

MARINE INVESTIGATION REPORT

M01L0080

GROUNDING

CONTAINER SHIP *CAST PRIVILEGE*
CANADA MARITIME SERVICES LTD.
OFF ÎLE SAINT-OURS IN THE ST. LAWRENCE RIVER
29 JULY 2001

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Marine Investigation Report

Grounding

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Summary

The *Cast Privilege*, under conduct of a pilot and in fair weather, was transiting the St. Lawrence River bound for the Cast Terminal in Montréal, Quebec. At 23:41, during a course alteration to starboard near Île Saint-Ours, the vessel experienced a blackout. As a result, the vessel swung to starboard and grounded outside the channel. Electrical power was restored within ten minutes and the vessel refloated shortly thereafter without tug assistance. There was no injury or pollution as a result of this occurrence.

Ce rapport est également disponible en français.

Other Factual Information

	<i>Cast Privilege - ex : Canmar Bravery</i>
Official Number	731238
Port of Registry	Hamilton, Bermuda
Flag	Bermuda
Type	Container Ship
Gross Tons	26 383
Length ¹	218.60 m
Draught	Forward: 10.00 m Aft: 10.10 m
Built	1978 - Bremer Vulkan Ag - Schiffbau-u. Maschinenfabrik, Bremen, Germany
Propulsion	MAN K9SZ90/160B, 24 310 kW, slow speed diesel engine driving a single fixed pitch propeller
Crew	23
Registered Owner(s)	Canada Maritime Services Limited (Canmar) Surrey, United Kingdom
Managing Agents (Company)	Split Ship Management Split, Croatia

Description of the Vessel

The *Cast Privilege* is a conventional container ship with five cargo holds located forward of the bridge and crew accommodations and two cargo holds aft. The vessel has double sides and is fitted with a bulbous bow and bow thruster. It is built to Lloyd's Register (LR) Ice Class 2 standards. The *Cast Privilege* is one of a fleet of container ships owned by Canmar and managed by Split Ship Management that maintains scheduled service between European ports and the Port of Montréal.

Three ship's service generators (SSG) generate a total of 3100 kW. The Nos. 1 and 2 SSG have a capacity of 900 kW, whereas the No. 3 has an output of 1300 kW. In addition to the vessel's domestic and machinery electrical requirements, the *Cast Privilege* has a capacity to carry 49 reefer containers which, on average, consume 10 kW each.

The vessel is equipped with an emergency generator. However, neither steering gear power units are connected

¹ Units of measurement in this report conform to International Maritime Organization (IMO) standards or, where there is no such standard, are expressed in the International System (SI) of units.

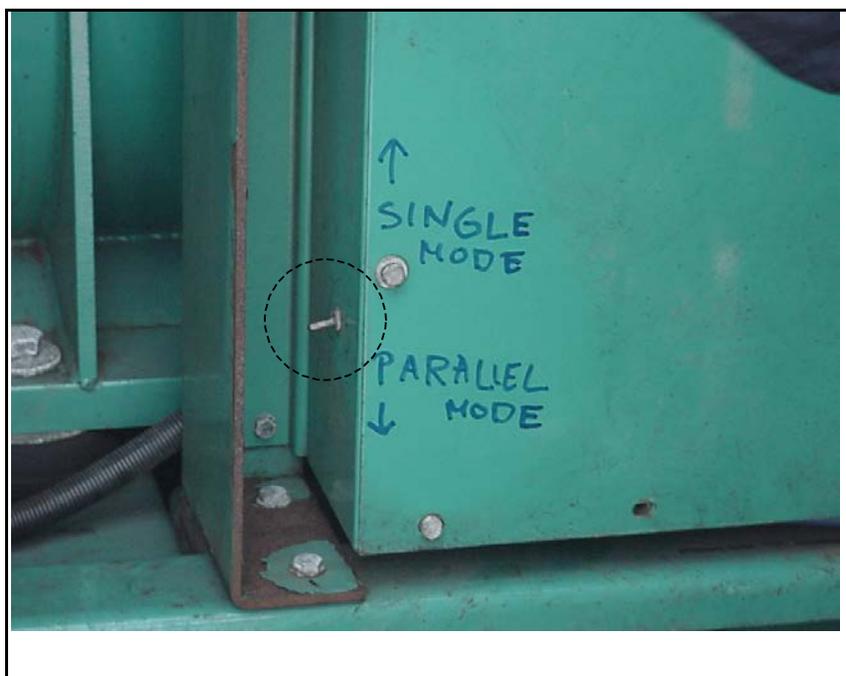
to it, as the vessel was built pursuant to the International Convention, Safety of Life at Sea (SOLAS) 74. Hence, their supply systems are separate from the emergency power system.

