Reg No. 00414/1987-W

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Our Ref: 4076/C4/R001/JMW/LOCS

"HEBEI SPIRIT"
COMMENTS ON THE INCHEON MARITIME SAFETY TRIBUNAL (SPECAIL TRIBUNAL) DECISION - 4TH SEPTEMBER 2008

Date: 21 November 2008

JMW/jit

CONTENTS

1. INTRODUCTION

I have been requested to comment on matters relating to the collision and pollution from the anchored, laden, very large crude carrier (VLCC) "HEBEI SPIRIT" after it was struck by the crane barge "SAMSUNG No.1" on the morning of the 7th December 2007. I have 31 years experience in shipping, having spent 18 years of my sea going career on various types of tankers through ranks from cadet to Master. Since 1995 I have been employed as a consultant with London Offshore Consultants in Singapore undertaking numerous investigations into various marine casualties on behalf of ship owners, insurance interests, government bodies and Admiralty lawyers. During these last 13 years I have investigated many collisions and pollution related cases, including numerous collisions between vessels when either one, the other, or both were anchored.

I have been provided with the Incheon Maritime Safety Tribunal (Special Tribunal) Decision (dated 4th September 2008) into the collision and resulting marine pollution following the contact between the "SAMSUNG No.1" crane barge, towed by tug boats "SAMSUNG T-5" and "SAMHO T-3", assisted by the anchor handling tug "SAMSUNG A1", and the anchored laden tanker, "HEBEI SPIRIT". This Decision document covers both the navigational aspects leading to the collision and the subsequent activities undertaken on board the tanker in respect of the marine pollution. I have commented on both these matters.

For ease of reference I have reproduced in full the body of the Decision in blue italics to differentiate it from other quotes and my comments (in black text). In this report, the Incheon Maritime Safety Tribunal is abbreviated as IMST.

2. COMMENTS

The IMST have summarized their ruling at the start of their report on their Decision. This is reproduced fully here: -

Ruling *The marine pollution due to the collision of this case ("Marine Pollution") was caused by the following: The tugboats, "Samsung T-5" and "Samho T-3," failed to take early actions in response to the weather changes while they were performing the towing operations for the barge "Samsung No. 1." The marine spread encountered bad weather and lost its towing ability to the extent that it was impossible to navigate the vessels as intended. However, the marine spread continued to navigate without taking any safety measures, such as warning the other vessels nearby or performing emergency anchoring, etc. In the end, the towing line of Samsung T-5 broke under the circumstances where the marine spread had approached too closely to the anchored vessel, M/V "Hebei Spirit," and "Samsung T-5" drifted towards "Hebei Spirit." The following contributed to the marine pollution due to the collision: Despite the fact that "Hebei Sprit" was anchored in an area frequented by sailing vessels and had a duty of care, it was negligent in performing its duty and failed to notice the marine spread early. Under the circumstance where it had to belatedly avoid the collision, Hebei Spirit could not help but go dead slow astern because it did not have its main engines fully prepared. In addition, after the occurrence of the collision, it failed to actively perform responsive measures under the Shipboard Oil Pollution Emergency Plan because it lacked understanding of the seriousness of the marine pollution.*

The second class officer license of the relevant party (in the marine accident) Seung Min Cho shall be revoked.

The duties of the relevant party Gan Tae Kim, as third class officer, shall be suspended for twelve months.

The relevant party Yi Hyun Kim is advised to make corrections [reprimanded].

The relevant party Boram Co., Ltd. ("Boram") is advised to make improvements.

The relevant party Samsung Heavy Industries Co., Ltd. ("SHI") is advised to make improvements.

The relevant party Jasprit Singh Chawla is ordered to make corrections [reprimanded].

The relevant party Chetan Syam is ordered to make corrections [reprimanded].

I will provide my comments on the various aspects of this ruling in more detail in the body of this report, however, it is necessary here to highlight that I find this ruling is both at times factually misleading and biased against the two crew members from "HEBEI SPIRIT", and the IMST has used hindsight to further their impartiality. For example:-

- The tow never lost its full towing ability prior to the parting of the towline of "SAMSUNG T-5" and, as the IMST have noted above, those on the marine spread never notified anyone of their movements or broadcast/signaled any warnings until prompted by the action of those on the "HEBEI SPIRIT".

- The breaking of the towline of "SAMSUNG T-5" was the prime cause of the collision. Prior to its parting the marine spread was passing clear, albeit to the windward side, of the anchored tanker. Had it not parted there would have been no collision, nor pollution. The tow wire, its maintenance and use, is the responsibility of the tug operators/managers and their masters and crew, as is the overall operation of the tugs and barge. As such, those on "HEBEI SPIRIT" have absolutely no liability for the way the marine spread was operated/managed.

