



**Interim Report of the investigation of  
the accident resulting in one fatality  
during maintenance operations on board the commercial yacht**

**ONE MORE TOY**

**in Saint Barthelemy  
on 14 January 2020.**



ONE MORE TOY

**Important Notes:**

***The information contained in this interim report is based on investigations to date.  
Readers are cautioned that there is the possibility new evidence may become  
available that might alter the circumstances as depicted in this interim report.***

***The analysis of events, conclusions reached and any recommendations made will be included  
in the final report which will be published after consultation with interested parties on the  
conclusion of the investigation.***

**The sole objective of the investigation of any accident conducted under the Cayman Islands  
Merchant Shipping Law (2016 Revision) and the Merchant Shipping (Marine Casualty Reporting  
and Investigation) Regulations, 2018 is the prevention of future accidents through the  
ascertainment of its causes and circumstances.**

**It is not the purpose of an investigation to determine liability nor to apportion blame.**

**Extract from the Merchant Shipping (Marine Casualty Reporting and Investigation) Regulations, 2018**

22. (1) If any part of a publication produced by the CEO as a result of a marine safety investigation, or any analysis or conclusion reached in the publication is based on information obtained through use of an inspector's powers under section 422 of the Law, that part, analysis or conclusion is inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame.

Admissibility in judicial proceedings of information obtained using inspector's powers

(2) For the purposes of these Regulations, an inspector who is required to attend judicial proceedings shall not, at those proceedings, provide -

- (a) information that was obtained through use of the inspector's powers under sections 422 of the Law; or
- (b) opinion evidence or analysis based on such information,

and any evidence provided in breach of this paragraph is inadmissible in the proceedings.

(3) In this regulation "judicial proceedings" include any civil or criminal proceedings before any court of competent jurisdiction or person having by law the power to hear, receive and examine evidence on oath.

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## Narrative Section

(all times local, UTC -4 )

### The Yacht

ONE MORE TOY is a large motor yacht with a glass reinforced plastic (GRP) hull. The yacht was built by Christensen Shipyards Ltd in Vancouver, Washington in the United States. Construction began in 1996 and the yacht was delivered in 2001.

At the time of the accident, the yacht was registered in the Cayman Islands as a commercial vessel and fully certified under the Red Ensign Group Large Yacht Code<sup>1</sup>. The yacht was classed by the American Bureau of Shipping.

### The Yacht's Electrical Generation and Earthing System

ONE MORE TOY generates three phase electricity at 480V 60Hz. This allows electricity to be distributed at either three phase 480V (between phases) or single phase 277V AC (phase to neutral). Other voltages are supplied on board the yacht via step down transformers. The yacht utilises “combined earth / neutral” distribution where the neutral from the generators is connected to the earth busbar in the switchboard. From the switchboard, this earth / neutral is connected to an earth (or ground) plate fixed to the exterior of the hull.



Fig 1: Hull Earth / Ground Plate (Courtesy of American Bureau of Shipping)

As the hull of the yacht is constructed from non-electrically conductive GRP, the exposed conductive parts of equipment are physically bonded to the switchboard earth. There is no direct path for any fault current to return to the earth / neutral in the switchboard or the hull earth plate via the yacht's hull.

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<sup>1</sup> As notified to IMO as an equivalent to the Safety of Life at Sea and Load Line Conventions for large yachts.

## Narrative Account

### Prior to the accident

One More Toy was described by the master as a “busy charter boat” in the period leading up to the accident. The yacht had a crew of nine comprising of a master, chief officer, engineer, bosun, deckhand, chef, chief stewardess, and two stewardesses.

Towards the end of November 2019, the yacht’s regular engineer left to go on vacation and a relief engineer (the Engineer) was hired to serve on board the yacht while the regular engineer was absent. At this time the yacht was undergoing a period of maintenance at the Seahaven Superyacht Marina in Ft Lauderdale, South Florida. The Engineer was expected to serve on board the yacht for approximately 2 months.

