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EVACUATION AND EMERGENCY RESPONSE

CHAPTER EIGHT EVACUATION AND EMERGENCY RESPONSE

At 1:30 a.m. on Monday, February 15, the *Ocean Ranger* informed Mobil's shore base and the *SEDCO 706* that its crew was going to lifeboat stations and that the rig was being evacuated; half an hour earlier (1:00 a.m.) the rig had requested assistance. This chapter, a continuation of the description of events in Chapter 5, describes the emergency response to the *Ocean Ranger's* 1:00 a.m. request for assistance, the actions of the personnel on the *Ocean Ranger* immediately before the evacuation notice, and the actions of those on and off shore who participated in the response.[1]

The first indication given to personnel on shore by the *Ocean Ranger* that a serious problem had developed was at 1:00 a.m. when Jack Jacobsen advised Merv Graham that the rig was listing and that the cause of this list could not be determined. Jacobsen requested Graham to alert the Canadian Coast Guard. Graham, who received the call at home via the MARISAT system, agreed and also undertook to muster the air and marine resources under contract to Mobil. Immediately after finishing his call, he telephoned the Search and Rescue Emergency Centre (SAREC) in St. John's[2] at 1:06 a.m. and told them the *Ocean Ranger* was listing to the bow and the cause of this list was not known. He informed SAREC about the number of crew on the rig, the weather conditions and the positions of the three supply boats and the two other rigs in the vicinity of the *Ocean Ranger*. He also told them that he would arrange for the supply boats in the area to proceed to the rig and that he would alert Universal Helicopters which were under contract to Mobil. He did not request direct assistance from SAREC at this time, but indicated that Jacobsen might contact them later.

Meanwhile, on board the *Ocean Ranger*, a Mobil foreman had directed the standby boat *Seaforth Highlander* to come to close standby at 1:05 a.m.; a distress telex was sent to the U.S. Coast Guard Rescue Coordination Center (RCC) in New York at 1:09 a.m. and a Mayday, on 2182 kHz, was dispatched at approximately 1:10 a.m. The *SEDCO 706* recorded picking up this Mayday. Jacobsen called the *SEDCO 706* at approximately 1:11 a.m. and asked the radio operator to issue Mayday relays for the *Ocean Ranger*. He also briefed Keith Senkoe on the emergency and requested that he dispatch the supply boats which were on standby to the *SEDCO 706* and to the *Zapata Ugland*. This call was monitored at Mobil's shore base where at 1:14 a.m., the radio operator Rick Flynn, called SAREC.

Flynn advised SAREC that the *Ocean Ranger* was experiencing a list and that evacuation appeared necessary. He said the crew had attempted to send a Mayday and had requested a Mayday relay from the *SEDCO 706*, adding that the helicopters

[1]A list of the major participants is given at the end of this chapter.

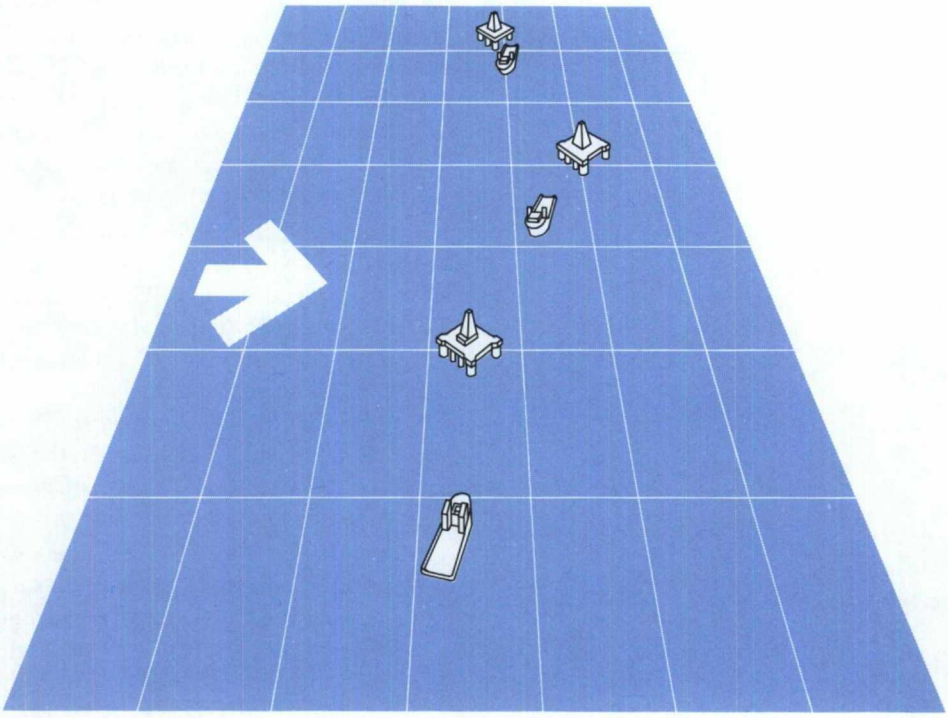
[2]For the purposes of this report, all references to SAREC refer to the St. John's location.

under contract to Mobil had been alerted. During this telephone conversation, Flynn maintained radio contact with the *Ocean Ranger* and both Flynn and SAREC heard Jacobsen say to the *SEDCO 706* that the rig was "... 'listing ... and not coming back for us so we need every helicopter in the air we can get out here ...." His voice during this conversation was surprisingly calm. SAREC and Flynn also overheard the *SEDCO 706* agree to the request for assistance from the supply boats. The SAREC controller, who could not speak directly with Jacobsen, used Flynn as an intermediary to request the wind direction and speed, and the number of vessels in the area. Jacobsen replied that winds were from the west with gusts up to 80 miles per hour and that there were three supply vessels in the area. Jacobsen discontinued this transmission at 1:17 a.m. This was the last time Jacobsen talked to Mobil's shore base.

At 1:20 a.m. Graham contacted Rod Fraser, Mobil's drilling foreman on the *SEDCO 706*, and appointed him Mobil's on-site co-ordinator. He advised Fraser that Mobil's helicopters were alerted and told him to dispatch the standby vessels, the *Boltentor* and the *Nordertor*, to assist the *Ocean Ranger*. He also told Fraser to monitor all radio communications and report events immediately to shore.

At 1:21 a.m. SAREC notified the Rescue Co-ordination Centre (RCC) in Halifax of the *Ocean Ranger*'s distress. RCC Halifax advised SAREC that they had just been informed of the situation by RCC New York. At the same time the *SEDCO 706* dispatched its standby vessel, the *Boltentor*, to the aid of the *Ocean Ranger*; the *Zapata Ugland's* standby vessel, the *Nordertor*, was sent on the same mission at 1:22 a.m.

At 1:30 a.m. Ken Blackmore, the night radio operator on the *Ocean Ranger* called Mobil shore base and said that the crew were going to lifeboat stations and requested that another Mayday relay be transmitted. After acknowledging what was to be the final transmission from the *Ocean Ranger*, Flynn immediately informed SAREC: "The crew of the *Ocean Ranger* is gone to lifeboat stations now ... [and] ... they're getting the *706* [to] relay another Mayday for them". Flynn again advised SAREC that the helicopters under contract to Mobil had been alerted and that all of the supply boats in the area of the *Ocean Ranger* had been directed to ren-



8.1 By 1:30 a.m. all three vessels had been directed to assist the *Ocean Ranger*. The *Nordertor* (top), dispatched from the *Zapata Ugland* at 0122 NST, was approximately 20 miles away, and the *Boltentor* (centre), dispatched from the *SEDCO 706* at 0121 NST, was approximately 9 miles away. The *Seaforth Highlander* (bottom) had been called to close standby at 1:05 a.m., and was approximately 6 miles from the rig.

0130 NST (0500Z)
The telex connection with the *Ocean Ranger* is broken.

der assistance. RCC New York noted that at 1:30 a.m. the MARISAT telex connection with the *Ocean Ranger* was broken; several attempts to regain the connection were unsuccessful.

On the *Boltentor*, second mate Malcolm Martin overheard the last radio transmission from the *Ocean Ranger*. Immediately after this transmission the *Boltentor* was called by the *SEDCO 706* and advised that the situation was now more serious and that they should proceed to the *Ocean Ranger* as soon as possible. Martin then directed the seaman on watch to alert the captain and the remainder of the crew. Within a few minutes Captain Davison came on the bridge and assumed command. The *Boltentor* was now travelling at approximately 6 knots. The second standby vessel, the *Nordertor*, was at this time about 20 miles northeast of the *Ocean Ranger*'s position travelling at approximately 9 knots.

0131 NST (0501Z)
RCC Halifax calls the 103 Rescue Unit at Gander to mobilize for a rescue mission.

At 1:31 a.m. RCC Halifax contacted Captain Rudolph Preus, duty officer for 103 Rescue Unit[3], at his home in Gander, Newfoundland. RCC Halifax advised Preus of the emergency on the *Ocean Ranger* and told him to have his helicopter crew, all of whom were at home, mustered for the rescue mission. In St. John's, Mobil personnel had alerted the Universal Helicopter crews. The Royal Canadian Mounted Police (RCMP) were contacted to arrange ground transportation for them because of the severe snow storm conditions in the city.

At 1:36 a.m. RCC Halifax asked SAREC in St. John's to have Coast Guard radio issue an All Ships Broadcast on behalf of the *Ocean Ranger*. The All Ships Broadcast was not issued by the Coast Guard radio station in St. John's (VON) until 2:04 a.m.

At 1:46 a.m. Captain Preus advised RCC Halifax that the helicopter crews for 103 Rescue Unit had been alerted and were proceeding to the airport. He conferred with weather forecasters at Gander and received actual weather observations for Gander, St. John's, and the rigs at Hibernia. He concluded that the low ceiling at Gander (800 feet) would make it necessary for him to fly through clouds enroute to St. John's, and that the forecast of "rime icing" in clouds meant that the helicopters could not fly. Preus advised RCC Halifax that his departure to St. John's would be delayed until the winds abated and the weather conditions improved.

STANDBY VESSELS

Meanwhile, the three standby vessels were proceeding towards the *Ocean Ranger* and reporting their relative positions to the *SEDCO 706*. Fraser, the on-site coordinator, testified that he advised the masters of each standby vessel that the *SEDCO 706* would receive and log all communications and relay the information to St. John's via the MARISAT system. As the standby vessels drew closer to the *Ocean Ranger*, they began to prepare equipment which might assist in a possible rescue. On the *Seaforth Highlander*, first mate Rolf Jorgensen and several crew members prepared the following rescue equipment:

1. a cargo net (12 feet by 9 feet)[4];
2. a grappling hook;
3. a boat hook;
4. two heaving lines (approximately ½ inch in diameter and 50-60 feet in length with monkey fists on the end);

[3]103 Rescue Unit is a Search and Rescue Unit stationed at Gander, Newfoundland, equipped with three Labrador/Voyageur helicopters.

[4]The cargo net, which was laid out on the afterdeck to be used as a scramble net was not fastened down and was washed overboard before any rescue attempt was made.

5. two life ring lines (approximately ½ inch in diameter and 100 feet in length spliced around two life rings);[5]

6. a Sampson rope (approximately 1 to 1½ inches in diameter and 70-80 feet in length with a thimble on the end).

After completing their preparations, the crew of the *Seaforth Highlander* gathered on the bridge and awaited instructions from the *Ocean Ranger*. The second mate, Jerry Higdon, testified that he made several unsuccessful attempts to contact the rig on VHF. The only radio communications overheard were the Mayday relays emanating from the *SEDCO 706*.

The *Seaforth Highlander* was heading in a northeasterly direction on a course which would take her to the *Ocean Ranger's* stern. The visibility on the bridge was limited by heavy seas and blowing snow, but, as she approached the *Ocean Ranger's* position, the rig came into sight. Jorgensen testified that it was fully lit, but that it was impossible to see whether or not it was listing. At that time, the *Seaforth Highlander* was approximately 3000 feet from the rig. As she moved closer, clusters of white lights and smoke flares were visible off the port beam. Upon inspection it was determined that these lights were attached to life preservers floating on the water. The life preservers were empty. The *Seaforth Highlander* was now, according to Jorgensen, only 1200 feet from the rig. The time, according to Captain Duncan, was 1:50 a.m. A distress flare was then sighted off the starboard quarter.

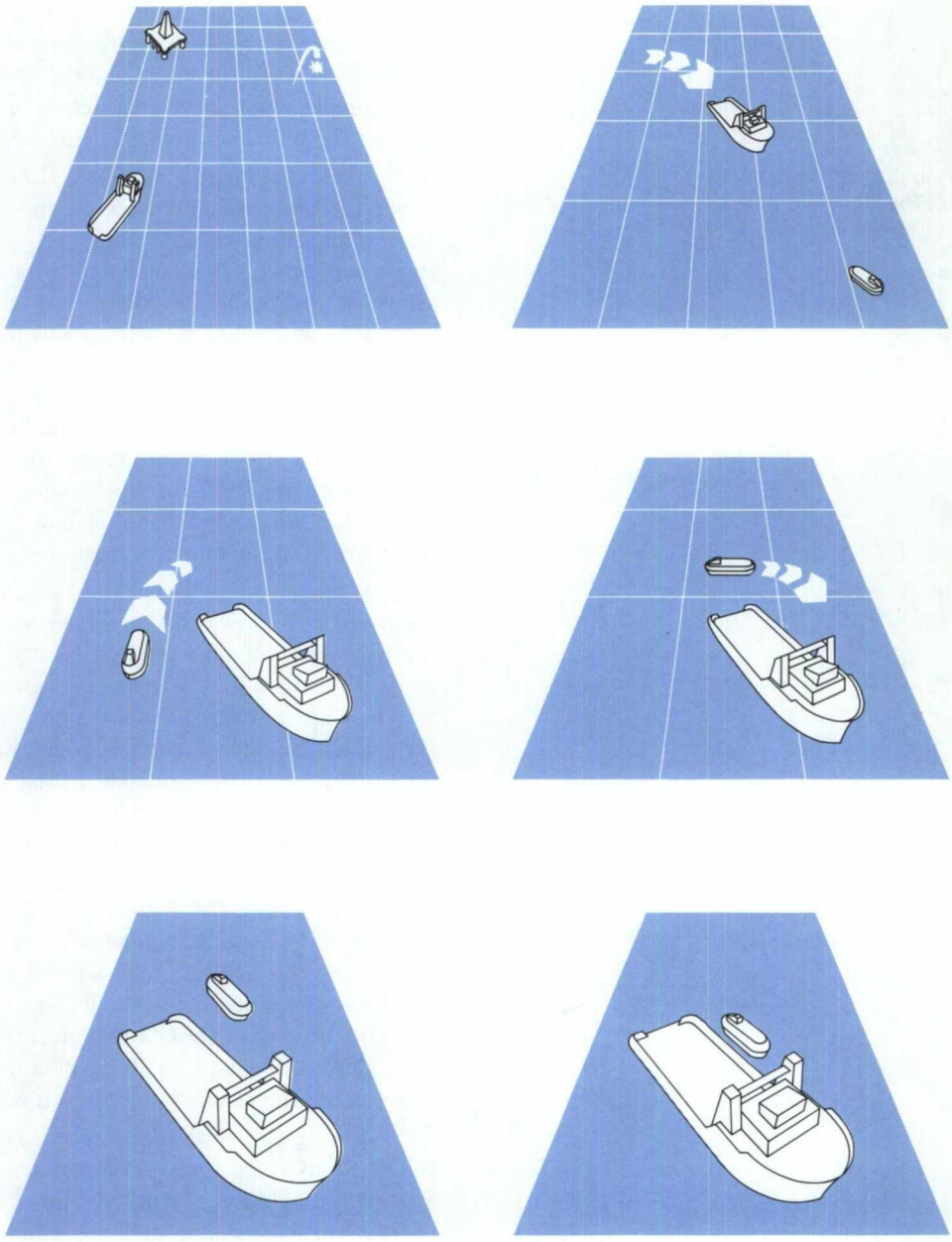
This evidence presented by crew members of the Seaforth Highlander *was inconsistent with events logged by other participants in the rescue attempt. The testimony of Captain Duncan regarding the time of his arrival at the* Ocean Ranger *and the sighting of the flare is in conflict with the logs of the* SEDCO 706 *and the testimony of Fraser. The* SEDCO 706 *log shows that at 1:55 a.m. Duncan reported his vessel to be three miles from the* Ocean Ranger *and that at 2:07 a.m. there were many flashing lights in the water. The log of the* SEDCO 706, *Fraser's personal log, the log entries of SAREC (St. John's), the personal log of Graham, and the logs of the* Nordertor *and the* Boltentor, *indicate that Duncan is in error. It is, therefore, concluded that the* Seaforth Highlander *made visual contact with the* Ocean Ranger *at 2:11 a.m. and the distress flare which Duncan stated he saw at 1:50 a.m. was actually seen at 2:14 a.m.*

0221 NST (0551Z)
The *Seaforth Highlander* spots a lifeboat and proceeds towards it.

A second distress flare was sighted along with the lifeboat from which it had originated. At 2:21 a.m. the *Seaforth Highlander* reported to the *SEDCO 706* that it had spotted a lifeboat and was proceeding toward it. This information was immediately passed on to Mobil's shore base and to SAREC. Graham testified that he issued instructions to Fraser to advise the masters of the supply vessels not to secure lines to lifeboats. In his testimony Graham explained that he was aware of an incident in the Gulf of Mexico in which a lifeboat had capsized while under tow. Fraser stated that the instructions were relayed to the supply vessels, but both Higdon and Duncan testified that they did not receive these instructions; nor did the other supply boats, the *Boltentor* and the *Nordertor*, have any record of receiving them.

The lifeboat which had fired the flare was approximately 1200 feet downwind of the *Seaforth Highlander*. Duncan testified that it was riding low in the water with its bow into the prevailing seas. He decided to position his vessel downwind of the lifeboat. He also decided to place her stern into the wind and waves. Duncan explained that with the bow into the seas his vessel's superstructure would act as a sail and force the *Seaforth Highlander* off its heading, thus creating the possibility of a collision with the lifeboat. He stated that his bow thrusters, which were used to keep the vessel in position, did not have sufficient power to hold his vessel in position under the sea conditions that existed at that time. He also stated that from the aft

[5]These heaving lines and life ring lines were improvised from a coil of polypropylene rope which the *Seaforth Highlander* had in store.



8.2 The *Seaforth Highlander* approached the port stern of the *Ocean Ranger* and subsequently manoeuvred to the assistance of a lifeboat.

control console he would have a full view of the aft deck from which all rescue attempts would be handled and that he could also keep an eye on the oncoming sea.

As Duncan was manoeuvring his vessel into position, four seamen (Eric Rees, Bert Woolridge, Kenneth Lidstone and Dennis Chaytor) and the first mate, Jorgenson, went outside onto the afterdeck. The lifeboat was now clearly visible and obviously damaged. The bow of the lifeboat was holed on both sides of the stem from the waterline to the gunwale. Seaman Rees testified that he watched the lifeboat as it moved from the starboard side of his ship, around the stern and up the portside to a position amidship of the *Seaforth Highlander*. He stated that he saw men bailing water. Jorgensen testified that the lifeboat was under power, and apparently steered by a man who stood in the aft hatch.