Machinery History

On 26 March 2001, the company was informed that No. 2 SSG was out of service. It is reported that a counterweight had become detached from the crankshaft and severely damaged cylinder units Nos. A2 and B2, and the engine casing. In order to maintain an adequate supply of electrical power, the company decided to install a temporary portable generator.

The temporary generator was a containerized Onan, model DFHD 60, manufactured by Cummins Power Generation.

It comprised a Cummins diesel engine driving an Onan single bearing alternator. The self-contained unit is equipped with a fully-integrated Power Command Control (PCC) microprocessor-based system, used for monitoring, metering, governing, and voltage regulation. The PCC manages a parallelling function, however by use of a bypass switch on the generator, it is possible to override the PCC system and operate the genset as a stand alone unit (see Figure 1).



The installation of the genset took place at the Royal Seaforth Container Dock in Liverpool (U.K.) on 05 April 2001 by a service engineer from the generator supplier in collaboration with the ship's engineers. The containerised genset was secured aft on a cargo hatch cover in way of bay 45. Power cables were run from the containerised genset circuit breaker to the No. 2 SSG circuit breaker, located on the main switchboard. Due to physical limitations of the size of the installed supply cables, the load was initially restricted to 400 kW.

As per arrangement with the company, a LR surveyor attended the vessel. Upon arrival, the surveyor was advised that No. 2 SSG was out of service, that a temporary replacement genset had been installed, but that all connections had not been fully completed. The surveyor was informed by the ship's staff that the remaining SSGs (Nos. 1 and 3) were capable of providing sufficient power to supply the vessel's electrical services, and that the temporary genset would not be paralleled with the other SSGs. Based on this information, Lloyd's accepted the genset after testing it in a stand-alone operation mode. Accordingly, a Condition of Class, expiring in August 2001 was imposed with a notation which read:

. . . temporary standby auxiliary engine now fitted on aft deck, in way of cargo hatch

cover at bay 45. Temporary engine power supply connected to vessel's switchboard. Engine trial carried out accordingly and found satisfactory.

After the survey, the vessel departed in the evening and the genset supplier's service engineer remained on board to conduct extra work during the voyage to Antwerp.

On the vessel's subsequent return to Liverpool on 26 April 2001, additional load and control cables were installed by a shore-based service engineer. This allowed the temporary genset to run at its maximum capacity of 900 kW. As the genset was still not capable of automatically sharing electrical load when running in parallel with the other SSGs, a potentiometer was installed on the main switchboard (see Figure 2), which allowed the crew to balance the load by controlling the genset's governor manually. Parallel tests up to 700 kW were conducted. A written procedure, detailing both stand-alone and parallel operations², was posted at the main switchboard. LR was not requested to attend the vessel at this time and was not made aware of the changes in the installation of the temporary genset. LR was still under the understanding that it would be used only in the stand-alone mode. Characteristics of the electronic PCC, however, were such that the temporary genset was unable to automatically share and balance the load when working in parallel with the other SSGs.



