MARINE OCCURRENCE REPORT

M95N0053

STRIKING AND SINKING

TUG "SEA ALERT"
NEAR NAIN, LABRADOR
01 NOVEMBER 1995

Transportation Safety Board
of Canada

Bureau de la scurit des transports

du Canada

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Synopsis

On 01 November 1995, while on passage from Ten Mile Bay to John Hay’s Harbour in fine clear weather, the “SEA ALERT” struck a rocky shoal and sank rapidly, with the loss of three of the four crew members. The survivor reached the shore after paddling on a wood-and-styrofoam raft for approximately two hours. Despite an extensive search of the area, the other three were not found. They became trapped when the vessel rolled onto her beam-ends, and they are presumed to have drowned. A slight oil patch was noted in the area where the tug sank.

The Board determined that the “SEA ALERT,” while navigating an unfamiliar and difficult route at full speed, struck a rocky shoal and sank due to an error in navigation probably associated with a loss of situational awareness. Contributing factors to the accident were the non-plotting of the tug’s position and the absence of a bridge resource management regime. The presence of non-essential personnel on the bridge also may have been a contributing factor.

Ce rapport est également disponible en français.

1.0 Factual Information

1.1 Particulars of the Vessel

	"SEA ALERT"
Official Number	816269
Port of Registry	St. John's, Newfoundland
Flag	Canada
Type	Tugboat
Gross Tons	155
Length	27.13 m
Breadth	7.16 m
Depth	3.65 m
Built	1960, Hessle, Yorkshire, England
Propulsion	470 kW diesel engine, driving one fixed-pitch propeller
Owners	Labrador Marine Services, Goose Bay, Labrador

1.1.1 Description of the Vessel

The tugboat was of all-welded single-shell steel construction, with a round bilge hull form. The hull below the main deck was subdivided by five transverse watertight bulkheads, such that the engine-room extended over approximately 60 per cent of the vessel's length (see Appendix A). The engine was operable from the wheel-house.

1.1.2 Stability Data

On entry into Canada on 01 June 1995, the recently purchased "SEA ALERT" was regarded as a "new ship", and as part of the regulatory approval process was required to comply with the intact and damaged stability requirements of Part VIII of the *Hull Construction Regulations* (HCR) for "Ships Built or Converted for Towing".

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

2 See Glossary for all abbreviations and acronyms.

The vessel was the subject of an inclining experiment on 29 June 1995 and the completed Inclining Report and related (Preliminary) Trim and Stability Booklet were forwarded for the information and approval of Transport Canada (TC) Marine Safety on 07 July 1995.

As submitted, all of the intact loading conditions complied with and exceeded the minimum criteria of STAB. 3, the "Interim Standard of Stability for Ships Built or Converted for Towing." Furthermore, the stability and freeboard characteristics of the vessel with individual compartments aft of the engine-room flooded also complied with the regulatory requirements of Part VIII of the HCR.

However, before final approval of the Trim and Stability Booklet by TC Marine Safety, several relatively minor points required clarification, and the suitably amended data were resubmitted on 31 October 1995.

At the time of the sinking, the stability data had been reviewed for preliminary approval and a final approval process was under way. Subsequent to the occurrence, as salvage of the sunken vessel was not contemplated, the stability data approval process was discontinued by TC Marine Safety.

1.2 History of Events

1.2.1 Background

The vessel was purchased in Ireland in May 1995 and arrived in St. John's, Newfoundland, on 01 June 1995. From that time until departure for Labrador and the Nain area, the vessel underwent structural and equipment modifications and additions at various ports in Newfoundland and Labrador to comply with Canadian standards.

The tug arrived in the Nain area on 27 August 1995, where she was employed in towing operations (barges, icebergs) and for seismic exploration.

1.2.2 History of the Voyage

One towing contract had been completed the day before the sinking and another was to start the following day. It was decided to take advantage of the 24-hour interval to replace a buoyed anchor in a sheltered bay, which was used to moor spare barges. This entailed a trip of approximately eight miles from the berth at the quarry in Ten Mile Bay to the mooring at John Hay's Harbour (see Appendix B). The tug left the berth on 01 November 1995 at 1430 and proceeded at her maximum speed of approximately eight knots.