- Those on the anchored "HEBEI SPIRIT" did not fail to notice the approach of the marine spread in a reasonable time. As was shown in the VTS VHF transcript, action was being taken on "HEBEI SPIRIT" before any notification from those on board the marine spread. Responses to calls from the VLCC and Daesan VTS were ignored by those on the tugs.

- "HEBEI SPIRIT"'s engine was fully prepared 40 minutes before the collision and it was not necessary to use the engine in any more than dead slow astern to stretch the cable prior to the collision. Thereafter, the evidence from the engine data logger after the collision shows that the vessel used slow astern and half astern settings successfully.

- The actions of the crew of "HEBEI SPIRIT" were not only exemplary in avoiding loss of life and the ship, which would have created greater pollution damage, but they correctly followed international guidelines, which have been developed over the years from incidents involving catastrophic casualties of tankers. In addition, at no time during the immediate aftermath of the collision were they ever criticized by the Korean authorities for failing to adequately respond to the leakage of oil.

Furthermore, the IMST have consistently used the insurance towage certificate as the deciding factor for the fitness and operation of the marine spread for the voyage despite it being invalid for this particular voyage. The insurance surveyor is acting on behalf of the insurers for the voyage who have a commercial contract with the assured (SHI). His certificate and voyage recommendations form part of this contract and do not override the statutory obligations under international marine law and regulations of the operators/managers and masters to provide suitable vessels, properly equipped, fit and correctly operated for the expected circumstances of the voyage. In this respect the IMST have fundamentally misunderstood of the role of the insurance surveyor, and demonstrated a reliance on this towage survey that is crucially misplaced particularly as it was not valid for this particular voyage.

At the bottom of the ruling each of the parties accused are listed with their recommended punishment. Even though the prime cause of the collision is clearly stated in the ruling as a result of the tow wire parting, that is, the fault of the operators/managers, masters and crew of the marine spread, only Mr Seung Min Cho and Mr Gan Tae Kim form "SAMSUNG T-5" and "SAMHO T-3" respectively, are punished, Mr Yi Hyun Kin, Boram Co. Ltd and Samsung Heavy Industries Co. Ltd. are only "advised" to make corrections. And yet, the two crew members of "HEBEI SPIRIT" are "ordered" to make corrections. The weight of this wording shows the impartiality of the IMST against the crew of "HEBEI SPIRIT" and illustrates a lack of knowledge on marine matters that the IMST are purporting to pass judgment on.

Rationale

I. Facts

Name of Vessel	*Samsung T-5*		*Samho T-3*		*Samsung No. 1*	*Hebei Spirit*	
Port of Registry	*Geoje-si*		*Busan*		*Geoje-si*	*Hong Kong*	
Shipowner	*Samsung Corporation ("Samsung Corp.")*		*Samho Industry & Development Co., Ltd. ("Samho I&D")*		*Samsung Corp.*	*HebeiSpirit Shipping Co. Limited*	
Operator of Vessel	*Samsung Heavy Industries*		*Samsung Construction Co., Ltd.*		*Samsung Heavy Industries*	*Same as above*	
Manager of Vessel	*Boram*		*Samsung Construction Co., Ltd.*		*Boram*	*Same as above*	
Gross Tonnage	*292 M/T*		*213 M/T*		*11,828 M/T*	*146,848 M/T*	
Type of Engine/ Generating Power	*Diesel engine 2 engines of 1,765kw*		*Diesel engine 2 engines of 1,323kw*		*Non-power driven barge*	*Diesel engine 1 engine of 20,594kw*	
Relevant Party of the Marine Accident	*Seung Min Cho*	*Gan Tae Kim*	*Yi Hyun Kim*	*Boram*	*Samsung Heavy Industries*	*Jasprit Singh Chawla*	*Chetan Syam*
Position	*Master*	*Master*	*Master*	*Vessel Manager*	*Vessel Operator*	*Master*	*Chief Officer*
Type of License	*Second class officer (JP-D2-07-0001)*	*Third class officer (BS-D3-03-0005)*					
Date of Accident	*December 7, 2007, at around 0706 hours*						
Place of Accident	*36-52.7N, 126-03.7E (Approximately 5.1 miles off at sea in the direction of 252 degrees from the lighthouse at Shin-do Island, Wonbuk-myeon, Taean-gun)*						

This case concerns a serious marine accident where a marine spread comprised of 2 tugboats, which were side by side in towing a large floating crane barge, each extended a towing line from its respective stern and while sailing along the coast, encountered bad weather. After being pushed by the wind and waves, the marine spread eventually collided with a Very Large Crude Carrier of a gross tonnage of 146,848 M/T and caused serious marine pollution.

