Figure 6 - Weather observations for area of the sail race ( <a href="http://www.timeanddate.com">www.timeanddate.com</a> )	20
Figure 7 - Drawing of the new keel	21
Figure 8 - Nuts and threaded rods and bolts that hold the keel in place	22
Figure 9 - Part of threaded rod welded to keel plate	22
Figure 10 - Drawing of keel plate seen from top with configuration of threaded rods	23
Figure 11 - Instruments in cockpit of sy CAPELLA	24
Figure 12 - Radar images of sy CAPELLA at time of capsizing	25
Figure 13 - SONAR location of the keel of the sy CAPELLA	26
Figure 14 - sy CAPELLA as it had been stored at Zeebrugge	27
Figure 15 - Keel plate still present on hull	28
Figure 16 - Numbering of the keel bolts	29
Figure 17 - Keel bolts 2, 4 and 5 as submitted to the laboratory	29
Figure 18 - Table with composition of broken off keel bolts	30
Figure 19 - Optical microscopy images of bolt 2	31
Figure 20 - Optical microscopy images of bolt 4	32
Figure 21 - Secondary electron image of white deposits	33
Figure 22 - Secondary electron image of the lead oxide	34
Figure 23 - Optical microscopy images of fracture surface of broken off keel bolt 5	35
Figure 24 - Secondary electron images of the edge of the low part of the fracture surface	36
Figure 25 - Sailing yacht recovered off the Belgian coast after keel was lost	37
Figure 26 - Derelict sailing vessel found in the Atlantic ocean	38

Figure 27 - Forces on keel bolts of sailing vessels during grounding	39
Figure 28 - Moments acting upon sailing vessels when sailing	40

## 2 List Of Abbreviations

AIS	Automatic Identification System
Al	Aluminium
As	Arsenic
B	Boron
C	Carbon
Co	Cobalt
Cr	Chromium
Cr	Cruiser Rating
Cu	Copper
DSC	Digital Selective Calling
E	Easterly longitude
ECDIS	Electronic Chart Display Information System
EDX	Energy Dispersive X-ray
ETA	Estimated Time of Arrival
GPS	Global Position System
IRC	International Rating Certificate
lt	Local Time
Mn	Manganese
Mo	Molybdenum
MRCC	Maritime Rescue and Coordination Center
N	Northern latitude
Nb	Niobium
Ni	Nickel
P	Phosphorus
RADAR	Radio Detecting and Ranging
RBSC	Royal Belgian Sailing Club
RHIB	Rigid Hull Inflatable Boat
S	Sulfur
SAR	Search And Rescue
Si	Silicon
Sn	Tin
SONAR	Sound Navigation And Ranging
sy	Sailing Yacht
Ti	Titanium
V	Vanadium
VHF	Very High Frequency
VTS	Vessel Traffic Service
Wt%	Mass Fraction
µm	micrometer

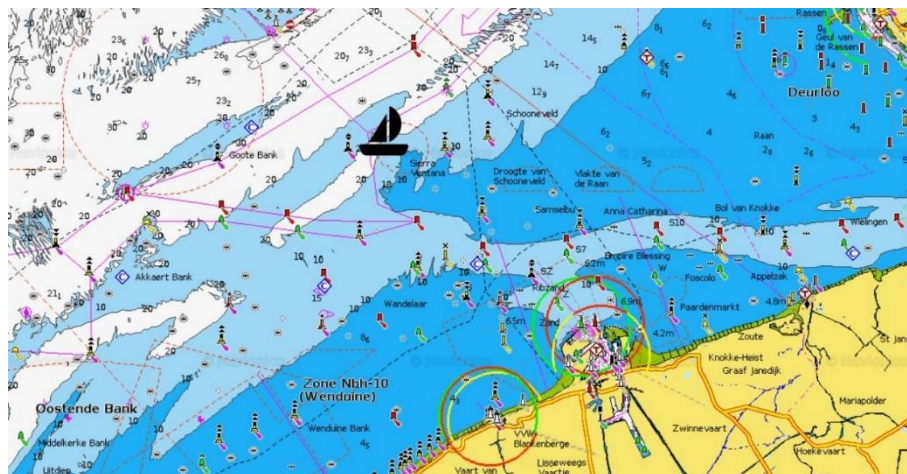
### 3 Synopsis

On July 1<sup>st</sup> 2017, around 8:00 hours<sup>1</sup> in the morning the sy CAPELLA, participating in a sail regatta, the Lightvessel Race, on easterly courses, sheered several times, before capsizing at 08:14 hours in the vicinity of the Noord Oost Akkaert buoy off the Belgian coast in approximate position 51°27'24 N and 003°00'88 E.

Another contender in the race was sailing very close to the sy CAPELLA at the time of the accident but none of the crewmembers on board the said contender had noted and or reported anything.

The sy CAPELLA did not emit any distress signals at the time of capsizing nor at any other moment thereafter.

The sy CAPELLA did not sink, but remained afloat in upside down position. Three crewmembers of the sy CAPELLA remained with the yacht. Two were able to clamber on top of the overturned hull, one crewmember held on to the forward pulpit.



*Figure 1 - Approximate position of the capsizing of the sy CAPELLA  
off the Belgian Coast at 08:14 lt on July 1st 2017*

---

<sup>1</sup> All times in this report are in local time, 24 hours format, i.e. UTC +2, unless otherwise stated



The same day as the incident, July 1<sup>st</sup> 2017, the Belgian maritime and coastal rescue services were mustered for a drill/demonstration and were all standing by from early morning.

All participants in the drill, and all participating rescue craft, were equipped with video cameras since a television station intended to dedicate a television programme to the working of the coastal and maritime rescue services in Belgium.

For the purpose of participating in a sailing regatta, off the coast of Belgium and The Netherlands, the crew of the sy CAPELLA consisted of 6 persons, of which one was the owner/builder of the yacht.

Only several hours after the capsizing of the sy CAPELLA, at 14:38, a piloted tanker vessel passing by, signalled VTS by VHF radiotelephone, that, what appeared to be, an overturned sailing yacht with persons on top of the hull, was seen in vicinity of NE Akkaert buoy and that a dredger appeared to be close to that position. The pilot on board the tanker vessel suggested that the dredger would rush to the scene since it was closest at that time.

Moments later, the organizers of the sailing regatta called the head of the MRCC by cell phone informing that one participant in the Lightvessel Race was unaccounted for. The head of MRCC replied to the organizers of the sailing regatta that they should contact the MRCC directly.

The dredger responded positively to the suggestion of the piloted tanker and after having located the overturned sailing yacht, the dredger rushed to the overturned sailing yacht, to find three persons that were clinging on to the overturned yacht.

A traffic controller from the VTS subsequently informed the MRCC that a dredger had located an overturned sailing yacht with three persons on top of it. The dredger would try to take the three persons on board.

Thereupon, the MRCC mustered the R6 ORKA, a SAR craft, the WIELINGEN, a small water area twin hull pilot tender, the ZEEHOND, a multipurpose tug boat, all three government operated vessels and further, the BRANDARIS a rescue craft operated by a private partner and the VBZR STERKE DRIES a rescue craft operated by a non-profit life boat organisation. The BRANDARIS, engaged in a salvage operation of a RHIB near the marina of Nieuwpoort cancelled that mission and headed for the capsized sailing yacht with an ETA of one hour later. The salvage operation of the RHIB would be continued by a government launch thereafter.

Further, a rescue helicopter from the Belgian Air Component, standing by<sup>2</sup> at Koksye Aerodrome, with coordinates 51°05',25N and 002°39',10E, was scrambled by the MRCC and hurried to the scene<sup>3</sup>. The helicopter flight crew calculated that it was 12 minutes flight time away from the capsized sy CAPELLA at take-off.

Soon after take-off the flight crew of rescue helicopter was initially informed by the MRCC that 2 crewmembers had survived and were sitting on the overturned hull but soon thereafter, the information was corrected and the flight crew were informed that three survivors were located on the overturned hull. Confusion arose at first about how many crewmembers were on board the sailing yacht during the race.

At 14:47 the organizers of the sailing regatta informed the MRCC by telephone that the sy CAPELLA was unaccounted for, with 3 to 5 persons on board. The organizers had reportedly contacted all Belgian marinas located at the coast and some Dutch marinas in the Scheldt estuary, but no trace of the sy CAPELLA was found. The sy CAPELLA, as all other participants in the Lightvessel race were asked to report by telephone at 09:00 hours that morning but no call had been received from sy CAPELLA at that foreseen time.

The dredger informed the VTS on the appropriate VHF radiotelephone working channel of its findings and was subsequently asked by VTS to report the findings to the MRCC by VHF radiotelephone on channel 67.

Some doubt arose about the exact number of survivors at 14:54 between the MRCC and the crew of a rescue craft and the crew of the helicopter.

At 14:57 hours, the capsized sailing yacht and the missing sailing yacht were linked one to the other. The capsized sailing yacht corresponded with the particulars of the sy CAPELLA. The survivors that had been taken on board the dredger, now confirmed the aforementioned and stated that there were 3 crewmembers in total, soon thereafter to be corrected into 6 crewmembers, so three remained missing. Two were separated from the sailing yacht immediately after capsizing, one held on for a little while but gave up soon thereafter. The survivors esteemed that the sailing yacht had capsized some three hours earlier.

---

<sup>2</sup> West Land Seaking MK48 rescue helicopters are kept on stand by by the Belgian Air Component with 3.000 lbs of fuel, giving them several hours of autonomy. During the daytime the Rescue Helicopter can be airborne within 15 minutes.

<sup>3</sup> The Belgian Air Component assures the airborne search and rescue tasks for the Belgian sector of the North Sea. Where usually the Westland Sea King MK48 helicopters' call sign start with NEMO XX and the call sign for the NH90 Tactical Transport Helicopters start with TRITON XX, in case of a search and rescue task the call signs of both types of helicopters are changed to RESCUE XX granting the rescue helicopters aeronautical privileges as to flight paths and priority.

At 15:03, VTS asked all ships in the vicinity of the capsized sy CAPELLA by VHF radio telephone to keep a sharp lookout. At the same time the MRCC called for a second rescue helicopter from Koksijde air base. A second rescue helicopter was however not available at that time and therefore the MRCC asked for assistance from the Netherlands. The rescue services in the Netherlands offered to dispatch a coastguard airplane that was patrolling the Wadden isles at that time and a rescue helicopter that was stationed at the Maas estuary.

At 15:15 the Belgian rescue helicopter was on scene and winched a medic down on board the dredger so that the medical condition of the survivors could be assessed. The survivors then informed that the sy CAPELLA most probably had capsized around 09:00.

Soon thereafter, the crew of the rescue helicopter had discovered what appeared to be a person in the water, and would recover the person. Subsequently the MRCC launched the medical intervention plan for 6 victims.

In the meantime, watch officers at the MRCC established a search box thereby using modelling software, taking into account drifting by current and wind drift from 09:00 hours onward. The modelling software considered three types of men over board. A swimming person without life jacket, a floating person with life jacket and a “face down” or deceased person. The software further calculated the probable position of the aforementioned which resulted in probable areas, or search boxes, where castaways should most probably be found.