At 1500 the master was heard to remark something to the effect that the vessel "must be past the rock," while moving from the Global Positioning System (GPS) to the radar. A few moments later the vessel struck Jenks Rock—at a speed of 7.7 knots as indicated on the GPS.

The striking consisted of three distinct bumps in rapid succession one after the other that caused the vessel

3 All times are NST (coordinated universal time (UTC) minus 3½ hours) unless otherwise stated.

practically to stop in the water. The engine was stopped immediately and all hands except the master proceeded to the engine-room to inspect for damage. Seawater was seen to be flooding in and, in an attempt to control the ingress, the vessel's three bilge pumps were started. These had a combined capacity of 36 tonnes/hour, but the space continued to flood and the "SEA ALERT" listed to starboard.

Once it was ascertained that the vessel was sinking, the crew decided to launch the eight-person outboard-equipped aluminium boat from its stowed position on the starboard side of the boat deck. All four crew manually lifted the boat from its cradle and pushed it over the side, but the painter became entangled in an obstruction on the main deck; the mechanical launching equipment was not used. One of the crew remained on the boat deck to attend the painter at its secured end while the other three went down to the main deck in an attempt to clear it.

Meanwhile, the list to starboard had increased. The vessel suddenly rolled to starboard onto her beam-ends, downflooded, and sank stern first on top of the three men who were engaged in freeing the painter on the main deck. None of them were seen again, and it is presumed that they were carried to the bottom as the vessel sank.

In the meantime, the other crew member, who also had been on the starboard side, on the boat deck, ran to the port side as the list suddenly increased, in order to launch the inflatable liferaft that was stowed there. He untied the painter with the intention of inflating the raft while in the water. By that time, the vessel was lying on her starboard beam-ends and rapidly sinking.

He found himself standing on the port side of the bow as the vessel sank from under him. He estimated that a total of about five minutes had elapsed from striking to sinking. At or about this time, he lost his boots.

When the uninflated liferaft surfaced in its canister, it was downwind from him and blowing away faster than he could swim. Fortunately, an empty oil drum surfaced beside him and he held on to it for buoyancy. A 1 m by 1.5 m wood-and-styrofoam raft, which had been stowed on top of the wheel-house, also surfaced beside him. This he used as flotation while paddling with his arms and legs toward the shore, which was about one mile distant.

After about two hours of paddling, and having crawled over land-fast ice, he reached the shore between 1700 and 1730. He then walked over hilly rocky terrain barefoot until about midnight, when he found a heated shed containing food and water. This shelter was near the quarry from which the vessel had departed earlier. Quarry workers discovered him at 0800 the following morning.

1.3 Injuries to Persons

The master, engineer and one deck-hand are missing and presumed drowned. The other deck-hand/engineer survived. He was taken by helicopter to the clinic at Nain, where he received medical treatment for hypothermia, exhaustion and lacerated feet. He made a full recovery.

1.4 Damage to the Vessel

The vessel sank in 42.6 m (23.5 fathoms) and is resting on the seabed in an upright position some 200 m from the rocky shoal which she struck (in approximate position 56°28.5'N, 061°38.5'W). A team of Royal Canadian Mounted Police (RCMP) divers attempted to inspect the wreck, but their equipment did not allow them to dive to a depth greater than 30 m. Consequently, they were only able to inspect the upper parts of the vessel, which appeared to be in good condition.

The survivor's description of events indicates that the vessel suffered extensive bottom damage, and the owners do not intend to attempt salvage.

1.5 Vessel Certification

The "SEA ALERT" held a valid SIC 17 and complied with the requirements for a vessel of her type in the trade in which she was engaged. Since she was not equipped with a medium frequency radiotelephone (MF R/T), the Radio Inspection Certificate that she was issued by TC Marine Safety during refit (valid until 12 December 1995) had been endorsed to read: "This certificate is valid only while the vessel is on Canadian Domestic Voyages and within the VHF area as per the regulations." However, the area in which the "SEA ALERT" was operating when she sank was outside of the very high frequency (VHF) coverage provided by Marine Communications and Traffic Services (MCTS) Centres.