A decision by the Maritime Safety Tribunal is a special administrative decision issued with the object of preventing similar accidents from reoccurring by identifying the various factors that brought about the accident from a maritime technology perspective. The subject of the decision is not just limited to human negligence, but covers the accident itself, and therefore, it must be clarified whether each and every one of the causes that directly or indirectly affected the occurrence of the accident has a causal relationship with the accident.

For this purpose, prior to describing the circumstances leading to the accident, an account of the facts and detailed explanation (excerpts) of the structure, equipment, performance, and the operator, as well as the maneuverability of the vessels in the accident, which are essential in analyzing the cause, shall be provided.

The above facts fail to mention the presence of the fourth vessel in the marine spread, the "SAMSUNG A1". In hindsight, the IMST have subsequently stated that this vessel, "SAMSUNG A1" did not have the physical attributes in the prevailing weather to undertake any activities prior to the collision. Even if this was so, from the perspective of those on board the VLCC, it would not be possible for them to determine that this tug had any inability to assist with this tow. The presence of a tug connected to the aft end of the crane barge, seen both visually and by radar, would suggest a steering tug.

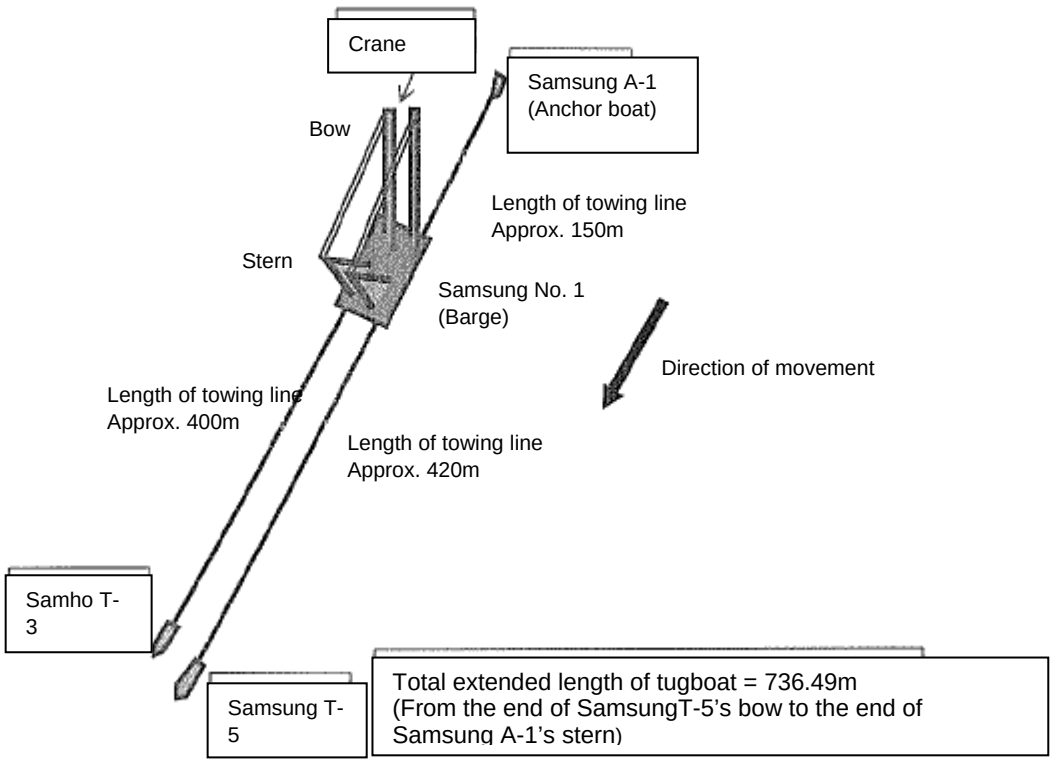
As the objective is to prevent a re-occurrence of such an incident, the IMST are correct in saying that they have to identify the relevant causal factors, but they should never forget the prime cause of this incident; the parting of "SAMSUNG T-5" tow line and the circumstances surrounding this factor. Addressing the operation and management of such marine spreads around the coast of Korea has to be the best way to avoid a re-occurrence of such an incident. I do note in a later section of the Decision, entitled V. Implications, which the IMST have said there is an increase in casualties around the Korean coast involving marine spreads. This illustrates where the problem lies and where the IMST should be focusing on in their assessment of causal factors to this particular incident; the failure of the operation and management of the marine spread.