Figure 2 –Search Box Prediction Software screenshot  
 with simulated search box for person with life jacket

These search boxes were communicated to all participants in the search party.

At 15:24 the Belgian rescue helicopter had found and recovered two persons from the water. The persons were showing no apparent signs of life. The question was raised whether or not someone could still be inside the overturned sy CAPELLA. The survivors that were on board the dredger confirmed that no one remained inside the sailing yacht.

Basing themselves on recorded radar images the MRCC adjusted the time of capsizing to 08:20 hours. Subsequently a new search box was established using the prediction software and the coordinates of the search box were communicated to all parties involved in the search party.

The MRCC subsequently tasked the five search vessels, each one with a specific search task.

At 15:56 the Dutch rescue helicopter reported to be on scene. The MRCC tasked the Dutch helicopter to perform a search in the whole predicted search box, and to have the Belgian rescue helicopter recuperate the survivors and medic from the dredger, and to fly them to the closest, most fitted, hospital capable of dealing with this kind of emergency at Bruges. At 16:05 the Belgian rescue helicopter had embarked the four people from the dredger, the medic and the three survivors, and set course for the hospital. The flight crew of the Belgian Rescue helicopter subsequently asked to have 2 stretchers and a wheel chair to be standing by upon arrival at the hospital.

At 16:15 hours, a first mentioning of the correct number and identities of the crewmembers of the sy CAPELLA was communicated by the Dutch coastguard. The Dutch coastguard also communicated that three more rescue craft were standing by and could be deployed if needed. The rescue craft WINIFRED from Cadzand in the Netherlands was subsequently deployed to assist with the search for the remaining crewmember.

Soon thereafter, the Dutch Coast Guard announced that the Dutch coast guard aircraft would be on scene within 15 minutes with an available flight time of 90 minutes and that the lifeboat ZEEMANSHOOP was underway to the scene of the accident as well.

The hospital communicated the identities of three survivors to the MRCC at 16:40 and two castaways were confirmed deceased however their identities could not yet be confirmed.

In the moments thereafter, the MRCC was in touch with the hospital on several occasions to obtain confirmation from the survivors that found objects, such as clothing and other flotsam, could or could not confirm the proximity of the sixth crewmember.

At 17:48 the organizers emailed a picture of the sy CAPELLA reportedly taken at the departure of the regatta with four crewmembers sitting in the cockpit of the sailing yacht, allowing the medical staff at the hospital to identify crewmembers.



*Figure 3 - sy CAPELLA at the start of the sailing regatta  
(faces of crew anonymised)*

The search continued into the evening and several participants in the search party found flotsam that related to the sy CAPELLA and the crewmembers however the sixth crewmember had not been found before night fall.

In the evening at 19:23 it was decided that the BRANDARIS would tow the overturned sailing yacht into the Port of Ostend, which subsequently happened.

At Ostend the sy CAPELLA was hoisted out of the water by crane and was placed ashore in right side up position.

At 21:22 the search was stopped and all participants were thanked by the MRCC.

Days later, the sy CAPELLA was transported to a boatyard at the Port of Zeebrugge, operated by an acquaintance of the owner/builder of the yacht.

On July 13<sup>th</sup> a Dutch trawler found a body in the Dutch territorial waters, that was later, on 14 July 2017, identified as the sixth crewmember of the sy CAPELLA.

## **4 Part 1 – Factual Information**

### **4.1 The Lightvessel Race**

The lightvessel Race is an annual recurring sailing regatta that was organised by the Royal Belgian Sailing Club from Zeebrugge. The sailing regatta had been organised for over more than 50 years and drew inspiration for the name of the event from the time that off the Belgian and Dutch coast, lightvessels marked the safe passage for seagoing vessels.

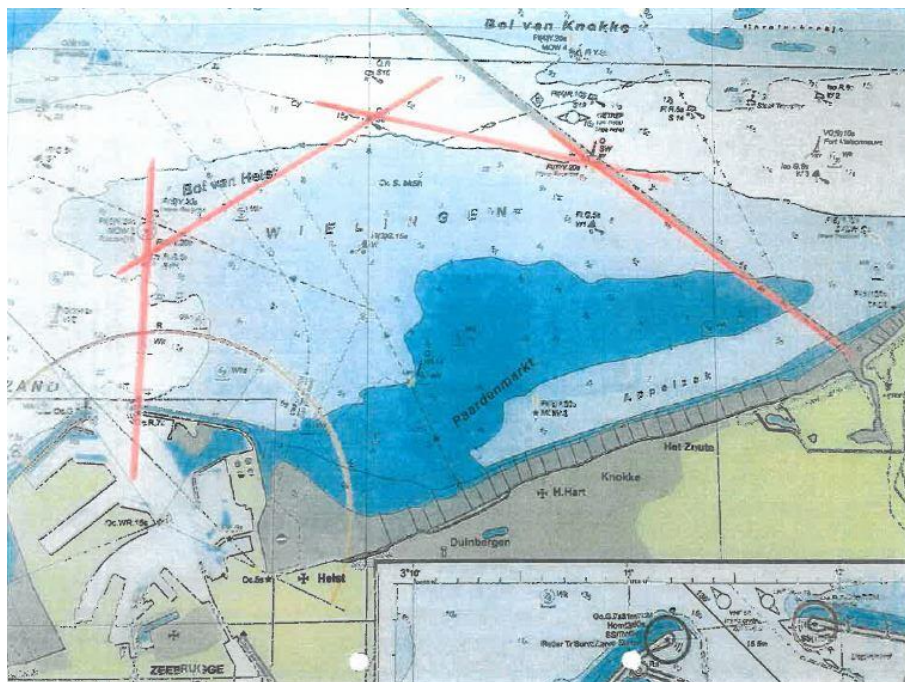
#### **4.1.1 The Legal framework**

Sailing regatta's off the Belgian Coast are subject to prior approval by the Federal Public Service Mobility and Transport, DG Shipping, as described in a royal decree of 1<sup>st</sup> of June 2016. The organisers of the regatta had submitted an agenda of sail regattas for 2017 with a corresponding delimited area, in which all referred races, including the Lightvessel Race, were to take place. The actual track of the Lightvessel Race lay outside the proposed delimitation, to a larger extent. The submittal for approval also mentioned that the organizers would have four seagoing motor craft accompanying the race at all times, and all rescue activities related to the race would be performed by the own fleet of deployed motor launches by the organizers of the regattas. The organisers had not deployed any rescue craft during the race. All participants to the race would also have a DSC VHF radiotelephone on board. The organisers did not check the aforementioned but accepted a safety checklist, stating amongst others that a DSC VHF radiotelephone would be on board, to vouch for it.

The organizers of the Lightvessel Race had however submitted the track of the Lightvessel Race to the MRCC for approval.

The MRCC, however not being the competent authority, had pointed out some issues and instructed the track to be altered. The evening of the race a revised track of the Lightvessel Race had been sent to the MRCC and was subsequently forwarded to the VTS.





*Figure 4 – Area within which all sailing regatta's would have taken place  
as submitted by the organising committee*

#### **4.1.2 Applicable rules and legislation**

The organizers of the Lightvessel Race issued a set of sailing instructions, for the participants in which a chapter was dedicated to the governing rules. The chapter states that the Lightvessel Race 2017 will be governed by:

- The Racing Rules of WORLD SAILING
- The World Sailing Offshore Special Regulations Cat 3 Monohull with Life Raft.
- The IRC Regulations for yachts competing in the IRC class.
- The CR Regulations for yachts competing in the CR class, without limitation on the use of spinnakers, gennakers or code-0 sails (this changes CR Rule 8.4.c).
- The Open North Sea Championship 2017 General Sailing Instructions

Further in the sailing instructions was mentioned that every yacht must return to race committee the document called Inspection Card for Race Category 3 (with life raft) Monohulls, before the briefing prior to the race. The sailing instructions also stated that any boat or equipment may be inspected for compliance with the class rules and the sailing instructions at any time.

## 4.2 The actual track of the race

According to the handicap<sup>4</sup> of the participating sailing vessel various tracks were applicable. Since the sy CAPELLA was participating as a World Sailing Offshore Special Regulations Cat 3 Monohull with Life Raft, one of three tracks were to be followed during the race: course 4 of more or less 70,60 nautical miles, course 5 of more or less 85,00 nautical miles or track 6 of more or less 94 nautical miles. The evening of the race, the organizers communicated which track had to be followed to the contenders during the briefing and to the MRCC via email.

The organizers of the race had decided to pick race course 6 for the category of vessels in which the sy CAPELLA was competing.



Figure 5 - Course 6 of the Lightvessel Race 2017

---

<sup>4</sup> Sailing vessel classes are usually defined by measurement rules which categorize vessels accordingly in to classes of vessels. Handicapping allows vessels to compete across classes. The race outcome data is adjusted to declare a handicap winner as distinct from a line honors (first over the finish line) winner

## 4.3 Meteorological conditions during sail regatta

### 4.3.1 Meteorological Forecasts

Coastal Radio Station Ostend radio emits at regular intervals a weather forecast for the area in which the Lightvessel race was to take place. The weather forecasts were obtained from the Belgian Royal Meteorological Institute. At 09:12 hours on June 30th 2018 the forecast for the area was: *"Thames and Dover :South-westerly or variable light to gentle breeze (2-3), increasing this afternoon light to moderate breeze (2-4) from west to northwest. This evening and this night further increasing with even risk of fresh breeze (5) and veering north northwest. At first breaks but risk of a shower. In the afternoon and evening, becoming very cloudy from the northwest with later on rain. Good visibility except during precipitation."* The forecast was said to be valid till 1<sup>st</sup> of July 2017 till 06:00 hours.

On June 30th 2018 at 22:00 the forecast sounded: *"Thames and Dover : Westerly to north-westerly gentle or moderate breeze (3/4), increasing tonight moderate to sometimes strong breeze (4-6) and veering north northwest. Saturday afternoon decreasing light to moderate breeze (2-4) backing to west. Very cloudy with rain from the northwest, and later on some showers. Saturday afternoon dry with breaks. Good visibility except during precipitation.* The forecast was said to be valid till 06:00 on July first 2017.

### 4.3.2 Meteorological observations

The weather observations during the regatta were in line with the forecasts as seen in Figure 6.