The sea conditions at this time were extremely rough. Duncan stated that the swells exceeded 60 feet and there were 15-foot breaking waves. The seamen on the afterdeck testified that the seas were breaking over the stern of the ship and that the

spray froze instantly, hampering their visibility and movement.[6] They were standing between the bulwarks and crashrail on the *Seaforth Highlander's* port side, and to improve mobility they removed the lifelines which secured them to the bulwark. As a consequence they placed themselves in danger of being washed overboard or smashed against the bulwarks by heavy seas crashing over the afterdeck.

0232 NST (0602Z)
The lifeboat is now alongside the *Seaforth Highlander*

At 2:32 a.m. the *Seaforth Highlander* reported the lifeboat to be alongside. Inside the lifeboat lights were on and men could be seen moving about. Some of the men were bailing through the port and starboard side doors. The sound of the seas and winds made voice communications between the lifeboat and the seamen on the afterdeck impossible. Higdon, who was monitoring the radio, stated that there were no radio communications from the lifeboat. On the afterdeck, seaman Woolridge attempted to throw a Sampson rope to the lifeboat, but it was blown away from its target. Woolridge then threw a line, with a life ring attached, to a man in the aft hatch of the lifeboat. The man caught the line and made it fast to a handrail on the canopy of the lifeboat; Jorgensen tied the other end of the line to the crashrail on the port side of the *Seaforth Highlander*. Meanwhile, seaman Rees threw a second line with a life ring attached; this line was made fast to the lifeboat by a man who appeared from the bow hatch and to the crashrail of the *Seaforth Highlander*.

While this was happening, seven or eight of the men in the lifeboat emerged onto the port gunwale. These men were wearing hard hats and either work vests or life preservers; some were lightly clad while others wore heavier clothing. The lifeboat began to roll slowly to port, away from the *Seaforth Highlander*, and within seconds capsized throwing the men who had been standing on the port gunwale into the sea and snapping the lines which had been attached to the *Seaforth Highlander*. As the men from the lifeboat spilled into the sea, the water in the immediate area was illuminated by the lights attached to the life preservers. The lifeboat had completely capsized. The time was 2:38 a.m.

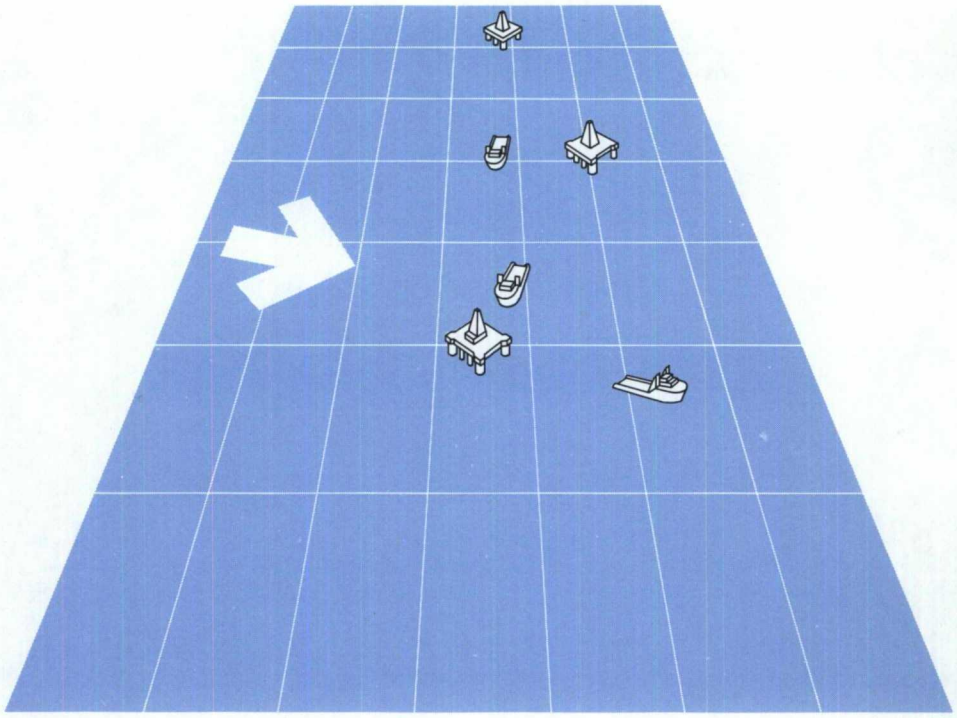
0238 NST (0608Z)
The lifeboat capsizes.

Second mate Higdon and a seaman then left the bridge and joined the crew on the afterdeck to assist in the rescue attempts. Jorgensen told two seamen to launch a life raft in the hope that some of the men in the water would be able to climb aboard. Launching the life raft took some time because its securing lines were frozen and had to be cut. The men in the water, however, were immobilized and unable to make any effort to board the life raft or grasp lines thrown to them and within their reach. Stormy seas, inadequate retrieval equipment, and the immobility of the men in the water made the rescue attempts futile.

During this time the *Seaforth Highlander* kept her stern to the wind and continued to take heavy seas on her afterdeck. The crew were forced to brace themselves against the bulwark and other solid objects to avoid being washed overboard. In spite of the hazardous and difficult conditions on the afterdeck, Jorgensen narrowly missed grasping a man who was washed against the port side of the supply vessel. One or two of the men in the water were able to hold onto the capsized lifeboat longer than the others. The lifeboat was very close to the ship's port propeller and Captain Duncan decided to shut down this propeller for fear it would injure the men in the water. This reduction in power combined with strong winds and high waves forced his vessel off location. He was able to manoeuvre her back within 50-70 feet of the capsized lifeboat. By this time the men in the water had drifted downwind and attempts to retrieve them were unsuccessful.

The crews of the other standby boats approaching the *Ocean Ranger* were made aware of the severity of the emergency by the reports from the *Seaforth Highlander*. The masters directed their crews to prepare any equipment on board which

[6]The evidence revealed that the crew of the *Seaforth Highlander* did not have suitable clothing for working outside in severe weather conditions which hampered their mobility. They wore coveralls which were not waterproof and provided little insulation. Some of them wore rubberized oil slickers over the coveralls but they became extremely wet and cold during that night's rescue attempts.



8.3 The *Boltentor* arrived at the *Ocean Ranger* at 2:45 a.m. and reported that helicopters could land on the rig. Approximately fifteen minutes later the *Nordertor* lost radar contact with the *Ocean Ranger*.

could be used to rescue survivors. The *Boltentor* was the second vessel to arrive and at 2:45 a.m. made visual contact with the *Ocean Ranger*. There were only a few lights visible. The vessel approached the rig's starboard quarter and a search light was used to survey the rig. There was no sign of life or lifeboats, either on board or in the immediate vicinity.

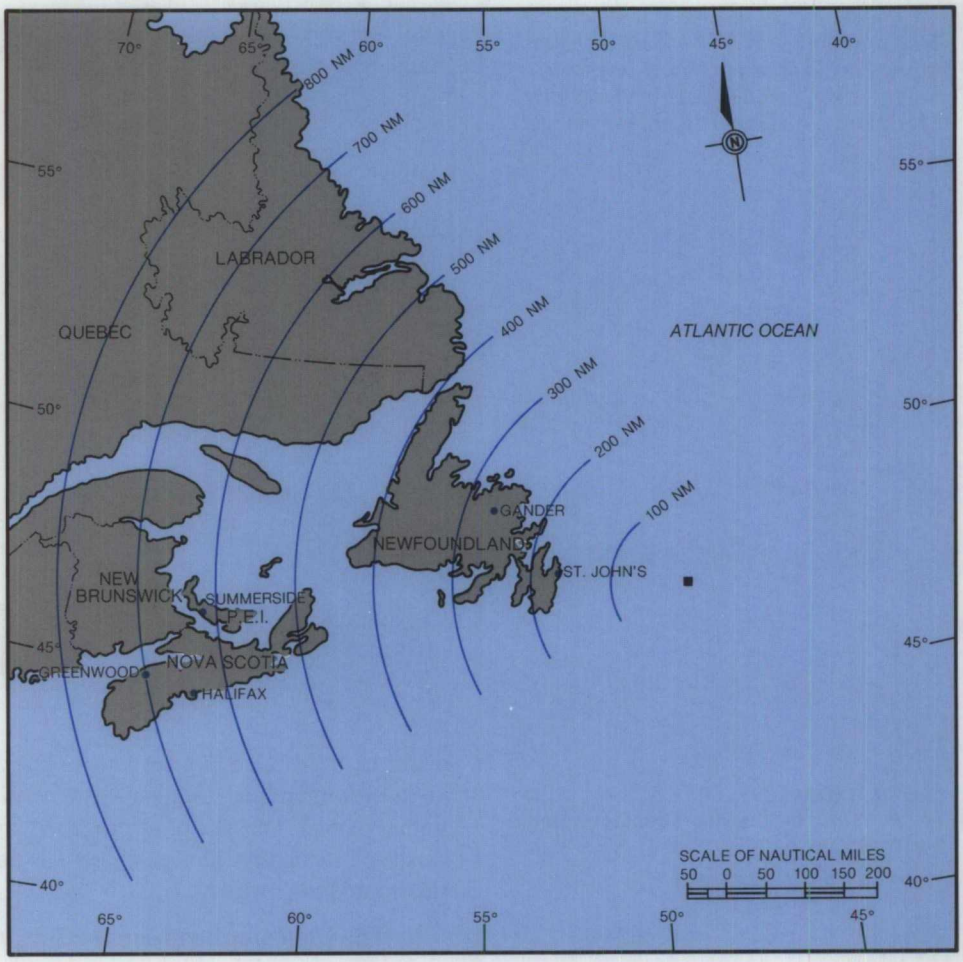
0245 NST (0615Z)
The *Boltentor* makes visual contact with the *Ocean Ranger*.

The *Boltentor* had been asked by the *SEDCO 706* to determine whether a helicopter could land on the deck of the *Ocean Ranger*. Captain Davison manoeuvred his vessel along the starboard side to its stern and concluded that the rig was sufficiently level to permit a helicopter to land. Several deckhands, however, testified that, from their vantage point, the rig had a severe trim with the helicopter deck almost in the water and exposed to breaking waves. At 2:55 a.m. the *Seaforth Highlander* requested the *Boltentor's* assistance in recovering the capsized lifeboat. At this time the *Seaforth Highlander* was approximately 1-1½ miles downwind of the *Ocean Ranger*.

In the meantime the *Nordertor* was proceeding at 8-9 knots towards the *Ocean Ranger*. Captain Allingham said that during his vessel's approach he picked up the rig on radar and maintained radar contact until 3:00 a.m., when the rig disappeared from the screen. He also testified that, after the rig had disappeared from radar, two small blips appeared briefly in the same location on the radar screen. Five minutes later, he checked with the *Boltentor* and the *Seaforth Highlander* to find out whether they still had radar contact with the *Ocean Ranger*. Both replied that radar contact had been lost. At 3:38 a.m. Allingham reported to the *SEDCO 706* that the *Ocean Ranger* was no longer visible on radar. This information was immediately relayed to Graham at Mobil's shore base; it was decided that Mobil's shore base would advise SAREC. The evidence, however, revealed that SAREC was not informed until 7:35 a.m. that the rig had disappeared and was presumed sunk.

0300 NST (0630Z)
(Approximate)
Radar contact is lost with the *Ocean Ranger*.

As the *Boltentor* approached the *Seaforth Highlander*, Captain Davison observed bodies and a capsized lifeboat in the water. The crews of the *Boltentor* and the *Seaforth Highlander* made repeated attempts to rescue possible survivors using lifebuoys and grapnels, but the 60-70 knot winds and the 50-60 foot seas rendered



8.4 The locations of the Search and Rescue aircraft tasked to the *Ocean Ranger* site by the Rescue Co-ordination Centre in Halifax.

0340 NST (0710Z)
The *Nordertor* arrives and joins the search effort.

rescue efforts futile. At 3:40 a.m. the third standby vessel, the *Nordertor*, arrived and joined the rescue. The masters of the three supply vessels then began to co-ordinate their search effort. Based on their assessment of the prevailing wind and seas they developed drift plots and concentrated their searching downwind of the *Ocean Ranger's* last position.

AIRCRAFT

0322 NST (0652Z)
Mobil-contracted helicopters depart St. John's.

While Mobil's supply vessels were searching for survivors, aircraft support was mustered by Mobil and RCC Halifax. In St. John's, the Universal helicopter crews had arrived at the airport by 2:15 a.m. but according to the testimony of the co-pilot, Bruce Hutchings, high winds hampered their engineers from getting the helicopters out of the hangars, and a further delay was caused by the fueling of auxiliary tanks. The first helicopter was ready at 3:15 a.m. and was airborne at 3:22 a.m., with ODECO rig superintendent Counts aboard. At this time the weather conditions at the site of the accident were marginal with a 300-600 foot overcast ceiling, mixed rain and snow, and winds gusting to 69 knots. Captain Hutchings testified that under normal circumstances the helicopters would not fly in these conditions but because of the severity of the emergency the pilots decided to take this risk. In so doing they exhibited great courage.

Additional aircraft were dispatched to the *Ocean Ranger* site by RCC Halifax. The 103 Rescue Unit at Gander was "tasked"[7] at 1:31 a.m. but, as stated earlier,

[7]Tasking occurs when RCC formally requests the assistance of primary and secondary SAR resources for a specific SAR mission. Once resources are tasked they depart as quickly as possible.

reported at 1:46 a.m. that adverse weather conditions prevented its helicopters from flying. At 2:24 a.m. 413 Rescue Unit at Summerside, Prince Edward Island, was "alerted"[8] and informed that aircraft would be required to provide communications and search support. At 3:00 a.m. RCC Halifax tasked a Voyageur helicopter stationed at Summerside to proceed to St. John's. This helicopter departed at 4:15 a.m. A Buffalo aircraft, also stationed at Summerside, was tasked at 2:24 a.m. and departed at 3:53 a.m. Additional air support was tasked at 4:40 a.m., when an Aurora aircraft[9] stationed at Greenwood, Nova Scotia, was appointed "On-Scene Commander"[10]; the Aurora departed for the accident site at 7:14 a.m. The first Search and Rescue aircraft from Summerside, the Buffalo, arrived in St. John's at 6:15 a.m.

0415-0714 NST (0745-1044Z)
SAR aircraft support departs from Summerside, Prince Edward Island and Greenwood, Nova Scotia.

0435 NST (0805Z)
The Mobil-contracted helicopters arrive on site.

The Universal helicopters arrived at the site of the accident around 4:35 a.m. but, because the helicopters were not equipped with retrieval equipment, their activities were restricted to directing supply vessels to lifeboats, life rafts, and bodies. The helicopters attempted to hover between 50 to 70 feet above the water, but had to pull up periodically, because high waves and breaking spray posed a threat to their safety. When the helicopters were landing on the *SEDCO 706* and *Zapata Ugland* to refuel, the pilots had to use extreme caution, because the heavy seas and strong winds caused the rigs to pitch and roll. The helicopters had to "hot refuel"[11] because the high winds did not permit the pilots to shut down the engines. Captain Hutchings stated that the winds were so strong that the refuelers had to crawl on the helideck with the assistance of lifelines. The helicopters stayed on the rigs until notification came that the SAR helicopters were on their way and that they could return to St. John's. At 6:00 a.m. they were airborne for the return trip.

The weather conditions at Gander improved in the early morning. At 6:00 a.m. the ceiling was 2000 feet, with 4 miles visibility and winds of 18 knots gusting to 25 knots. By 6:30 a.m. there was a 3000-foot ceiling and improved visibility of 12 miles but winds were gusting to 28 knots. At 6:30 a.m. and 6:50 a.m. the SAR helicopters departed for St. John's. Before their departure, the pilots received very little information on the accident. They were advised by a Universal Helicopter's dispatcher that the rig could not be detected on radar but they were given no pertinent information on the rescue effort. The SAR helicopters landed in St. John's shortly before 7:30 a.m. to refuel and receive updated information on the rescue effort.

Captain Clarke, one of the SAR helicopter pilots, testified that Mobil personnel at the airport had no knowledge of the activities of the supply vessels and did not know whether or not the rig was still upright, even though the *SEDCO 706* had been advised at 3:38 a.m. that radar contact with the *Ocean Ranger* had been lost. He stated that at that time not even RCC Halifax had any up-to-date information and that when he left St. John's shortly before 8:30 a.m. he did not know whether the *Ocean Ranger* was still afloat or whether survivors had been located and rescued. The two Universal helicopters arrived back in St. John's at 8:35 a.m. and reported that the *Ocean Ranger* had sunk. This was the first visual confirmation of the tragedy received by the Mobil and the SAR personnel at St. John's airport.

0835 NST (1205Z)
The Mobil-contracted helicopters land at St. John's and report that the *Ocean Ranger* has sunk.

[8]An Alert is the first stage of a SAR incident. Resources which may be required to render assistance are advised of the incident.

[9]An Aurora is a military aircraft which is used in submarine detection and surveillance operations. The Aurora is fitted with sophisticated radio equipment and sensing devices which are useful during SAR incidents where multi-aircraft and vessel resources are used.

[10]The On-Scene Commander is designated to co-ordinate and control the search and rescue mission.

[11]Hot refuel is a fueling procedure used by helicopters whereby the rotor blades are not shut down. This procedure is required when wind speeds exceed either the shut down or start up limits of the helicopter.

SEARCH FOR SURVIVORS

The supply vessels continued their search throughout the night but sea conditions and inadequate retrieval equipment frustrated all efforts to recover bodies. At 7:00 a.m. the *Nordertor* spotted a capsized lifeboat with a life ring from the *Seaforth Highlander* attached to it. The *Nordertor* made several unsuccessful attempts throughout the morning to recover the lifeboat. On one of its recovery attempts the *Nordertor* retrieved the propellor and shaft of the lifeboat. During the final unsuccessful attempt to recover this lifeboat, Captain Allingham observed some 20 bodies strapped inside; several bodies floated out through a hole in the bow and one was washed onto the afterdeck of the *Nordertor*. Allingham stated that the lifeboat eventually disappeared and, in his opinion, sank. It was obvious from the life ring attached that this was the same lifeboat encountered by the *Seaforth Highlander* at 2:21 a.m.

0935 NST (1305Z)
First SAR aircraft arrives on site.

By 9:45 a.m. all the air support tasked by RCC Halifax had arrived. The Aurora assumed control and began to co-ordinate the search. The SAR helicopter from 103 Rescue Unit in Gander, commanded by Captain Clarke, had arrived at approximately 9:35 a.m. He spotted two lifeboats and two life rafts. One of the lifeboats was completely capsized while the other was observed to be holed and down on one end; the two life rafts were partially inflated and floating just below the ocean surface. Captain Clarke and his crew also observed bodies floating in the water in clothing that ranged from pajamas to the orange immersion suits worn by rig crews when they are being transported by helicopter. Captain Clarke attempted to recover one of the bodies dressed in an immersion suit by lowering SAR Technician Master Corporal Randy Brown on the SAR helicopter's hoist system. Brown was able to touch the back of the victim's life preserver but a breaking wave separated him from the body and prevented recovery. Brown reported that the body appeared lifeless and, except for resurfacing occasionally, was floating just below the ocean surface.