On leaving Ft Lauderdale, the yacht proceeded to the Caribbean where a number of cruises were undertaken with guests on board. During his time on the yacht, the Engineer was described as conscientious, competent and hardworking by all on board. In addition to the routine engineering tasks required to keep the yacht operating, the Engineer also spent time in attending to various maintenance and repair tasks that were scheduled for the yacht’s next shipyard repair period. The Engineer was also engaged in expanding the use of the yacht’s Planned Maintenance System (PMS) to manage more of the maintenance and repairs tasks required on board.

During his time on board ONE MORE TOY, the Engineer had been periodically working on a generator load bank that had been out of service for an extended period of time.

On the morning of the accident the yacht was alongside in Gustavia, St Barths with a party of seven guests on board. The party of guests comprised of the owner, family members and friends of the owner. No guest activities had been planned for that morning and the master described such “owner’s trips” as generally slow and routine when compared to when a party of charter guests was onboard.

### The accident

On the day of the accident, the work day on ONE MORE TOY started when the bosun came on duty at 06:30 to “open the boat” for a normal day’s activities with guests embarked. The bosun met the Engineer in the crew mess and after a coffee together they both went about their work day. The bosun was working on deck and the Engineer in the engine room. The Engineer was working on the load bank that had recently been returned to service three days previously. The load bank was located below the floor plates of the engine room close to the division with the Engine Control Room (ECR)

At around 10:30 the Engineer called the bosun on the radio and asked for the bosun to assist him in the engine room. This was common when the Engineer needed an “extra pair of hands” with the task he was working on. The bosun joined the Engineer in the engine room and assisted him in the routing of a new flexible sea water hose connected to the generator load bank. After assisting the Engineer with the routing of the flexible hose the bosun returned to his other duties on deck.

At approximately 11:45, the bosun noticed that the yacht’s underwater lights had been left on from the previous evening. The switch for these lights was located in the yacht’s ECR and the bosun went there to switch off the lights. On entering the ECR from deck, the bosun noticed the Engineer was

lying on the floor plates apparently still working on the load bank located below the floor plates. The Engineer was lying across the door sill between the engine room and the ECR with his legs and lower body in the ECR.



Fig 2: ECR Entrance from deck



Fig 3: View from ECR entrance

When the bosun called to the Engineer he received no acknowledgement. The bosun then approached the Engineer and found the Engineer to be unresponsive. The Engineer was described as “extremely pale” with visible injuries to his head which the bosun attributed to the Engineer’s head making contact with the load bank or the surrounding structure. When the Engineer remained unresponsive to verbal and physical stimuli the bosun raised the alarm on board the yacht.

While the bosun was checking the unconscious Engineer for life signs, help arrived from other crew members. While the master and two crew members administered first aid to the Engineer, a third crew member raised the alarm ashore at the “Harbour Office” located about 20-30m from the yacht.

Those attending the Engineer could not discern a pulse and the Engineer was not breathing. A stretcher, neck brace and Automatic External Defibrillator (AED) were brought to the ECR. With the Engineer in the neck brace, he was placed on the stretcher and CPR was started. The AED was attached and indicated “No Shock”. Suspecting that the Engineer may have received an electric shock, the master also disconnected the yacht’s running generator from the switchboard thereby cutting electrical power from the yacht’s switchboard.

An ambulance quickly arrived at the yacht and the paramedics then took over the efforts to resuscitate the Engineer. An AED from the ambulance was attached and this also indicated “No Shock”. CPR was continued for a further 20 minutes. Despite the best efforts of the crew and the paramedics the Engineer was declared dead at 12:40.

### The Engineer

The Engineer was a 50yr old UK national. He held a UK Certificate of Competency to serve as the chief engineer on board yachts and similar vessels of less than 3,000GT and with an engine power of less than 9,000kW. ONE MORE TOY is 462GT and has a propulsive power of 2,686kW, and so the Engineer was qualified to serve as chief engineer on board the yacht.