1.6 Personnel Certification and History

1.6.1 Master

The master had some 19 years' seafaring experience on many different types of vessels and had been serving as master on tugs for approximately 9 years. He was reputed to be knowledgeable and familiar with the Labrador coast. He held a Canadian Certificate of Competency as Master for vessels up to 350 gross tons for selected geographical areas. As a prerequisite for this certificate, he had taken a Marine Emergency Duties (MED) course in 1986. He also held a Radiotelephone Operator's Restricted Certificate (Maritime). He had passed Jenks Rock approximately 30 times before and had operated in the general area for three years. He was also one of the co-owners of the "SEA ALERT".

1.6.2 Engineer

With 37 years of seagoing experience, mainly on large fishing vessels, the engineer held a Canadian Certificate of Competency as Chief Engineer for fishing vessels of unlimited tonnage. He and the master had been on the "SEA ALERT" since April 1995, when the vessel had been purchased by the present owners.

He also was recognized as a good "all-round seaman" and had attended a MED course. His Certificate of Competency did not qualify him to act as chief engineer while serving on the "SEA ALERT" but only on fishing vessels. For a tug of the size and power of the "SEA ALERT", the minimum requirement is a Third Class Engineer's Certificate of Competency.

1.6.3 Deck-hand

The deck-hand lost when the tug sank was an experienced seaman who had worked most of his adult life as a fisherman. He had no formal marine qualifications or MED training, nor is any required by regulation to hold such a job on a vessel of the type and size of the "SEA ALERT". He had served on the vessel since June 1995.

1.6.4 Deck-hand/Engineer

The fourth crew member, the survivor, had worked in the capacity of assistant engineer/deck-hand on board the vessel for approximately two weeks before the accident and had attended a MED course some 10 years before. With the passage of time, he had forgotten that there was a knife in the liferaft to cut the painter, and he did not fully appreciate the use of the hydrostatic release attachment between the liferaft and the tug.

1.7 Bridge Watch

The entire crew was in the wheel-house before and during the striking: the master, who navigated, the chief engineer, who hand-steered to the master's orders, and the two deck-hands, who had gathered there although they had no specific duties to perform related to the navigation of the vessel. The survivor described the atmosphere in the wheel-house as being relaxed.

1.7.1 Bridge Resource Management (BRM)

No one other than the master was involved in the planning of the passage. Reportedly, the Canadian Hydrographic Service (CHS) chart for the area, No. 4748, was on board but was not used for position plotting.

BRM principles and techniques encourage the use of all available resources to ensure a team approach for the safe completion of the voyage. The master had not received any formal BRM training, nor was such training required. There was no indication that the crew aboard the tug, with the exception of the master, had navigational experience.

1.8 Weather and Tidal Information

1.8.1 Weather Conditions

The weather was fine and clear with a westerly wind of 10 to 15 knots. The sea was calm in the sheltered waters of the channels, and visibility was 5 to 10 miles. The air and sea temperatures were -10°C and 5°C, respectively.

1.8.2 Currents in the Area

Information on the currents and tidal flows in many areas of Labrador is either vague or unavailable. Local knowledge is, therefore, of paramount importance and was available in the search for survivors. The "SEA ALERT" struck at or near high water in the area of Jenks Rock. At or near the time of the sinking, the wind was westerly and possibly assisted the survivor in making a landfall somewhere in the bay, south of Glassis Point.

1.9 Canadian Charts of the Coast of Labrador

Many areas of the Labrador coast are either poorly or inaccurately charted. Apart from shorelines being depicted by pecked lines and an absence of depth-soundings, mariners are further cautioned by printed warnings on some of the charts; an example states, in part:

> Positions plotted from navigational systems such as GPS, SATNAV, LORAN C, OMEGA may be in error by one mile because the horizontal reference datum for this chart is unknown. Positioning methods, such as range and bearing should therefore be used.

CHS chart No. 4748 has three cautions and danger warnings regarding soundings and approaches to shorelines.