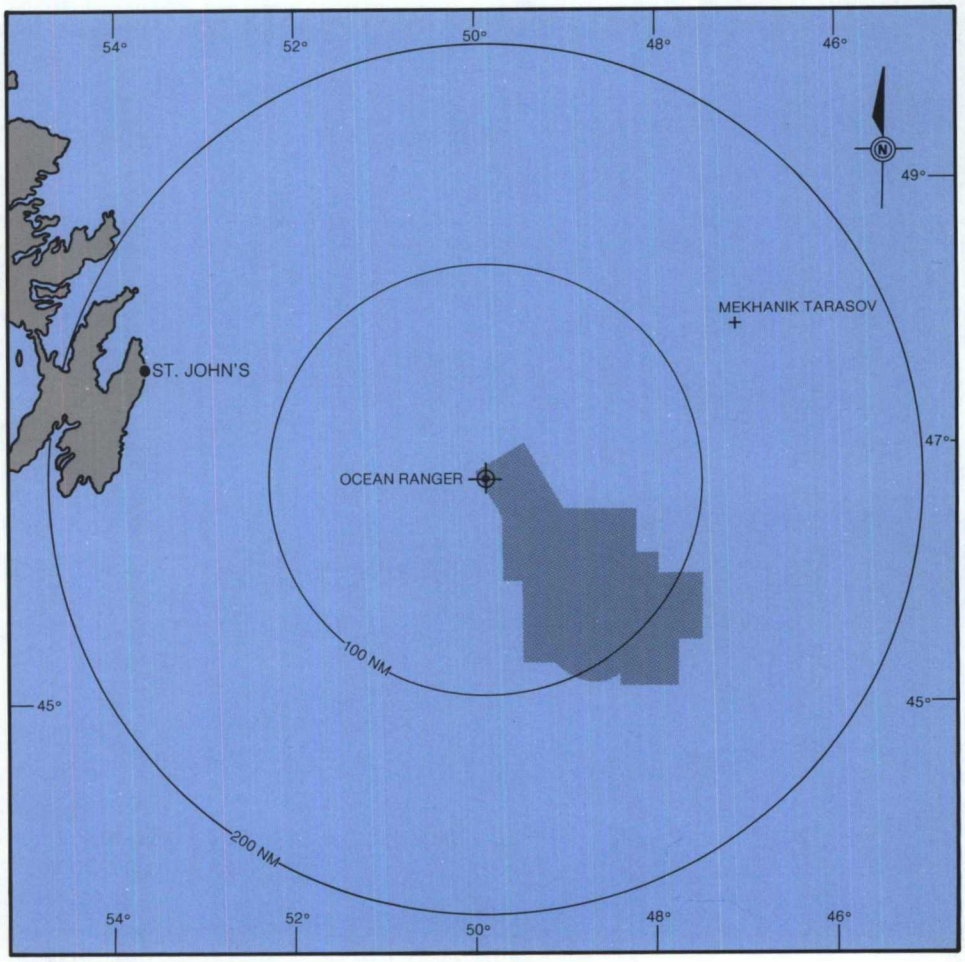
0946 NST (1316Z)
RCC Halifax tasks vessel support.

In addition to air support, RCC Halifax tasked vessels in the general vicinity of the accident and the Canadian Coast Guard Ships (CCGS) stationed in St. John's. At 9:46 a.m. RCC instructed SAREC to task the CCGS *Bartlett*. However, at 10:43 a.m. the *Bartlett* was released and CCGS *Sir Humphrey Gilbert* was tasked instead. It departed St. John's at 11:39 a.m. but because of the poor sea conditions and heavy winds the *Gilbert* estimated its arrival time at the *Ocean Ranger* site at 1:00 a.m. on Tuesday, February 16. While enroute, the *Gilbert* was reassigned to assist the *Mekhanik Tarasov*,[12] a Russian cargo vessel which was in distress in the vicinity of the *Ocean Ranger*.

RCC Halifax also tasked the *Gadus Atlantica*, a research vessel under charter to the Canadian Department of Fisheries and Oceans, at 10:42 a.m., February 15. The *Gadus Atlantica* was 119 miles from the accident site and estimated its arrival at 6:00 a.m., February 16. The *Java Seal*, a seismic vessel, was also tasked at 11:39 a.m. on February 15. Several vessels also responded to the 2:04 a.m. All Ships Broadcast from the Coast Guard Radio Station in St. John's but because of their distance from the site of the accident, most were tasked and then released.

The search efforts of the helicopters and supply vessels on Monday, February 15, were unsuccessful in locating survivors. Throughout the day supply vessels, assisted by aircraft, searched for lifeboats, life rafts, and bodies. With the exception of the one body recovered by the *Nordertor*, all vessels were unsuccessful in recovering additional bodies. Several visual inspections of lifeboats by SAR helicopters revealed no sign of life nor any sign of having been occupied.

[12]The *Mekhanik Tarasov* sank at 5:00 a.m., February 16, 1982. A total of 32 crew members died. Five crew members, however, were successfully rescued by the Faroese fishing trawler *Sigurfari*. The Master of the Faroese trawler, Mikkjal Olsen, testified that the heavily clothed Russian seamen were in the water for approximately 20 minutes before they were recovered. With the exception of one, all were in a hypothermic condition and one died shortly after being recovered. Sea conditions at the time were rough and winds exceeded 45 knots.



8.5 A search area of over 6000 square miles was covered during the four days after the loss, through the combined efforts of both industry and government aircraft and vessels.

On Tuesday, February 16, the search efforts continued with support provided by the Aurora and two Buffalo aircraft. The CCGS *Bartlett*, still in St. John's, was retasked at 9:08 a.m. to replace the *Gilbert* which had been reassigned earlier to assist the Russian cargo vessel. Additional vessels had arrived to assist the *Boltentor* and the *Nordertor*. Throughout Tuesday, a thorough search of the area was completed; one body was recovered, and the *Nordertor* located and recovered an unoccupied lifeboat. The *Bartlett* arrived in the search area at 1:00 a.m. on Wednesday, February 17. At 4:30 p.m. that day, RCC Halifax formally requested that the search effort be reduced, and approval was received from SAR in Ottawa the following day. The search for survivors was discontinued at 11:10 p.m., Friday, February 19, although vessels in the area maintained a watch for bodies and debris for a number of days after. Two lifeboats and six life rafts were also recovered.

The search and rescue operations led to the recovery of 22 bodies from the 84-man crew with the last body recovered on February 20 by the *Boltentor* (Appendix G). Autopsy results indicated that in all cases the cause of death was drowning while in a hypothermic condition.

Personnel Named in Chapter 8
Alphabetical

NAME	POSITION	COMPANY
ALLINGHAM, Baxter	Master, *Nordertor*	Crosbie Offshore
BLACKMORE, Ken	Medic/Radio Operator, *Ocean Ranger*	ODECO
BROWN, Randy	SAR Technician, Gander	103 Rescue Unit
CLARKE, George	Aircraft Commander, Gander	103 Rescue Unit
CHAYTOR, Dennis	Seaman, *Seaforth Highlander*	Seaforth Maritime
COUNTS, Jim	Drilling Superintendent, St. John's	ODECO
DAVISON, James	Master, *Boltentor*	Crosbie Offshore
DUNCAN, Ronald	Master, *Seaforth Highlander*	Seaforth Maritime
FLYNN, Rick	Radio Operator, Mobil Base, St. John's	Harvey Offshore Services
FRASER, Rod	Drilling Foreman, *SEDCO 706* (On-site Co-ordinator of Rescue Mission)	Mobil Oil
GRAHAM, Merv	Area Drilling Superintendent, St. John's	Mobil Oil
HIGDON, Jerry	Second Mate, *Seaforth Highlander*	Seaforth Maritime
HUTCHINGS, Bruce	Co-pilot, St. John's	Universal Helicopters
JACOBSEN, Jack	Senior Drilling Foreman, *Ocean Ranger*	Mobil Oil
JORGENSEN, Rolf	First Mate, *Seaforth Highlander*	Seaforth Maritime
LIDSTONE, Kenneth	Seaman, *Seaforth Highlander*	Seaforth Maritime
MARTIN, Malcolm	Second Mate, *Boltentor*	Crosbie Offshore
PREUS, Rudolph	Aircraft Commander, Gander	103 Rescue Unit
REES, Eric	Seaman, *Seaforth Highlander*	Seaforth Maritime
SENKOE, Keith	Drilling Foreman, *SEDCO 706*	Mobil Oil
WOOLRIDGE, Bert	Seaman, *Seaforth Highlander*	Seaforth Maritime

Personnel Named in Chapter 8
By Location

ONSHORE	OFFSHORE	
St. John's	**Hibernia**	
	Ocean Ranger	*Seaforth Highlander*
GRAHAM, Merv	JACOBSEN, Jack	JORGENSEN, Rolf
FLYNN, Richard	BLACKMORE, Ken	HIGDON, Jerry
HUTCHINGS, Bruce		DUNCAN, Ronald
COUNTS, Jim		REES, Eric
		WOOLRIDGE, Bert
		LIDSTONE, Kenneth
		CHAYTOR, Dennis
Gander	*SEDCO 706*	*Boltentor*
PREUS, Rudolph	SENKOE, Keith	MARTIN, Malcolm
CLARKE, George	FRASER, Rod	DAVISON, James
BROWN, Randy		
	Zapata Ugland	*Nordertor*
	———	ALLINGHAM, Baxter

9

ANALYSIS OF EMERGENCY RESPONSE

CHAPTER NINE ANALYSIS OF EMERGENCY RESPONSE

The analysis of the response to the emergency that developed on board the *Ocean Ranger* on the night of February 14 and resulted in the loss of the entire crew includes the response of the crew on the rig as well as the response of both industry and government.

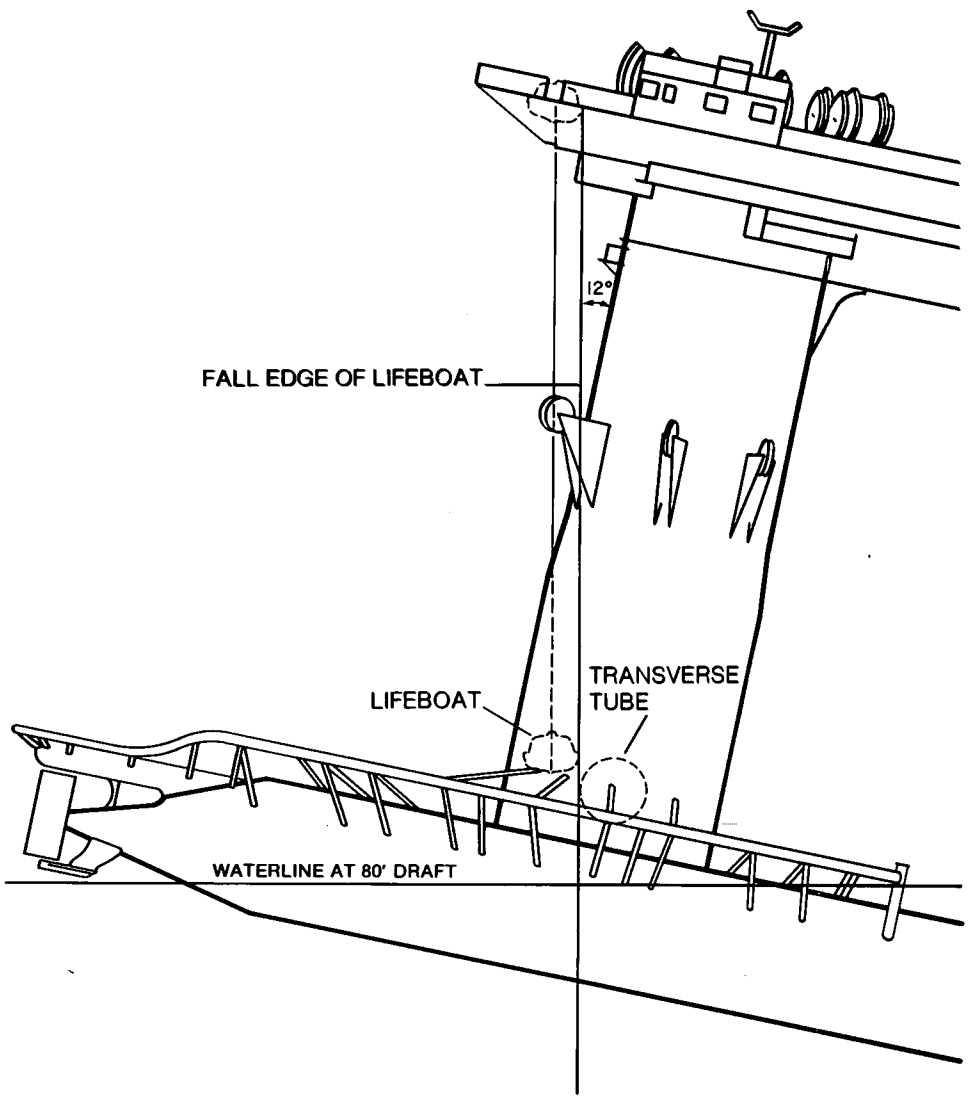
The last communication from the *Ocean Ranger* was at 1:30 a.m. when it was stated that the crew were going to the lifeboat stations. There is evidence to indicate that key personnel on board were unaware, up to the last hour, that a serious problem existed, and, when they did become aware, they may have thought they could remedy it as they remedied the severe list on February 6. When they began to realize, around 1:00 a.m., that the problem was beyond their ability to solve, they were minutes away from abandoning the rig and unable to give adequate warning to those who might have helped them.

There was no communication from Jacobsen or Thompson to their shore bases before 1:00 a.m. to indicate any realization of a serious situation nor did the VHF conversations overheard by personnel on the *SEDCO 706* earlier in the evening reflect serious concern. Senior personnel on the *Ocean Ranger* knew that their standby vessel, the *Seaforth Highlander*, was eight miles away, but they made no request until 1:05 a.m. for her to come to close standby. When the *Ocean Ranger* weather observer transmitted his report at 11:30 p.m., he gave no information other than routine weather observations. Even at 1:00 a.m. when Jacobsen spoke to Graham, there was no mention of a Mayday. That conversation did indicate that Jacobsen recognized possible danger and was giving an alert. But even at that late hour, he appeared to think that the situation was not beyond control. Whatever happened thereafter, happened quickly.

Little warning was given to the Mobil shore base. In fact, when the telex went out for help at 1:09 a.m., it was not in a proper form to depict the urgency of the situation since the word "Mayday" was not used. The telex, which had no addressee, went of necessity to the MARISAT operator in Connecticut who, after checking with the *Ocean Ranger*, directed it to the U.S. Coast Guard in New York, who later phoned it to RCC Halifax. Time would have been saved if the telex had been addressed to RCC Halifax. The telex was, however, interpreted and treated as a Mayday. After the dispatch of the telex, the *Ocean Ranger* attempted to send out a Mayday on the 2182 kHz distress frequency. Their messages were not picked up on shore, presumably because of the low power of their transmitter. The relays being sent out by the *SEDCO 706* were not heard initially for the same reason. When the transmission power was increased on the *SEDCO 706*, the Mayday relay was picked up by the Canadian Coast Guard station in St. John's at 1:45 a.m. but evidently not by any ship of passage.

When the seriousness of the situation was fully recognized around 1:15 a.m., the only resource available for evacuation was the lifesaving equipment on board the rig. The *Seaforth Highlander*, steaming towards the rig, was still over seven miles away. Helicopters were at least one hour flying time away and even under ideal weather conditions and at 30-minute standby, could not have arrived in time to evacuate the crew. Not all of the lifesaving equipment on board the rig was available to the crew at 1:30 a.m. The rig had by then developed a trim in excess of 15 degrees, with waves crashing over its bow, and the lifeboat located there would have been submerged most of the time, if not already smashed. It would in any case have been inaccessible. The only lifeboats accessible were the two located on the stern. The life rafts were also available at various locations on the upper deck, but their use that night was impossible.

How the crew left the rig is not known. The only definite evidence available is that 30 or more left in the Harding lifeboat positioned on the rig's port stern, the same lifeboat that came alongside the *Seaforth Highlander* and eventually capsized. It is not known whether the Watercraft lifeboat, also located on the stern, was launched nor whether a muster list existed for this recently installed boat. That lifeboat was not recovered. It is, however, known that at approximately 2:55 a.m. when the rig was last observed by the crew of the *Boltentor* no lifeboats were seen on the



9.1 This illustration is taken from the ODECO installation plans for the Watercraft lifeboats. The design limitation for safe launching is illustrated at a 12 degree bow trim. The pitch and roll of the rig in heavy seas would restrict safe launching to a much smaller angle.

stern. It is evident from the large number of bodies sighted in the vicinity by the supply vessels and the helicopters, that the crew had abandoned the rig. Whatever the means of evacuation adopted, it is evident that none was practicable or safe under the prevailing wind and sea conditions. When it became evident that the severe trim was beyond control, confusion may have developed in the rush to the lifesaving equipment and that may explain the light clothing on some of the bodies that were either recovered or sighted.

INDUSTRY RESPONSE

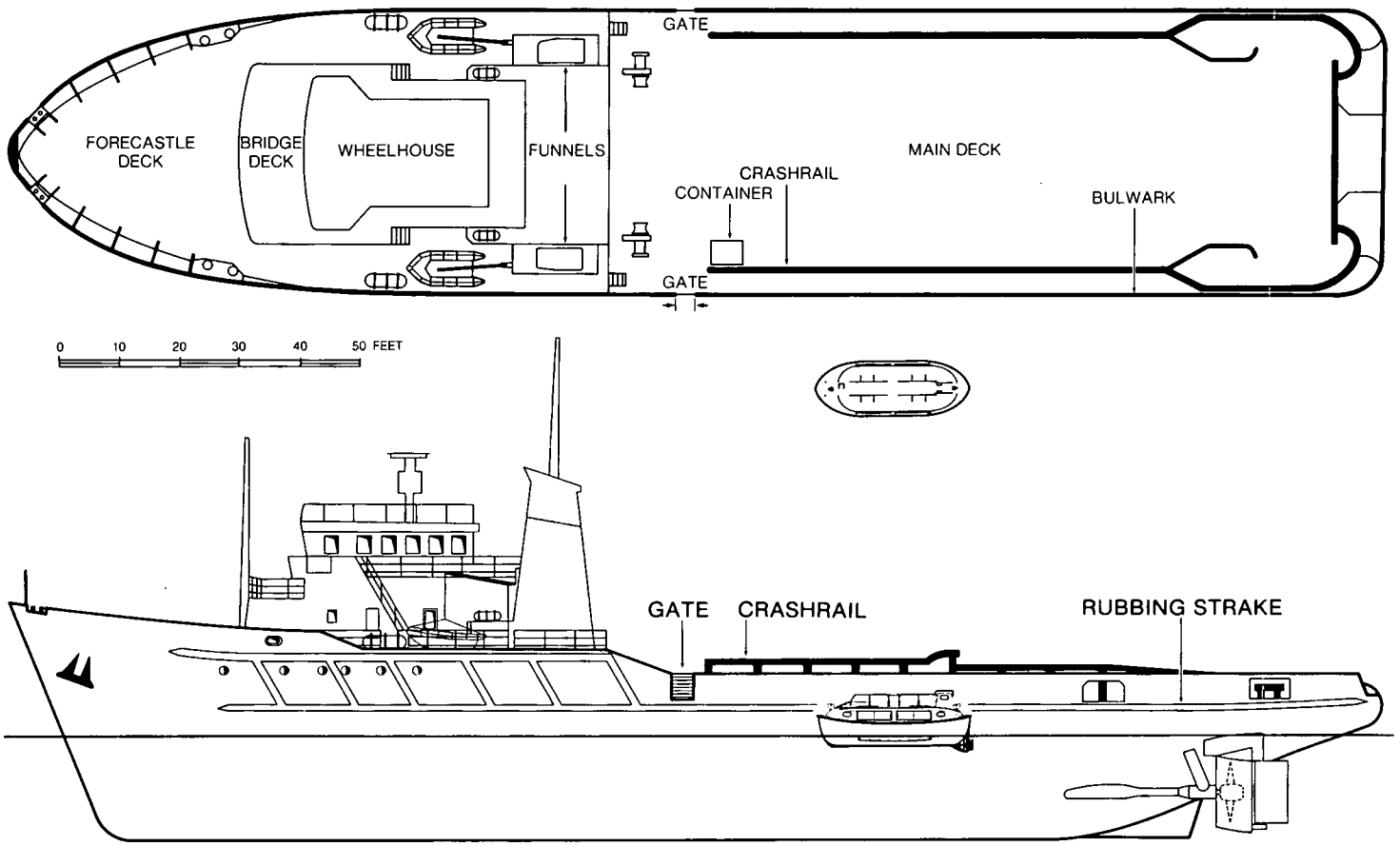
Industry's response to the disaster was primarily the responsibility of Mobil who controlled the supply vessels and the helicopters. Mobil's *Contingency Plans and Emergency Procedures* manual was designed to facilitate the mobilization of personnel and the co-ordination of communications and resources in the event of an emergency. Responsibility for initiating and supervising these functions rested, according to the manual, with the emergency communications officer who, on that night, was Merv Graham. It was his duty to summon key Mobil personnel in St. John's and to dispatch vessels and helicopters to aid the stricken rig. He also had to co-ordinate communication with the other rigs, the standby vessels and the helicopters under contract, and with SAREC in St. John's and RCC Halifax.