A. Details of the Marine Spread

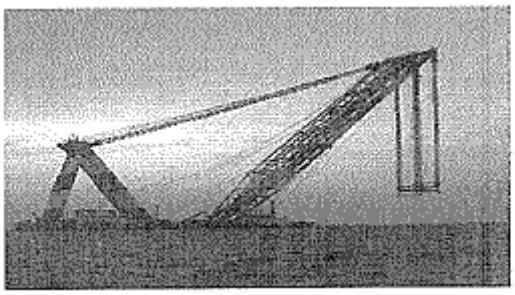
1) Composition of the Marine Spread

The marine spread in the present case (the "Marine Spread") is composed of a total of 4 vessels as follows: (i) "Samsung No.1," a large floating crane barge with a gross tonnage of 11,828 M/T that is equipped with a floating crane with a lifting load of 3,000M/T, (ii) 2 tugboats, "Samsung T-5" and "Samho T-3," which tow the said barge by its stern in a backwards direction through the connection of a towing line from each tugboat to each side of the barge at its stern, and (iii) "Samsung A-1," an anchor boat of "Samsung No. 1," which assists in controlling the direction in which "Samsung No. 1" moves, by following behind with a towing line connected to the center of the barge's bow. ([Diagram 1] through [Diagram 5], [Table 1]).

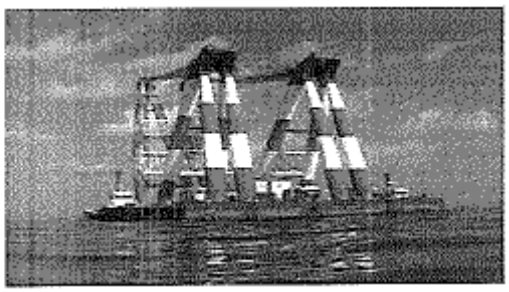
"Samsung A-1" is a working boat whose main duty is to drop and retrieve the positioning anchors during the operations of the floating crane by "Samsung No. 1" within a port.



[Picture 1] The position of the vessels during normal navigation of the Marine Spread. (The bow of the barge is where the crane boom is located. Therefore, the barge was being towed by its stern at the time of the accident).

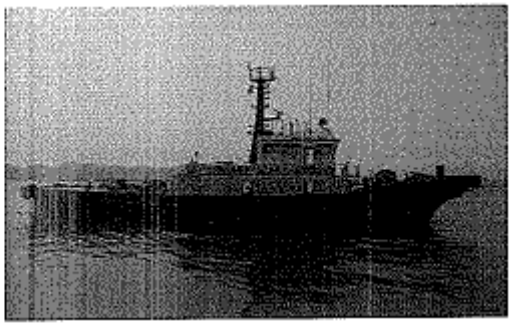


[Picture 2] Starboard side of Samsung No. 1



[Picture 3] Stern of Samsung No. 1

[Picture 4] Samsung T-5



[Picture 5] Samho T-3

[Table 1] Major particulars in this case for the vessels composing the Marine Spread

Name of Vessel	G/T	Purpose	Generating Power of Main Engine (in the form of screw)	Owner
	Length x width x depth	Shipment		Operator
Samsung No. 1 (Floating crane barge)	11,828	Crane barge	Non-power driven (Barge subject to towing)	Samsung Corp.
	105.63 x 45.0 x 7.0	Geoje-si		Samsung Heavy Industries
Samsung T-5 (Lead tug)	292	Tugboat	1,765kw x 2 engines (Approx. 4,800HP) (C.P.P)	Samsung Corp.
	35.69 x 10.0 x 4.6	Geoje-si		Samsung Heavy Industries
Samho T-3 (Assist tug)	213	Tugboat	1,323kw x 2 engines (Approx. 3,600HP) (Z-peller)	Samho I&D
	30.81 x 9.4 x 4.15	Busan		Samsung Heavy Industries
Samsung A-1 (Anchor boat)	89	Working boat	317kw x 2 engines (Approx. 805HP) (F.P.P)	Samsung Corp.
	25.17 x 7.8 x 2.85	Geoje-si		Samsung Heavy Industries

The IMST acknowledge here that "SAMSUNG A1" was connected as a steering tug in addition to its anchor handling duties. That is, it was an integral part of the marine spread and would be recognized as such by those observing from other vessels.

2) Owners and operators of the vessels composing the Marine Spread

The ownership, operation and safety management of the vessels composing the Marine Spread are all provided for in four contracts.