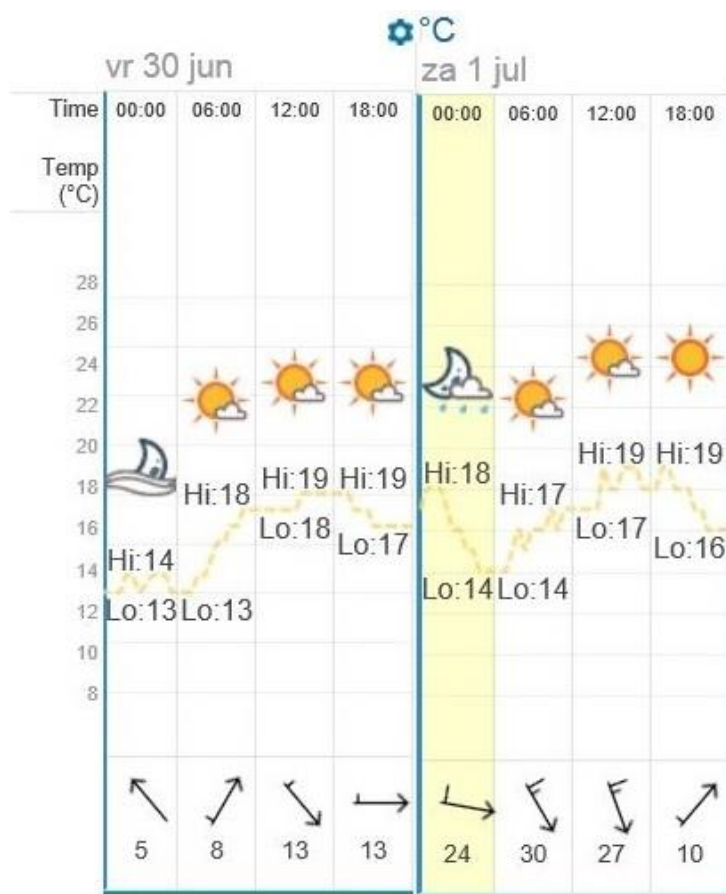


Figure 6 - Weather observations for area of the sail race ([www.timeanddate.com](http://www.timeanddate.com))







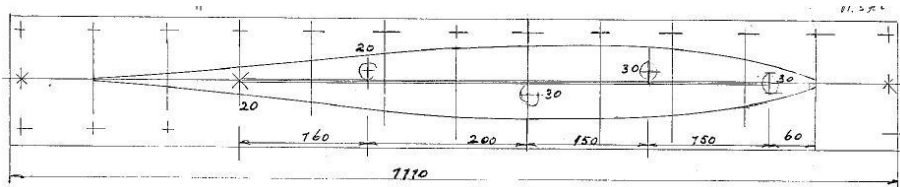
*Figure 8 - Nuts and threaded rods and bolts that hold the keel in place  
seen from inside the sy CAPELLA*

The keel plate was welded perpendicularly to a stainless steel plate in the centre of the keel. The threaded rods were also welded to the bottom of the keel plate.



*Figure 9 - Part of threaded rod welded to keel plate*

Four threaded rods had a diameter of 30 mm, the aftermost threaded rod had a diameter of 20 mm. The threaded rods or keel bolts were all located near or on the centre line of the keel. The additional two bolts were not included in the drawing.



*Figure 10 - Drawing of keel plate seen from top with configuration of threaded rods*

#### **4.4.2 Equipment**

The sy CAPELLA was said to be fitted with a GPS receiver, a magnetic compass a speed and distance indicator, an echo sounder and an anemometer.

The sy CAPELLA was not fitted with an AIS transceiver, but reportedly one fixed radio communication device such as a VHF was registered with the vessel, however not present at the time of salvage. One or more portable VHF radio sets were reportedly on board at the time of capsizing.

The sy CAPELLA was further equipped with nautical charts and some sort of ECDIS for the area of the regatta.

Reportedly, a life raft and life jackets were on board for all crew members as well as life harnesses. Lifelines running from fore to aft were reportedly rigged on deck.



*Figure 11 - Instruments in cockpit of sy CAPELLA*

*1 GPS Receiver*

*2 Magnetic compass*

*3 Speed and Distance indicator and Echo Sounder*

*4 Anemometer*



## 5 Part 2 – Analyses

### 5.1 Time and position of capsizing

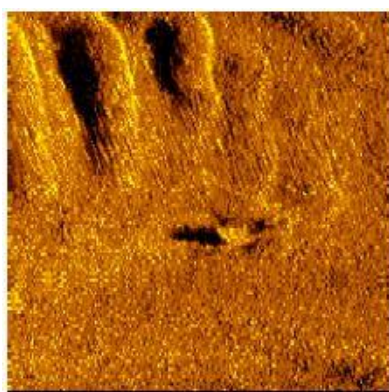
Analyses from recorded radar images indicated that the sy CAPELLA capsized at 08:14 in the morning on July 1<sup>st</sup> 2017. At that time the sy CAPELLA disappeared from the radar in position 51°27'24 N and 003°00'88 E, when sailing with wind on the port quarter, as seen on recorded radar images from VTS



*Figure 12 - Radar images of sy CAPELLA at time of capsizing  
with another contender in very close vicinity*

Months later, at the end of the month of September 2017, a Belgian navy vessel BNS CASTOR located the sy CAPELLA's keel, by means of active sonar<sup>5</sup>, in position 51° 27'045 N and 003°1'105 E, or very close to the last position of the sy CAPELLA before capsizing as determined by radar, indicating that the keel of the sy CAPELLA was lost at the time of capsizing, and that the loss of the keel played a part in the capsizing.

No VHF radiotelephone communications with sy CAPELLA were recorded during the regatta, before or after the capsizing.



<b>Name</b>	012
<b>Latitude</b>	51°27.045' N
<b>Longitude</b>	3°1.105' E
<b>Depth</b>	18.6m
<b>Width</b>	0.64m
<b>Height</b>	0.34m
<b>Length</b>	1.15m

*Figure 13 - SONAR location of the keel of the sy CAPELLA*

---

<sup>5</sup> Sonar, an acronym for sound navigation and ranging, uses sound propagation to detect objects under the surface of the water, such as other vessels. Two types of technology share the name "sonar": passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes.

## 5.2 Investigation of the wreck of sy CAPELLA

After the sy CAPELLA had been salvaged and transported to Zeebrugge an investigation was conducted on the wreck. The boatyard operator had placed the sy CAPELLA onto a trestle in the yard where it was hidden/protected from third party involvement. The inside of the wrecked sailing yacht had been emptied and cleaned. The inboard engine had been removed and cleaned out in order to preserve it. The rig of the sy CAPELLA had been removed as it had been severely damaged during the capsizing.



*Figure 14 - sy CAPELLA as it had been stored at Zeebrugge*

Apart from a damaged rig, and damaged roof of the superstructure, the latter most probably by the rigging giving way, the hull of the sy CAPELLA appeared in sound condition.

The keel of the sy CAPELLA was found missing. Closer investigation revealed that a part of the keel, the keel plate, was still present and in position against the vessels hull.



*Figure 15 - Keel plate still present on hull  
with larger part of keel missing*

It was noted that the threaded rods or keel bolts, provided to keep the keel in place, were sheared off below the welds, where the threaded rods or keel bolts had been welded to the keel plate. It was also noted that all keel bolts had been positioned near the centre line of the keel.

Therefore it was decided to have the keel plate removed from the hull of the sy CAPELLA, to subsequently have what was left of the keel bolts separated from the keel plate and to have the surface of fracture of the parts from the keel bolts, that remained, forensically analysed.

### 5.3 Forensic Analyses of the broken off keel bolts

The part of the keel that was still attached to the sy CAPELLA at the time of recovery of the vessel, was removed. The remnants of the bolts were grinded loose and were submitted for forensic analyses.

Prior to submitting the bolts to the laboratory of the University Ghent they had been numbered as follows

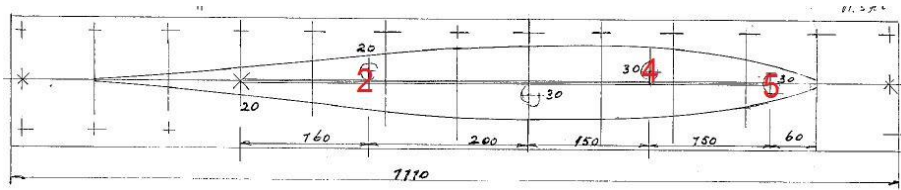


Figure 16 - Numbering of the keel bolts

*Right is forward*

Bolts numbers 2, 4 and 5 had been submitted for fracture surface analysis.

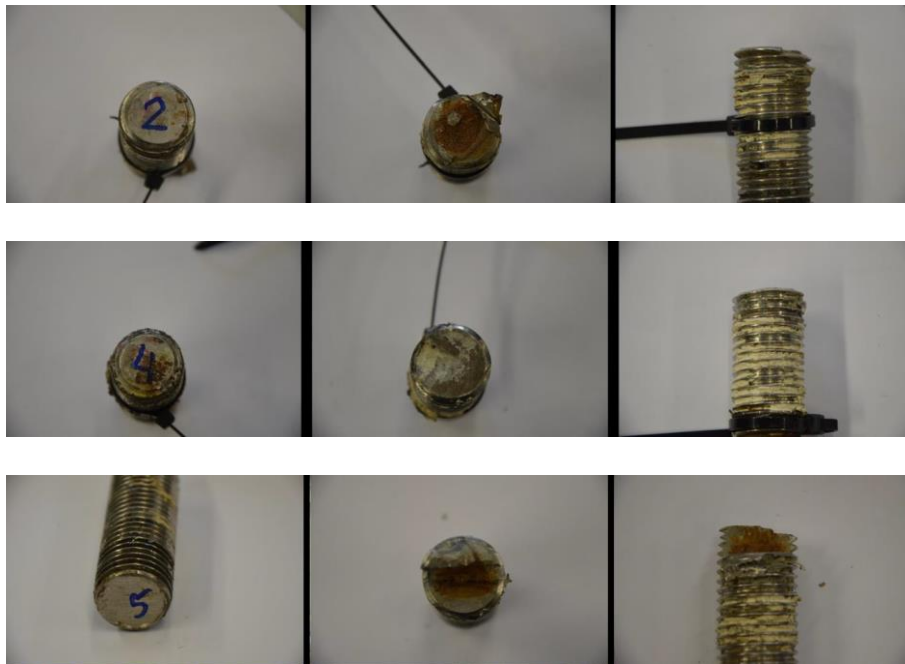


Figure 17 - Keel bolts 2, 4 and 5 as submitted to the laboratory

## 5.4 Composition of the broken off keel bolts

At first, since no records of the used materials were available, an analyses of the composition of the broken off keel bolts was performed by means of Spark Source Optical Emission Spectrometry<sup>6</sup>. The results are shown in the following table

Element	Wt% <sup>7</sup>	SD <sup>8</sup>
C	0,0338	0,0003
Mn	1,3914	0,0047
Si	0,4332	0,0025
P	0,0243	0,0002
S	0,0193	0,0003
Ni	10,2	0,8
Cr	17,6	0,7
Cu	0,3016	0,0003
Mo	1,9637	0,098
V	0,0543	0,0006
Ti	0,0055	0,0000
Al	0,0143	0,0002
Nb	0,0593	0,0006
As	0,0115	0,0001
Sn	0,0157	0,0002
Co	0,2536	0,0001
B	0,0028	0,0000

*Figure 18 - Table with composition of broken off keel bolts*

The amounts of Ni and Cr, values in red, were out of the calibrated range of the Spark Source Optical Emission Spectrometry technique. These elements were, therefore, determined separately by Energy Dispersive X-ray<sup>9</sup>, which is a technique with a larger standard deviation.

The analyses indicated that the broken off keel bolts were manufactured from austenitic stainless steel, most probably 316L stainless steel, which is a specific type of stainless

---

<sup>6</sup> Spark Source Optical emission spectrometry is a spectrometry method whereby hi electrical energy in the form of spark is generated between an electrode and a metal sample, whereby the vaporized atoms are brought to a very high energy state, so-called “discharge plasma” that creates a unique emission spectrum specific to each element.

