# MARINE OCCURRENCE REPORT

## SERIOUS INJURY TO A WHEELSMAN

## THE RO-RO CONTAINER "CICERO"
## OFF ST. JOHN'S, NEWFOUNDLAND
## 22 MAY 1997

REPORT NUMBER M97N0071

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## *Summary*

Whilst en route to Montreal, from St. John's, Newfoundland, the wheelsman of the watch was struck in the head by the 10 cm quick connect cap from the Flume tank filling line when he attempted to remove the cap while the line was pressurized. The vessel returned to St. John's, to land the injured wheelsman.

*Ce rapport est également disponible en français.*

# *Other Factual Information*

| | "CICERO" |
|---|---|
| Port of Registry | St. John's |
| Flag | Canada |
| Registry/Licence Number | 376894 |
| Type | Ro-Ro Container |
| Gross Tons | 11 819.27 |
| Length | 147.175 m |
| Draught | Aft: 4.82 m<br>For: 6.46 m |
| Built | 1977, Smith's Dock Co. Ltd., UK |
| Propulsion | Diesel, 2 Pielstik, 12PC2-5v-400 |
| Number of Crew | 22 |
| Number of Passengers | 0 |
| Registered Owner | Oceanex Inc. |

The MV "CICERO" is a steel-hulled vessel arranged with the accommodation forward. A container deck extends aft from the accommodation, below which are the ro-ro decks. The machinery space is midships, below the main ro-ro deck.

Valid certificates for the vessel and the nature of the voyage undertaken were on board the vessel. The officers held valid certificates of competency for the positions they occupied and for the intended voyage.

The vessel is fitted with a Flume Stabilization System, which provides roll stabilization. The Flume tank is fitted between frames 124 and 131 above the container deck, aft of the accommodation.

Sea water is supplied to the Flume tank from the general service pump in the engine-room through a non-return valve at the pump, then via a 10 cm pipe fitted with a butterfly valve in the engine-room. To prevent accidental filling of the Flume tank, the 10 cm pipe was fitted with a male quick connect coupling and a cap, made of brass, weighing approximately 0.9 kg. A 10 cm flexible hose is used to join the fixed supply pipe to the fixed supply pipe that runs up the forward face of, and into, the Flume tank.

When filling the Flume tank, the cap is removed from the pipe and a 10 cm hose with a female quick connect coupling is connected. The hose section in the filling system had reportedly been installed approximately two years prior to the occurrence, as there was concern that there could be accidental filling of the Flume tank via fixed pipe and hose. When not in use the Flume tank is drained.
The Flume tank is normally filled to the desired level prior to departure from port. Once filling is completed,

the flexible hose is disconnected and the cap put in place.

There is nothing at the deck level to indicate if the supply pipe is pressurized or if the Flume tanks contain water.

*History of the Voyage*

On the 22 May 1997 the "CICERO" was engaged in discharging and loading containers and ro-ro trailers for Montreal. During that time the Flume tank was empty. The chief officer ordered the Flume tank filling hose connected and made ready to fill the tank to its working level.

The chief officer, prior to taking over his watch confirmed that, as ordered, the flexible hose in the Flume tank filling line had been connected. Following departure from St. John's, the chief officer again observed that the flexible filling hose was connected.

Once the aft mooring lines had been secured, the second mate, with two wheelsmen and the deck cadet, proceeded to the midship area on the starboard side just aft of the Flume tank and secured the gangway for sea. The second mate then checked the Flume tank filling hose. Finding that it was connected, he felt it to ascertain whether or not water was flowing through it. He was satisfied that no water was flowing through the pipe. The second mate, who had neither received instructions from the chief mate nor consulted the posted operational instructions, believed that the Flume tank had been filled prior to departure, as was normally done. He directed one of the wheelsmen to disconnect the hose and install the cap. No report of this action was made to the officer of the watch.

At 2254 the vessel departed St. John's bound for Montreal.[1] Once outside the narrows of St. John's, the master decided that about 100 tonnes of water would be required in the Flume tank to attenuate the roll of the vessel. The chief officer called the engineer on watch to start pumping water up to the Flume tank. After a short period, the engineer of the watch phoned the wheelhouse and stated to the chief officer that there was a problem, as the pressure on the discharge side of the pump was too high, at about 7 bar. Normal discharge pressure was 3–4 bar.