A) *Management Service Agreement for Construction Machinery: Long-term lease agreement between Samsung Construction Co., Ltd. ("Samsung Construction") and relevant party to the marine accident, SHI.*

A "Management Service Agreement for Construction Machinery" was entered into on December 29, 1995, for the three vessels, "Samsung No. 1," "Samsung T-5" and "Samsung A-1," excluding "Samho T-3," which was one of the four vessels composing the Marine Spread. The agreement was made on the condition that SHI lease the same from the then-owner Samsung Construction for 12 years from January 1, 1996, to December 31, 2007, and make payment of a certain amount of hire on a yearly basis. According to Article 8 of this Agreement (Liability for Accidents), the lessee, SHI, agreed to take responsibility for any and all accidents concerning these vessels that are caused intentionally or by its gross negligence. Further, while the name of the contract is "Management Service Agreement for Construction Machinery," given the agreement that SHI shall pay hire to the owner, Samsung Construction, the contract can also be viewed as a kind of charter party.

B) *Equipment Management Service Agreement: Management Service Agreement between SHI and relevant party to the marine accident, Boram.*

SHI, which chartered the above three vessels for a long term from Samsung Construction, entered into a "Equipment Management Service Agreement" with Boram on March 1, 2007, in order to entrust the management of these vessels for one year from the said date until February 29, 2008. According to the Agreement, Boram shall be in charge of operating the marine spread, the construction plan, the hiring of additional tugboats needed for SHI to carry out the construction work, and safety inspection and management of the construction necessary for the management and maintenance of the equipment, etc. In particular, with respect to safety management, Article 4 of the said Agreement provides that, while Boram shall be responsible for the safety management, it shall comply with SHI's safety management regulations.

C) *Marine Spread Lease Agreement: SHI's leasing of the marine spread to Samsung Construction.*

SHI, which leased the above three vessels for a long term from Samsung Construction, entered into an "Equipment Management Service Agreement" for these vessels with Boram as described above, after which it entered into a "Marine Spread Lease Agreement" with Samsung Corp. for a contract period of 14 days from November 26, 2007, to December 9, 2007, and leased the marine spread accordingly. In this lease agreement, Samsung Construction and Samsung Corp. are both indicated as the lessee in one contract, but Samsung Corp. is the owner of these three vessels under the certificate of registry. Therefore, Samsung Construction and Samsung Corp. are the same party in the said lease agreement, and the three vessels were leased back to Samsung Construction (Samsung Corp.) by SHI.

D) *Lease Agreement for "Samho T-3": Samsung Construction's lease of "Samho T-3" from Samho I&D.*

On November 19, 2007, Samsung Construction leased "Samho T-3" from Samho I&D from November 26, 2007, to December 12, 2007, and had the vessel join the Marine Spread in order to operate it together with "Samsung T-5" in towing "Samsung No. 1" from SHI in Geoje-do to the Incheon Bridge construction site within Incheon Port.

From paragraphs A, B, C and D above I note that whereas Boram have the responsibility for the safety management of three of the four vessels in the marine spread, the agreement between them and SHI provides that they shall comply with SHI's safety management regulations, who also have that responsibility for "SAMHO T-3". Even though this has been highlighted by the IMST and they subsequently describe many failings with the safe management and operation of the marine spread, neither the Boram or SHI safety management procedures were examined as part of the evidence. And yet, the internal safety management procedure guidelines from "HEBEI SPIRIT" were part of IMST's evidence. As any marine investigator will know, the safety management systems on all vessels involved in a marine casualty should be examined to see if they are sufficient and are being correctly observed. As the IMST have stated, a purpose of this decision is to avoid re-occurrence of such an incident, and yet the failure of them to examine the safety management systems of the marine spread, and yet do so on the "HEBEI SPIRIT", smacks of impartiality.

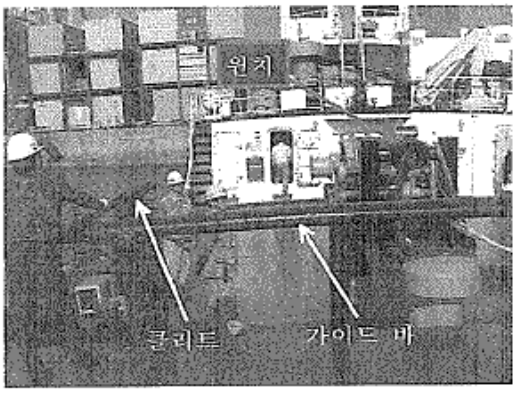
3) Towing equipment, etc.

While the two tugboats, "Samsung T-5" and "Samho T-3" were towing "Samsung No. 1" by its stern, the towing line of "Samsung T-5" broke, causing "Samsung No. 1" to be pushed by the wind and waves and collide with "Hebei Spirit," which was anchored nearby.