Since 2006, the Engineer served on over 20 yachts as both the “full time engineer” and was also employed on various short term contracts (typically for delivery voyages or to cover the holiday periods of a yacht’s regular engineer). The Engineer was employed on ONE MORE TOY under a fixed term Seafarers Employment Agreement running from 22 November 2019 until 01 February 2020. Upon leaving this yacht the Engineer had arranged his next employment to start in mid-February 2020 as the engineer on a delivery voyage from Uruguay to Palma.

As noted previously, the Engineer was described as conscientious, competent and hardworking by all on board. He was in good general health having undergone his previous seafarer medical examination on 08 November 2019, prior to joining the yacht. During this examination he was determined to fit for work without limitations or restrictions on his fitness.

On 03 June 2020 an inquest touching the death of the Engineer concluded with the coroner recording a verdict of “Accidental Death” and stating the medical cause of death as “Electrocution”.

### The Load Bank

A load bank is a device to introduce an additional electrical load on a generator to prevent problems associated with running diesel engines at extremely low load. The load bank on the yacht operated by heating seawater with three industrial immersion heater elements inside a steel casing through which seawater is circulated (As shown below).

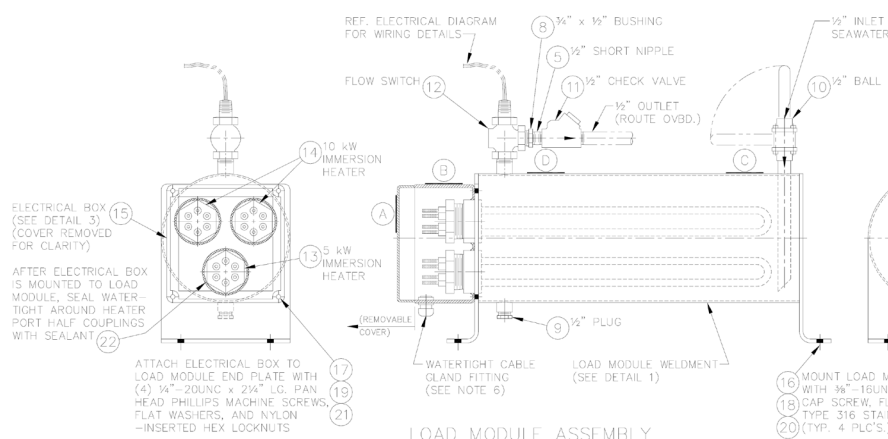


Fig 4: Generator Load Bank

The three immersion heater elements operated on 3 phase 480 V and were switched by a control unit at the main switchboard (which energised individual contactors located near to the load bank for each element). This permits a number of different load combinations to be selected depending on the power demand on the generators. Actual loads available are determined by the programming of the load bank control unit.

The yacht’s maintenance records show a history of problems with the load bank dating back to 2006. Included in the records are an invoice for extensive work on the unit carried out in January 2016 and a second invoice for “investigative work” in April 2019. The load bank was reported as out of service when the Engineer joined the yacht and the regular engineer did not use the load bank, preferring instead to manage the load on the generators manually.

During his time on board, the Engineer made five entries in the PMS relating to the load bank. The first of these entries was dated 15 December 2019 and the final entry was dated 11 January 2020. The 15 December entry that noted water ingress in the load bank electrical junction box had occurred in the past and that the Engineer was expecting to encounter problems with the heating elements.

On 11 January 2020, the Engineer recorded in the PMS that load bank was operational after replacing a number of fittings to increase water flow through the unit. According to the PMS record<sup>2</sup>, it was the intention of the Engineer to continue to monitor the performance of the load bank. This entry was made three days prior to the accident.