Page 256 of the *Sailing Directions*, *Labrador and Hudson Bay* states, in part:

> Dangers. — A large shoal area charted 0.7 to 1.2 miles north of Turn Island has a rock 8 feet (2.4 m) high near its south extremity. Jenks Rock, with 2 feet (0.6 m) over it lies 0.4 mile ENE of this rock.

1.10 Change of Routine

In the two months preceding the accident, the tug had been employed in towing barges in the same general area and had navigated safely past Jenks Rock many times. On those occasions, the master had conned the vessel and, generally, the chief engineer had steered.

The route taken on this occasion was reportedly different from the route usually taken when towing. It was slightly shorter and took the vessel to the east of Jenks Rock, whereas the usual course would have taken the vessel to the westward.

The nature of the channels required frequent course alterations on either route. The master used references to the appropriate chart, the radar, the depth-sounder, and visual observation to navigate. The GPS was also in use to indicate speed over the ground.

In this instance the two deck-hands, who normally performed various duties regarding the safety of the tow during towing operations, had few duties to perform on the day of the occurrence and had gathered in the wheel-house.

1.11 Radio Communications

The vessel was equipped with two VHF R/T sets, one of which the master had used to contact another vessel regarding work-related business about 10 minutes before the accident. It is not known if he attempted to send a VHF R/T "MAYDAY" message, but neither of two other vessels which were well within VHF range heard such a message from the "SEA ALERT".

The nearest shore-based MCTS Centres, in Goose Bay, Frobisher and Cartwright, are unable to provide VHF coverage for this region. The site at Hopedale is not VHF-equipped.

In recent years there has been a general increase in shipping in the Voisey Bay area. Search and Rescue (SAR) aircraft are equipped with VHF and MF/HF radios for marine communications. In the absence of VHF coverage for the area, SAR aircraft experienced some difficulty in communicating with the Marine Rescue Sub-Centre (MRSC) at St. John's and with flight service stations.

1.12 Emergency Position Indicating Radio Beacon (EPIRB)

The vessel's 406 MHz EPIRB is a battery-operated transmitter which transmits a coded signal when activated. The signal is received by a satellite that relays the information back to one of many land-based receiving stations. The radio signal is then decoded and the identity of the vessel, the owner of the beacon, is established as well as the possible search area.

After the "SEA ALERT" sank, her float-free EPIRB transmitted a radio signal, alerting the Canadian Mission Control Centre (CMCC) at Rescue Coordination Centre (RCC) Trenton, Ontario, at 1534, 01 November 1995.

1.13 Search and Rescue

The resources tasked to search for the crew included Canadian Forces fixed-wing aircraft, helicopters, Canadian Marine Rescue Auxiliary (CMRA) vessels, tugs, pleasure craft, a RCMP Boston whaler, and the "NORTHERN RANGER".

The "NORTHERN RANGER" had departed Nain at 1630 on 01 November, and at 1810 the vessel was requested by RCC Trenton to return to an area near The Bridges Passage to establish a search pattern. The search succeeded in identifying the exact location of the wreck; a fuel oil slick was sighted. The liferaft, which was uninflated and still in its canister, the raft used by the survivor, the EPIRB, a lifebuoy and several other pieces of flotsam were recovered.

The crews of the 12 surface units involved in the search for the missing crew members all possessed local knowledge. At about 1635, the first vessel reached the area of Jenks Rock, followed by the first aircraft at approximately 1731. As night fell, the fixed-wing aircraft circling overhead dropped flares to illuminate the area.

The survivor found the illumination invaluable as he climbed over the rough terrain. Earlier, when he was on the beach, he thought that he had been sighted by a helicopter as he was in the beam of its searchlight. However, despite frantically waving his jacket, he was not sighted by the helicopter crew.

Searchers on land, in aircraft, or in vessels later were stood down for the night because of darkness and of the need for the aircraft to refuel. The searchers resumed their tasks at first light the next morning. The search was downsized on 03 November, and the RCMP assumed responsibility for a missing persons case.

1.14 Life- saving Equipment

The aluminium boat replaced an earlier inflatable dinghy and formed part of the vessel's life-saving equipment, which included an inflatable liferaft fitted with an hydrostatic release mechanism, eight lifejackets, four immersion suits, and a buoyant apparatus (a "Carley Float"-type raft). The dinghy had been used previously in a launching demonstration for TC Marine Safety. The aluminium boat subsequently had been used during an on-board lifeboat drill when the vessel was off Nain, a few days before the sinking.