History of the Voyage

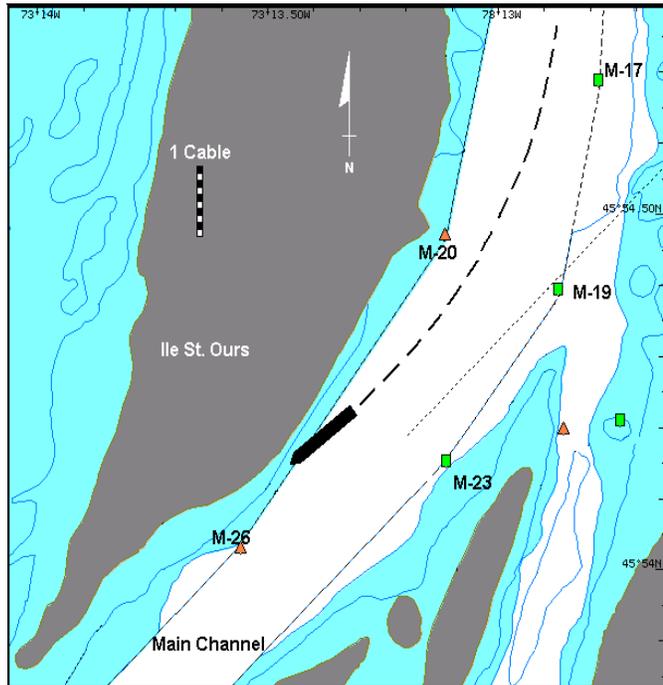
On 22 July 2001, the *Cast Privilege* sailed from Antwerp, Belgium, bound for Montréal, Canada, with a load of containers, 19 of which required electrical power to operate refrigeration equipment.

On 29 July 2001, around 0800, the vessel arrived at the St. Lawrence River pilot boarding area off Les Escoumins, Quebec. A second steering gear pump was started and the Chief Engineer, in accordance with company procedures, began stand-by duty in the engine control room. SSGs 1 and 3 were running in parallel, as they had been since Antwerp, to meet the electrical demand which varied between 800 and 1000 kW.

² See Appendix A for English translation of posted instructions.

That evening, shortly after 2300, the duty engineer noticed a fuel leak emanating from the fuel pump on cylinder B-3 of the No. 3 SSG. The Chief Engineer was immediately informed and he detailed the 3rd Engineer to undertake repairs. Before shutting down the No. 3 SSG, the temporary genset was started and, as per the posted procedure, was run in parallel with No. 1 SSG. Once the load was switched from the No. 3 SSG to the temporary genset, the No. 3 SSG was shut down for repairs. At 2341, some forty minutes later, No. 1 SSG tripped off the main board and the temporary genset shut down, blacking out the vessel.

At the time of the blackout, the vessel was proceeding at 9.5 knots and on a starboard course alteration into Bellmouth curve (just southeast of Île Saint-Ours). The rudder, which was already to starboard due to the course alteration, caused the vessel to swing out of the channel and run aground in position 45° 54' 10"N; 073° 13' 26"W (see Figure 3).



The Chief Engineer immediately attempted to reset the main circuit breaker on No. 1 SSG. At this time, he noticed that the No. 1 SSG was not generating any voltage. He then decided to send the 3rd Engineer to the temporary genset on deck and restart it locally. The 3rd Engineer reached the genset container, opened the door, flipped the toggle switch to single unit, reset the PCC, and turned the key switch to the run position, at which point the genset started.

Power was restored at about 2350. The vessel's engineers then worked to repair the No. 3 SSG. Once operational, No. 3 SSG was tested and readied to be put on line. When the temporary genset was operating in stand-alone mode, it was not possible to bring it on line with the SSG. To prevent any further electrical interruption, the main breaker of the No. 3 SSG was kicked in as the main breaker of the temporary genset was simultaneously tripped out. The temporary genset was then shut down, its selector switch turned to "parallel", the unit restarted and run parallel with the No. 3 SSG.

About 0150, after some manoeuvring, the *Cast Privilege* was refloated without tug assistance and resumed the voyage without further problem. During the transit to Montréal, the ship's electrician discovered three burnt diodes on the No. 1 SSG exciter. The vessel docked at section 78 of the Port of Montréal at 0527.