<sup>7</sup> Wt%: Mass Fraction expressed with a denominator of 100, as percentage by mass. It is a way of expressing the composition of a mixture in a dimensionless size

<sup>8</sup> Standard Deviation: in statistics it is a measure to quantify the amount of variation or dispersion of a set of data values

<sup>9</sup> Energy Dispersive X-ray is an analytical technique used for the elemental analysis or chemical characterization of a sample relying on interaction of X-ray excitation and a sample



steel alloy typically used in marine environments because of the greater resistance to pitting corrosion, compared to other stainless steel variants.

## 5.5 Fracture surface analysis of the broken off keel bolts

### 5.5.1 Fracture surface analysis of bolt 2

With the use of an optical microscope bolt 2 was investigated as seen in Figure 19. The fracture surface was highly corroded, which indicated that fracture had not occurred recently, but that the fracture surface had been submitted to seawater for a longer period of time.

The corroded nature made it hard to determine the type of failure. Some zones, indicated with red arrows in Figure 19 had a reflective appearance, which indicated that the metal was ground against another metallic part for a certain period of time. Friction between two parts of the broken off keel bolt must have taken place, so that consequentially, corrosion products were ground away or never had the chance to be formed in these particular positions



*Figure 19 - Optical microscopy images of bolt 2*

*Left: fracture surface with indication of reflective surfaces. Right: more detailed image of reflective surfaces and corrosion products*

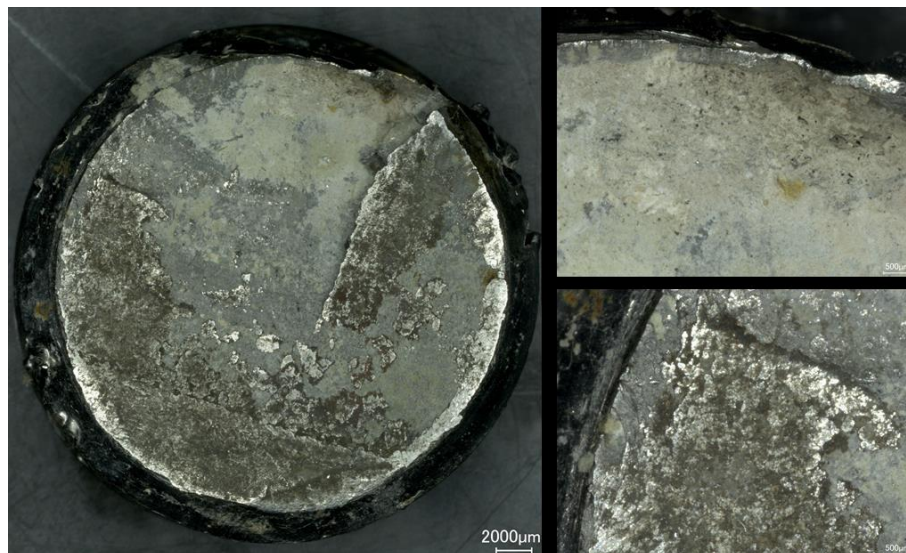
An EDX analysis was conducted on the corrosion products and on the fracture surface of broken off keel bolt 2 and the following elements were detected: Fe, O, C, Cr, Mo and Ni.

Cr, Mo and Ni were part of the passive protective layer of the stainless steel, however, the presence of iron indicated that corrosion had taken place. The red rust, ferric oxide -  $\text{Fe}_2\text{O}_3$ , was also a clear indication of the aforementioned corrosion.

Besides aforementioned elements, 10 wt% of sodiumchloride -  $\text{NaCl}$ , commonly known as salt, and some small amounts of sulphur, 2 wt%, were detected. The present of sodiumchloride indicated that corrosion had taken place in saline environment, such as sea water.

### 5.5.2 Fracture surface analysis of bolt 4

In Figure 20 images of optical microscopy investigation of the fracture surface of broken off keel bolt 4 are shown. In the overview left image, a white deposit was visible. Most of the fracture surface of the broken off keel bolt, when not covered with white deposits, consisted of reflective surface. Similar to the fracture surface of broken off keel bolt 2, this reflectiveness indicated that the metal surface had been ground against another metallic part.

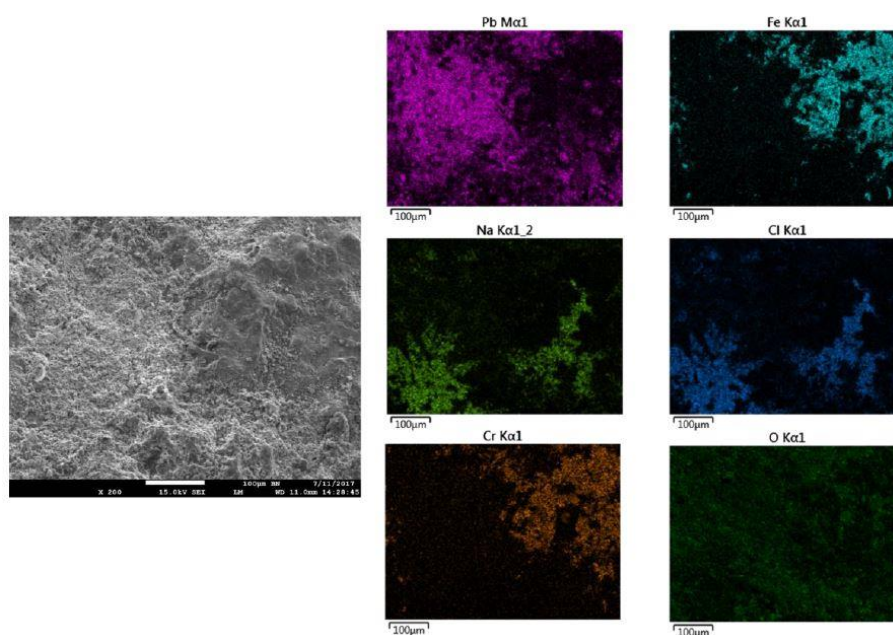


*Figure 20 - Optical microscopy images of bolt 4*

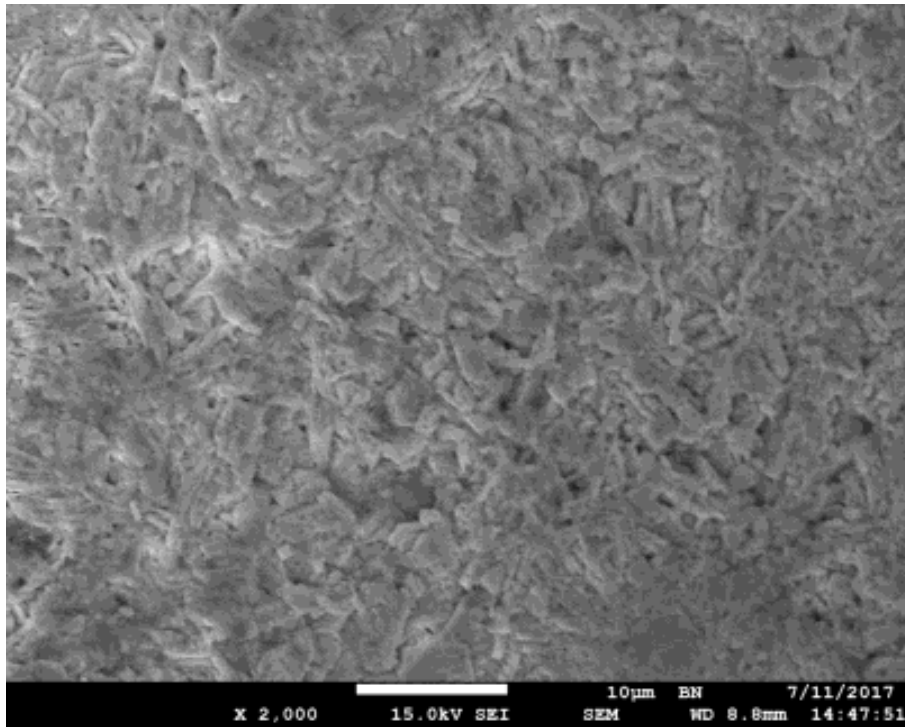
*Left: fracture surface. Right: detailed image of the white deposits (top) and reflective surface (below) of the fracture surface*



With use of the EDX mapping technique the nature of the white deposits was determined. In figure 10 a secondary electron image of the white deposit on the fracture surface is shown. EDX mappings of Pb, Fe, Na, Cl, Cr and O are displayed. Traces of Si, Ca, C, Mg, Mo, Al and Ni were also found, but since they were present in very small amounts and were distributed more or less evenly over the surface, they were not shown. The mappings visualized the presence of lead oxides, PbO, on the fracture surface of the broken off keel bolt. Some parts of the investigated area were not covered with the PbO, but instead iron with passive Cr<sub>2</sub>O<sub>3</sub>, chromium oxide, on top was present. The presence of salt, NaCl, was also demonstrated.



*Figure 21 - Secondary electron image of white deposits  
and the EDX-map of Pb, Fe, Na, Cl, Cr and O.*



*Figure 22 - Secondary electron image of the lead oxide*

### 5.5.3 Fracture surface analysis of bolt 5

Figure 23 shows the optical imaging of the fracture surface of broken off keel bolt 5. Attention was drawn to the important findings on this surface, delimited by the red and green boxes.

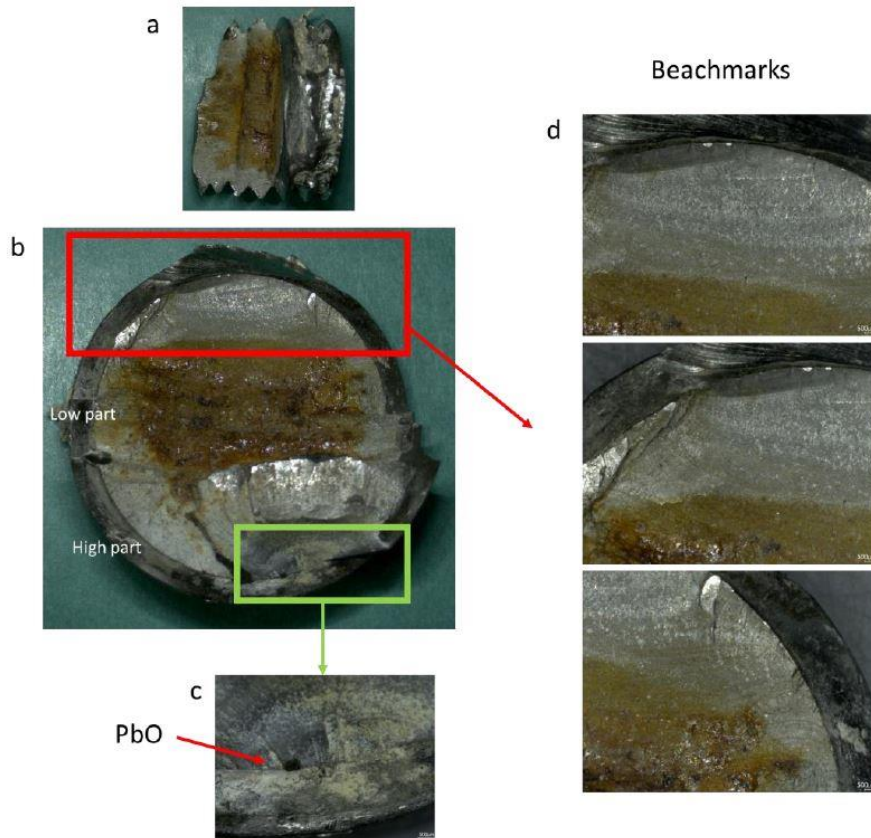


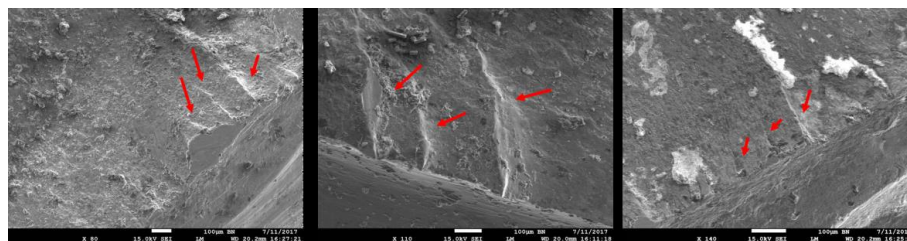
Figure 23 - Optical microscopy images of fracture surface of broken off keel bolt 5

a) Side view b) Overview of fracture surface c) PbO deposits, high part fracture surface d) Beachmarks, low part fracture surface.