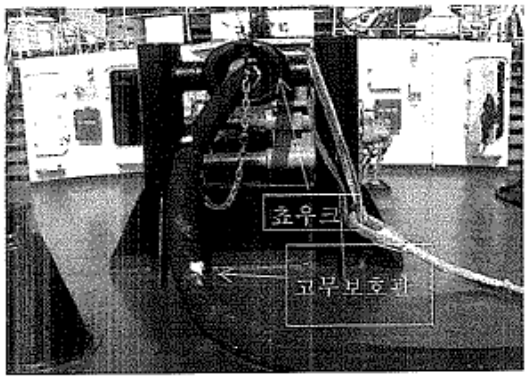
In rendering a decision in this case, an analysis of the cause of the breaking of the above towing line and determination of whether there exists a causal relationship between such an event and the collision must be made. Therefore, in order to achieve this, clarification must first be made with regard to the instalment, method of use, strength, etc. of the towing equipment that was used by the tugboats towing "Samsung No. 1" at the time of the accident.

A) *Towing equipment of "Samsung T-5" and "Samho T-3"*

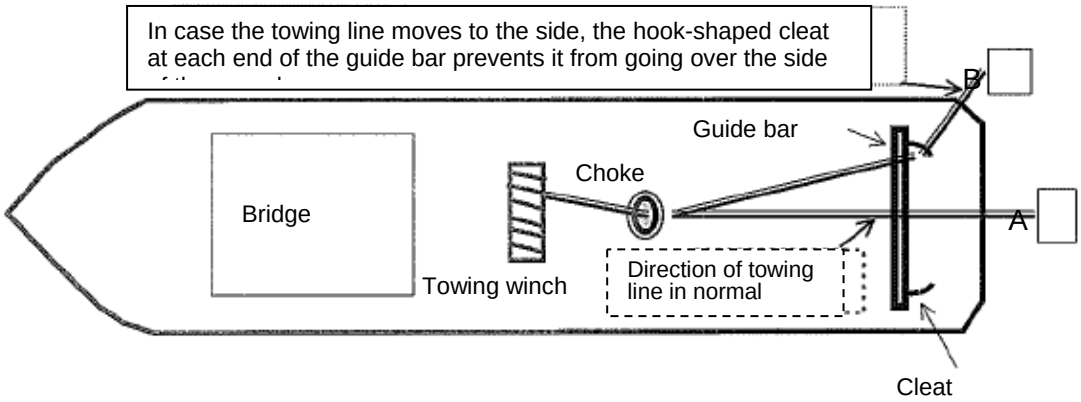
One capstan (hereinafter, "towing winch") that winds up and releases the main towing wire at the center of the stern deck of "Samsung T-5" and "Samho T-3" behind the bridge was respectively installed. A horizontal railing (hereinafter, "guide bar") was set up at the center of the stern deck so that the towing line goes over the guide bar without brushing against the deck, and there is a rise in the shape of a hook (hereinafter, "cleat") at both ends of the guide bar for the purpose of preventing the towing line from going too far from the longitudinal centerline of the hull and going over the side of the vessel ([Picture 6], [Picture 8]).



[Picture 6] The shape of the towing winch, and guide bar and cleat on the stern deck of "Samsung T-5"

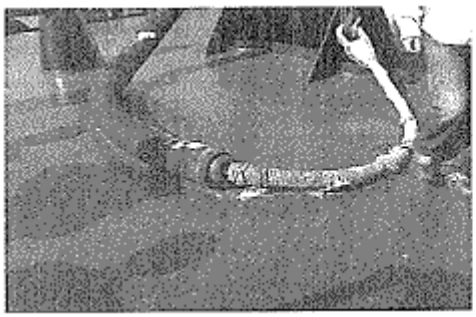


[Picture 7] Towing line choke and rubber sleeve behind the towing winch of "Samsung T-5"

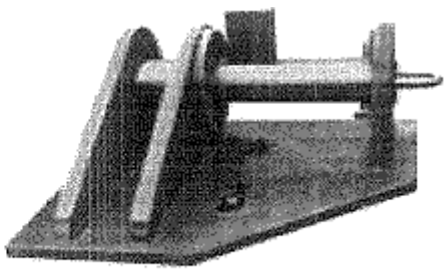


[Picture 8] The towing line that is released out of and wound onto the towing winch goes through and over the choke and the guide bar.
c[A]rs in a normal case where the towing line stretches out along the center of the stern. is[B] illustration of how the towing line gets trapped by the cleat at the end of the guide bar and is prevented from falling off when straying to the side.