The chief officer, who was now officer of the watch, sent the wheelsman down to check the Flume tank pipe connection. The wheelsman returned to the bridge and reported to the chief officer that the hose was not connected and that the supply pipe was capped. The chief officer called the engine-room and told the engineer of the watch to shut down the pump. He did not ask for the Flume tank supply line to be drained.

The wheelsman was sent down to connect the hose. The chief officer cautioned him to ensure that the pressure in the line had dropped. At about 2325 the wheelsman undid the quick connect cap on the still-pressurized 10 mm line and was struck on the head by the cap.

The master, who was outside on the port side of the bridge deck heard a loud report from the vicinity of the Flume tank filling line. He immediately proceeded to the bridge, alerted the chief officer that the wheelsman

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[1] All times are coordinated universal time.

may have been injured, took control of the vessel and sent the chief officer to check on the wheelsman.

The chief officer found the wheelsman lying unconscious and bleeding on the deck near the Flume tank filling line. The flexible filling line was disconnected and the 10 cm quick connect cap was found off the pipe, hanging from its securing line.

The chief officer went to the crew mess to get assistance. He retrieved the first aid kit and returned to the site of the accident with three crew members and a stretcher. First aid was administered to the wheelsman and he was removed by stretcher from the deck into the accommodation.

At 2332 the master informed St. John's Coast Guard Radio that he was in approximate position 47° 30.7' N, 052° 35.3' W and had an emergency on board and requested an ambulance to be available when the vessel docked at Pier 5 in St. John's.

On May 23, at 0028, the vessel arrived at Pier 5 and was met by the ambulance. The injured wheelsman was transported to the Health Science Centre in St. John's for treatment.

Weather at the time of the occurrence was reported as clear with winds southwest at 7–10 knots with a light swell.

## *System Design*

Simply defined, a system is an entity that exists to carry out some purpose.[2] A system is composed of humans, machine and other things that interact to accomplish a goal. Basic principles of systems design seek to reduce error by eliminating opportunities for operators to produce error within the system, by making errors visible and reversible and by mitigating error consequence. Every interaction between the operator and the machine (any type of physical object) within the system provides an opportunity for human error. For those operator-machine interfaces that are considered essential, it is imperative that the operator is able to control the machine. In order to do this, the user must know the state the machine is in and must be able to change that state or effect change. These two tasks are carried out by means of displays and controls, respectively.[3]

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[2] R. Baily, *Human Performance Engineering: A Guide for Systems Designers* (Englewood Cliffs, N.J.: Prentice-Hall, 1982) as cited in Mark S. Sanders and Ernest J. McCormick, *Human Factors in Engineering and Design* (New York: McGraw-Hill Book Co., 1987) 12.

[3] I.A.R. Galer, ed., *Applied Ergonomics Handbook* (London: Butterworths & Co. Publishers, 1987) 6.

### *Effective Communication*

Information transfer is a complex process and there are numerous opportunities for breakdown. A common problem is the failure to initiate communication. In many cases the needed information exists but is not made available to, or sought by, those who require it. Another common problem is incomplete or ambiguous communication. Additional problems could include failure to transmit information at the appropriate time or a misunderstanding of the information by the receiver.

## *Analysis*

When the general service pump was started, the pressure built up in the discharge pipe to about 7 bar, which the engineer noticed and relayed to the chief officer. When the pump was shut down, the pressure remained in the pipe because the non-return valve prevented the water from draining back through the pump. When the wheelsman disconnected the cap, it was propelled into his head by the pressure in the pipe.

Several factors contributed to this occurrence: system design deficiencies, ineffective crew communication, and inadequate crew familiarization with vessel systems.

### *System Design*

In this occurrence, the connect/disconnect design of the piping system used to supply water to the Flume tank required more operator-machine interfaces than a permanent piping system, thereby increasing the opportunity for human error.

Moreover, notwithstanding the availability of system feedback to the engineer on watch, the system did not provide adequate feedback to all of the involved crew members as to its state.