Graham, who was at home when he received the MARISAT call from Jack Jacobsen at 1:00 a.m., immediately alerted SAREC and instructed Ken Beattie, Mobil's logistics supervisor, to alert the helicopters and to go to the airport. Graham then told Rod Fraser, senior Mobil drilling foreman on the *SEDCO 706*, to dispatch the standby vessels of the other two rigs to the *Ocean Ranger*. He then proceeded to the Mobil shore base where a communication centre was manned on a 24-hour basis. He appointed Fraser as on-scene co-ordinator to organize the emergency response of the standby vessels and to channel communications to the shore base. Graham told Fraser that shore base would keep SAREC and the Canadian Coast Guard informed of developments.

Transcripts of the tape-recorded SAREC and RCC telephone conversations throughout the rescue operations, including those with Mobil personnel, were entered in evidence. It is apparent from a review of these transcripts that communications emanating from Mobil shore base were neither accurate nor prompt, with consequent confusion and delay. This was evident not only with respect to communications from the shore base to SAR agencies but even among Mobil personnel. The Mobil radio operator told SAREC that there were three ships in the area of the *Ocean Ranger* and that three or four "Chinooks"[1] were being dispatched to evacuate the crew. This information was inaccurate and may have influenced RCC's decision not to press additional SAR resources immediately into service. Mobil did not use Chinooks in their offshore operations, rather they had under contract from Universal Helicopters Ltd. three Sikorsky S-61s of which two were dispatched. As late as 5:27 a.m., SAREC was told by a senior Mobil employee that there was no real change in the status of the rig and that two standby vessels were at the scene. This is difficult to understand because the *Nordertor* reported at 3:38 a.m. that the *Ocean Ranger* had disappeared from radar. This information was not passed on by Mobil to SAREC until 7:35 a.m. and even later to Mobil personnel at the airport. In fact the pilot of one SAR helicopter testified that when he left Torbay airport around 8:30 a.m., Mobil personnel at the airport did not have any pertinent up-to-date information on the rescue efforts nor did they know whether the rig was afloat or had sunk.

It is evident that Mobil's key personnel had not practised their emergency procedure roles to gain an understanding of what they would be required to do in the

[1] A Chinook is a twin rotor helicopter similar in design to the SAR Labrador/Voyageur helicopters.



9.2 This is a plan and elevation view of the *Seaforth Highlander* and the Harding lifeboat in stillwater. On February 15, 1982, the severe sea conditions seriously hampered rescue attempts.

event of evacuation of a rig. It is only fair to state, however, that through circumstances beyond their control, Graham and Fraser and even the radio operator were laden throughout that period with duties and responsibilities which they were not qualified by training or experience to carry out.

The marine resources available under contract to Mobil were seven supply vessels. Three of them were on standby duty on the Hibernia Field; the other four were tied up in St. John's harbour. Supply vessels, however, are designed for carrying heavy goods and materials, for towing, and for anchor handling. Their wheelhouse is located on the top of a high superstructure near the bow of the ship. The working and cargo deck runs from this superstructure to the square stern of the ship and is fitted with solid bulwarks on both sides. There are no appropriate gates or openings in these bulwarks to facilitate rescue which, in any case, would be difficult because of the high freeboard that is up to eight feet when the ship is without cargo. Another complicating factor is the rubbing strake running along both sides of the ship, which not only lessened the possibility of rescuing someone from the stormy seas but which could possibly catch the gunwale of a lifeboat and capsize it. The configuration of the supply vessels also hampered rescue operations. It is difficult to hold the bow into the wind at minimum speed in heavy seas because of the high superstructure. The captain or mate cannot keep an eye on the oncoming seas and the rescue efforts taking place from the deck behind him. The only alternative is to manoeuvre the stern of the ship into the wind and waves. The wheelhouse has a window and a control console facing aft. This enables him to watch both the waves and the actions of the crew while manoeuvring the vessel. In this position, however, waves can break over the low unprotected stern and wash over those involved in the rescue attempt. None of the vessels had special rescue equipment, such as a crane with basket or net, suitable for

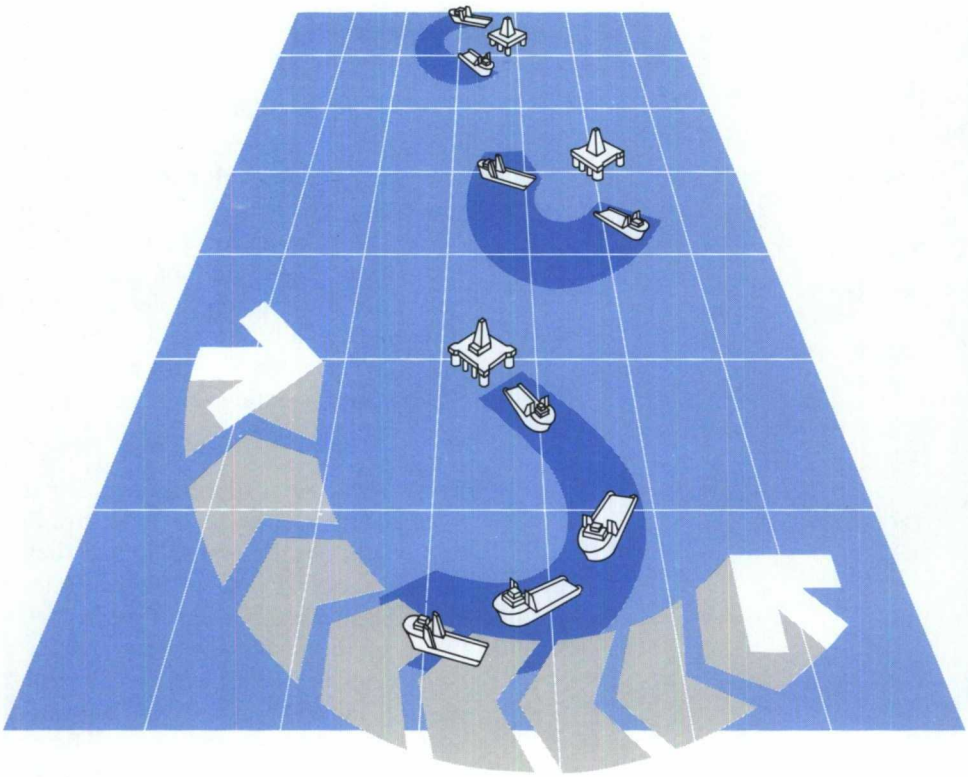
rescue operations during a storm. In fact, they did not even have the meagre amount of rescue equipment required under the COGLA regulations.

COGLA required the presence of a "suitable" standby vessel but its regulations did not specify the type of vessel that would be suitable to rescue the entire crew of a drilling unit and to treat, if necessary, a large number of survivors suffering from hypothermia. The regulations also did not require adequate rescue equipment and training for the crews of these vessels to cope with an emergency of this magnitude. Mobil did not specify what was required of the vessels for rescue purposes nor did the companies providing the vessels question the fact that they were expected to fulfill a standby role although they did not have the necessary equipment. Reasonable foresight ought to have dictated that these vessels be appropriately designed, adequately equipped and properly manned with specially trained personnel for rescue operations.

The crew of the *Seaforth Highlander*, who, without safety lines and with the deck awash, strove valiantly to save the men in the lifeboat displayed courage in the best traditions of the sea. Neither they nor the crews of the other vessels had training in rescue operations and, in their efforts to find and rescue survivors more could not have been asked of them. The *Seaforth Highlander*, however, as the standby vessel assigned to the *Ocean Ranger*, had a special duty and responsibility towards that rig. And yet, when help was urgently required, she was some eight miles away. There are several factors that may mitigate in defence of her master, Captain Duncan, and there are other people who must bear some share of responsibility for the location of his ship. When Captain Duncan took command of the *Seaforth Highlander* on February 7, 1982, he had no instructions regarding the standby role of his vessel nor were there any instructions posted on board for this assignment. He understood that he was taking command of an anchor handling supply vessel and it was only upon his arrival at the Hibernia site that he discovered that his vessel and crew would have to fill the rescue role.

Captain Duncan testified that he was told while he was at sea by someone on the *Ocean Ranger* that he should stay, weather permitting, within two miles of the rig. This was the practice of the other masters and was commonly known and accepted within the industry. Duncan intended to raise the matter with his employers upon his return to port but, in the meantime, on the basis of that conversation, drew up standing orders for "the particular benefit of bridge watchkeeping personnel who have little or no degree of experience with subject concerned." These standing orders stated that the primary duty of the vessel is "to maintain standby status as ordered by the rig and to be ready in all respects to save life." They specified the maximum distance (weather permitting) from the rig to be two miles and the actions to be taken in the event of a major disaster at the drill site. In compiling his standing orders Captain Duncan drew upon his experience in the North Sea. There were no COGLA or Newfoundland Petroleum Directorate regulations to guide him nor instructions from his company or from Mobil. COGLA regulations simply state that the "person in charge of a standby craft . . . shall . . . maintain the craft within such distance from the drilling unit as is approved by the Chief."[2] Neither the Chief nor any other COGLA official, however, had issued or approved written instructions on standby distances. The responsibility in practice was left to the operator but Mobil had issued no written instructions on the matter. Duncan's company, through a representative of Seaforth Fednav, argued that there was no mention of a standby role in its contract with Mobil. This is, however, not satisfactory either as an excuse or as an explanation. The role of these supply vessels was well known in the industry. The

[2]*COGLA Drilling Regulations 1980* – Secton 142 (b). (The "Chief" was the Chief Conservation Officer or Administrator of COGLA under the *Oil and Gas Production and Conservation Act*.)



9.3 As the storm centre passed to the east of the Hibernia Field during the evening of February 14, the wind veered from the southeast to the west. The *Seaforth Highlander* proceeded into the wind and followed a course which led to a position approximately eight miles south of the *Ocean Ranger*. The *Boltentor* (centre) and the *Nordertor* (top) maintained dodging patterns upwind of their respective rigs.

company should have used the same initiative as Captain Duncan and issued the necessary standing orders for standby duties for its vessels under contract to oil companies exploring off Eastern Canada, or at least given verbal instructions to its captains.

The masters of the *Nordertor* and the *Boltentor*, both of whom had more experience on the Grand Banks than Captain Duncan, testified that it was their practice to move off from their assigned rig during stormy weather and to dodge upwind to a maximum of six miles and then downwind to within two miles. That is the course, according to their testimony, that they followed that night. In that way they were approximately within a half an hour of their respective rigs at all times. Captain Duncan's practice, according to the standing orders he drew up, was to dodge at a speed and on a course that "when conditions permit, the vessel presents bow or stern to heaviest swell to reduce rolling to a minimum." On the night of the loss he kept the bow of his vessel into the wind and maintained just enough power to maintain steerage and to keep control of the ship. He estimated, on the basis of the weather forecasts,that in this way he would initially move farther away from the rig but, as the wind swung around, his vessel would circle closer. Ironically, when he was called at 1:05 a.m. to come closer, his ship was at the farthest point away from the rig that the course that he adopted would take it. He testified that the waves that night were so tremendous that he was reluctant to turn his ship, fearing for the integrity of her structure and the safety of his crew. That reluctance was reinforced by his experience as captain of the *Seaforth Highlander* during a storm in the North Sea when the sea damaged her upper structure.

It is unquestionably the rule of the sea that the captain has the right to use his best judgement in protecting the safety of his ship and of her crew. That is his first and prime responsibility. But the captain of a standby vessel also has a direct responsibility for the crew of the rig. The course of action adopted that night by Captain Duncan was in marked contrast with those of Captain Davison of the *Boltentor* and Captain Allingham of the *Nordertor*. Taking into account, therefore, the actions of

the other captains and the responsibility of a standby vessel, one is led to the conclusion that Captain Duncan ought to have been at closer standby. When, however, he heard the call to come to close standby, he did turn his ship and sped towards the rig with engines at full speed.

The three Sikorsky S-61 helicopters under contract with Mobil were used primarily to transport crew, light material and supplies. They were not equipped with hoists or any other equipment designed to lift men from a rig or from the sea, nor were the crews trained in rescue operations. They were alerted around 1:20 a.m. and the crews reached the airport around 2:15 a.m. but take-off was delayed by high winds. The first helicopter was airborne around 3:20 a.m. with ODECO rig superintendent, Counts, as the sole passenger. The second helicopter departed at 3:45 a.m. The weather conditions were highly questionable for flying: there was a low ceiling; it was overcast with mixed rain and snow; winds were gusting to 69 knots and there was the possibility of icing at the Hibernia site. There was no guarantee that the helicopters would be able to land on any rig for fuel, if it were required for the return trip but because of the nature of the emergency and the number of lives at stake the risk was taken and the flight made. The possibility existed that the pilots might be able to land on the rig to rescue the crew or otherwise participate in a rescue effort. In fact, they arrived too late to land on the *Ocean Ranger* but participated in the unsuccessful rescue attempt. Even if they had been alerted at around 1:00 a.m. when personnel on the *Ocean Ranger* first realized they were facing a serious situation, these helicopters would have been too late to rescue anyone. The courage, however, displayed by those who ventured out that night is highly commendable.

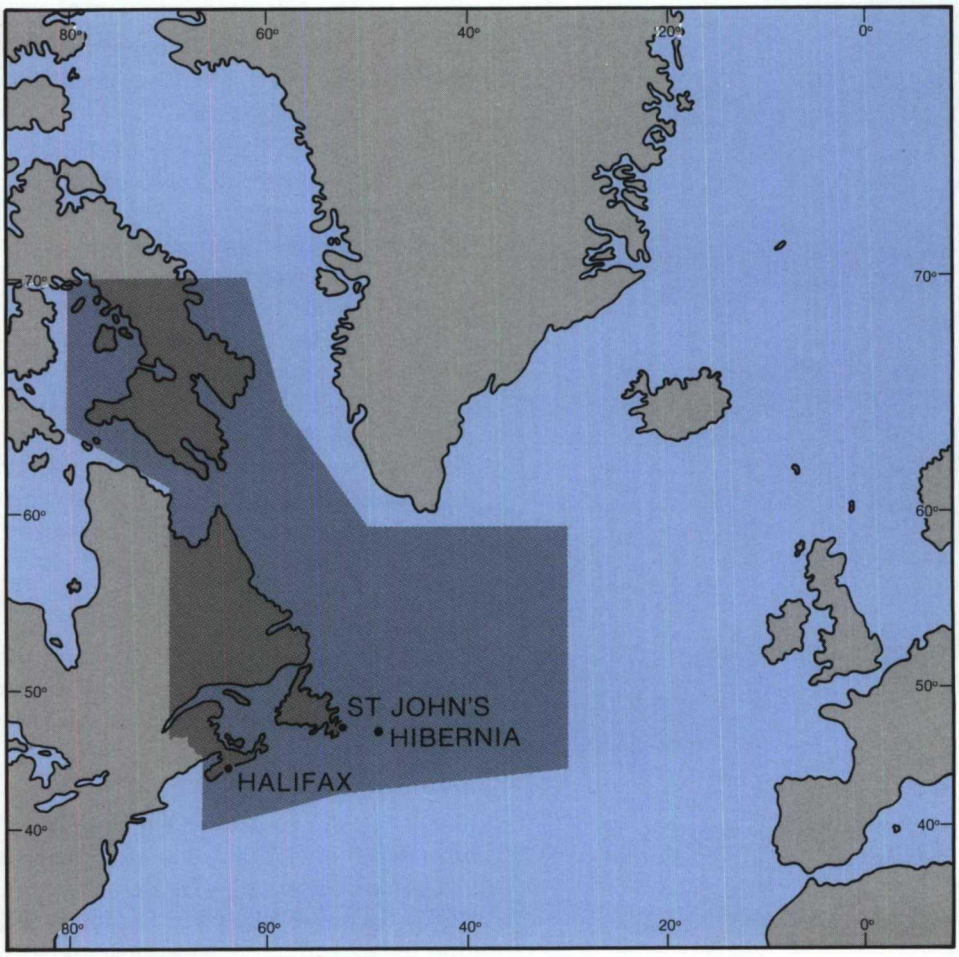
SAR RESPONSE

The SAR organization in Eastern Canada consists of the Rescue Co-ordination Centre (RCC) in Halifax which has the responsibility for co-ordinating search and rescue efforts for the entire eastern region of Canada and the Search and Rescue Emergency Centre (SAREC) at St. John's which has the responsibility for marine search and rescue within the Newfoundland area, unless that responsibility is taken over by RCC Halifax.

SAR uses a Time Line to depict the series of events marking the stages of a SAR incident. (The part of that Time Line relevant to the loss of the *Ocean Ranger* and its crew extends from the "incident occurs" to the "commencement of aid", marking the end of the response time of the SAR system.) The dedicated[3] SAR response system is started at the time RCC or SAREC is made aware that an incident has occurred. The amount of time which elapses before the response system starts depends upon the speed with which an incident is reported and the time consumed in relaying the crucial information that assistance is needed.

When an incident is reported, RCC or SAREC controllers either act immediately or obtain more information. Their actions are controlled in part by SAR procedures and by their own discretion and experience and are influenced by the nature, accuracy and completeness of the information that they have at their disposal. The controllers decide when and what SAR resources to task. The reaction of the SAR resource depends upon its standby status which, in the case of aircraft, may vary from 30 minutes to 2 hours depending upon time of day. The weather, the circumstances of the incident and other factors also influence the response time. Transit time depends on the distance between the base of the SAR resource and the location of the incident, the type of the resource, and the speed with which it can reach the

[3]"Dedicated" is a SAR term used to differentiate between primary and secondary SAR resources. Primary resources, or those dedicated specifically to search and rescue in the Halifax SAR region include aircraft stationed at Summerside, Prince Edward Island, and Gander, Newfoundland, and marine resources in Newfoundland and Nova Scotia. Secondary resources include air and marine resources of various government departments or ships of opportunity which could also be "tasked".