1.15 Hypothermia

The Canadian Red Cross has published a diagram that provides information pertaining to hypothermia. After people have been immersed in water at a temperature of 5°C for two hours, their chances of survival are slim, even if rescued.

The deck-hand/engineer survived in great part because he was able to lie on top of the raft, mainly out of the water, and to paddle to shore, although the air temperature was -10°C.

1.16 Health and Fatigue

All of the crew were reportedly in good health and had slept well the previous night. The striking occurred some 30 minutes after departure from the berth; there is no reason to believe that any of the crew were fatigued.

2.0 Analysis

2.1 Decision to Abandon Ship in the Aluminium Boat

It is not known why the crew of the "SEA ALERT" decided to abandon ship in the aluminium boat. Although the boat was positioned under the davit, the inflatable liferaft would have been quicker and easier to launch.

It is also not known why the painter was not cut at the boat deck level instead of trying to free it at the main deck level.

2.2 Communications

As more oil exploration and related maritime activity takes place in Labrador in general and in Voisey Bay in particular, the need for effective ship/shore radio communications increases. Effective communication with MCTS Centres in this region is provided by MF transmissions; there is no VHF coverage. Also, the MF radios that are currently required for vessels operating in this area can be used effectively for bridge-to-bridge communications.

Although the lack of a shore-based VHF relay station made radio communications difficult among those involved in the SAR operation, it would not have precluded the other vessels known to have been within VHF range at the time of the occurrence from receiving a "MAYDAY" message from the "SEA ALERT". Given how quickly the situation leading to the vessel's capsizing developed, it is unlikely that a "MAYDAY" was sent; none was heard. The vessel's float-free EPIRB, however, was heard to be transmitting at 1534, about 30 minutes after the vessel had struck Jenks Rock.

Digital selective calling (DSC) capability increases the probability that a vessel in distress can send an alert and that it will be received. With this technology, alerts can be sent at the push of a button. The use of pre-formatted distress messages with position information ensures that essential information is included in the distress message.

The "SEA ALERT" and the vessels within VHF range were not fitted with VHF R/Ts with channel 70 DSC capability, nor were they required to be. A DSC capability would have greatly improved the chance of a ship-to-ship alert being sent and successfully received. In addition, ships that fit a satellite terminal approved for Global Maritime Distress and Safety System (GMDSS) have the capability of worldwide (70°N to 70°S latitude), automated ship-to-shore distress alerting. The implementation of the GMDSS to domestic ships is currently being reviewed by TC Marine Safety, in consultation with the marine industry.

2.3 *Flooding and Sinking*

Regulatory hull construction requirements for tugboats of this size and class do not call for the incorporation of double-bottom or side tanks and, consequently, these vessels are highly vulnerable in the event of extensive damage to the single-shell plating. Furthermore, with the exception of compliance with the flooding requirements of Part VIII of the HCR, there is no regulatory subdivision limitation restricting the length of any under-deck compartment.

The engine-room of the "SEA ALERT" extended over nearly 60 per cent of her length, and post-casualty calculations based on the reported departure loading condition show that uncontrolled flooding of this compartment would have caused the vessel to settle and trim by the stern, downflood, lose reserve buoyancy, and sink stern first.

The extent and precise location of the underwater damage is unknown, but the engine-room was observed to be flooding at a rate in excess of the vessel's total bilge-pumping capacity of 1,000 L/min (16.67 L/sec). The steady and sudden final heel to starboard would indicate that the initial ingress of flood water and principal underwater damage most likely were sustained on that side, and this is consistent with the sinking sequence reported by the survivor.

2.4 *Significant Factors in the Striking*

There is nothing to suggest that there was a malfunction of the mechanical, electrical, or navigational instruments, or of the steering gear. Further, no distress message was received by any ship or shore station nor was a voyage plan from the master found. The only surviving crew member, a deck-hand who had limited experience, could not provide definitive information. Therefore, it is difficult to determine the precise sequence of events and circumstances that led to this occurrence.