Vessel Condition and Certification

The vessel and the company were in possession of valid ISM certification issued by Bureau Veritas in April 1998. The vessel's inspection certificates were valid for the voyages being conducted however, as the engine-room machinery's alarm and automatic mode operations were not functioning, the "Unmanned Machinery Space" certificate had been suspended by LR in March 2000.

At the time of the occurrence, the No. 2 SSG was out of service.

Personnel Certification and Experience

The Chief Engineer was in possession of a Croatian-issued Certificate of Competency as Chief Engineer for use on motor-driven vessels. He had been working in the capacity of Chief Engineer on this and on other vessels for approximately three years. He had joined the *Cast Privilege* after the temporary genset had been installed and (like all other engineers on board) had been made aware of its operation during hand over.

The LR surveyor dispatched to the *Cast Privilege* at Liverpool on 05 April 2001 graduated in July 1991 from University of Liverpool as Bachelor of Engineering in Mechanical / Marine / Design Engineering. He became a Lloyd's Register Trainee Surveyor from September 1991 to September 1993, Surveyor on Development from September 1993 to September 1995 and Basic Surveyor as of September 1995.

Requirements for Replacement Machinery

Both SOLAS and Lloyd's have performance requirements which must be met by temporary equipment replacements.

SOLAS 2001, Part D, Electrical Installations, Reg. 40 pt 1.1, and 1.2 state, inter alia, that:

Electrical installations shall be such that: all electrical auxiliary services necessary for maintaining the ship in normal operational and habitable conditions will be ensured without recourse to the emergency source of electrical power.

and,

Electrical services essential for safety will be ensured under various emergency conditions.

Lloyd's Register *Ship Division Survey Procedures Manual* Part E, Existing Ships, July 1993 (Lloyd's internal surveyor guide) states that:

The surveyor should see that all essential repairs are efficiently carried out and, whenever advisable, should witness a working test upon completion.

(Section 6, Paragraph 6.8 Effecting Repairs)

Where it is proposed to fit on board a classed ship a second-hand part intended for essential service and which was not made under LR survey, then it should be examined throughout, the scantling checked and any necessary hydraulic, electrical or running tests applied. When the part in question is fitted in place of one which has been removed on account of damage or some other reason, it should be verified that its power or capacity is adequate for the purpose intended.

(Section 8, Paragraph 8.2 Fitting On Classed Ships)

Analysis

Loss of Power

In order for two generators to work effectively in parallel, it is essential that they maintain their speed and balance the electrical load between them. To achieve this, their respective governors and control systems must be compatible and capable of working together. The temporary genset was unable to balance the load automatically and there was not enough time for the crew to respond to the unforeseen loss of the No. 1 SSG by manually taking up the load with the available potentiometer.

When the diodes failed and caused No. 1 SSG to lose voltage and trip off the board, the temporary genset could not respond to the sudden load change. The automatic control / protection system on the genset sensed an overload and under-voltage condition and shut down the engine, blacking out the vessel. The control system of the temporary genset installed at Liverpool was not totally compatible with the vessel's SSGs. When operated according to the onboard instructions, it could be physically paralleled with the other units. However, because of the characteristics of its control system, the temporary genset was unable to balance the load or respond to the sudden load change due to the failure of No. 1 SSG, causing the vessel to blackout.

Inspection and Intended Use of Temporary Generator

Replacement equipment supplied to a vessel, even on a temporary basis, should provide an equivalent level of safety as the machinery it is replacing. The temporary genset installed on the *Cast Privilege* had been brought on board to replace the generating capacity lost due to the No. 2 SSG being out of service. Although the vessel was originally designed to be run at sea with only one SSG, the growth in electrical load on the vessel, particularly with the carriage of reefer containers (which add additional electrical load), required two generators to be on line while at sea. Additionally, two generators were essential to ensure redundancy while operating in confined waters. At the time that the temporary genset was installed, the operator and ship's staff indicated to the Class surveyor that it would be run as a stand-alone unit only; it would not be paralleled with the vessel's remaining generators. As a result, the genset was not tested in parallel with the SSGs. Additionally, because of the size of the power cables installed, the output of the genset was initially limited to 400 kW, even though this was insufficient to run the vessel under normal sea-load conditions. In this configuration, the failure of either of the remaining SSGs would have resulted in an inadequate supply of power being available to safely operate the vessel. Notwithstanding that the characteristics and power output of the temporary genset installation did not match that of the unit it was replacing, the installation was approved by Lloyd's.