The towing line gets neatly wound around or released from the towing winch by passing through the round choke right behind the towing winch. It is made to pass through a thick rubber tube in order to protect it from being damaged as a result of being placed under excessive bending tension when passing through the choke at a great angle ([Picture 7]), and a round eye is inserted at the other end of the towing line that goes overboard so that the towing line can be connected to the tugboat to be towed through a connecting towing line such as a stretcher or a pennant wire. In the case of this accident, the towing line was connected to the smit bracket attached to both sides of the stern deck of "Samsung No. 1" ([Picture 7], [Picture 9], [Picture 10]).



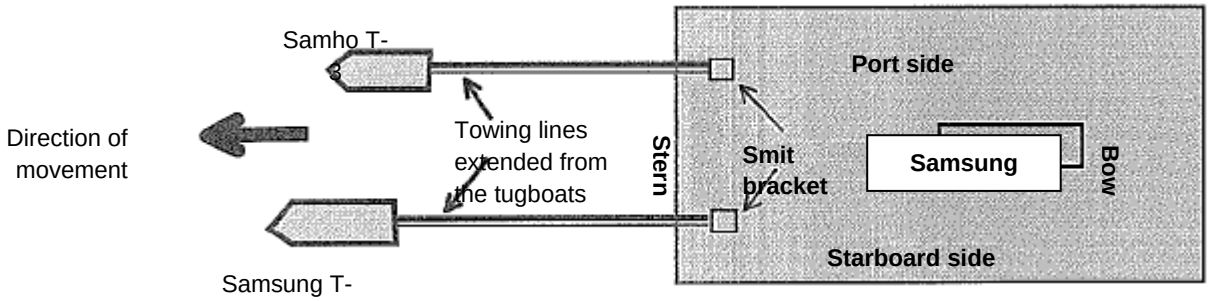
[Picture 9] Round eye at the end of the towing line winded around the towing winch



[Picture 10] Smit bracket that is attached respectively to the port and starboard side of the stern deck of "Samsung No. 1"

B) *Towing equipment of "Samsung No. 1"*

A smit bracket is attached to the bottom of both the port side and the starboard side of the stern deck of "Samsung No. 1," enabling the towing line or a connecting towing line, such as a stretcher or pennant wire, extended from the tugboat to be fastened thereto. In the case of the present accident, the towing line of "Samsung T-5" was connected to the starboard side (or on the port side based on the direction of the Marine Spread's movement, since the tugboats were towing "Samsung No. 1" by its stern), and that of "Samho T-3" was connected to the port side. ([Picture 11])



[Picture 11] Illustration of "Samsung No. 1" being towed by its stern by connecting the towing lines of "Samsung T-5" and "Samho T-3" to the smit bracket attached to the bottom of the stern deck of "Samsung No. 1"

It is obvious from the pictures/videos taken both during the collision and afterwards that the "SAMSUNG NO.1" was being towed with its crane booms fully rigged, with falls and spreaders beams hanging loosely. The wind resistance of the crane booms is a substantial component of the resistance of the crane barge against the towing pull of the tugs as the IMST have described in their Decision below. However, they have just accepted this situation and not commented on whether this was the correct towing arrangement for this barge (i.e. should the boom have been lowered for towage, the spreaders secured), and whether the consequences of this were taken into account by the operators/managers of the marine spread and the masters on the marine spread. That is, being aware of the effects of the increased wind resistance on the movement of the barge.

C) Manufacturer's test results on the towing line of "Samsung T-5"

The towing line of "Samsung T-5" that broke at the time of the accident in this case was a Japanese product manufactured in 1995, which, after being purchased and used as luffing wire for the crane of "Samsung No. 1," was stored on-board the barge and later used as a towing line replacement on June 26, 2007, which is around five months before the occurrence of the accident. The breaking load and the safe working load are respectively 217 M/T and 99 M/T. ([Table 2])

[Table 2] Manufacturer's test results on the "Samsung T-5" towing line

Manufacturer: Tokyo Rope MFG. Co. Ltd. *Diameter: 47.5mm* *Number of wire strands: 41 (thinner fibers) x 6 (number of strands)* *Quality: Galvanized flexible steel wire rope* *Date of test results: March 23, 1995* *Load at which sample broke : 217 M/T* *Safe Working Load : 99 M/T*

I find it astonishing that the IMST has not investigated the broken tow line and its use in more depth. This wire was originally a luffing wire used on the crane barge then taken off and stored for how long is not mentioned. However, the wire was constructed in 1995 and so had been used for luffing then been stored over a 12 year period. From later information provided it would appear that this luffing wire was originally tested in 1995 and that a test on a section of this wire subsequent to the collision showed that it retained a breaking load of 182t. However, the subsequent testing of portions of this wire alone cannot justify the acceptance of the wire as being fit to use as a tow wire. It would be essential for any investigator to examine the wire to see if it was defective in any way (e.g. was kinked, had broken strands, crushed etc) as well as determining the necessary checks conducted on the wire before being put into use as a tow line. I cannot find in the list of evidence any reference that IMST had examined the records on the tugs and crane barge to determine whether this wire had been periodically inspected prior to the collision or sighting of the log indicating its usage. Again, such records surely must form part of both Boram's and SHI's safety management systems, particularly on a lifting vessel. In the IMO Guidelines for Safe Ocean Towing, IMO MSC/Circ.884, the following guidance is given with regard to towlines:-