However, several observations by the survivor provided some useful insight regarding the actions of the master and the other crew members. In particular, his recall of the master's remark that the tug "must be past the rock," when this was not the case, strongly suggests that the master had lost awareness of his vessel's exact position. It would appear that this loss of situational awareness led to the tug striking the rocky shoal.

Situational awareness can be defined as all knowledge that is accessible and can be integrated into a coherent picture, when required, to assess and cope with a situation. More simply, situational awareness is knowing what is going on around you. The successful completion of a complex task such as navigation of a vessel depends upon situational awareness in both the development and implementation of plans and procedures. Situational awareness develops on three different levels. First, there has to be a perception of the situational elements

[4] N.B. Starter and D.D. Woods, "Situational Awareness: A critical but ill-defined phenomenon," *The International Journal of Aviation Psychology*, 1(1), pp. 45-57, 1991.

[5] Geiss-Alvaro Associates, *Human Error Accident Training* (U.S. Coast Guard training manual, July 1991).

derived from a variety of potential sources of information such as equipment displays, task-specific communication with others, and a view of the external environment. Next, the perceived information must be integrated into a meaningful context using one's personal experiences and knowledge. Finally, that information is then used to modify plans as the task progresses.

Several factors may have contributed to the master's loss of situational awareness:

1) The master chose to follow an unfamiliar route (which was difficult in that it required frequent course alterations) while the tug proceeded at eight knots (a speed greater than her normal towing speed), without assistance from either of the two deck-hands. Both the route and the speed probably increased the workload associated with the navigation of the vessel. Since the master was the one involved in the navigation of the vessel, which included close monitoring of the tug's progress and speed using visual observation, radar information and GPS, and giving helm orders, it is likely that between course alterations he would have had limited time for information processing, decision making, and plan modification and execution. As the master had decided to transit the difficult route and to perform the navigation tasks alone, good nautical practices dictate that he should have reduced the tug's speed to afford himself more time to assess and respond to any developing situation.

2) The master was familiar with the general area and was aware of the limitations of the electronic navigation aids. As horizontal reference datum for the chart in use is unknown, positions obtained by GPS could have been in error by about one mile. Because of this limitation posed by the GPS, the master could not use it to verify the tug's position and, consequently, the GPS was used only as a speed log.

3) The master did not plot the vessel's position on the appropriate chart. Such plotting would have assisted him in better monitoring the vessel's progress.

4) The presence in the wheel-house of additional persons who—though acting responsibly—were not actively involved in operational tasks, may have distracted the master.

The master had the conduct and the engineer was tasked to steer the tug. For BRM to be effective, it is essential that the personnel forming the bridge team be knowledgeable in the principles of navigation or have some navigational experience. The extent of the relevant knowledge and navigational experience of the deck-hands, or the contribution they may have been able to make to BRM, are not known. The master was generally a prudent and cautious navigator, but he did not employ the deck-hands' assistance in the navigation of the vessel.

3.0 Conclusions

3.1 Findings

1. The "SEA ALERT" struck a rocky shoal eastward of Jenks Rock due to an error in navigation probably associated with a loss of situational awareness.

2. The loss of situational awareness may have been attributable to:

    - the relatively high speed of the vessel while navigating an unfamiliar and difficult route;
    - the non-plotting of the tug's position on the chart; and
    - the distraction associated with the presence of non-essential personnel in the wheel-house.

3. No bridge resource management (BRM) regime was in place to assist the master in the navigation of the tug.

4. The flooding observed in the engine-room occurred at a rate in excess of the vessel's bilge pumping capacity.

5. The vessel rolled onto her starboard beam-ends, downflooded, and sank by the stern.

6. While attempting to free a fouled painter instead of cutting it, the master, engineer and deck-hand became trapped and are presumed to have drowned.

7. The crew of the "SEA ALERT" first attempted to abandon ship in the aluminium boat rather than in the inflatable liferaft, which would have been quicker and easier to launch.