There was no display information available to the wheelsman to alert him that the water pipe was pressurized before he began to remove the cap, nor was there any information available to the second mate to inform him that the Flume tanks were empty when he had the filling lines disconnected. Had the system provided this information, the actions of the wheelsman and the second mate would likely have been different.

### *Communication*

Several errors related to communication were evident in this occurrence. In the morning, upon arrival at the port, the master instructed the first mate to connect the Flume tank and place it on standby in readiness for filling, if necessary, depending on the weather and sea conditions outside. On most other occasions the ballast had been taken on in port, prior to departure.

When the chief officer did not receive an order to take on ballast following loading, or prior to departure as per usual procedure, he did not seek additional information from the master nor did he communicate to those crew members whose duties or actions could have been affected by the significant change that had occurred in ballasting procedures. The decision on the timing of ballasting was the master's to make. However, because it was not further communicated effectively, the second mate, as well as some other members of the crew, were

unaware of the actual status of the vessel. Had the second mate known that ballast was not taken on prior to departure he may not have disconnected the ballast lines and capped the pipe.

When the second mate returned to the vessel just prior to departure he did not attempt to communicate with the third mate or the chief officer who was officer of the watch at the time. Had he sought information regarding the status of the vessel from either of them he may have learned that ballast had not yet been taken on.

Although it was common practice for the second mate to ensure that the Flume tank filling line was disconnected and that the standing pipe was capped as part of his normal duties, he usually did not perform those duties until specifically told to do so by the chief officer. In addition, whether or not he had been specifically tasked, it was his practice to advise the chief officer if and when those tasks had been completed. Had the second mate adhered to the established work practices, he would have either:

a) not disconnected the filling line and capped the line because he had not been asked to do so, or

b) advised the chief officer what actions had been taken and subsequently would have been told to reconnect the filling line.

Because the second mate did not communicate with the chief officer, the chief officer was unaware that the state of the Flume tank filling line had changed.

Ineffective communication contributed to this accident in yet another instance. When the chief officer told the engineer on watch to restart the pump, no indication was given to the engineer on watch as to what would have caused the high pressure in the filling line, i.e., that the flexible hose was not connected and/or the line was still capped. Had he relayed this information to the engineer, including his plan to send the wheelsman to connect the lines, probably the engineer would have drained the lines, thereby releasing the line pressure. Conversely, had the engineer on watch sought additional information from the chief officer, his actions might have been different. However, during the communication between the first mate and the engineer on watch, a noise, or alarm sounded, indicating a malfunction in the main engine, distracting, and effectively disrupting the flow of information.

### *Crew Familiarization with Vessel Systems*

An introduction to basic engineering principles is included in the deck officer certification training program, which the chief officer had successfully completed. The chief officer knew how both a centrifugal pump and a screw down, non-return valve worked. However, he was unaware that such a valve was part of the pumping/piping system used in conjunction with the Flume stabilization system on the “CICERO”. The chief officer believed that once the centrifugal pump had been shut down, the pressure in the filling line would reduce over a short period of time as the water drained back through the pump. As a result, he did not ask the engineer to drain the lines before he sent the wheelsman to remove the cap from the filling line and to connect the hose. Had he been more familiar with the piping/pumping system, it is probable his actions would have been different.

## Findings

1. The wheelsman of the MV "CICERO" was struck in the head by the 10 cm quick connect cap from the Flume tank filling line when he removed the cap from the pressurized line.

2. There was a lack of communication between the crew regarding the Flume tank.

3. On deck, there was no method of determining if the capped line was pressurized or if the Flume tanks contained water.

4. The chief officer was unaware that there was a screw down, non-return valve in the Flume tank filling line. Therefore, he incorrectly believed that when the general service pump was stopped the pressure on the line would bleed off over a period of several minutes.

## Causes and Contributing Factors

The wheelsman was injured when he removed the cap from the pressurized ballast line. The Board determined that this wheelsman removed the cap as a result of ineffective crew communication and system design deficiencies in, and inadequate crew familiarization with, the vessel's ballasting system.

## Safety Action

The company reviewed the use of the flexible hose in the Flume tank filling system and determined that a rigid piping system was more suitable. Accordingly, the flexible filling hose was removed and a rigid pipe installed.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 10 December 1998.*

*Appendix A*