Subsequent to receiving Lloyd's approval of the installation on 05 April 2001, modifications were made to the temporary genset which enabled the unit to be paralleled with the SSGs. Detailed instructions were posted on the main switchboard (in Croatian) describing the temporary genset paralleling procedures to be followed by the engine room staff.³ As the managing operator did not advise Class of the changes to the installation, the classification society was deprived of the opportunity to conduct tests. Tests would have revealed that the genset was not capable of automatic load balancing with the other SSGs and was therefore, not safe to operate in parallel with the other SSGs. Consequently, the information provided by the managing owner to Class was

³ See Appendix A.

insufficient to allow Lloyds to evaluate and make an informed decision as to whether the temporary genset installed on the vessel was capable of providing an equivalent level of performance and safety as the vessel's original equipment.

Findings as to Causes and Contributing Factors

1. The diodes failed and caused No. 1 SSG to lose voltage and trip off the board.
2. Characteristics of the temporary genset control system were such that it was unable to automatically balance the load or respond to the sudden load change caused by the failure of No. 1 SSG, causing the ship to black-out.
3. Notwithstanding that the characteristics and power output of the temporary genset installation did not match that of the unit it was replacing, the installation was approved by Lloyd's.
4. Information provided by the managing owner to Class was insufficient to allow Lloyd's to evaluate and make an informed decision as to whether the temporary genset installed on the vessel was capable of providing an equivalent level of performance and safety as the vessel's original equipment.

Safety Action Taken

Following the occurrence, a second Condition of Class was imposed by Lloyd's, stating that :

Generator set on deck previously installed to replace stb'd lower generator to run on single mode (stand alone) till next port with port and stb'd upper generators readily on stand by. Vessel allowed to sail to Europe (one trip), where repairs will be carried out.

A surveyor from the flag state (Bermuda) attended the vessel in November 2001 and his report identifies safety measures in addition to their initial recommendations. A subsequent visit to the vessel in February 2002 included a verification audit for the issuance of the Safety Management Certificate.

Recommendations, which were found to have been implemented, included, inter alia:

- 1) **Simplify the recording of planned maintenance;**
- 2) **Performance test of generators to be carried out at 85/90% load; and**
- 3) **Enhancement of the maintenance programme for generators and all associated systems, including alternators, breakers, switchboard and protection systems. This programme should also ensure that parts replacements can be safely carried out in an organized manner.**

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 06 December 2002.

Appendix A: Instruction for work with "GEN SET" in parallel and single work⁴

1. PARALLEL WORK WITH SHIP'S GENERATORS

The switch No. 1 set in position 2. Start main generator switch by pushing on switch No.2 (Green push button "ON"). Start the "Gen Set" by placing switch No. 3 in position 1 (After the start the main switch of "Gen Set" will start automatically). The regulation of power is done by built in potentiometer.

IMPORTANT!! Before you start "Gen set" please verify that the switch on "Gen Set" is in position for work in parallel mode.

2. SINGLE WORK

Switch No. 1 has to be in position 3. The switch No. 3 has to be in position 1. The "Gen Set" starts before it is connected in system by engaging switch 2. It is necessary to place generators out of service (by producing a "Black Out") and after that to connect "Gen Set" in the system - by pushing green button "On".

IMPORTANT!! Before you start "Gen Set" please verify that the switch on "Gen Set" is in position for work in single mode.

⁴ N.B. Free translation from Croatian.