

030 – December 2010

***Carnival Splendor* perplexes engine room safety experts**

General

Cruise ships in general and the super sized new generation of cruise ships in particular are fantastic floating cities, floating hotels, floating restaurants, floating casinos, floating spas, floating amusement parks, floating power stations, floating shopping malls, but they suffer from poor seagoing qualities in rough seas, because of their limited draft and the enormous surface exposed to lateral winds. What is most worrisome they have very limited capabilities to return safely to port in the case of an engine room fire! The *Carnival Splendor* near-miss blaze had the potential of a big disaster as nearly 4500 passengers and crew have barely missed a catastrophe. This incident might affect cruising in the future and will most certainly put an end to mega cruise ships!

What has happened on Monday, 8 November 2010 aboard the *Carnival Splendor*?

The *Carnival Splendor*, one of the largest vessels in the Carnival fleet, had experienced the most serious event that can happen on a cruise ship – a main space fire on the second day of a voyage from Long Beach to the Mexican Riviera at approximately 6 a.m. Pacific Time cutting all electric power. Luckily enough this incident happened relatively close to several ports – 160 miles southwest of San Diego and 44 miles off the coast of Mexico – making rescue easy and did not result in major injuries or illnesses. It finally turned out to be only an “extremely trying situation” for the crew and the passengers, as Gerry Cahill, Carnival Chief Executive put it.



The fire was extinguished after three hours by the crew and the automatic fire suppression system, leaving the vessel adrift in relative tranquil waters. As the crew was unable to restore power to the engines, the ship had to be towed to San Diego assisted by ships of the Coast Guard and Navy.

Something that was supposed to work, did not work!

All information on the progress of the investigation will be released by the Panama Maritime Authority (Autoridad Maritima de Panama).

Propulsion System

The diesel-electric propulsion system of the *Carnival Splendor* consists of two banks (three in the forward and three in the aft engine room) of Wärtsilä 12V46C four stroke diesel engines each rated at 12.600 kW driving (2) converter type motors (2 x 42 MW) from Converteam (ex Alstom), France.

First findings revealed that diesel engine number five in the aft engine room suffered a split of the crank case and caught fire damaging the engine control room and the electric cabelling. This had a devastating effect as it took the crew far too long a time to extinguish the fire. Nearly everything requiring electricity was inoperable after the fire. There was no electric power to the propeller shafts, no air conditioning, no hot water, no lighting, no refrigeration, no cooking, no drinking water treatment, not even the toilets were functioning. Most of the ship's communication was dead. Ship's operators started backup generators to provide limited emergency power supply.

When ships like the *Carnival Splendor* are being built, the engines are deployed in the hull very early and the rest of the ship is assembled around them. So if number 5 engine has to be replaced, this will be a tough job!

Redundancy

The *Carnival Splendor* was designed and built to standards that should have prevented a total loss of power from a single engine catching fire. The ship was built by a "reputable builder" in Italy – Fincantieri – , and its design was approved by Lloyd's Register and the US Coast Guard. It has been regularly inspected by the Coast Guard since its first cruise in July 2008. Experts are asking the question: What about the redundant safety systems which have existed in cruise ships for fifty years?

Shipbuilder and owner had claimed during the inaugural ceremony and in press releases that the *Carnival Splendor* has a very high level of plant redundancy ; at least 50 per cent of the nominal capacities remain available after a single failure. So something very strange must have caused the total black out. We obviously have complex redundant systems that aren't redundant and an engine management and monitoring system that can't cope with this type of multiple failure.

Safe Return to Port

The motto of the CIMAC WG 18 ERS Engine Room Safety (Fire)

"to avoid stop of the propulsion system under all circumstances in the case of engine room fire"

drafted in the 2nd meeting of the working group on the 5th of September 2007 in Vienna, perfectly fits into the IMO perspectives on future regulations for safer shipping.

The Maritime Safety Committee completed in its 82nd session among others a revised standard on passenger ships – IMO MSC 216 – which was expected to enter into force on 1 July 2010. The work of the MSC in developing new and amended regulations has based its guiding philosophy on

the dual premise that the regulatory framework should place more emphasis on the prevention of a casualty from occurring in the first place and that future (passenger) ships should be designed for improved survivability so that, in the event of a casualty, persons can stay safely on board as the ship proceeds to port or weathers the storm.