On the higher part of the fracture surface of the broken off keel bolt, PbO deposits were found and were verified by EDX, as well as a reflective surface similar to the reflective surfaces found on the fracture surfaces of broken off keel bolts 2 and 4. On the lower parts of the fracture surface of the broken off keel bolt 5, two zones can be determined. One zone consisted of corrosion products similar in composition to the corrosion products found on the fracture surface of broken off keel bolt 2, which indicated that this part of the bolt had been exposed in a saline environment, such as sea water, for some time.

The second zone was not corroded, nor did it exhibit a reflective appearance or PbO deposits on the surface.

This zone exhibited clear signs of a recognizable failure mode, i.e. fatigue. The lines visible on figure 12d and 13 were referred to as beachmarks<sup>10</sup> and were an indication of failure by fatigue. Fatigue is a form of failure that occurs in structures subjected to dynamic and fluctuating stresses, after a lengthy period of repeated stress or strain cycling. Fatigue failure is characterized by three distinct steps. 1) crack initiation, 2) crack propagation, and 3) sudden final failure. Beachmarks are formed during the crack propagation step. They indicated that there were interruptions during the crack propagation stage. A possible explanation for the presence of the not corroded beachmarks, was that this part of the bolt was attached for a longer period of time to the counter part of the bolt compared to the corroded part.



*Figure 24 - Secondary electron images of the edge of the low part of the fracture surface of broken off keel bolt 5 with indication of the beachmarks*

#### **5.5.4 Conclusions of the forensic analyses of the broken off keel bolts**

- Reflective fracture surfaces were found on all broken off keel bolts, indicating grinding against metallic parts after failure.
- Lead oxide, PbO, was found on the fracture surfaces of broken off keel bolts 4 and 5
- A fatigue failure was observed on fracture surface of broken off keel bolt 5.
- Unclear failure mechanisms were found on fracture surfaces of broken off keel bolts 2 and 4 . The surfaces were heavily corroded and reflectiveness as a result of the grinding against metals after failure was observed.

Some of the fracture surfaces were showing signs of corrosion and signs of chafing. Taking into consideration the process of corroding of stainless steel in a seawater environment and the process of chafing, it can be concluded that the damage to the keel bolts did not appear in

---

<sup>10</sup> Beachmark: a macroscopic progression mark on a fatigue fracture or stress-corrosion cracking surface that indicate successive positions of the advancing crack front

the moments before the capsizing, but had already occurred in the weeks or months prior to the capsizing. The keel bolt that had suffered from fatigue was the last keel bolt to maintain its structural integrity until it gave way.

### 5.5.5 Origin of the fracturing of the keel bolts

The sy CAPELLA had grounded on several occasions in the years prior to the Lightvessel race. Some groundings of the sy CAPELLA had been documented in the press such as the grounding of May 2016 whereby the sy CAPELLA grounded on a sandbank and reportedly all of the stops had to be pulled out to refloat the sy CAPELLA, since, the sy CAPELLA drifted time and again back onto a sandbank.

Reportedly, after each grounding, the sy CAPELLA had been hoisted out of the water, however the keel had never been removed for inspection.

The breaking off of keel bolts, and consequential loss of the keel, was not uncommon in the sailing world.

Only a few years earlier a similar documented incident happened off the Belgian coast whereby the overturned sailing vessel was salvaged.



*Figure 25 - Sailing yacht recovered off the Belgian coast after keel was lost*



The yacht that had lost its keel, had reportedly grounded in the months prior to losing its keel. In 2014, a 40 foot sailing vessel lost its keel and capsized in mid Atlantic.

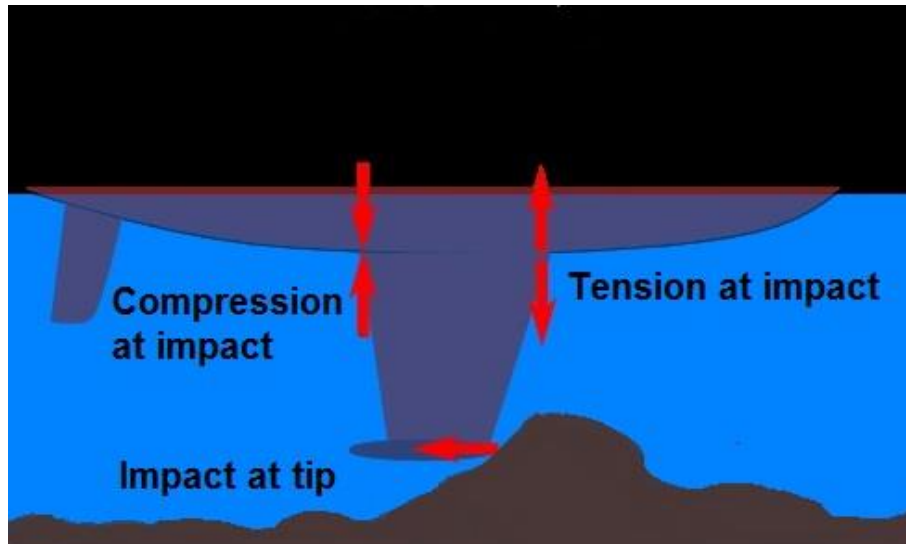


*Figure 26 - Derelict sailing vessel found in the Atlantic ocean  
with keel missing*

There were no survivors. The hull was found adrift in upside down position, with the keel missing. An investigation into the cause of capsizing, by a marine accident investigation body, revealed that the vessel had capsized after having lost its keel and that the vessel had grounded in the past, without having the keel removed for inspection of the keel bolts, after it had grounded.

### 5.5.6 Forces that act upon the keel bolts during grounding

Forces that act upon the keel bolts during grounding are as follows



*Figure 27 - Forces on keel bolts of sailing vessels during grounding*

The tension at impact can be that severe that keel bolts break, in which case the broken off ends of the bolts could be observed from inside the sailing vessel when checking the pre-tension on the nuts.

In case a sailing vessel grounds on a sandy bottom, the damage to the outside of the keel would be rather minimal.

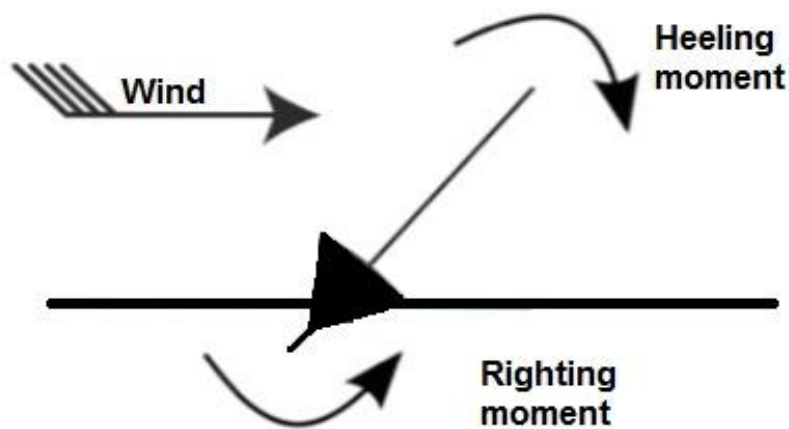
In the case of the sy CAPELLA, with the keel bolts welded to the underside of the keel plate it was also not possible to assess the condition of the keel bolts by checking the pre-tension on the nuts holding the keel bolts in position inside the sy CAPELLA, since the way of fastening concealed the condition of the keel bolts below the welds on the bottom of the keel plate.

### 5.5.7 Forces acting upon sailing vessels when not running free

Sailing vessel like the sy CAPELLA undergo two main forces when not running free. One is the force of the wind forcing the sailing vessel to lean over one side, the other would be the force of the gravity pulling the keel downward towards the vertical plane. Both the force of wind and the force of gravity create a moment.

The moment created by force of the wind onto the sail is the heeling moment, and the force created by the force of gravity acting upon the keel is the righting moment. The Heeling moment can be influenced by reducing or increasing the sail surface or adjusting the sail trim, the righting moment can be influenced by the position of the crew on board the sailing vessel.

A sailing vessel assumes a certain heel, when for that specific heel, the heeling and righting moments are in equilibrium with each other.



*Figure 28 - Moments acting upon sailing vessels when sailing*

The sudden loss of the keel disrupts the equilibrium between the heeling and the righting moment in such way that there would not be any time for the crew to adjust the sails in such way, or to reposition themselves on board, so that a new equilibrium is created between the newly developed righting moment without keel and heeling moment as a result of the force of the wind acting upon the sails.



## **5.6 The search for survivors**

### **5.6.1 Number of crew on board**

During the search and rescue of the survivors on July 1<sup>st</sup> 2017, confusion had arisen about the exact number and the identities of the crewmembers on board the sy CAPELLA during the Lightvessel race.

Prior to the race, the skipper of the sy CAPELLA had been asked to report the names of all crewmembers that would be participating in the race. The skipper only reported the first names of the potential crewmembers.

The organisers did not require contact details of relatives of the skipper or crew. Only the email address and GSM telephone number of the skipper were registered with the organisers.

### **5.6.2 Rescue as proposed by organisers**

The organisers applied for a permit for the race with the competent authority, the Federal Public Service Mobility and Transport, Directorate Shipping, under condition that at all times four support vessels, equipped with VHF radiotelephones and GSM handheld telephones would be waterborne, and would be accompanying the regatta. It was also stated that all rescue would be performed by the organiser's own fleet of rescue craft. Furthermore, the race would be monitored by the organisers at all times. Race officials would be present as well as beachmasters.

The race was not monitored by the organisers. Participants were asked to report their position by GSM telephone at specific times, such as 09:00 on July 1<sup>st</sup> 2017. The sy CAPELLA did not report its position at that time.