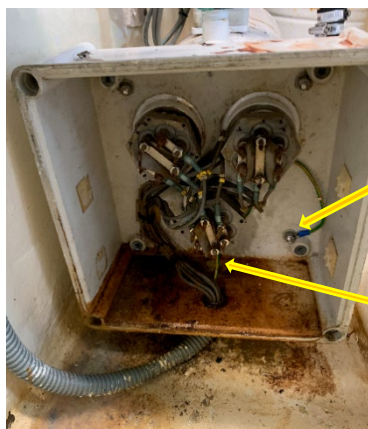


Fig 5: Generator load bank electrical junction box showing signs of previous water ingress. Also shown is the earth connection (green / yellow wire) between the load bank casing and the yachts earth bus bar.

Earth connection to load bank casing

To earth busbar.

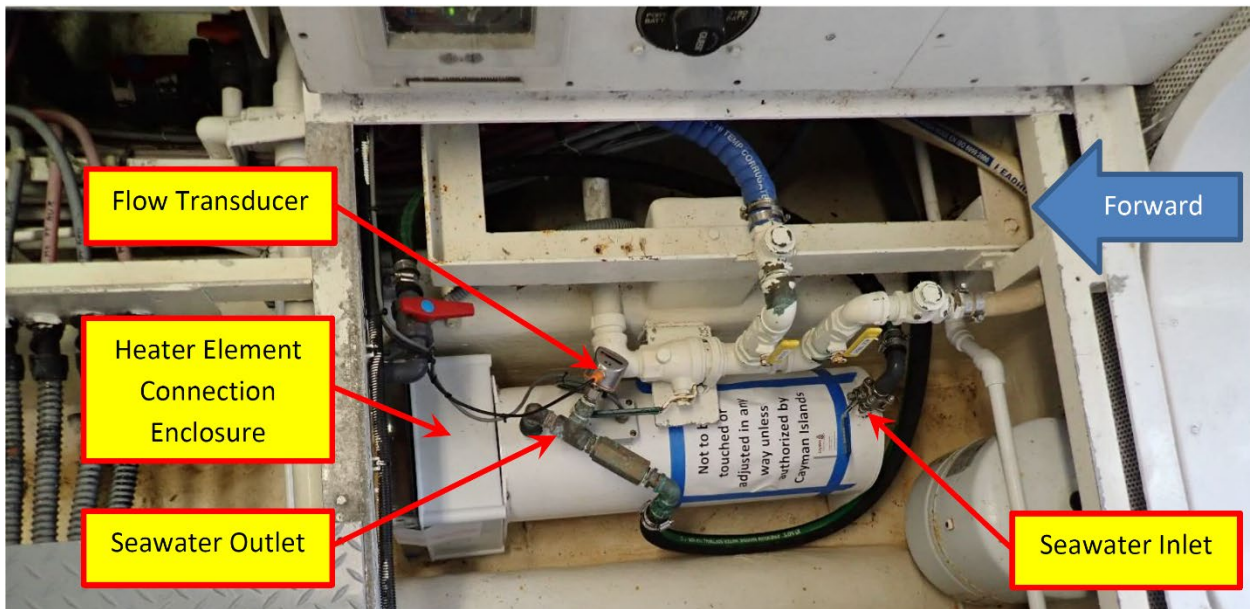


Fig 6: Generator Load Bank in situ (from 01 April 2020 electrical tests)

<sup>2</sup> In his 11 January 2020 entry in the PMS relating to the load bank the Engineer noted “It seems to be working well at this, with both the 65 and 99kW gens. I have had flow trips previously on a 99kW but will monitor now and see”.



## The Investigation

An investigator from the Maritime Authority of the Cayman Islands (MACI) attended on board ONE MORE TOY from 20 to 22 January 2020 while the yacht was berthed in Isle de Sol Marina in Simpson Bay, St Maarten. During this visit a team of electrical engineers from a Florida based contractor previously used by the yacht also attended on board to conduct electrical safety tests on the load bank and associated equipment.