9.4 RCC Halifax is responsible for co-ordinating all Search and Rescue operations within an area of approximately 1.8 million square miles, of which 1.2 million square miles is over water.

scene. It is against this Time Line that the SAR response to the *Ocean Ranger* disaster must be judged.

SAREC was notified at 1:06 a.m. that the *Ocean Ranger* had problems and potentially needed help. This notification was repeated between 1:14 a.m. and 1:17 a.m. with the additional information that the rig had dispatched a Mayday. SAREC notified RCC Halifax at 1:21 a.m. that the *Ocean Ranger* had problems but made no reference to the Mayday. Information was included that there were three supply vessels in the area and that three or four commercial helicopters were being mobilized. RCC Halifax at the same time received a telephone call from RCC New York conveying the distress telex message sent from the *Ocean Ranger* by MARISAT at 1:09 a.m. and which RCC New York and RCC Halifax interpreted as a Mayday. At 1:31 a.m. RCC Halifax alerted the SAR 103 Rescue Unit at Gander. A fixed wing aircraft normally accompanies SAR helicopters to provide communications and search support, but the Buffalo at Summerside, Prince Edward Island, was not tasked by RCC Halifax until 2:24 a.m. It was not until 4:40 a.m. that the Aurora aircraft at Greenwood, Nova Scotia, was tasked and appointed "on-scene commander." RCC Halifax asked SAREC at 1:36 a.m. to have an All Ships Broadcast issued, but this was not issued until 2:04 a.m., 28 minutes later. Clearly, there were significant delays between each stage of the reporting and response process that require analysis and comment.

The summary of action taken by Search and Rescue authorities has been repeated for convenience and to facilitate a comparison with the SAR Time Line.

SAR TIME LINE
(OCEAN RANGER INCIDENT)

Incident Occurs	**0100**	Ocean Ranger alerts Mobil, St. John's
Agency Notified	**0106**	Mobil notifies SAREC St. John's
RCC Notified	**0120**	SAREC notifies RCC Halifax
SAR Retasked	**0131**	RCC Halifax tasks 103 Rescue Unit at Gander Nfld.
	0136	All Ships Broadcast Requested
	0146	RCC Halifax advised helicopters cannot take off
	0204	All Ship's Broadcast issued
	0224	RCC Halifax tasks Buffalo at Summerside P.E.I.
	0300	RCC Halifax tasks helicopter at Summerside
SAR Resource Departs	**0353**	Buffalo departs Summerside for St. John's
	0415	Helicopter departs Summerside for St. John's
	0440	RCC Halifax tasks Aurora at Greenwood, N.S.
	0615	Buffalo arrives St. John's
	0630 **0650**	Helicopters depart Gander for St. John's
	0714	Aurora departs Greenwood
	0735	Mobil advises SAREC that *Ocean Ranger* had disappeared
Commencement of Aid	**0935**	First SAR aircraft on site

Fifteen minutes passed from the time SAREC was initially alerted until they notified RCC Halifax and another ten minutes before RCC Halifax alerted Gander. Neither SAREC St. John's nor RCC Halifax had information readily available regarding the coordinates of the three rigs at Hibernia, the radio frequencies used by them, the dimensions of the *Ocean Ranger*, or the location, capacity and call signs of the commercial helicopters under contract to Mobil. Even though time is the single most critical factor in an emergency of this magnitude, SAR did not have a contingency plan which outlined the procedures to be followed in the event of a major marine disaster. There seemed to be a lack of preparedness at RCC and SAREC to meet the demands that would be made upon them when one did occur. There was no sense of urgency displayed by either organization in mustering resources and in responding to the request for help. Actions, even to sending out the All Ships Broadcast, were characterized by undue and unexplained delay. A mitigating factor may have been the false impression given that, with ships in the area and helicopters being mobilized, help was not urgently required. This circumstance, however, does not change the fact that, in spite of a clear warning that a major marine casualty was imminent, one hour was to pass before the Buffalo was tasked and five hours before it arrived at the St. John's airport. Likewise three hours went by before the Aurora was appointed an On-Scene Commander by RCC and more than eight hours before it arrived. In the meantime, co-ordination of the rescue effort was left to untrained Mobil personnel, and the captains of the three supply vessels, inexperienced in rescue operations, had to develop a search pattern without aid of air surveillance and without aid from RCC Halifax.

The air resources available to RCC Halifax to task in support of the *Ocean Ranger* came from 103 Rescue Unit at Gander, which had three Labrador/Voyageur helicopters; from 413 SAR Squadron at Summerside, P.E.I., which also had three Labrador/Voyageur helicopters and three Buffalos; and from Greenwood, N.S. which provided an Aurora.

To provide air response 24 hours per day, 7 days per week and 365 days per year, and to maintain the capability of having one helicopter ready to launch with a high degree of reliability, a SAR helicopter unit has to have a minimum of three helicopters and five crews[4]. If the squadron had only two helicopters, there would be no helicopter available for approximately 8% of the year, because of the random effect of helicopter downtime due to planned and unplanned maintenance (Appendix G, Item 6). If three are assigned, there will be no helicopter available for approximately 1% of the time. Unplanned maintenance can make the situation even worse; the Gander squadron, for example, had no helicopter ready to respond to a request for aid for a 63-hour period in March, 1982. The number of crews required to man three helicopters depends upon the length of the standby[5].

The Labrador/Voyageurs are twin turbine, tandem-rotor amphibious helicopters with a normal cruising speed of 115 knots and an operating radius of approximately 225 nautical miles. They carry a full complement of rescue equipment and normally a crew of five, consisting of pilot, co-pilot, two SAR technicians and a flight engineer. These helicopters were manufactured some twenty years ago and have undergone extensive renovations. They are no longer being produced and spare parts are therefore difficult to obtain. To maintain them to Department of National Defence standards requires a rigorous maintenance program involving long periods of time when a helicopter is not available for duty. The helicopters at Gander in February 1982 did not have radar, automatic flight control systems, hover coupler systems or VHF/FM marine band radios. Radar allows the pilot to fly below cloud

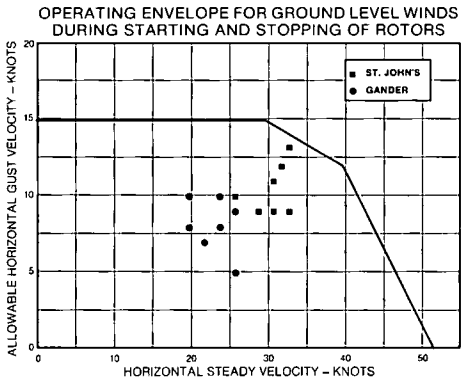
[4]This establishment will make possible the provision of a response at 30 minutes' notice during working hours and at two hours' notice during off-duty hours when at least one crew will be on call at home.

[5]For a 30-minute standby, eight hours per day every day of the year, six crews are required.

cover at night because he can differentiate and locate high ground. The absence of radar would force the pilot to fly above the high ground possibly into clouds where rime icing may exist. An automatic flight control system and hover coupler system would aid considerably in rescue operations as they would allow the helicopter to hover in a fixed position close to the water without pilot assistance. The absence of VHF/FM marine radios prohibited the helicopters from communicating directly with vessels during a rescue attempt. The main deficiency of the Labrador/Voyageur, however, is its relatively short range and endurance for marine rescues offshore. There are also weather limitations because these helicopters are not permitted to fly when there is icing, present or forecast. The Labrador/Voyageurs are also limited for start up and shut down, by manufacturer's specifications, to steady winds of 52 knots. The presence or forecast of gusts will reduce that limitation to 30 knots when the gust spread reaches the allowable maximum of 15 knots.

When RCC Halifax placed 103 Rescue Unit (Gander) on alert at 1:31 a.m. one helicopter was serviceable but later that morning, at 5:30 a.m. a second helicopter became available. Weather conditions, however, in the opinion of the aircraft commander, prohibited flying. Although there existed some ambiguity about wind conditions in Gander at that hour, a review of the forecast has shown that the winds at Gander were less severe than those at St. John's and at neither place did they exceed the limitations imposed upon the helicopter for start up. The limiting factor, according to the helicopter's operating manual, was that an area forecast indicated the possibility of rime icing in the clouds between Gander and St. John's. There is no method of verifying quickly whether rime icing in clouds is in fact occurring except by actually flying. To fly the direct route between Gander and St. John's, it would have been necessary for the pilot to enter the low cloud layer to avoid the high intervening ground and thus possibly encounter rime icing if it, in fact, were present in the clouds. The commanders of the helicopters decided not to take the risk. There was an alternate route along the Gander River to the coast and thence over water to St. John's beneath the cloud layer. But without radar and an automatic flight control

9.6 A SAR Labrador/Voyageur helicopter.



TIME	ST. JOHN'S				GANDER			
0130	33	gusting	to	42	26	gusting	to	35
0230	31	"	"	42	26	"	"	31
0330	33	"	"	46	24	"	"	34
0430	31	"	"	40	22	"	"	29
0530	26	"	"	36	24	"	"	32
0630	29	"	"	38	20	"	"	28
0730	32	"	"	44	20	"	"	30

9.7 A comparison of the actual wind velocities at Gander and St. John's shows that at neither place did they exceed the start-up limitations imposed on the Search and Rescue helicopters.

system, flying a helicopter in instrument conditions at low level would be, as one of the pilots observed, "just too risky."

The question of risk or safety as Major Fred Rehse, the commander of the SAR 103 Rescue Unit testified, ". . . is a relative thing. It is a very difficult practice and we leave it to the discretion of the aircraft commander to in fact decide whether he can do that job, that particular mission or not." He also testified that, "there is always a pressure to try and do the mission." When a major disaster is imminent and many lives are at stake the degree of risk to be run or parameter of safety to be observed becomes an even greater question. Conscious of this pressure when lives are at stake, the SAR pilot must make his own assessment of adverse weather reports, equipment limitations, the operating capabilities of his aircraft and the route to be flown. After weighing these factors against what he knows of the emergency confronting him, he must decide whether to leave immediately or wait for improved conditions. SAR 103 Rescue Unit reported at 1:46 a.m. that they would not be flying because of weather limitations. The two SAR helicopters eventually left Gander at 6:30 a.m. and 6:50 a.m. respectively, around first light, and reached St. John's airport at 7:17 a.m. and 7:30 a.m. where they refuelled before proceeding to Hibernia. At 3:00 a.m. RCC Halifax tasked a Voyageur helicopter at Summerside to proceed to St. John's where it arrived at 8:30 a.m. The Buffalo arrived there from Summerside at 6:15 a.m.

These delays precluded the possibility of the SAR aircraft participating in the rescue of the crew of the *Ocean Ranger*. They arrived too late. But they would still have been too late even if conditions had been ideal. For if the SAR helicopters had been based in St. John's, fully fueled and with the crews on 30-minute standby, when SAREC was first informed between 1:14 a.m. and 1:17 a.m. of the emergency, the earliest time of departure, even if the effects of the wind are ignored, would have been 1:45 a.m. When they eventually flew to the site of the *Ocean Ranger*, the flying time was 70 minutes. The earliest time of arrival at the site would, therefore, have been around 2:55 a.m. The rig was evacuated between 1:30 a.m., when the men went to the lifeboats, and, possibly, 2:00 a.m. The lifeboat alongside the *Seaforth Highlander* capsized at 2:38 a.m. and its occupants, lacking survival suits, appeared lifeless within minutes of the capsize. The helicopter would in fact have been delayed in getting started up under the weather conditions that night, as were the Universal Helicopters.

The vessels of the Canadian Coast Guard closest to Hibernia were in port in St. John's. Their distance from the site precluded any possibility of aid to the *Ocean Ranger*. Even if there had been more time, however, it appears doubtful that these vessels could have played an active part in that night's rescue. Their crews had been granted shore leave and were not mustered to the ships until much later in the morning of February 15. These vessels were not, however, dedicated SAR resources and were not, therefore, primarily concerned with nor responsible for maintaining a standby/rescue role. The dedicated SAR vessels were the *Jackman*, which was at Burgeo, and the *Grenfell* located in Notre Dame Bay.

COMMUNICATIONS AND RESPONSE TIMES

TIME	FROM	TO	MESSAGE
		FEBRUARY 15	
0100	*Ocean Ranger* J. Jacobsen	St. John's Merv Graham	*Ocean Ranger* listing; cause unknown requests Coast Guard alert; 84 men on board
0105	*Ocean Ranger*	*Seaforth Highlander*	Called to close standby; listing badly; countermeasures ineffective
0106	Mobil St. John's Merv Graham	SAREC St. John's	*Ocean Ranger* listing to bow; cause unknown; 84 men on board; local weather conditions; supply boats to be dispatched; Universal Helicopters to be alerted no direct assistance requested from SAREC
0109	*Ocean Ranger*	MARISAT Connecticut	Distress Telex received and routed to RCC New York;
	Connecticut MARISAT Operator	RCC New York	Routed distress message
0110	*Ocean Ranger* Ken Blackmore	Mobil St. John's Rick Flynn	Requests Mayday for *Ocean Ranger*
0111 Approx.	*Ocean Ranger* Jack Jacobsen	*SEDCO 706* Keith Senkoe	Advises assistance needed; requests Mayday relays; request for helicopters and supply boats of *Zapata Ugland* and *SEDCO 706* to assist in evacuation
0112	Connecticut MARISAT Operator	RCC New York	Distress message received
0112	*Ocean Ranger*	RCC New York	Distress telex giving location, weather conditions; severe list 10-15 degrees and increasing; requesting assistance ASAP
0114- 0117	Mobil St. John's Rick Flynn	SAREC St. John's	*Ocean Ranger* listing; evacuation appeared necessary; *Ocean Ranger* attempted Mayday and requested Mayday relay via the *SEDCO 706*; Mobil helicopters alerted; Flynn patches SAREC into *Ocean Ranger* transmissions
	Site via Mobil base	SAREC St. John's	SAREC overheard conversation between *Ocean Ranger* Drilling Foreman/Mobil Operator and *SEDCO 706* Drilling Foreman requesting assistance from other supply boats; winds from the west gusting to 80 mph; three supply boats in the area; helicopters alerted
0120	Mobil St. John's Merv Graham	*SEDCO 706* R. Fraser	Appoints Fraser as On-Site Coordinator; advises that Mobil's helicopters alerted; requests other supply boats be dispatched; monitor all radio communication and report to shore

0121	*SEDCO 706*	*Boltentor*	Directed to proceed to *Ocean Ranger* and assist as required
	SAREC St. John's	RCC Halifax	Advised of *Ocean Ranger's* distress; failed to indicate *Ocean Ranger* had attempted Mayday and had requested that *SEDCO 706* transmit Mayday relay
	RCC New York	RCC Halifax	Transmitted info contained in distress message
	RCC Halifax	SAREC St. John's	Acknowledges receipt of information from RCC New York
0122	*SEDCO 706*	*Zapata Ugland*	Directed Nordertor to proceed to *Ocean Ranger* site and assist as required
0130	*Ocean Ranger* K. Blackmore	Mobil St. John's Rick Flynn	Advises that the crew were going to the lifeboat stations; Both Mobil base and *SEDCO 706* acknowledge message
	Mobil St. John's Rlck Flynn	SAREC St. John's	Advises that the crew had gone to the lifeboat stations; *SEDCO 706* sending Mayday relay; Mobil's helicopters alerted; all supply boats directed to proceed to *Ocean Ranger* and assist as required
	RCC New York		Telex connection with the *Ocean Ranger* broken; attempts to regain connection unsuccessful
	SEDCO 706	*Boltentor & Nordertor*	All speed to *Ocean Ranger*
0131	SAREC St. John's	RCC Halifax	*Ocean Ranger* crew to lifeboat stations
0131-0136	RCC Halifax	103 Rescue Unit Gander Capt. Preus	Advised of emergency on *Ocean Ranger*; requested to muster helicopter crew for rescue mission
	RCC Halifax	Maritime Command Operations (MARCOM)	Determine marine and air resources under control of Dept. of National Defence in position to render assistance; Aurora at CFB Greenwood available later in a.m.
	RCC Halifax	RCC New York	Request for surface picture (SURPIC) vessels within 100 mile radius of *Ocean Ranger*
	RCC Halifax	SAREC St. John's	Request to issue All Ship's Broadcast
0146	103 Rescue Unit Gander	RCC Halifax	Advises that crews alerted and proceeding to the airport; advises that departure delayed until weather improves
0148	SAREC St. John's	Coast Guard (VON) Marine Radio Stn St. John's	Telex request to issue All Ship's Broadcast
0155	*Seaforth Highlander*	*SEDCO 706*	Three miles from *Ocean Ranger*
0203	Coast Guard (VON) Marine Radio Stn St. John's		Receipt of telex
0204	Coast Guard (VON) Marine Radio Stn St. John's		All Ship's Broadcast issued

0211	*Seaforth Highlander*	*SEDCO 706*	Made visual contact with *Ocean Ranger* and reported seeing life jacket lights in the water
0214	*Seaforth Highlander*	*SEDCO 706*	Sighted distress flare from lifeboat
0215	St. John's		Universal Helicopters crew arrived at airport
0221	*Seaforth Highlander*	*SEDCO 706*	Sighted second distress flare and was proceeding toward lifeboat
0224	RCC Halifax	413 Rescue Unit Summerside, PEI	Aircraft required to provide communication & air support; Buffalo aircraft & Voyageur helicopters tasked
0232	*Seaforth Highlander*	*SEDCO 706*	Reported lifeboat alongside
0234	RCC New York	RCC Halifax	Supplied surface picture (SURPIC)
0238	*Seaforth Highlander*	*SEDCO 706*	Lifeboat capsized
0245	*Boltentor*		Arrives at *Ocean Ranger* site
	Boltentor	*SEDCO 706*	Advises rig still upright; few lights visible
	SEDCO 706	*Boltentor*	Determine if helicopter could land on the rig; Reply affirmative
0255	*Seaforth Highlander*	*Boltentor*	Requests assistance in recovering the lifeboat
0300	RCC Halifax	413 Rescue Unit Summerside, PEI	Tasked a Voyageur to proceed to St. John's
0300 Approx.	*Nordertor*		Capt. Allingham noticed that radar contact was lost with *Ocean Ranger*
0315 Approx.	*Nordertor*	*Boltentor* *Seaforth Highlander*	Capt. Allingham checked to see if other vessels had radar contact with *Ocean Ranger*, they replied no
0322	St. John's		First Mobil helicopter departs St. John's
0338	*Nordertor*	*SEDCO 706*	Reported that the *Ocean Ranger* disappeared from the radar screen
	SEDCO 706	Mobil St. John's Merv Graham	Relay that radar contact lost with *Ocean Ranger*; agreed that Mobil would advise SAREC
0340	*Nordertor*		Arrives at site
	SEDCO 706	Mobil St. John's	Three supply boats would coordinate search efforts
0353	413 Rescue Unit Summerside, PEI	RCC Halifax	Buffalo aircraft departs PEI
0408	*SEDCO 706*	All Supply Vessels	Advised to cease direct transmission to shore and told to relay all information to *SEDCO 706*
0415	413 Rescue Unit Summerside, PEI	RCC Halifax	Voyageur departed for St. John's
0435	Universal Helicopter		Arrives at site
0440	RCC Halifax	CFB Greenwood	Additional air support tasked; Aurora aircraft stationed at Greenwood, N.S. appointed on-scene commander