The amendments include new concepts such as the criteria for the casualty threshold (the amount of damage a ship is able to withstand, according to the design basis, and still safely return to port. The amendments also provide regulatory flexibility so that ship designers can meet any safety challenges the future might bring.

The amendments include:

- alternative designs and arrangements
- safe areas and the essential systems to be maintained while a ship proceeds to port after a casualty, which will require redundancy of propulsion and other essential systems
- on-board safety centres, from where safety systems can be controlled, operated and monitored
- fixed fire detection and alarm systems, including requirements for fire detectors and manually operated call points to be capable of being remotely and individually identified
- fire prevention, including amendments aimed at enhancing the fire safety of certain areas, the means of escape in case of fire and ventilation systems
- time for orderly evacuation and abandonment, including requirements for the essential systems that must remain operational in case any one main vertical zone is unserviceable due to fire

The requirements of the new regulation “safe return to port”, and paragraph 4 in particular, refers to the following systems, which shall remain operational in the remaining part of the ship not

affected by fire

- propulsion
- steering systems and steering-control systems
- navigational systems
- systems for fill, transfer and service of fuel oil
- internal communication
- external communication
- fire main system
- fixed fire extinguishing systems fire and smoke detection systems
- bilge and ballast system
- power operated watertight doors
- systems intended to support “safe areas”
- flooding detection systems
- other systems determined to be vital to damage control efforts

The implications of new construction technologies, enforced structure, fire protection, detection and extinction, subdivisions, stability precautions, enhanced machinery redundancy and multiple electrical installations on owners, shipbuilders and equipment manufacturers will be significant and will – no doubt – result in additional costs.

Admittedly – passenger ships are extremely sensitive to fires on board and the number of accidents and casualties caused by fire are the highest in the shipping industry. For the time being the safety concern is directed to the most precious cargo – passengers, but LNG carriers, ULCCs, chemical tankers, ships carrying dangerous chemicals in bulk, and even container ships will be considered in the future as a huge potential for secondary environmental threats to human beings. As a consequence similar standards will be released by IMO – for sure.

A similar scenario can be expected for naval vessels.

Inspection and Repair

The *Carnival Splendor* will be undergoing inspections and limited repairs (if at all possible) until mid January 2011. A first cost estimate is in the range of USD 56 million, but Carnival will come up soon with a more precise calculation considering the fact that dock facilities on the West Coast for a ship of this size are scarce. Mechanical damages caused by the fire and an explosion as well as necessary repairs will have to be assessed, not to mention to cope with the extinguishing water and the odour of smoke. The *Carnival Splendor* is too wide to fit through the Panama Canal, and a trip of the disabled ship around Cape Horn is not an option. But the broken No. 5 engine must be taken out of the hull and replaced by a new one. To do this, huge sections of the ship will have to be removed. It might quite well be that restoration costs for the trapped *Carnival Splendor* turn out to be so costly that the owners will decide to scrap the ship.