The organisers did not foresee a scenario in case a participant would not report its position at any of the required times.

### **5.6.3 The interval between capsizing and rescue**

The sy CAPELLA capsized at 08:14 in the morning.

At 14:38 hours a piloted tanker reported sighting of an overturned vessel with persons on top of the hull. More than six hours passed between the incident and first sighting.

Although the organisers of the regatta had asked participants to report their position at 09:00 hours on July 1<sup>st</sup> 2017, 46 minutes after the capsizing, no scenario was foreseen on how to cope with a non-reporting participant.

The survivors of the capsized yacht had seen several vessels passing close by after the capsizing. Of one vessel passing very close by, a crewmember in the wheelhouse was clearly distinguished and was seen holding a mug, by the survivors on top of the hull of the capsized sy CAPELLA, but the hand signals given by the survivors, that were standing on top of the hull of the sy CAPELLA, were not noticed by the bridge team of the vessel passing very close by.

The crew of the contender that was sailing in very close vicinity of the sy CAPELLA at the time of capsizing had not witnessed the capsizing and had consequentially not reported the incident.

Two handheld VHF radio sets were carried on board the sy CAPELLA, one in a grab bag the other in the pocket of a life jacket. None of the crew members had the opportunity to get hold of one of the two VHF sets during and after the incident thus not being able to transmit a distress signal by VHF radiotelephone in the moments after the capsizing.

At 16:15 hours, 8 hours after the capsizing, the exact number of crewmembers and the identity of the crewmembers could be confirmed for the first time.

## **5.7 Cause of the capsizing**

The sy CAPELLA capsized after the equilibrium between the heeling moment and the righting moment was disrupted when the bolted on keel of the sy CAPELLA fell off as a result of the keel bolts breaking, and subsequent breaking of the keel plate, as a consequence of excessive forces acting upon the bolts during previous grounding or groundings, and as a result of the last intact bolt giving way as a consequence of fatigue.

### **5.7.1 Contributing factors**

The bolts had not been inspected since the keel had been fixed to the sy CAPELLA in 2000 and after the sy CAPELLA had run aground on several occasions.

The welding of the keel bolts at the bottom of the keel plate, that was perpendicular to the centre plate of the keel, had resulted in the pre-tension, that had been applied to the nuts securing the bolts at the inside of the hull, being applied only to the part of the bolt from the weld to the securing nut, and the welding had eliminated all visual indicators that a bolt or bolts were broken off.

### **5.7.2 The cause for the interval between incident and rescue of the survivors**

The regatta was not monitored by organisers nor by any official instance.

The participants themselves were asked to report their position by GSM telephone at largely spread intervals. GSM coverage for the whole of the course could not be guaranteed.

The organisers had not foreseen in a scenario in case a competitor or competitors did not report at the expected time.

The four motor launches, that had been included in the demand for a permit by the organizers, and that would be accompanying the regatta at all times were not accompanying the regatta.

The exact number and identities and contact details of the crewmembers had not been registered with the organisation at the start of the regatta.

The organizers did not check whether the information supplied to them by the contenders, by means of the inspection card, corresponded with the actual situation. Doing so would have indicated that the sy CAPELLA was not fitted with a DSC VHF radiotelephone as indicated.

## 6 Recommendations

The recommendations hereunder are mentioned in random order, and are by no means listed in order of importance

- 1) The Maritime Rescue and Coordination Centre are recommended to check the presence of, and to liaise with, the rescue workers appointed by the organisers of waterborne competitions at least for the duration of the competition in order to have a clear oversight on what means of rescue are on the water ready to be deployed in case of emergency.
- 2) The Belgian Federal Public Service Mobility and Transport, DG Shipping, directorate pleasure craft, are recommended to inform sailing craft owners and sailing craft operators of the possible hidden dangers of failing keel bolts on sailing yachts with bolt-on keels, and to address the importance of a thorough inspection of keel and keel bolts after grounding.
- 3) The Royal Belgian Sailing Club are recommended, when asking for a permit for waterborne events, to submit correct data to the competent authority and to only seek permission from competent authorities and to adhere to clauses and conditions mentioned in the permit when issued.
- 4) The Royal Belgian Sailing Club are recommended, when asking for information from participants and participating vessels, in waterborne competitions organised by the former, with respect to identity and safety to verify the completeness and accuracy of the supplied information, and to foresee in a scenario in case of emergency, when occurring, whereby the supplied information would be very valuable.

## **7 List of Appendixes**

Appendix 1 – Sailing Instructions Lightvessel Race 2017	47
Appendix 2 - Inspection Card for Race Category 3 monohulls	56

# **LIGHT VESSEL RACE 2017**

**30th June and 1st July 2017**

## **SAILING INSTRUCTIONS**

### **1. GOVERNING RULES**

The Light Vessel Race 2017 will be governed by:

- 1.1 The Racing Rules of WORLD SAILING
- 1.2 The World Sailing Offshore Special Regulations Cat 3 Monohull with Life Raft.
- 1.3 The IRC Regulations for yachts competing in the IRC class.
- 1.4 The CR Regulations for yachts competing in the CR class, without limitation on the use of spinnakers, gennakers or code-0 sails (this changes CR Rule 8.4.c).
- 1.5 The Open North Sea Championship 2017 General Sailing Instructions
- 1.6 The event shall rank as category "C". The flag of the main sponsor can be prominently displayed from a backstay, according to Appendix 1 section 20.3.2. (b).
- 1.7 All yachts must carry a sail number corresponding with the one of her measurement certificate and according to RRS 77. This is a warning as mentioned in RRS G4. Belgian yachts participating in a regatta must carry a sail number issued by the FRYB-KBYV (check [www.belgiansailing.be](http://www.belgiansailing.be))
- 1.8 Between sunset and sunrise, the International Regulations for Preventing Collisions at Sea (IRPCS) will replace the World Sailing Rules.
- 1.9 When encountering other shipping than racing yachts, the IRPCS or the local rules shall be complied with.
- 1.10 In case of conflict between languages the English text will prevail.
- 1.11 The Domus Team Light Vessel Race 2017 qualifies for the Open North Sea Championship 2017

### **2. NOTICES TO THE COMPETITORS**

- The official notice board will be located at the harbour office.

### **3. CHANGES TO SAILING INSTRUCTIONS**

- Any change to the Sailing Instructions will be posted at least 30 minutes before code flag G is on display (see 4.4), except that any change to the schedule of races will be posted by 20:00 on the day before it will take effect.

### **4. SIGNALS MADE ASHORE**

- 4.1 Signals made ashore will be displayed from a flag staff located near the clubhouse Alberta.
- 4.2 Code Flag "L" will be displayed if any Notice to Competitors or Change to Sailing Instructions has been posted.
- 4.3 When flag "AP" is displayed ashore, "1 minute" is replaced with "not less than 90 minutes" in race signal "AP". Boats are requested not to leave the harbour until this signal is removed.
- 4.4 When flag G is displayed boats are requested to proceed to the racing area. The starting signal will not be given within 1.30 hours after display of this signal.

### **5. SCHEDULE OF RACES AND FORMAT**

- 5.1 For the IRC and CR class:  
For both classes, the Domus Team Light Vessel Race 2017 will consist of one long distance race of approximately 100 NM.



- 5.2 The first warning signal time each day is scheduled as follows:

Light Vessel Race 2017		
Date	Time	Event
30 <sup>th</sup> June Friday	09:00-19:00	Registration for the CR and IRC class at the harbour master office.
	16:00-19:00	Possible equipment and safety inspection
	19:00	Skippers briefing at the clubhouse Alberta
	20:55	1 <sup>st</sup> Warning Signal Starting groups :      IRC 1-2 (TCC $\geq$ 1,000) & CR 1 - 2 IRC 3 (TCC < 1,000) & CR 3 - 6
1 <sup>st</sup> July Saturday	+18:00	Prize giving and Diner participants in the clubhouse Alberta

#### 6. CLASS FLAGS AND CLASSES

- 6.1 The rating bands and class flags for the IRC class will be as defined in the ONZK GSI 2017:  
 IRC 1 (TCC  $\geq$  1,045)      White Class Flag  
 IRC 2 (1,000  $\leq$  TCC < 1,045)      Yellow Class Flag  
 IRC 3 (TCC < 1,000)      Blue Class Flag  
 The white, yellow and blue class flags for the IRC classes will be available at the race office for a guarantee fee of 10,00€.
- 6.2 The rating bands and class flags for the CR class will be as defined in the CR Rules 2017:  
 CR 1&2 (BA RAT > 27,5)      IC "W" Class Flag  
 CR 3&4 (BA RAT  $\leq$  27,5 > 22,3)      IC "K" Class Flag  
 CR 5&6 (BA RAT  $\leq$  22,3)      IC "U" Class Flag  
 In case of insufficient entries classes may be combined

#### 7. RACING AREA

- 7.1 The Racing Area is the North Sea; starting line in front of the coast of Knokke-Heist in the area of WK14.
- 7.2 The starting vessel will be recognised by its RBSC club pennant.
- 7.3 The Regatta site is the RBSC Zeebrugge, Rederskaai 1 8380 Zeebrugge

#### 8. THE COURSES

- 8.1 For the IRC Class there will be only 1 long distance race.
- 8.2 For the CR Class there will be only 1 long distance race.
- 8.3 Attachment 1 show the courses.

#### 9. MARKS

- 9.1 The long distance will be sailed around existing navigational buoys.

#### 10. THE START

- 10.1 To inform boats that a start, or sequence of starts, will be given, an orange flag will be shown for at least 5 minutes.
- 10.2 The starting line will be between a staff displaying an orange flag on the race committee boat at the starboard end of the starting line, and a black buoy at the port end.
- 10.3 Boats whose warning flag has not been displayed shall keep clear of the starting line between the warning and starting signals of the other fleet's start.
- 10.4 The RC Signal boats may use their engines to stay in position if needed, this cannot be used as ground for protest or redress by a boat.
- 10.5 In addition to RRS 29.1, the Race Committee **may** also announce individual recalls on VHF, using the words "X-Ray". Individual recall details such as "sail numbers" and/or "boat names" may subsequently be given, but not necessarily immediately after the start. It always remains the individual responsibility of a boat to start correctly under RRS 29.1 and RRS 30.1.
- 10.6 In addition to RRS 29.2, the Race Committee **may** also announce general recalls on VHF, using the words "General Recall".
- 10.7 Starting groups :      IRC 1-2 (TCC  $\geq$  1,000) & CR 1 - 2  
                                      IRC 3 (TCC < 1,000) & CR 3 - 6

**The order of the starting groups can change at the discretion of the race committee**

#### 11.CHANGE OF THE POSITION OF THE NEXT MARK

- 11.1 To change the position of the next mark, the race committee will move the original mark (or the finishing line) to a new position. The change will be signalled before the leading boat has begun the leg, although the mark may not yet be in the new position. Any mark to be rounded after rounding the moved mark may be relocated without further signalling, to maintain the course configuration.

#### 12.THE FINISH

- 12.1 The finishing line will be between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.
- 12.2 Boats – participants must approximately 0,5 NM before the finishing line, report on channel 72 to the race committee boat "race committee Light Vessel" announcing their approach.