0500	*Selfoss*	Coast Guard (VON) Marine Radio Stn St. John's	The *Selfoss* was the first vessel to respond to All Ships Broadcast
0600	Universal Helicopter		Airborne for return trip to St. John's
0615	SAREC St. John's	RCC Halifax	First Search and Rescue helicopter from Summerside arrives St. John's
0630	103 Rescue Unit	RCC Halifax	SAR helicopter leaves Gander for St. John's
0650	103 Rescue Unit	RCC Halifax	Second SAR helicopter leaves Gander for St. John's
0714	CFB Greenwood	RCC Halifax	Aurora departs for site
0730	SAREC St. John's	RCC Halifax	SAR helicopters from Gander arrive St. John's to refuel and receive updated information on rescue effort
0735	Mobil St. John's	SAREC St. John's	Advised *Ocean Ranger* had disappeared
0830	SAREC St. John's	RCC Halifax	Two SAR helicopters depart for site
0835			Two Universal helicopters return to St. John's from *Ocean Ranger* site
0935	SAR aircraft	SAREC St. John's	SAR aircraft arrive at site and begin co-ordinated search
0946	RCC Halifax	SAREC St. John's	Instructions to task CCGS *Bartlett*
1042	RCC Halifax	SAREC St. John's	Instructions to task the *Gadus Atlantica* which was 119 miles from site
1043	RCC Halifax	SAREC St. John's	CCGS *Bartlett* released CCGS *Sir Humphrey Gilbert* tasked
1139	RCC Halifax	SAREC St. John's	Tasked the *Java Seal*
1139	SAREC St. John's	RCC Halifax	CCGS *Bartlett* was retasked to replace the *Gilbert*
		FEBRUARY 16	
0908	RCC Halifax	SAREC St. John's	CCGS *Bartlett* was retasked to replace the *Gilbert*
		FEBRUARY 17	
1630	RCC Halifax	SAR Ottawa	Formal request that search effort be reduced
		FEBRUARY 19	
2310	SAR Ottawa	RCC Halifax	Search for survivors discontinued although vessels in the area maintained watch

10

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER TEN CONCLUSIONS AND RECOMMENDATIONS

Part I of the Terms of Reference of the Royal Commission directs it to inquire into, report upon, and make recommendations with respect to matters directly relating to the *Ocean Ranger* and its loss. The preceding nine chapters contain in considerable detail the results of this inquiry. From the testimony and other evidence, conclusions have been reached on the cause of the loss of the rig and its crew and recommendations have been developed which address a number of the issues raised during the inquiry. This final chapter contains the conclusions and recommendations related to each of the Part I Terms of Reference. Since the evidence heard was generally restricted to the *Ocean Ranger* and was not intended to provide information and opinions on an industry-wide basis, recommendations are being deferred until the final report in cases where additional information is thought to be necessary. Part II of the Terms of Reference goes beyond the loss of the *Ocean Ranger* to consider safety aspects of exploratory drilling operations off Eastern Canada. A much wider range of evidence and opinion is, accordingly, being sought before conclusions are reached and recommendations made with respect to these operations.

"1. Inquire into and report upon the loss of all members of the crew of the semi-submersible self-propelled drill rig *Ocean Ranger*, and of the *Ocean Ranger*, on or about the 15th day of February, 1982, on the Continental Shelf off Newfoundland and Labrador, the reasons and causes therefor . . ."

The loss of the *Ocean Ranger* was caused by a chain of events which resulted from a coincidence of severe storm conditions, design inadequacy and lack of knowledgeable human intervention. Once the design decision was made to locate the ballast control room in the third starboard column, 28 feet above mean water level at operating draft, the room and its equipment should have been protected from all reasonably foreseeable environmental forces. The design weaknesses included a failure to specify portlights of adequate strength, and to provide a ballast control panel with components that were suitable for operation in an environment where there was a risk of exposure to sea water. The ballast control system was unnecessarily complicated, and the interconnection between the electrical circuits for the control and monitoring aspects of the system made the ballast control console susceptible to common faults and the presentation of confusing information. The lack of a remote system for reading the draft of the rig made it necessary for the deadlights to be open as a routine matter in order to view the draft marks. This weakness in design led to the development of the dangerous habit of leaving the deadlights open at all times.

Despite the failure of the portlight and the malfunctioning of the ballast control panel, the loss could have been prevented by knowledgeable intervention on the part of the crew. Indeed, had the crew only closed the deadlights, shut off the electrical and air supplies to the panel, cleaned up the water and glass and then retired for the evening, the *Ocean Ranger* and its crew would have survived the storm that night.

The failure of the crew to adopt and follow a proper and prudent operational practice – closing the deadlights in storm conditions – allowed the first link in the chain of events to be forged. In attempting to remedy the problems caused by the ingress of water into the ballast control room, the crew, because of a lack of understanding of the ballast system as a whole, reactivated the panel as part of the maintenance process and unintentionally allowed water to enter the port pontoon. Then, in attempting to remedy the port forward list of the rig by pumping out forward tanks, they failed to realize the possibility that one or more valves to aft ballast tanks were open, and actually increased the forward list by unintentionally pumping out of the aft tanks. The crew did not understand the proper function of the manual control rods and inserted them in a mistaken attempt to close valves. This resulted in the opening of up to 15 ballast tank valves, which allowed ballast water to gravitate forward and accelerated the rate of forward trim.

Another weakness in design allowed water to flood into the chain lockers which had no weather-tight covers, and no permanently installed means of pumping out water. Flooding into the upper deck spaces through damage to the accommodation area and to the ventilators leading to the sack storage area also contributed to the capsize of the rig.

All 84 members of the crew lost their lives in the casualty. The cause of death of those bodies recovered was drowning while in a hypothermic condition. Once abandonment of the rig became necessary, it was of paramount importance that the crew be able to survive until help arrived. That they were not able to do so was due firstly to the absence of an evacuation system which could provide reasonable assurance of a safe departure from the rig under the circumstances that existed. One of the stern lifeboats did miraculously get clear of the rig although it was severely damaged during launching to the point where it could no longer be regarded as safe. The other stern lifeboat is believed to have been launched but to have been lost in the process. The second major factor contributing to the loss of the crew was a lack of "survival suits". These suits, which were commercially available at the time of the loss, would, if provided and properly worn, have appreciably lengthened the time of survival. Had every man been properly protected by a survival suit, there is a real probability that some of them would have survived.

"1. (a) . . . to inquire into, report upon and make recommendations in respect of the design, construction and stability of the *Ocean Ranger* and its suitability to conduct marine and drilling operations on the Continental Shelf off Newfoundland and Labrador;"

There were features of the design of the *Ocean Ranger* that contributed to its loss – the location of the ballast control room, the inadequate strength of the portlights, the lack of protection of the ballast control console and the vulnerability of the chain lockers to flooding. There were also other features that are cause for concern – the diminishing capability of the pumping system to pump water from the forward tanks as the rig inclined by the bow and the location of the sensor tubes for the tank level gauges.

Apart from the failure of the portlight in the ballast control room, there is no evidence to indicate that the *Ocean Ranger* was other than structurally sound. The dive surveys revealed no evidence of primary structural failure, and the damage which was observed was the result of the capsize rather than a contributor to it. Indeed, that not more damage was discovered is testimony to the structural strength of the rig.

There is no evidence to indicate that any loss of intact stability contributed either to the initial trim or to the eventual capsize of the rig. According to the morning report for February 14 and to the working copy of the stability report recovered from the ballast control room during the dive, the *Ocean Ranger* had on February 14, 1982, a relatively light deckload and a positive metacentric height well in excess of the minimum requirements. With the additional stability enhancement provided by the moorings, the rig had an even greater effective metacentric height and more

than sufficient stability to survive the storm conditions. Nevertheless throughout the hearings a number of matters relating to stability were raised and require comment.

It is a common phenomenon that drilling units[1] are susceptible over the years to weight growth that is unrecorded. This is a function of additional weight not being recorded and of errors in estimating the weights that were recorded. Annual unrecorded weight growth has been estimated to be 20 tons or more. This growth can have an adverse effect on the stability of a rig, particularly since the additional weight would usually be above the vertical centre of gravity (VCG) of the rig and would have the undesirable consequence of raising the VCG. If the draft marks on the rig cannot be measured with precision, and in the absence of periodic dead weight checks or a reinclining test, this weight growth would accumulate undetected.

The process by which the stability of a semisubmersible is reviewed during the design and classification process includes the determination of a downflooding angle and calculation of righting and heeling moments up to this angle. If up to this angle the ratio of righting energy to heeling energy in stipulated wind conditions satisfies classification requirements, the unit is considered to meet the intact stability requirements. On the *Ocean Ranger* the downflooding angle was considered to be that angle at which the chain lockers would commence to flood in still water and no account was taken of waves reaching the chain lockers before the downflooding angle was reached by the rig. The model tests confirmed that, in storm conditions, flooding of the chain lockers commenced long before the downflooding angle was reached. In the absence of weather proofing of the downflooding opening, the use of static conditions to determine the downflooding angle appears to be unrealistic.

The *Ocean Ranger* capsized after a loss of stability caused by gravitation and the ingress of water into the forward ballast tanks and by flooding of the chain lockers and upper hull. It appears that an assessment of damage stability involving the flooding of only one compartment is too restrictive, and that consideration should be given to revising the criteria. Where stability calculations assume, as in the case of the *Ocean Ranger*, the integrity and buoyancy of the upper hull structure, that structure must be watertight for the necessary distance from the periphery. The flooding of the sack storage area and of the accommodation area caused a loss of that buoyancy and precipitated the capsize of the *Ocean Ranger*.

The suitability of a rig to conduct marine and drilling operations on the continental shelf off Newfoundland is a function of many variables including the design and structural arrangement of the rig and its possible deterioration during its lifetime. The design weaknesses that contributed to its loss have been outlined above. They indicate that sooner or later an occurrence of that nature was probable and therefore considerably reduced the suitability of the *Ocean Ranger* for drilling operations on the continental shelf off Newfoundland. Knowledgeable human intervention, however, could have offset these design inadequacies and prevented the disaster. There is no evidence to suggest that the condition of the *Ocean Ranger* had deteriorated during its lifetime or that it was not adequately maintained. It is recommended:

1. That all drilling units be subject to an immediate review of structural openings leading to areas containing critical equipment affecting the stability and safety of the rig and that this review include an assessment of potential environmental forces on these openings, and of the strength of the material used to cover them. That, if the strength of the material is deemed not to provide an adequate safety margin, it be reinforced or removed and replaced with material of appropriate strength.

[1]Unless evident otherwise from the context, the words "drilling unit" when used in this chapter refer to mobile offshore drilling units of the semisubmersible type operating or proposed for operation off Eastern Canada.

2. That all drilling units be required to have or to install, over the openings referred to above, covers that can be quickly and easily secured in the event of adverse weather forecasts. That each drilling unit be required to establish and enforce operating procedures that ensure the closing and securing of these covers when weather forecasts or actual conditions exceed established criteria.

3. That all equipment critical to the stability and safety of the rig be subject to a systems analysis which includes an analysis of the susceptibility of the equipment to damage and a review of the adequacy of the backup system, if any, and that, where required, appropriate measures be taken to protect that equipment from reasonably foreseeable risks.

4. That if flooding one or more of the chain lockers adversely affects the stability of the rig, they be equipped with flooding alarms and be adequately weather proofed and fitted with effective means of dewatering them.

5. That the system of pumping ballast water on drilling units be capable of pumping at an adequate flow rate to restore the rig to level attitude when the rig is inclined up to and including the static downflooding angle or the angle reached in the "worst case" damage stability situation, whichever angle is the greater.

6. That sensor tubes for tank soundings be located to permit maximum possible accuracy of readings when the rig is in other than a level attitude.

7. That conversion tables be provided for accurate assessment of tank contents when the rig is in other than a level attitude.

8. That sea chest valves be capable of being shut manually from a position on the rig which is above the weather deck.

9. That all drilling units be equipped with remote draft sensing and reading devices.

10. That all drilling units be equipped with recording gauges that provide accurate determination of maximum and minimum anchor tensions and produce a permanent record of all anchor tensions.

11. That each drilling unit be subject to a quadrennial deadweight check and weight audit carried out under the supervision of the regulatory authority or its authorized agent.

12. That the use of static downflooding angles for calculation of a righting/heeling energy ratio in the moment balance diagram be discontinued except where the point of downflooding is adequately weather proofed. That in the absence of weather proofing at the point of downflooding, a dynamic angle be calculated based upon deck flooding in design wave conditions and, where appropriate, on model tests and computer simulations.

"1. (b) . . . Inspection, inspection procedures, licensing, classification and certification pertaining to the conduct of marine drilling operations by the *Ocean Ranger* on the Continental Shelf off Newfoundland and Labrador;"

The Royal Commission heard considerable evidence on the rules, standards, regulations and enforcement procedures used by various agencies which affected the *Ocean Ranger* and its crew. The evidence revealed deficiencies in the manner in which the marine operations of the *Ocean Ranger* were controlled by the regulatory agencies. The regulations which governed the industrial operation were adequate and through bi-weekly inspections were adequately enforced. Canada Oil and Gas Lands Administration (COGLA) and the Newfoundland and Labrador Petroleum Directorate (the Petroleum Directorate), however, relied upon the certificates issued by the American Bureau of Shipping (ABS) and the U.S. Coast Guard to attest to the safety of the marine operations of the rig. When the *Ocean Ranger* arrived on the Grand Banks, Canada had no standards of its own to assess the rig. Consequently

Canadian authorities accepted the ABS classification of the rig and its approval of the *Booklet of Operating Conditions* and did not conduct their own assessment of the rig and its operating procedures. Officials of COGLA and the Petroleum Directorate stated in evidence that they did not give priority to the safety of the marine operations and assumed that the certificates of the Flag State and the approval of the classification society provided the necessary assurance.

The regulations and guidelines of the Province of Newfoundland did not address the marine operations of the rig. Since there were general COGLA regulations in this area, the Petroleum Directorate relied upon COGLA and COGLA inspectors to enforce them. COGLA, however, did not enforce its regulations because they overlapped with regulations that were the traditional responsibility of the Flag State and with the rules of the classification societies. COGLA and the Petroleum Directorate acted on the incorrect assumption that ODECO would comply with the requirements of the 1979 *Certificate of Inspection*, issued by the U.S. Coast Guard, and with the *Booklet of Operating Conditions* approved by ABS and the U.S. Coast Guard. The U.S. Coast Guard did not monitor or follow up the conditions attached to the *Certificate of Inspection* which required modifications to the lifesaving equipment on the rig. Neither did they monitor the marine crew requirements set out in the *Certificate* or maintain any check on its expiry date. According to these requirements, the *Ocean Ranger* was undermanned by a minimum of three certificated lifeboatmen and two able-bodied seamen. The *Certificate of Inspection* and the *Cargo Ship Safety Equipment Certificate* issued by the U.S. Coast Guard to the *Ocean Ranger* had expired on December 27, 1981. It is recommended:

> **13.** That the continuing validity of a Drilling Program Approval or Authority to Drill a Well be conditional upon the validity of all certificates applicable to the drilling unit as detailed in the April 1984 *COGLA Guidelines and Procedures*, Section 1, Appendix B.

An argument was advanced by the counsel for the Government of Canada that Canada did not have legal jurisdiction to enforce marine safety regulations on foreign registered MODUs operating on its continental shelf outside the 12-mile limit. Foreign registered MODUs like the *Ocean Ranger*, he contended, are subject to regulation by the country of registry and are presently not subject to the *Canada Shipping Act*. Although this argument is legally correct, foreign registered MODUs can and should be regulated by Canada under the drilling permits issued to the operators. In light of the limited enforcement procedures used by the U.S. Coast Guard in regulating the *Ocean Ranger*, Canada should enforce its own standards.

Subsequent to the loss of the *Ocean Ranger*, Canadian regulatory agencies have changed their regulations. In July 1982, the Petroleum Directorate promulgated regulations governing the design, construction and stability of MODUs operating off Newfoundland. After a MODU is assessed by an independent third party for compliance with the Provincial regulations, a *Certificate of Fitness* is issued that is valid for up to 5 years.

Changes in the federal regulatory system since the loss of the *Ocean Ranger* are not clear. In 1984 the Ship Safety Branch of the Canadian Coast Guard published *Interim Standards Respecting Mobile Offshore Drilling Units*, the provisions of which are based on the International Maritime Organization's *Code for the Construction and Equipment of Mobile Offshore Drilling Units*.

Although in the form of regulations the *Interim Standards* have not been enacted under the provisions of the *Canada Shipping Act* and do not have the force of law. The authority given for their adoption is Section 370(2)a of the *Act* which relates to decisions of the Board of Steamship Inspection. Section 370(3) of the *Act* is the section which authorizes the making of rules and regulations and provides,

inter alia, that, after they are approved by the Governor-in-Council, they are in force and have effect as if they had been included in the *Act*. The *Interim Standards* have not received the approval of the Governor-in-Council.

Even if the *Interim Standards* had the force of law, they are applicable primarily to new construction and regulate existing rigs only "to the extent considered reasonable and practicable" by the Board of Steamship Inspection. Accordingly there is no assurance that any of the standards, a number of which are very desirable, will be applied to existing rigs. It would have been preferable to set, by regulation, minimum standards for all units, and, if desirable, more stringent standards applicable only to new construction.

In the preamble to the *Interim Standards* it is proposed that all foreign registered drilling units comply to the same extent as if they were Canadian registered units. The Royal Commission is in full agreement with this requirement but is nevertheless concerned that the existing regulatory system may not be adequate to accomplish that purpose. COGLA's 1984 guidelines require detailed construction drawings to be submitted to the Canadian Coast Guard (CCG) "to ensure compliance with CCG standards for mobile offshore drilling units." They also provide that for a foreign flag drilling unit, compliance with CCG standards involves the submission of the information detailed in Appendix B of the guidelines, but that appendix lists information that is unsupported by the COGLA regulation which it purports to interpret. Even if compliance of foreign flag rigs with the Canadian Coast Guard's *Interim Standards* could be enforced, the standards would be unknown for they would only be those termed reasonable and practicable by the Board of Steamship Inspection.

Accordingly, although some of the recommendations which have been made already and some which follow may appear to duplicate the provisions of the *Interim Standards*, they are nevertheless made to emphasize the view that the requirements should be applicable to all drilling units and that they should be in such form that they can be unquestionably enforced. It is recommended:

> **14.** That Canada adopt standards for the design, construction and stability of offshore drilling units and that no drilling unit be permitted to operate unless it meets those standards as evidenced by a *Certificate of Fitness* issued by or on behalf of the regulatory authority.

Not only should there be Canadian standards for the design, construction and stability of drilling units but there should be operational standards as well. The operation of ships, as well as their design, construction and stability, is subject to regulation under the *Canada Shipping Act*. There is no reason why drilling units should not also be regulated. Although provision is made in the proposed *Interim Standards* for some operational requirements for drilling units the provisions are not the comprehensive operational standards which should be specifically developed for application to units operating off Eastern Canada.