8. It is unlikely that the vessel sent a "MAYDAY" message by very high frequency (VHF) radio. Search and Rescue (SAR) authorities were alerted by transmissions from the vessel's float-free Emergency Position Indicating Radio Beacon (EPIRB) about 30 minutes after the vessel had struck the rocky shoal.

9. In the area of increasing traffic where the vessel sank, there is no shore-based radio coverage for VHF transmissions.

10. In the area of the sinking, positions obtained by electronic navigational systems, including by Global Positioning System (GPS), do not necessarily correspond to those obtained by bearing and distance when plotted on the chart, and warnings to that effect are printed on the relevant publications.

3.2 Causes

The "SEA ALERT", while navigating an unfamiliar and difficult route at full speed, struck a rocky shoal and sank due to an error in navigation probably associated with a loss of situational awareness. Contributing factors to the accident were the non-plotting of the tug's position and the absence of a bridge resource management regime. The presence of non-essential personnel on the bridge may also have been a contributing factor.

4.0 Safety Action

4.1 Action Taken

Following this occurrence, the Canadian Coast Guard (CCG) sponsored a study, *Requirements for CCG Services Along the Labrador Coast.* The objective of the study, conducted by Consulting and Audit Canada(CAC), was to assess the requirements for CCG services along the Labrador coast in light of the current CCG levels of service (LOS), the current demand, and the expected economic developments bringing increased marine traffic to the area. The study evaluated the adequacy of CCG services, which include Aids to Navigation, Search and Rescue, Safety and Environmental Response, Marine Communications and Traffic Services, Ice Services, and the *Navigable Waters Protection Act.* The report identified several deficiencies in CCG LOS in the area, including the following:

1. Only about 10 per cent of the Labrador coast is surveyed to modern standards, which does not allow for a safe marine transportation system.

2. CCG services delivered along the Labrador coast meet neither national LOS standards nor the standard delivered to the rest of Newfoundland.

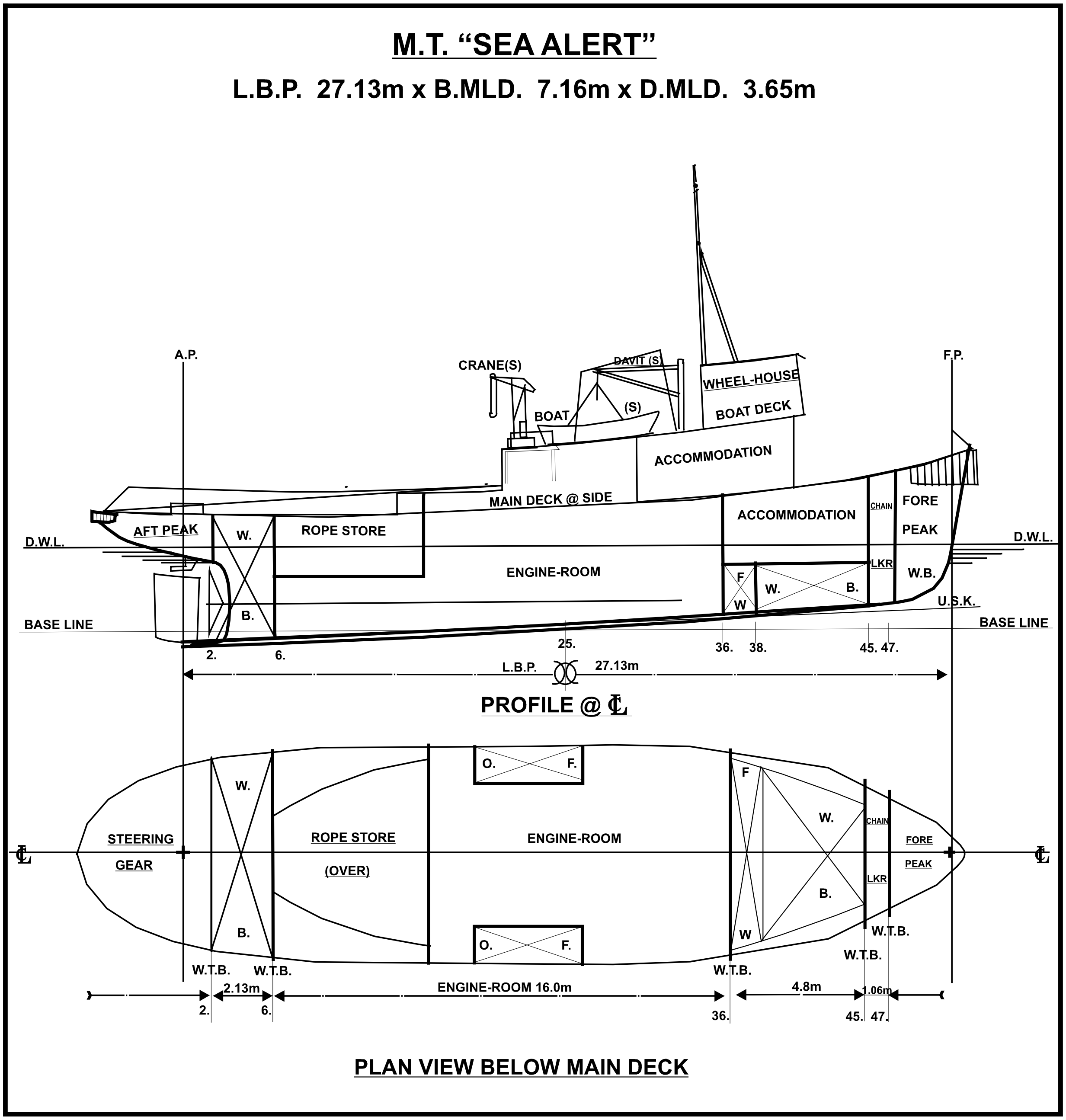
3. The marine transportation system being provided along the Labrador coast may not be as safe and reliable as it is in other parts of Canada.