#### 13.PENALTY SYSTEM

- 13.1 A boat that has taken a penalty under RRS 44.1 or retired under RRS 31.2 shall complete and file an acknowledgement form at the Regatta Office.
- 13.2 RRS 42.1 will be applied. As foreseen in the Fundamental Rule of the I.S.A.F.(assistance) or to recover a person who fell overboard, the RRS 42.3 (f) (propulsion) allows to use the engine or other means of propulsion. Such an incident must be declared at the finish of the race and shall be reported on the race declaration. In case of unforeseen circumstances, a yacht may be in a position whereby she is bound to use the engine or other means of propulsion, so as not to infringe the International Regulations For Preventing Collisions at Sea (IRPCS) or the governing right-of-way rules applicable to the area. Such an incident must be reported on the race declaration. In this case, the Jury may announce a disqualification if it is convinced that the involved yacht gained a significant advantage.
- **13.3 An infringement of the IRPCS or local harbour rules will be scored DSQ without a hearing, this changes Appendix A5.**
- 13.4 When at a boat's starting signal she is subject to RRS 29.1 Individual Recall and she fails to comply with RRS 29.1 to start correctly, the Race Committee shall, without a hearing, apply a penalty by adding 1 hour to her elapsed time. This changes RRS63.1 & A5.

#### 14.TIME LIMITS

For the IRC and CR class:

- 14.5 The finishing time limit on Saturday 1<sup>st</sup> July is 17.00 h.
- 14.6 Boats failing to finish within the time limit will be scored as Did Not Finish without a hearing. However, if the first boat of the IRC or CR fleet finishes within the time limit, all boats of the IRC or CR fleet which finish after the time limit but within two (2) hours after the first boat of the IRC or CR fleet, will be scored. The race committee can extend the time limit by means of a verbal message on VHF channel 72.
- 14.7 A boat starting later than 15 minutes after her starting signal will be scored "DNS".

#### 15.PROTEST AND REQUEST FOR REDRESS

- 15.1 Protest forms are available at the Regatta office. Protests and request for redress and reopening shall be delivered there within the appropriate time limit. Hearings will be held in the club committee room.
- 15.2 For each class, the protest time limit is 90 minutes after the last boat has finished the last race of the day. The same protest time limit applies to all protests by the race committee and Protest Committee and to requests for redress. This changes RRS 61.3 and 62.2. This time will be posted on the official notice board.
- 15.3 Notices will be posted within 30 minutes of the protest time limit to inform competitors of hearings in which they are parties or named as witnesses.
- 15.4 Notices of protests by the race committee or Protest Committee will be posted to inform boats under RRS 61.1(b).
- 15.5 A list of boats that, under sailing instruction 13.1, have acknowledged breaking RRS 42 or have been disqualified by the Protest Committee will be posted before the protest time limit.
- 15.6 For the purpose of RRS 64.3(b) the 'authority responsible' is the measurer appointed by the organizing authority.
- 15.7 On the last day of the regatta a request for reopening a hearing shall be delivered:
  - o Within the protest time limit if the party requesting reopening was informed of the decision on the previous day.
  - o No later than 30 minutes after the party requesting reopening was informed of the decision on that day.This change rule 66.

#### 16.SCORING

- The ranking of the Domus Team Light Vessel Race 2017 for the IRC and CR class will be as follows:  
The long distance will count for overall points with a factor 1,0.

#### 17.SAFETY REGULATIONS

- 17.1 Any yacht which retires must immediately show her national flag and report ASAP to the Race Committee by VHF channel 72.
- 17.2 Before the first warning signal of the first race of the day, each yacht will pass the starboard end extension of

the starting line within 2 boat lengths of the Race Committee signal boat. Each yacht shall have her sail number acknowledged by the Race Committee.

- 17.3 Every Yacht must return to race committee the document form "Inspection Card for Race Category 3 (with liferaft) Monohulls" before Friday 30<sup>th</sup> June 19.00 hours.

#### 18.REPLACEMENT OF EQUIPMENT

- 18.1 Substitution of damaged or lost equipment will not be allowed unless approved by the race committee. Requests for substitution shall be made to the committee at the first reasonable opportunity.

#### 19.EQUIPMENT AND MEASUREMENT CHECKS

- 19.1 Each competitor shall present a valid measurement certificate on the first day of his registration.
- 19.2 Any boat or equipment may be inspected for compliance with the class rules and the sailing instructions at any time.

#### 20.SUPPORT BOATS

- 20.1 Team leaders, coaches and other support personnel shall remain at least 100 metres outside areas where boats are racing from the time of the preparatory signal for the first fleet to start until all boats have finished or the race committee signals a postponement, general recall or abandonment.
- 20.2 The penalty for infringing these requirements will be at the discretion of the Protest Committee, but may include disqualification of one or all boats associated with the infringing vessel.

#### 21.RADIO COMMUNICATION

- 21.1 Except in an emergency, to announce its finish or retirement, and to reply to the race committee, a boat shall neither make radio transmissions while afloat nor receive radio communications not available to all boats. This restriction also applies to mobile telephones.
- 21.2 The VHF channel used for information by the Race Committee: VHF 72. Yachts are not allowed to transmit on this channel except in an emergency and or to announce their imminent arrival or to report retirement.
- 21.3 In case VHF fails, the participants can communicate with the Race committee over mobile phone, the number is 0495/21.99.22.
- 21.4 When sailing in harbours, the harbour approaches and crossing the shipping lanes in the Southern North Sea and the Westerschelde, either before, during or after the race, yachts equipped with VHF shall keep a continuous listening watch on the appropriate channels. **It is mandatory to contact Port Control of Zeebrugge on VHF channel 71 when leaving or entering the harbour. In case of non respect of these rules a yacht can be disqualified.**

#### 22.PRIZES

- 22.1 Several prizes will be awarded at the discretion of the race organisation.
- **22.2 PRIZES WILL BE REWARDED ONLY TO TEAMS WHO ATTEND THE PRIZE GIVING (REPRESENTED BY THEMSELVES)**

#### 23.DISCLAIMER OF LIABILITY

Rule 4 of the Racing Rules of Sailing states: "The responsibility for a boat's decision to participate in a race or to continue racing is hers alone. "Sailing is by its nature an unpredictable sport and therefore inherently involves an element of risk. By taking part in the event, each competitor, each parent present or not, each coach agrees and acknowledges that:

- a) They are aware of the inherent element of risk involved in the sport and accept responsibility for the exposure of themselves, crew and their boat to such inherent risk whilst taking part in the event;
- b) They are responsible for the safety of themselves, crew and their boat and their property whether afloat or ashore;
- c) They accept responsibility for any injury, damage or loss to the extent caused by their own actions or omissions;
- d) Their boat is in good order, equipped to sail in the event and they are fit to participate;
- e) The provision of a race management team, patrol boats and other officials and volunteers by the event organiser does not relieve them of their own responsibilities;
- f) The provision of patrol boat cover is limited to such assistance, particularly in extreme weather conditions, as can be practically provided in the circumstances;
- g) Their boat is adequately insured.

#### 24.INSURANCE

- Each participant shall have a current Public Liability and Third Party Property Insurance policy, including coverage when racing at the venue of the race, of not less than 1.500.000 € or equivalent for each boat.



#### **25.ELIGIBILITY**

- All entrants, to be eligible for the race, shall:
  - Comply with RRS Appendix 2 – WORLD SAILING Eligibility Code.
  - Comply with World Sailing Offshore Special Regulations Inspection Card for Race Category 3 (with liferaft) Monohulls
  - Have a current Public Liability and Third Party Property Insurance policy, including coverage when racing at the venue of the race, of not less than 1.500.000 € or equivalent for each boat.
  - Any competitor under the age of 18 yrs will be required to obtain parental/guardian consent prior to commencement of the race.

#### **26.IMAGE AND MEDIA RIGHTS**

- In sailing the Domus Team Light Vessel Race 2017 a competitor automatically grants to the Organising Authority and the sponsors of the event the right in perpetuity to make, use and show from time to time and at their discretion, any motion or still pictures, and live, taped or film television and any other reproductions of him/her during the period of the race in which the competitor competes and in all material related to the race without any compensation.

## **ATTACHMENT 1**

### **Long Distance Race for the IRC and CR Class on Saturday.**

The starting line will be between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

The finishing line will be between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end. Approximately 0,5 NM before the finishing line, boats must report on channel 72 to the race committee boat "race committee Light Vessel" announcing their approach.

In case VHF fails, the participants can communicate with the Race committee over mobile phone, the number is 0495/21.99.22.

#### **ATTENTION :**

**Links to the Navionics charts and Coordinates of the marks are no ground for protest!**

#### **FOLLOWING EXCLUSION ZONE MUST BE RESPECTED AT ALL TIMES:**

The boundary of the exclusion are :  
S1°25.959'N 2°34.932'E  
VG2  
MBN  
OOSTDYCK 1  
S1°23.450'N 2°29.920'E

View it: <http://tinyurl.com/ycm6gxu9>

Download it: <http://tinyurl.com/y92su74f>

**To allow the Race Committee to locate the fleet, participants are asked to text (SMS) their position and boat name at 09.00 AM Saturday morning 1 July to the following number +32.495.21.99.22.**

**Participants with AIS transponder are asked to send their AIS position at any time.**

#### **COURSES :**

**THE COURSE TO SAIL WILL BE COMMUNICATED AT THE BRIEFING FROM 19 HOURS :**

#### **Course 1 / IRC 1-2 en CR 1-2 / +-98.5 NM**

View it: <http://tinyurl.com/y7dfq228>

Download it: <http://tinyurl.com/yd7hb6qf>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

W	- round to PORT
SAMSELBU	- round to STB
WK 28	- leave to STB
ZSB	- round to STB
CHR HUYGENS	- leave to STB
MAGNE	- leave to STB
NBJ	- leave to STB
OOSTER	- round to PORT
BOLLEN	- leave to PORT
SBO	- round to PORT
MW	- round to PORT
BOTKIL N	- leave to STB
SAMSELBU	- round to PORT
MOW 2	- round to PORT
W1	- round to STB
W3	- leave to PORT
STEEN	- round to PORT
W9	- round PORT
SEGRE	- round to PORT
S12	- round to PORT





FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.

#### **COURSE 2 / IRC 1-2 en CR 1-2 / +-118.5 NM**

View it: <http://tinyurl.com/y2wag6tn>

Download it: <http://tinyurl.com/yacahooq>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

W	- round to PORT
SAMSELBU	- round to STB
WK 28	- leave to STB
ZSB	- round to STB
CHR HUYGENS	- leave to STB
MAGNE	- leave to STB
NBJ	- leave to STB
OOSTER	- leave to STB
Hinder	- round to PORT
SBO	- round to PORT
MW	- round to PORT
BOTKIL N	- leave to STB
SAMSELBU	- round to PORT
MOW 2	- round to PORT
W1	- round to STB
W3	- leave to PORT
STEEN	- round to PORT
W9	- round to PORT
SEGRE	- round to PORT
S12	- round to PORT

FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.