It is not suggested that all regulations under the *Canada Shipping Act* be applied to drilling units on the grounds that they are ships within the meaning of the *Act*. What is suggested is that recognition be given to the fact that these units, even though they may not be properly termed "ships", are structures of a special class which carry out specialized operations in a manner significantly different from that of conventional ships. Recognition of that fact should give rise to operational standards specifically designed for drilling units, which, if prepared in consultation with the offshore industry, should be both realistic and acceptable.

The changes effected by COGLA since 1982 have been primarily enforced by way of "guidelines" to the regulations. The regulations have not changed. The use of guidelines as a means of enforcing standards merely represents an interpretation of

regulatory requirements. Because these guidelines are subject to interpretation by industry and government, they may not be applied in a consistent manner to all operators. The effectiveness of this "guideline" system of regulating the industry will be examined in more detail in the final report of the Royal Commission. It is recommended:

15. That whether regulations or guidelines are used to express the wishes of the regulatory authority, there be consultation with industry to ensure proper administration and consistent enforcement.

16. That Canada adopt general operational standards for drilling units.

The proposed *Interim Standards* also provide for the submission and approval of an operating manual containing guidance for the safe operation of the unit under normal and emergency conditions. That provision should be adopted but the operating manual and the book of emergency procedures should be combined and should clearly state whether the procedures intended to be taken are mandatory or simply guidelines. Furthermore it should provide that where mandatory requirements are not carried out the failure to do so should be logged and a written report of the fact be made to the appropriate regulatory authority. It is recommended:

17. That in addition to the general and type-specific operational standards there also be platform- or rig- specific operating standards or procedures. That these standards be set out in a manual of operating conditions and emergency procedures for each unit and be subject to the approval of the regulatory authority. That the conditions or procedures which are mandatory be clearly designated and provision made for logging and reporting to the regulatory authority any noncompliance with mandatory provisions.

In the event of a marine casualty involving a Canadian registered drilling unit the organization or person having any information, document or record relating to the unit is obliged to make it available to Federal Marine Casualty Investigators if it should be required in the course of an investigation under the *Canada Shipping Act*. There is no corresponding requirement in the event of a casualty involving a foreign registered rig. The fact that noncompliance by the owner of the unit could result in the loss of the operator's permit does not ensure that this information is made available to Canadian investigators.

Since it is Canadian policy to have, to the extent that it is feasible, its citizens man foreign registered rigs operating under Canadian permits, it should afford to Canadian citizens the same benefits arising from Marine Casualty Investigations as are enjoyed by those who work on Canadian registered rigs. Just as the proposed *Interim Standards* require that foreign registered drilling units comply with these standards as if they were Canadian registered, so too should all units be required to comply with Canadian requirements in the case of Marine Casualty Investigations. It is recommended:

18. That no drilling unit be permitted to drill unless and until the owner or other appropriate person provides the appropriate Canadian authority with an irrevocable authorization directing the builder, designer, classification society and the state of the rig's registry to provide the information and documentation with respect to the rig as may be requested.

19. That no drilling unit be permitted to drill unless and until the owner or other appropriate person provides the appropriate Canadian authority with an irrevocable undertaking to comply in all respects with the requests, demands and subpoenas of any Canadian authorized marine casualty investigation and that to ensure compliance with that undertak-

ing the owner or other appropriate person be required to post a bond or other security in an amount or type satisfactory to the Canadian authority.

Even with the stringent standards and thorough inspections contemplated by the proposed *Interim Standards*, there may still exist on drilling units features that may be inherently unsafe or at least undesirable. On the *Ocean Ranger*, for example, the location of the fairleads and anchor cables above the surface of the water, the location of the ballast control room, the lightly designed and dangerously exposed portlights in the ballast control room, the unprotected openings to the chain lockers, and the use of throw overboard inflatable life rafts equipped with painters which barely reached the surface of the water, were all features which did not have to exist.

Before they commence drilling operations off Eastern Canada and periodically thereafter all drilling units should be subjected to an analysis of their critical systems, the methods of operating those systems and their interrelationship. If the appropriate regulatory authority does not have the expertise to conduct this analysis, it should retain the necessary experts to act on its behalf. In this respect it would be inappropriate to retain the organizations or persons who had previously been involved in the design, construction or classification of that unit. It is recommended:

20. That the appropriate regulatory authority conduct or cause to be conducted an analysis of the critical systems and their interrelationships on all drilling units in order to determine the adequacy of their response to emergency conditions. That there be subsequent periodic analyses as may be warranted.

Valuable lessons are to be learned from information about casualties, mishaps, and equipment failures. Where that information, if known by the other operators or contractors, could have the effect of making a safer workplace, it should be made available to all. It is recommended:

21. That data be collected on equipment failures, accidents, dangerous occurrences, and any "significant events" as defined by the appropriate regulatory authority. That the data collected be systematically analyzed, indexed and disseminated to the offshore industry in a form that does not identify, if possible, the unit on which the event occurred.

"1. (c) . . . to inquire into, report upon and make recommendations in respect to all aspects of safety of life at sea, including the sufficiency of life saving equipment on board the *Ocean Ranger* and whether such life saving equipment was used or could have been used;"

The primary lifesaving equipment available to the crew during their evacuation of the *Ocean Ranger* included totally enclosed fibreglass lifeboats, inflatable life rafts and life preservers. The evidence revealed that only the lifeboats and life preservers were actually used. The *Ocean Ranger* had on board four lifeboats at the time of the loss but not all were available to the crew during their evacuation; one Watercraft lifeboat, located on the stern, may not have been fully provisioned and another Watercraft lifeboat was awaiting installation. A Harding lifeboat located on the stern was launched during evacuation with 30 or more crew members on board. Either during or shortly after the launching, it was badly damaged. The damage was sufficient to permit water to enter the boat and to contribute to a loss of stability leading to its capsize. The Watercraft lifeboat located at the stern of the rig was not recovered. Some of the crew may have used this lifeboat and it is probable that it was severely damaged or destroyed during launching. The Harding lifeboat located on the bow of the rig and the uninstalled Watercraft lifeboat were recovered. Both were severely damaged but showed no signs of having been occupied.

On February 15, 1982, the lifeboats represented the primary means of escape. To conclude that this means was inadequate is but to state the obvious. To launch a lifeboat even in calm weather is a difficult and risky operation and was rarely undertaken by the crew even though regulations required them to do so every three

months. It is highly improbable that a lifeboat could be launched safely during a storm with the rig severely inclined. As there is no protected side on a rig, the chances of a successful evacuation are even more reduced.

Research into a better method of evacuation from drilling units is currently going on in a number of countries, but it appears to lack the incentive and the concerted effort necessary to see an early resolution of the problem. A solution, however, must be found. An effective system may well be costly and its development could be delayed if regulatory pressures are not maintained. Canadian authorities should consider the development of an effective evacuation system to be a matter of urgent priority and provide incentives for the development and installation of new systems. It is recommended:

22. That Canadian authorities consider the development of an evacuation system that will provide an adequate and safe means of escape in foreseeable emergency and storm conditions to be a matter of the utmost priority and that they encourage through every means at their disposal the earliest development and use of a safe system.

As the majority of the personnel on a drilling unit are members of the industrial crew and as their industrial rather than marine skills improve with experience, the drilling unit, when on location, should be organized for lifeboat evacuations more like a passenger ship. The industrial crew should be regarded as passengers who will occupy the lifeboats in an evacuation and not as a crew capable of operating them. (The marine crew necessary for this purpose is discussed under item 1(e) of the Terms of Reference.) Because of the forward trim of the *Ocean Ranger*, two of its lifeboats could not be launched. Although it is recognized that the *Interim Standards* contain a similar provision, it is recommended:

23. That drilling units be equipped with sufficient lifeboats for 200% of the crew.

The *Ocean Ranger* was equipped with sufficient inflatable life rafts to accommodate 200% of the crew. Six were recovered, all severely damaged; none had been occupied or used during the evacuation. They were manually or hydrostatically released and could only be entered from the sea. To gain access to them the crew would have been required to climb down scramble nets from a height of 70 feet or more. The effectiveness of this type of life raft as a means of evacuation from the deck of a MODU in storm conditions is highly questionable.

In 1979 the U.S. Coast Guard required the installation on the *Ocean Ranger* of either davit-launched life rafts or an acceptable substitute. ODECO elected to provide two additional lifeboats, but only one had been installed at the date of the loss. Although the davit-launched life rafts would be subject to the same limitations as were the lifeboats, the davit-launching mode of deploying them would be superior to that which existed on the *Ocean Ranger*. It is recommended:

24. That life rafts required to be on drilling units be davit-launched.

The crew had available a sufficient quantity of life preservers for the evacuation. Many of the crew members were observed to be face down in the water and some were suspended beneath their life preservers. This may have been caused by the fact that the preservers were not worn properly. An unknown quantity of life preservers did not meet the buoyancy and righting moment criteria required by the U.S. Coast Guard. Although the life preservers were below required standards, that fact did not contribute to the loss of life.

The *Ocean Ranger* was not equipped with survival suits. There were no regulations at that time requiring them on MODUs operating off the East Coast of Canada, although eight months before the accident COGLA had issued a telex to all offshore operators recommending that survival suits be installed on all MODUs and support craft operating on the East Coast of Canada and in the Arctic. The industry and COGLA did not move quickly in implementing this recommendation. If survival suits had been provided at least a few of the crew might have survived. Since the casualty, COGLA has issued a directive to the effect that all drilling units must have sufficient survival suits for 200% of the crew.

"1. (d) . . . to inquire into, report upon and make recommendations in respect of all aspects of occupational health and safety which related to the officers and crew of the *Ocean Ranger;*"

The evidence suggests that in the first few months of the *Ocean Ranger*'s operations on Hibernia the accident rate among crew members was higher than the industry average. This was attributed, not unreasonably, to the influx of workers who were not experienced in offshore drilling or indeed drilling generally, and to the hazards inherent in this activity. The situation, however, improved over time and as of the date of the loss the accident record on the *Ocean Ranger* was comparable to that of other rigs operating in the area. There is no evidence to indicate that any matters relating to occupational health and safety caused or contributed to the loss of the rig and its crew.

"1. (e) . . . to inquire into and report upon and make recommendations in respect of the certification, training and safety of the officers and the crew and their respective responsibilities including those of the Master and the Toolpusher on board the *Ocean Ranger;*"

The *Ocean Ranger*, as previously noted, was not manned in accordance with the requirements of the *Certificate of Inspection* of the U.S. Coast Guard. Because there were no survivors, it cannot be said with certainty that failure to comply with these requirements contributed to the loss of the crew. It is, however, apparent that evacuation under the circumstances that existed on February 15, 1982 requires a high degree of skill and training. The operation of the rig's lifeboats should be the responsibility of specially trained lifeboat crews who could have regular industrial or marine assignments on the drilling units but who should, as a part of their assignments, be required to become specialists in the operation of lifeboats. The lifeboat drills for the lifeboat crews should be an integral part of their regular work. It is recommended:

25. That drilling units be required at all times to have sufficient lifeboat crews to man lifeboats for 100% of the crew plus one additional lifeboat crew.

26. That a lifeboat crew consist of four persons each holding a *Certificate of Efficiency* as a lifeboatman under the *Certification of Lifeboatmen Regulations* and that in addition to these requirements each prospective member of a lifeboat crew be required to establish to the satisfaction of the examiner that he is skilled and knowledgeable in:

a) passenger control and crew organization in emergencies involving evacuation of the unit;
b) survival procedures and techniques;
c) search and rescue procedures and organization;
d) the sea-keeping characteristics of the lifeboats;
e) the operation of the lifeboat radio.

27. That lifeboat crews be required to be trained in the use and operation of the type of lifeboat to which they are assigned and that this training include actual launching and operation of the lifeboat in the sea.

28. That lifeboat crews be required to launch and operate the lifeboat in the sea at least twice each year. If this cannot be conveniently or safely done from the drilling unit then it should be done from a shore-based installation.

29. That industry establish appropriate practices and incentives which recognize the importance of the lifeboat crews and which ensure adequate time and resources for their preparation and training.

30. That drilling contractors be required by regulation to identify to inspectors during their periodic inspections of MODUs those crew members who are certificated lifeboatmen.

Under the regulations in force at the time it was the duty of the operator (Mobil) to ensure that all the rig's crew were instructed and trained in all necessary operational and safety procedures. Mobil, in fulfilling that obligation, relied on the owners of the drilling units. Canadian regulatory authorities relied on industry to determine the content and adequacy of the marine training program and to ensure that it was carried out. They established no minimum standards as a guide to industry, even for critical positions. Although the Marine Emergency Duties (MED) course was available at the time, it was not required by regulation and there was no evidence to indicate that any of the *Ocean Ranger* crew had taken it.

Under the 1984 COGLA guidelines there have been changes in the provisions relating to training. The crews of drilling units are now to take an approved marine emergency training course and to receive training in the use of rescue baskets; the personnel on moored units drilling on the Grand Banks are to be trained in the use of quick release mooring lines; appropriate marine personnel are to complete successfully training in ballast control for floating units including the use of back-up systems; the crews of standby vessels are to be trained in the use of the rescue equipment on such vessels.

These guidelines are merely an extension of the original requirement that persons be "adequately trained" and are too vague. Under the *Canada Shipping Act* a regulatory scheme is in place for establishing training requirements and examinations for proficiency of the crew of conventional ships. The regulatory authority itself determines the standards required and issues certificates of proficiency upon the satisfactory completion of training. There appears to be no reason why a similar scheme should not be established for the crew of offshore drilling units. It would not be necessary for every job category to be certificated but those responsible for the operation of the critical systems and for the overall safety of the rig should be included. It is recommended:

31. That there be an assessment of the adequacy of training methods used on drilling units, with particular reference to "on-the-job" training methods; that the regulatory authority, in conjunction with representatives of the offshore industry, determine the adequacy of that training and establish minimum standards for specified positions.

32. That within an appropriate time after the establishment of these standards, no person be permitted to hold a specified position on any drilling unit unless he holds a valid certificate issued by the appropriate authority or an equivalent certificate issued by the authority of another state where the course of training meets Canadian standards.

33. That steps be taken by Canada to promote the establishment of uniform international standards for the certificates referred to in the preceding recommendation.

During the Public Hearings attention was focused on the training of ballast control operators. Neither of the two operators on the *Ocean Ranger* at the time of the loss had received any formal course of training but had learned through on-the-job experience. No formal training or testing was required by regulation. There was no manual available which fully described the operation of the ballast control panel or provided detailed drawings of the components of the panel.

Because of the critical function of the ballast control operator, specific recommendations are made with respect to training. The matters to be included in the recommended training program are not in any way intended to be complete but should be developed in detail in conjunction with the industry. It is recommended:

34. That there be a course of training setting standards of knowledge and skill for ballast control operators. That upon successfully completing that course or by demonstrating to the regulatory authority the required skills and knowledge, an individual be granted a certificate to that effect.

35. That the course of training referred to in the preceding recommendation include, *inter alia*:

a) detailed instruction in the composition and operation of the ballast systems of drilling units;

b) instruction in the appropriate use of the system in emergencies;

c) instruction in all matters affecting the stability of drilling units;

d) instruction in the practical operation of a ballast system by simulator and on a rig itself when available.

36. That within an appropriate time after the establishment of these standards, no person be permitted to hold the position of ballast control operator on any drilling unit unless he holds a valid certificate duly issued by the appropriate authority or an equivalent certificate issued by the authority of another state where the course of training meets Canadian standards.

37. That before assuming the position of ballast control operator for the first time on any drilling unit a certificated operator be required to receive orientation in or familiarization with the unique characteristics of the unit's ballast system and operating procedures, and with the alternative method, if any, of operating the ballast system.

The issue of respective responsibilities of the master and toolpusher evokes strong and varied opinions. For a time the question was simply "who should be in charge, the master or the toolpusher?". To residents of the Atlantic Provinces with their long seafaring history and traditions there is only one answer to that question. Rigs like the *Ocean Ranger* are self-propelled, have a crew and go on long ocean voyages. The mere thought of replacing the traditional marine crew with industrial personnel is foreign to the mind of a seafaring community.

Throughout the Public Hearings, however, as evidence was presented showing the complexity of a drilling unit's operations and the limited role of the master while the unit is in a moored condition, the answer became less clear. COGLA's reaction shortly after the loss was to issue a directive to the effect that a master mariner was to be in charge of the unit at all times while at sea even while moored. The directive has undergone some modifications and now states that:

> Drilling units shall at all times have one person on the unit clearly identified as responsible for the safety of the drilling unit and its crew. On floating drill units this person shall: be qualified in marine matters; be experienced in drilling unit operations; and, possess a recognized master mariner's certificate. This requirement recognizes the need for the person ultimately responsible for safety to make decisions in full consultation with the person responsible for drilling operations.

That directive is equivocal; it does not deal with the issue of command but only with the question of who shall be responsible for the safety of the rig and its crew. It makes no reference to formal training in drilling unit operations. While the philosophy behind this directive is neither accepted nor rejected at this time, it is believed that the requirement should be expanded to include formal training in drilling unit operations. It is recommended:

38. That the certificate held by a ballast control operator who has not worked full-time in that capacity for an appropriate period of time become invalid on the expiry of that period and that the operator be required to complete a prescribed refresher course in order to validate his certificate.

39. That the current COGLA guideline regarding the qualifications of the person responsible for the safety of the drilling unit and its crew be amended to include training in drilling unit operations and in the operation of the unit's ballast control system.

The importance of the question of command and its modification is recognized. The evidence heard in Part I was directed primarily at command on the *Ocean Ranger*. A different command structure existed on the *Zapata Ugland*, where the master was in charge at all times, and on the *SEDCO 706*, where the toolpusher was in charge and there was no master on the rig. Consideration of the question should not be governed by labels but rather by the qualifications necessary for the person in charge to be able to exercise competent command. There must also be considered the question of whether that command should change from one qualified type of commander to another when the type of activity taking place on the unit changes. It is also necessary to consider the command structure of units other than semisubmersible units and whether special command arrangements are necessary where, for example, there are requirements to disconnect rapidly on account of the presence of ice. A wide range of views will undoubtedly be presented during Part II of the inquiry and more informed recommendations can then be made.

The command structure on the *Ocean Ranger* was stated in the foreword to the *Booklet of Operating Conditions* where it was specified that during all industrial operations the toolpusher is designated as the "person in charge" of the unit. While the rig is being prepared for a move and while in transit, the barge master, a master mariner, is designated as being in complete charge. The *Booklet* also states that "the barge master is responsible for the stability of the unit at all times". On paper the command structure appears clear. The *Booklet*, however, was designed primarily for ballast control operators and was not readily available to all personnel. Testimony indicated that some crew members were in doubt from whom they would take orders in an emergency. An appropriate command structure requires that the lines of authority and responsibility be clear to all concerned, and that those entrusted with specific responsibilities have the necessary authority.

It is difficult to segregate the issue of command structure from the qualifications and training of those in command. The *Ocean Ranger* toolpusher, although experienced in offshore drilling, had no formal marine qualifications or training. On him, however, fell the responsibility to order the abandonment of the rig because of a lack of stability in extreme storm conditions. Apart from limited previous offshore experience, the master on board had not been to sea for a number of years, and his position in the command structure had been seriously weakened by the fact that, although he was responsible for the stability of the unit, the toolpusher had ordered him, as a result of the February 6 incident, not to touch the ballast control panel.