The report was completed and published in May 1998, making 14 recommendations to improve CCG services along the Labrador coast regarding the state of hydrography, delivery of CCG services, availability of reliable marine traffic data, and traffic density and routes.

In accordance with CAC recommendations, the implementation plan for the Labrador Seaway Program includes a detailed study of additional CCG service requirements and further analysis of costs and priorities. The program includes additional hydrographic work to increase the coverage and accuracy of navigation charts near the main shipping routes. With regard to the need for 250 conventional aids to navigation, the CCG is looking at all opportunities to use surplus equipment from other regions. In 1998, 140 new navigational aids have been installed along the Labrador coast.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 02 September 1998.

Appendix A - Outline General Arrangement



Appendix B - Sketch of the Occurrence Area

Appendix C - Photographs

Appendix D - Glossary

A.P.	aft perpendicular
B.MLD.	breadth moulded
BRM	bridge resource management
C	Celsius
CAC	Consulting and Audit Canada
CCG	Canadian Coast Guard
CHS	Canadian Hydrographic Service
℄	centre line
CMCC	Canadian Mission Control Centre
CMRA	Canadian Marine Rescue Auxiliary
D.MLD.	depth moulded
DSC	digital selective calling
D.W.L.	designed waterline
ENE	east-north-east
EPIRB	Emergency Position Indicating Radio Beacon
F.P.	forward perpendicular
F.W.	fresh water
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
HCR	*Hull Construction Regulations*
IMO	International Maritime Organization
kW	kilowatt
L.B.P.	length between perpendiculars
LKR	locker
L/min	litres per minute
L/sec	litres per second
LOS	level of service
m	metre
MCTS	Marine Communications and Traffic Services
MED	Marine Emergency Duties
MF	medium frequency
MF/HF	medium frequency/high frequency
MHz	megahertz
MRSC	Marine Rescue Sub-Centre
M.T.	motor tug
N	north
NST	Newfoundland standard time
O.F.	oil fuel
RCC	Rescue Coordination Centre
RCMP	Royal Canadian Mounted Police

R/T	radiotelephone
(S)	starboard
SAR	Search and Rescue
SI	International System (of units)
SIC	Ship Inspection Certificate
TC	Transport Canada
TSB	Transportation Safety Board of Canada
U.S.K.	underside of keel
UTC	coordinated universal time
VHF	very high frequency
W	west
W.B.	water ballast
W.T.B.	watertight bulkhead
°	degree
'	minute