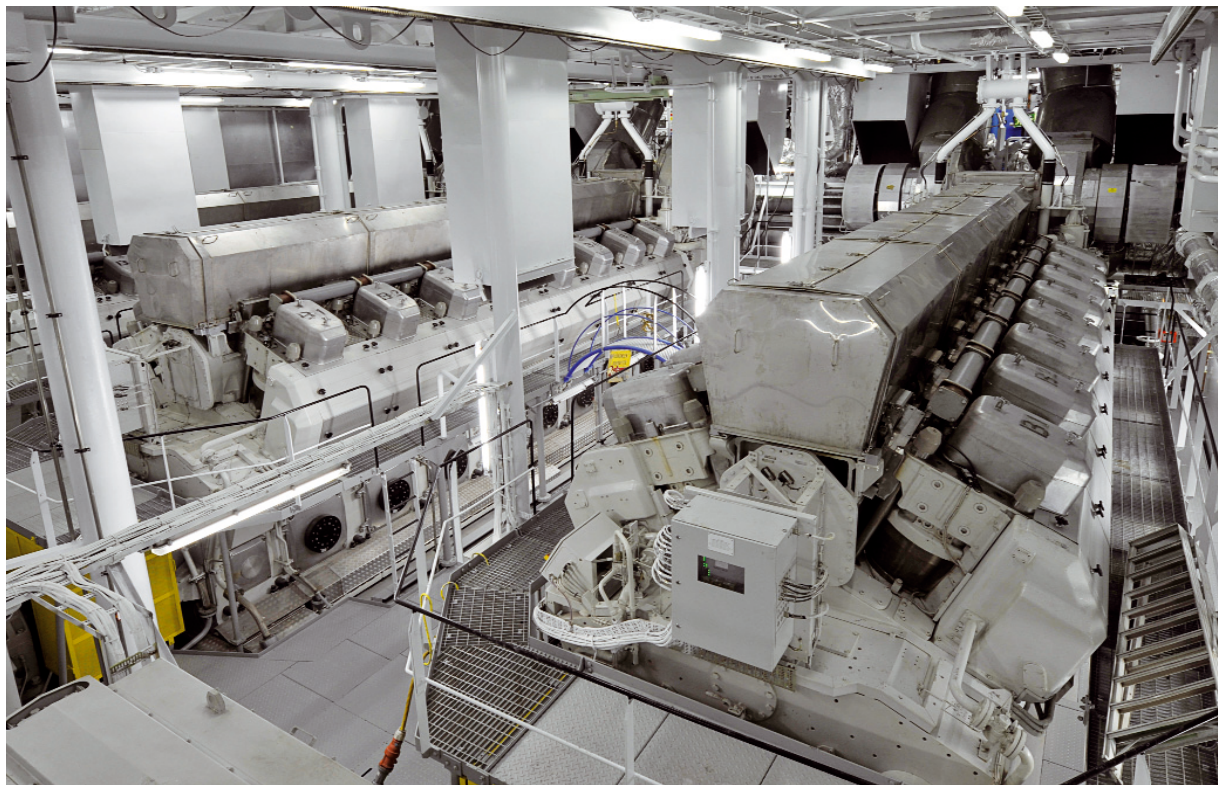
Lesson learned

The *Carnival Splendor* has – in any case – offered a lesson on the huge vulnerability of mega cruise ships sailing the seven seas. If this accident was hundred of miles out in the Pacific, and you had a fire that wasn't suppressed immediately, and if you had rough weather, you'd have a complete disaster!

On a cruise ship up to three quarters of the population are passengers. They become problems and liabilities in a major fire, as they have to be shepherded to safe areas. In comparison, on a navy ship every person has a fire-fighting role.

The *Carnival* cruise ship mishap shows the unpredictability of sea travel. It has given a proof how quickly things can go wrong on a giant floating city carrying thousands of people. If the *Carnival Splendor* had been crossing the North Atlantic in the winter – instead of about 40 miles off the coast

Wärtsilä engines like those in *Carnival Splendor*



of Mexico in calm waters – things could have been far worse. This fire has changed cruise shipping. It has been perplexing marine experts as it is absolutely unusual that two individual engine rooms are shut down by an accident and every backup electrical system on board is taken out. That raises a lot of concerns.

Accident and casualty investigation

Several maritime authorities and safety boards will be involved in the investigation of the *Carnival Splendor*:

- Panama Maritime Authority (PMA)
Marine Casualty Investigation Department
www.segumar.com
- United States Coast Guard (USCG)
www.uscg.mil
- National Transportation Safety Board (NTSB)
Marine Division
www.nts.gov

As the *Carnival Splendor* was flying the Flag of Panama, the Panama Maritime Authority will preside the investigation, assisted by the United States Coast Guard and the National Transportation Safety Board who were asking for the permission to join PMA, because of the majority of the passengers aboard the ship were U.S. citizens and Panama consented. The US Coast Guard in turn had requested the National Transportation Safety Board to provide them with technical assistance and the NTSB Marine Division responded by providing two experts to assist the Coast Guard in their involvement in Panama's investigation. Other organizations and companies aiding the investigation will be – Carnival's own engineers and technicians, the Classification Society Lloyd's Register headquartered in the UK, the Italian shipbuilder Fincantieri, the diesel engine manufacturer Wärtsilä from Finland and other suppliers of engine room equipment.