A command structure which is not absolutely clear to all concerned, which fixes responsibility without sufficient authority, and in which critical decisions can be taken without access to or availing of all the necessary expertise and experience undermines an adequate level of safety. There was no evidence, however, that the command structure itself on the *Ocean Ranger* was a factor contributing to the loss.

The local preference policies of the Government of Newfoundland may have affected the certification and training of the crew of the *Ocean Ranger*. The evidence indicated, however, that the conflict over local preference for labour was not a contributing factor to the loss of the rig or its crew. Nevertheless, guidelines requiring a very rapid phase in of local residents can affect the overall level of safety of the drill-

ing operations. In light of the province's inability to ascertain whether the local labour force can supply the required number of *qualified* workers, it is recommended:

> **40.** That the Offshore Employment Register be scrutinized to ensure that individuals listed for employment on drilling units and support craft are qualified.
>
> **41.** That the rate of phase in of local residents be controlled, in consultation with industry, to ensure that the highest level of safety is maintained.

"1. (f) . . . to inquire into, report upon and make recommendations on the search and rescue response and any other emergency response thereto, both from within Newfoundland and elsewhere;"

The response of personnel on and off shore to the request for assistance from the *Ocean Ranger* included air and marine resources under contract to Mobil and the Search and Rescue (SAR) resources of the Government of Canada. Mobil was the only operator drilling on the Grand Banks in February 1982. Its emergency communications officer that night, who was responsible for mobilizing human and physical resources, was Merv Graham, the drilling superintendent. The shore base received little warning of the pending tragedy but when the request for help came, action was prompt. SAREC St. John's was immediately alerted, the crews of two Sikorsky helicopters were mustered and the *Boltentor* and *the Nordertor*, the standby vessels for the *Zapata Ugland* and the *SEDCO 706*, were directed to proceed to the *Ocean Ranger*. The *Seaforth Highlander*, the standby vessel for the *Ocean Ranger*, was requested directly by the rig at 1:05 a.m. to come to close standby. It is apparent from the evidence, however, that communications emanating from Mobil shore-base were neither accurate nor prompt, with consequent misunderstanding, confusion and delay. SAREC was told shortly after it was alerted, that there were three ships in the area of the *Ocean Ranger* and that three or four helicopters were being dispatched to evacuate the crew. This misinformation may have contributed in part to the lack of any apparent sense of urgency in the SAR response. It is evident that Mobil's key personnel had not practised adequately their emergency procedure roles. Graham, the emergency communications officer that night, Fraser, the on-site co-ordinator on the *SEDCO 706* and Flynn, the shore-based radio operator were laden throughout that period with duties and responsibilities for which they were not qualified by training or experience. There are now other operators on the Grand Banks and they have developed contingency plans for joint and co-ordinated response to emergencies. It is recommended:

> **42.** That periodic exercises be held by industry for the purpose of training its key personnel in what would be required of them in the event of an emergency.

Mobil promptly ordered the deployment of helicopters and supply vessels to aid the *Ocean Ranger* but their response, because of the prevailing weather conditions, was delayed. Before the first helicopters were airborne (3:22 a.m.) the rig had capsized and sunk. When they arrived at the site, they were too late to effect any rescue. Their role was to assist the supply vessels in searching for survivors. The helicopters were not equipped with rescue equipment such as hoists and rescue baskets nor were their pilots trained in marine rescue operations.

The crews of the supply vessels that responded to the casualty were hampered in their efforts by severe winds and sea conditions, inadequate rescue equipment and the design of the vessels themselves. COGLA regulations stipulate that there be a suitable standby craft for each rig but what is suitable is not defined. The supply vessels on standby duty on the Hibernia Field were designed for carrying heavy cargo, towing icebergs and for handling anchors. Their solid bulwarks without appropriate gates, their high freeboard, the rubbing strake and the configuration of the ships hampered rescue operations.

COGLA also required each standby vessel to have sufficient capability and equipment to evacuate all personnel from the rig and have first aid equipment to treat persons suffering from hypothermia. None of the vessels had special rescue equipment such as a crane with basket or net nor did they have the meagre amount of rescue equipment required under the regulations. The crews had not been trained in rescue operations nor in the treatment of hypothermia. Reasonable foresight ought to have dictated that vessels in a standby role be appropriately designed, adequately equipped and properly manned for rescue operations.

The *Boltentor* reached the site of the *Ocean Ranger* after it had been abandoned, *the Nordertor* after it had capsized. Both arrived too late to participate in any rescue attempt. The *Seaforth Highlander*, on standby duty to the *Ocean Ranger*, had a special duty and responsibility for that rig but when help was urgently required, she was eight miles away. COGLA, neither in its regulations nor in any guidelines issued to the industry, specified the standby distance nor was any written instruction on the matter issued by Mobil. Captain Duncan, master of the *Seaforth Highlander*, testified that only upon arrival at the site was he informed that he should stay, weather permitting, within two miles of the rig and he issued standing orders accordingly. The captains of the other supply vessels, in spite of the heavy seas, kept within a half an hour of their respective rigs that night. Duncan, however, was reluctant to turn his vessel, fearing for the integrity of her structure and the safety of her crew. Recognizing the responsibility of a captain and taking into account the actions of the other captains that night, it is concluded that Captain Duncan ought to have been in closer standby.

The *Seaforth Highlander* reached the *Ocean Ranger* after it had been abandoned and endeavoured to save the survivors in one of the lifeboats. Without safety lines and with the deck awash, the *Seaforth Highlander* crew strove valiantly to save the men in the lifeboat and displayed courage in the best traditions of the sea. Had the vessel been differently designed and better equipped with the crew trained in the use of that equipment, and had the men in the lifeboat been wearing survival suits, some might have been rescued. Since the loss of the *Ocean Ranger* the guidelines governing standby vessels have been improved with additional rescue equipment such as fast rescue craft and rescue baskets now required. The crews are to be trained in rescue operations. It is recommended:

43. That there be an immediate assessment by the appropriate authority of the capability and suitability of the various types of vessels now serving as standby craft to drilling units off Eastern Canada to perform adequately their rescue role.

44. That the primary responsibility of a vessel acting in the capacity of a standby vessel for a drilling unit be to standby within the prescribed time or distance from the unit and be ready at all times to render whatever assistance to the rig and its crew that may be required.

45. That no vessel be permitted to act as a standby vessel if its cargo would interfere with its ability to render assistance to the rig and its crew.

46. That there be established training standards for the crew of any vessel which is to be used as a standby vessel and that training embodying these standards be required.

47. That the training embodying these standards include, *inter alia*, instruction in:

a) the use and operation of all rescue and emergency aids with which the standby vessel is equipped;

b) the treatment of survivors for the injuries and other conditions from which they may be suffering upon rescue;

c) the deployment of the standby vessel and its equipment to render effective assistance to the drilling unit and its crew in various emergencies that may occur.

48. That the crews of standby vessels, while on standby duty, be exercised in the use of the vessels' rescue equipment at least weekly, weather permitting.

49. That the person in command of the rig and the master of the standby vessel be required to log any occasion when the standby vessel exceeds the prescribed standby time or distance. That where the standby vessel exceeds the prescribed time or distance without the consent of the person in command of the rig, both the person in command of the rig and the master of the standby vessel be required to submit written reports to the regulatory authority.

SAREC was notified by Mobil at 1:06 a.m., and RCC Halifax was notified by SAREC at 1:21 a.m. that the *Ocean Ranger* had serious problems. At 1:31 a.m. RCC Halifax alerted 103 Rescue Unit Gander; at 2:24 a.m. it tasked the Buffalo at Summerside, Prince Edward Island, and at 4:40 a.m. the Aurora at Greenwood, Nova Scotia, and appointed it the "on-scene" commander. SAREC was requested by RCC Halifax at 1:36 a.m. to issue an All Ships Broadcast but it was not issued until 2:04 a.m.

Time is of the essence in an emergency yet time was lost in seeking information regarding the coordinates of the rigs in the Hibernia Field, their radio frequencies, the dimensions of the *Ocean Ranger*, the size of its crew, and the location, capacity and call signs of the commercial helicopters. This information should have been already available to RCC Halifax. Neither RCC nor SAREC had a contingency plan for a major marine disaster nor were they in a state of preparedness, if one did occur. There was no sense of urgency displayed by either of them in mustering resources and in responding to the requests for help. Actions in transmitting communications, tasking resources and sending out an All Ships Broadcast, were characterized by undue and unexplained delay. This delay may be due in part, but only in part, to the information given by Mobil that three ships were already in the area and commercial helicopters were being mobilized to evacuate the crew. Nevertheless, an hour was to pass before a fixed wing aircraft was tasked, three hours were to pass before an on-scene commander was appointed and eight hours before they arrived on the scene.

The SAR helicopters at Gander were manufactured some twenty years ago and although they have undergone extensive upgrading they did not have radar, an automatic flight control system, a hover coupler system or VHF/FM marine radio. Consequently they were unable to fly below low lying cloud at night; they could not hover in a fixed position close to the water without pilot assistance during rescue operations nor could they communicate directly with vessels during a rescue attempt. An upgrading program (SARCUP) has been initiated to remedy these deficiencies. The main weakness of the Labrador/Voyageur, however, is its relatively short range and consequent lack of endurance for rescue missions offshore. There are also certain weather conditions which restrict its operation.

The SAR helicopters, because of weather conditions, could not leave Gander until after 6:30 a.m. and arrived too late to participate in a rescue attempt. But they would have been too late even if conditions had been ideal, and if they had been in St. John's, fully fueled and with crews on 30 minute standby. The rig was evacuated between 1:30 a.m. and 2:00 a.m. and the lifeboat alongside the *Seaforth Highlander* capsized at 2:38 a.m. The earliest possible time of arrival of the SAR helicopters would have been 2:55 a.m. It is recommended:

50. That the Rescue Co-ordination Centre in Halifax and the Search and Rescue Emergency Centre in St. John's have available, for instant retrieval, all relevant information with respect to offshore drilling operations on the continental shelf within their respective zones of responsibility that might be required in the event of a marine casualty. That this information include relevant data not only with respect to the drilling units but also with respect to the contracted helicopters and supply vessels.

51. That upon receiving a forecast issuing a storm warning for an area in which drilling units are situated the Rescue Co-ordination Centre at Halifax obtain SURPICs of all ships within a radius of approximately 100 miles of the units every 6 hours commencing 6 hours before the storm is forecast to reach the location of the drilling units.

52. That the practice of Canadian Coast Guard radio operators waiting for written confirmation of the recorded verbal instructions to issue urgent messages be discontinued. That where personnel at either RCC or SAREC in St. John's are of the view that an urgent message should be transmitted, instructions be issued directly to Coast Guard radio, and, where relevant, the agency giving such instructions inform the other.

53. That as a matter of urgent priority Canada complete its SARCUP program to upgrade existing SAR helicopters and obtain others capable of longer ranges and with endurance for rescue missions offshore.

54. That Canada develop a contingency plan outlining the procedures to be followed in the event of a major marine disaster and that joint exercises be periodically held to train key personnel of SAREC, RCC, industry both on shore and on the rigs and standby vessels in what they would be required to do in the event of rig evacuation under emergency conditions.

COGLA, in its December 1983 *Guidelines to Operators – East Coast*, provided that "... operators on the Grand Banks shall, on a joint and continuing basis, maintain a helicopter dedicated to search and rescue with personnel trained and qualified in the use of such equipment ...."

The communiqué accompanying the guideline elaborated that this would be a *full-time* dedicated search and rescue helicopter, that the Department of National Defence (DND) would assess the search and rescue programs of the operators on a continuing basis, and that DND would provide search and rescue training for industry personnel.

COGLA, in its April 1984 guidelines and procedures provided that:

> ... drilling units are to be evacuated when wind speed exceeding 90 per cent of the design standards of the unit are forecast, provided that such an evacuation, in the opinion of the person in command of the drilling unit, can be conducted in a safe manner. Dynamically-positioned drilling units will have the option to evacuate all rig personnel or to move away from the forecast storm track ...

This guideline recognizes the fact that existing evacuation methods are inadequate during severe storms and directs that precautionary evacuation take place. Because of the transitory nature and the doubtful enforceability of guidelines as opposed to regulations, it is recommended:

55. That when wind speeds are forecast which exceed 90 per cent of the design parameters of a drilling unit, the crew from that unit be evacuated before the storm arrives, provided that the evacuation, in the opinion of the person in command of the drilling unit, can be conducted in a safe manner.

56. That there be required a full-time search and rescue dedicated helicopter, provided by either government or industry, fully equipped to

search and rescue standards, stationed at the airport nearest to ongoing offshore drilling operations, and that it be readily available with a trained crew able to perform all aspects of rescue.

"1. (g) . . . to inquire into, report upon and make recommendations in respect of oil pollution prevention procedures and whether the drill hole was left in a safe condition prior to or at the time of the casualty;"

Subsequent to the loss of the *Ocean Ranger* the blowout preventer was removed along with the drill string remaining in the hole at time of disconnect. On the basis of an assessment of the Hibernia J-34 Re-Entry and Suspension Program (Appendix F, Item 1), it is concluded that the well was properly secured before the loss, that there was no escape of well fluids at any time as a result of the casualty and that the drill hole was left in a safe condition prior to the time of the casualty. The equipment used and the procedures followed were suitable for the purpose of preventing oil pollution. No recommendation is necessary.

"1. (h) . . . to inquire into, report upon and make recommendations in respect of any acts or omissions of the owner, the charterer, the operator or any contractor in respect thereto;"

The preceding commentary outlines many areas in which the *Ocean Ranger* was deemed to be deficient in its design and manner of operation. Section 1 (h) of the Terms of Reference refers to acts or omissions which are contrary to law or which may amount to negligence. Based on the evidence, it has been concluded:

A. That ODECO, contrary to U.S. Coast Guard Regulations, omitted to provide the *Ocean Ranger* with the required number of qualified marine personnel and had not met U.S. Coast Guard requirements for lifesaving equipment.

B. That ODECO, contrary to U.S. Coast Guard Regulations, did not have a valid *Certificate of Inspection* for the *Ocean Ranger* at the time of its loss.

C. That Mobil (the operator), contrary to COGLA Drilling Regulation 151 (a) failed to ensure that ". . .every person employed on a drilling program receives instructions and training in respect of all operational and safety procedures that the person may be required to carry out during the course of his duties during such employment. . . ."

D. That ODECO, Mobil, and other contractors failed to provide survival suits for their personnel on board the *Ocean Ranger*.

E. That Mobil and/or Seaforth Fednav failed to inform Captain Duncan adequately of his duties as master of a standby vessel.

F. That neither Mobil, Seaforth Fednav, nor Crosbie Offshore properly equipped or caused to be equipped the standby vessels with proper rescue equipment with which to discharge adequately their responsibilities as standby vessels.

"1. (i) to inquire into, report upon and make recommendations on any other related matter."

The provision of timely and accurate weather forecasting is critical to the safe management of offshore drilling operations. Weather forecasts which predict environmental conditions which require the institution of safety measures must be taken into account and acted upon in order to ensure the safety of the operation. The crew of the rig must be able to interpret these forecasts properly if appropriate action is to be taken. The existence of a misunderstanding between NORDCO, Mobil and ODECO regarding the terminology used in the forecasts served to limit the effectiveness of this information. Testimony, however, indicated that operational decisions were made not on the basis of weather forecasts, but in response to weather conditions as they occurred. This general disregard for weather forecasting with respect to drilling operations and the operating history of the *Ocean Ranger* suggest that even if the NORDCO forecast had been properly understood, defensive action such as deballasting the rig would not have been taken. Accordingly it is concluded that the misunderstanding was not of itself a factor contributing to the loss of the rig. It is recommended:

57. That government and industry jointly take steps to ensure that a standardized weather reporting and forecasting system is adopted and understood.

58. That when a forecast predicts one or more environmental parameters which require defensive or emergency procedures, and when the required procedures are not in fact taken, a notation to that effect be logged by the person in command of the drilling unit, and a written report be forwarded by the person in command to the regulatory authority within 48 hours setting out the details of the forecast, the established parameter or parameters, the action required to be taken and the reason for not taking that action.

Evidence indicated a tendency on the part of offshore personnel not to report, or to delay reporting significant events to shore base or to the regulatory authority. A minor fuel spill, the listing incident of February 6, 1982, and the broken portlight were not the subject of timely communication, even when a report was required by regulation. One of the predominant objectives of regulatory control is the prevention of events which can lead to injury or loss of life. Failure, however, to report these events at the time that they occur significantly diminishes the effectiveness of this function. Some of the difficulty is no doubt caused by the lack of a clear definition of a significant event. It is recommended:

59. That the regulatory authority, in consultation with industry, more adequately define, by way of examples, the meaning of the term "significant event" which, should one occur, must be reported to the regulatory authority within the prescribed time.

60. That where a drilling unit exceeds its allowable KG at any time, it be deemed to be a "significant event" and a detailed written report and explanation be made by the person in command to the regulatory authority.

Throughout the public hearings it became evident that several systems of measurement were being used offshore. Wind speeds were forecast in knots and reported in miles per hour while the inland radio forecast gives them in kilometers per hour. Distances were alternately given in nautical miles, statute miles or cables. While this mixture of systems did not in any way contribute to the loss of the *Ocean Ranger* it is seen as a potential source of problems for the industry which can and should be avoided. It is recommended:

61. That in order to avoid misunderstanding and confusion in reporting procedures there be a single system of measurements used in all reports.

Examination of the *Ocean Ranger*'s ballast control system identified weaknesses not only in its design and in the training of those who operated it, but also in the manner in which the system was operated and managed. Critical stability information was not regularly tabulated or reviewed, aids for completing stability calculations were not made available, adequate written instruction in the use of the system was not available, particularly for junior operators, and there were indeterminate periods of time during which the ballast control room was unmanned.

The public address system, at least to the extent to which it could be operated from the ballast control room, was damaged by sea water when the portlight broke. Examination of the wiring plan, together with testimony, indicated that this system was on the same circuit as the fire and abandon ship alarms. A muting system rigged by the crew to reduce noise in the accommodations area required that the alarm system be triggered in order to use the public address system at full volume in this area.

In addition, there was no power supply to the public address system which was independent of the main and emergency generators. In the event of loss of all power, no rig-wide communication was possible. It is recommended:

62. That the public address and emergency alarm systems each be independent of the other and that each be operable for up to six hours in the event of a loss of electrical generation capability.

63. That there be a separate operating manual for the ballast system describing in detail its mechanical, electrical, pneumatic or hydraulic functions and components, its limitations, any alternate method of operation, and instructions for the systematic location of faults and their correction. That it be the responsibility of the person in overall charge of the ballast system to assure himself that the contents of this manual are known and understood by each ballast control operator.

64. That both this operating manual and the *Booklet of Operating Conditions* contain detailed instructions for the guidance of ballast control operators and others for operations in other-than-normal conditions, including, but not limited to, intentional slackening of anchor lines; dumping or shifting of mud, drill water or other weight; breakage of one or more anchor lines; accidental flooding of various combinations of lower tanks; accidental flooding of one or more chain lockers and spaces in the upper hull, and inclination of the rig because of second order wave effects.

65. That ballast control operators be required to calculate and log the drilling unit's transverse and longitudinal angles of inclination weekly. That where the calculated moments of either are in excess of 1,000 foot tons from the actual moments (as determined by the inclinometers) the amount of the variation be entered in the log and contained in the next morning report.

66. That the primary control centre for the ballast system on a drilling unit be manned and attended at all times.