On 01 April 2020, an independent electrical contractor commissioned by the owner of ONE MORE TOY attended on board to conduct further testing of the load bank and electrical systems while the yacht was in Florida. MACI could not attend for this testing due to travel restrictions imposed due to the COVID-19 pandemic. However, the owner consulted with MACI on the protocol for these tests and made the report of this testing available to MACI on completion.

MACI again attended on board ONE MORE TOY in November 2020 during the annual survey by the yacht's Classification Society (American Bureau of Shipping) after the yacht had completed scheduled maintenance in a Florida shipyard. During this visit, a number of findings from the previous testing were confirmed by the American Bureau of Shipping.

## Electrical Test Findings

The following findings are taken from the electrical testing conducted during January 2020 (Jan 20) and April 2020 (Apr 20)

- Prior to energising the load bank elements post accident, the measured resistance between the load bank earth connection and a "true earth"<sup>3</sup> was measured at 105,000 Ohm. (Jan 20)
- When energising one of the load bank elements an electrical arc was observed between the load bank earth connection termination and the casing of the load bank. (Jan 20)
- Smoke marks were observed at the termination of the load bank earthing connection at the load bank casing following the above test. (Jan 20)(Apr 20)
- After the observed arcing and subsequent smoke marking at the load bank earthing connection (and after the electrical isolation of the load bank) the resistance between the load bank earth connection and a "true earth" was measured at 0.2 Ohm. (Jan 20)
- Continuity testing between the load bank earthing connection and the load bank casing recorded a resistance in excess of 100,000 Ohm. (Apr 20)
- 500-volt DC<sup>4</sup> insulation resistance tests with an Extech Instruments Digital Megohmmeter showed electrical insulation failures between all of the three heater elements and the load bank canister. (Apr 20)

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<sup>3</sup> A "true earth" is considered as a minimal electrical resistance path between the "assumed earth" and the earth busbar in the switchboard, and then onward to both the neutral tap of the generator(s) supplying electrical power to the switchboard and to the earth plate mounted external to the hull.

<sup>4</sup> Although the yacht generated power at 480 V, this is a "rms" value, the actual "peak" voltage generated was 679 V or 179 V above the DC test voltage.

### Initial Investigation Findings

**These findings should be considered as provisional and are subject to change should new evidence become available.**

The initial findings of the investigation are consistent with HM Coroner's determination of the medical cause of death.

It is probable that the accident occurred when the Engineer was monitoring the performance of the load bank following its recent return to service.

The mechanical connection between the load bank casing and its earth connection was not effective in providing electrical continuity to a "true earth".

It is probable that the Engineer died as a result of an electrical fault in the load bank such that there was an electrical path between the heating elements of the load bank and its casing.

It is also probable that the lack of effective earth bonding for the load bank casing resulted in the Engineer suffering electrocution by providing a current path between the heating elements and a "true earth" through his body. This path would have been completed via an earthed component<sup>5</sup> in the vicinity of the load bank.

### The Way Ahead for the Investigation

The final part of the investigation will focus on existing electrical safety requirements for yachts, with an emphasis on GRP hulled yachts with nonconductive hulls. The investigation will also look at what changes to these requirements, if any, would prevent a similar accident occurring in the future.

**MACI March 2021**

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<sup>5</sup> Such earthed components would include the metal engine room floor plates, the structure supporting these floor plates and other electrically grounded equipment and fittings in the vicinity of the load bank.

## Incident Particulars

### Vessel details:

Vessel Name	:	ONE MORE TOY
IMO Number	:	8986808
Port of Registry	:	George Town
Flag	:	Cayman Islands
Type	:	Commercial Vessel
Classification Society	:	American Bureau of Shipping (ABS)
Year of Build	:	1996
Year of Delivery	:	2001
Length	:	43.37m
Gross Tonnage	:	462
Engine Power	:	2686 kW

### Accident Details

Time and Date	:	14 January 2020 (11:45 Local time)
Location	:	Gustavia, Saint Barthelemy
Fatalities	:	One
Other injuries	:	None
Damage	:	None