#### **COURSE 3 / IRC 1-2 en CR 1-2 / +-106.00 NM**

**CAUTION FOR THE EXCLUSION ZONE!**

View it: <http://tinyurl.com/yvm6gxu9>

Download it: <http://tinyurl.com/y92su74f>

The boundary of the exclusion are :

51°25.959'N 2°34.932'E  
VG2  
MBN  
OOSTDYCK 1  
51°23.450'N 2°29.920'E

View it: <http://tinyurl.com/y7bf3cuh>

Download it: <http://tinyurl.com/y8coseva>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

Samselbu	- round to PORT
Goote bank	- leave to PORT
<b>CAUTION FOR EXCLUSION ZONE</b>	
Westhinder	- round to PORT
<b>CAUTION FOR EXCLUSION ZONE</b>	
S5	- round to STB
WK7	- round to PORT
Nippon	- round to STB
Z	- round to PORT
BVH	- round to STB
MOW2	- round to PORT
W7	- round to PORT
Trawl	- round to PORT
S10	- round to PORT
MOW2	- round to PORT



W1 - round to PORT  
S9 - round to PORT

FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.

#### **COURSE 4 / IRC 3-6 en de CR 3-6 / +-70.60 NM**

View it: <http://tinyurl.com/ybz94grw>

Download it: <http://tinyurl.com/y9mhwax5>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

W - round to PORT  
SAMSELBU - round to STB  
WK 28 - leave to STB  
ZSB - round to STB  
CHR HUYGENS - leave to STB  
MAGNE - leave to STB  
OSB - round to STB  
BOTKIL N - leave to STB  
SAMSELBU - round to PORT  
MOW 2 - round to PORT  
W1 - round to STB  
W3 - leave to PORT  
STEEN - round to PORT  
W9 - round to PORT  
SEGRE - round to PORT  
S12 - round to PORT

FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.

#### **COURSE 5 / IRC 3-6 en de CR 3-6 / +-85.00 NM**

View it: <http://tinyurl.com/ybp8y4zs>

Download it: <http://tinyurl.com/yd3rakd9>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

W - round to PORT  
SAMSELBU - round to STB  
WK 28 - leave to STB  
ZSB - round to STB  
CHR HUYGENS - leave to STB  
NB3 - round to PORT  
MW - round to PORT  
SBZ - round to PORT  
BOTKIL N - round to STB  
SAMSELBU - round to PORT  
MOW 2 - round to PORT  
W1 - round to STB  
W3 - leave to PORT  
STEEN - round to PORT  
W9 - round to PORT  
SEGRE - round to PORT  
S12 - round to PORT

FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.





**COURSE 6 / IRC 3-6 en de CR 3-6 / --94.00 NM**

**CAUTION FOR EXCLUSION ZONE**

View it: <http://tinyurl.com/ycm6gxu9>

Download it: <http://tinyurl.com/y92su74f>

The boundary of the exclusion are :  
51°25.959'N 2°34.932'E  
VG2  
MBN  
OOSTDYCK 1  
51°23.450'N 2°29.920'E

View it: <http://tinyurl.com/y8xpkqnp>

Download it: <http://tinyurl.com/y72uyz9s>

Start, line between a staff displaying an orange flag on the starting vessel at the starboard end and a black buoy at the port end.

Samselbu - round to PORT

Goote bank - leave to PORT

**CAUTION FOR EXCLUSION ZONE**

Westhinder - round to PORT

**CAUTION FOR EXCLUSION ZONE**

S5 - round to STB

Z - round to PORT

BVH - round to STB

MOW2 - round to PORT

W7 - round to PORT

Trawl - round to PORT

S10 - round to PORT

MOW2 - round to PORT

W1 - round to PORT

S9 - round to PORT

FINISH, is the line between a staff displaying a blue flag on the finishing vessel at the starboard end and the WK14 at the port end.

**Race Officers**

Patrick Demesmaeker - Marc Seynaeve - Guy Houvenaghel - Benoit Van Den Haute

**Jury**

Dirk Sledsens

**THE ORGANIZING AUTHORITY WISHES YOU A PLEASANT LIGHT VESSEL RACE 2017**

## World Sailing Offshore Special Regulations

### Inspection Card for Race Category 3 (with liferaft) Monohulls

- **PERSON IN CHARGE** (see Racing Rules of Sailing 46): please prepare the boat, initial above the underline and sign where indicated.
- **INSPECTORS** mark each inspected item with a checkmark or cross. Note any deficiencies on the Deficiency Report. Show the Deficiency Report to the Person in Charge, then return the report to the Race Committee as soon as possible.

Boat	<u>CAPELLA NED 5111</u>
Serial number	<u>ONE-01F</u>
No of persons on board	<u>6</u>
Disclaimer of Liability	<p>The inspection is carried out as a courtesy. An inspector cannot limit or reduce the complete and unlimited responsibility of the owner and the person in charge.</p> <p>"I hereby declare that I am the Person in Charge, that whenever I initial an item on this checklist it conforms to its associated Offshore Special Regulation (OSR), that I have read and understand the OSRs and in particular 1.02.1 and 1.02.2</p>
Printed name	<u>[REDACTED]</u>
Signed	<u>[REDACTED]</u>
Date	<u>30-06-2017</u>

**JANUARY 2016- DECEMBER 2017 including updates January 2017**

© ORC Ltd. 2002, amendments 2003-2017 © World Sailing Limited

Version 0.3 - 03 March 2017

**Lay out on Chart Table or other Surface**

- |           |   |                                     |
|-----------|---|-------------------------------------|
| 3.04.1    | Proof that boat meets ISO 12217-2 category B                    | <input checked="" type="checkbox"/> |
| 4.11.1    | Charts (not solely electronic ), light list, plotting equipment | <input checked="" type="checkbox"/> |
| 4.20.5 b) | Servicing certificate for each liferaft                         | <input checked="" type="checkbox"/> |

**Lay out on Bunk(s)**

- |  |   |
|--|---|
|  | - |
|  | ✓ |
|  | ✓ |
|  | ✓ |
|  | ✓ |
|  | ✓ |
|  | ✓ |

### ZONING BOARD

✓
✓
—
✓
✓
✓
✓
✓

- |   |
|---|
| ✓ |
| ✓ |
| — |
| ✓ |
| ✓ |
| ✓ |
| ✓ |
| ✓ |

### Below Deck Inspection

- [illegible]

3.22.1	Handholds below deck	<input checked="" type="checkbox"/>
3.27.4	Spare bulbs for navigation lights (not required for LED)	<input checked="" type="checkbox"/>
3.28.4 a)	Separate starting battery or hand-starting device	<input checked="" type="checkbox"/>
3.28.4 b)	All batteries are of sealed type	<input checked="" type="checkbox"/>
3.29.02	25W DSC enabled VHF with masthead antenna & programmed MMSI	<input checked="" type="checkbox"/>
4.03.1	Tapered soft wood plug at each through-hull fitting	<input checked="" type="checkbox"/>
4.05.1	A fire blanket adjacent to every cooking device with an open flame	<input checked="" type="checkbox"/>
4.05.2	2 fire extinguishers, 2kg each, accessible, in different parts of the boat	<input checked="" type="checkbox"/>
4.12.1	Safety equipment location chart	<input checked="" type="checkbox"/>
<b>At Helm, Ready for Rapid Deployment</b>		
4.22.3	Lifebuoy with self-igniting light and drogue	<input checked="" type="checkbox"/>
4.22.7	Heaving line min.6mm, 15-25m	<input checked="" type="checkbox"/>
4.22.8	Recovery sling	<input checked="" type="checkbox"/>
<b>On Deck, Where Stowed or Ready for Deployment.</b>		
3.08.4 h) ii	Hatch blocking devices attached and can be secured in place	<input checked="" type="checkbox"/>
4.07 a)	Watertight, high powered searchlight with spare batteries and bulbs	<input checked="" type="checkbox"/>
4.07 b)	Watertight flashlight with spare batteries and bulbs	<input checked="" type="checkbox"/>
4.20.1 a)	Liferaft(s) capable of carrying the whole crew	<input checked="" type="checkbox"/>
4.20.2 a)	Liferaft SOLAS A Pack	<input checked="" type="checkbox"/>
4.20.3 a)	Liferaft(s) stowed in rigid container, or <u>valise</u> in dedicated locker	<input checked="" type="checkbox"/>
4.25.1	A strong, sharp knife, sheathed and securely restrained	<input checked="" type="checkbox"/>

3.22.1	Handholds below deck	<input checked="" type="checkbox"/>
3.27.4	Spare bulbs for navigation lights (not required for LED)	<input checked="" type="checkbox"/>
3.28.4 a)	Separate starting battery or hand-starting device	<input checked="" type="checkbox"/>
3.28.4 b)	All batteries are of sealed type	<input checked="" type="checkbox"/>
3.29.02	25W DSC enabled VHF with masthead antenna & programmed MMSI	<input checked="" type="checkbox"/>
4.03.1	Tapered soft wood plug at each through-hull fitting	<input checked="" type="checkbox"/>
4.05.1	A fire blanket adjacent to every cooking device with an open flame	<input checked="" type="checkbox"/>
4.05.2	2 fire extinguishers, 2kg each, accessible, in different parts of the boat	<input checked="" type="checkbox"/>
4.12.1	Safety equipment location chart	<input checked="" type="checkbox"/>
<b>At Helm, Ready for Rapid Deployment</b>		
4.22.3	Lifebuoy with self-igniting light and drogue	<input checked="" type="checkbox"/>
4.22.7	Heaving line min.6mm, 15-25m	<input checked="" type="checkbox"/>
4.22.8	Recovery sling	<input checked="" type="checkbox"/>
<b>On Deck, Where Stowed or Ready for Deployment.</b>		
3.08.4 h) ii	Hatch blocking devices attached and can be secured in place	<input checked="" type="checkbox"/>
4.07 a)	Watertight, high powered searchlight with spare batteries and bulbs	<input checked="" type="checkbox"/>
4.07 b)	Watertight flashlight with spare batteries and bulbs	<input checked="" type="checkbox"/>
4.20.1 a)	Liferaft(s) capable of carrying the whole crew	<input checked="" type="checkbox"/>
4.20.2 a)	Liferaft SOLAS A Pack	<input checked="" type="checkbox"/>
4.20.3 a)	Liferaft(s) stowed in rigid container, or <u>valise</u> in dedicated locker	<input checked="" type="checkbox"/>
4.25.1	A strong, sharp knife, sheathed and securely restrained	<input checked="" type="checkbox"/>

- 3.24 Magnetic compass, unpowered, with deviation chart, and
- 3.24 a) 2nd magnetic compass, may be hand-held and/or electronic
- 3.25 No less than 2 halyards per mast, each capable of hoisting a sail
- 3.28.1 b) Propulsion engine provides minimum OSR speed
- 3.28.3 b) Sufficient fuel to charge batteries and motor as OSR speed for 8 hours
- 3.29.08 GPS
- 4.01.1 Sail letters and numbers meeting RRS 77
- 4.13.1 Knotmeter or log
- 4.17.1 Boat's name on buoyant equipment
- 4.18 Marine grade retro-reflective material on buoyant equipment

✓
✓
✓
✓
✓
✓
✓
✓
✓
✓