Quote

12.17 Inspection of the towline should be carried out on completion of each towing operation. The results of the inspection should always be recorded as a basis for decision on future inspection programs. The inspection should also be noted on the towing log (Appendix B).

12.18 No part of any towline arrangement should be used for the towing operation if:

- the reduction in cross sectional area due to wear, abrasion, corrosion and broken wires exceeds 10% or there is severe kinking, crushing or other damage resulting in distortion of the rope structure;
- end sockets or other towline terminations such as thimbles, etc., are damaged, deformed or significantly corroded.

Unquote

It is essential that parties involved in towage at sea should refer to such international guidelines and it must surely be an objective of the IMST to determine whether the marine spread was being correctly operated and managed to these standards.

In addition, as part of their objective to ensure the re-occurrence of such incidents involving marine spreads around the Korean coast, the IMST should have determined the reason as to why this tow line parted. As I understand, the line parted about 50m aft of the tug, that is, a location not subjected to any obvious cause for its severing. Consequently, the IMST have concluded that the line parted because of the shock loads imposed upon it. This maybe the reason, but I cannot see where the IMST have investigated the overall condition and maintenance of the wire, apart from the breaking load tests conducted on different portions after the collision. Nowhere do I find any report on the condition of the wire itself; was it fraying, was it kinked, was it crushed, was it corroded etc.? These key areas appear to be ignored by the IMST and yet they are a fundamental facet of any safe operation and management of tugs and tows as shown in the extract from the IMO Guidelines on Safe Ocean Towing.

4) Towage survey

In order to prepare for the dangers at sea which were anticipated during the towing of "Samsung No. 1" from Geoje-do to the Incheon Bridge construction site at Incheon Port, SHI received an insurance survey at its own cost at Busan port on November 26, 2007, around fifteen days before the occurrence of the accident, in order to be insured by Samsung Fire & Marine Insurance Co., Ltd. ("Samsung F&M") for the Marine Spread.

As a survey that provides verification to the insurers as to whether the Marine Spread is fully capable of safely completing the voyage, SHI had applied for such a survey to BMT Marine & Offshore Survey located in Hong Kong, but the survey itself was conducted by Hyopsung Surveyors & Adjusters Corp. ("Hyopsung"), an agency in Korea. Below are relevant excerpts from the survey results that relate to the accident.

The IMST are correct in that this insurance survey provides verification to the insurers for a stated voyage. However, this forms part of a commercial contract between the insurers and the assured and does not remove the overriding duty on the part of the operators/managers and masters and crew of the marine spread to ensure that their vessels, its equipment and manning, comply with the basic obligation of being safely managed and operated before the voyage commences. The IMST subsequently solely use this insurance certificate as the deciding consideration on the operation and management of the marine spread. This is a fundamental misunderstanding of the role of the insurance surveyor, that is, the insurance surveyor is not responsible for the tow. Whereas the insurance certificate is only a snapshot of the readiness of the marine spread for the voyage, it is not statutory or mandatory and does not provide a full assessment of its operation and management. For that, the IMST should have conducted a detailed investigation into the safety management systems currently in place on these vessels. From the list of evidence that they have provided, it clearly shows that they did not look at this which is surprising given that an objective of this Decision is to avoid a reoccurrence of such incidents to marine spreads around the coast of Korea.

Notwithstanding the above, the IMST also fail to mention that this insurance survey was made for the previous voyage from Geoje Island to Incheon, not the return voyage. It is essential that for any insurance surveyor to fully understand the nature and planning of a particular voyage and he will issue an insurance certificate on the basis of this understanding. If the voyage, craft and equipment changes in anyway, then he will need to re-assess the voyage and re-issue his approval. Therefore, rather than implying that SHI had acted correctly in obtaining an insurance certificate, the IMST must not ignore the fact that SHI had not arranged an insurance survey for the voyage from Incheon.

A) *Voyage recommendation*

After completing the towage survey, Hyopsung issued an Insurance Survey Certificate to SHI for "Samsung No. 1," in which the voyage recommendations for safe voyage (towing) were specified for compliance. Below are excerpts relevant to this accident. ([Table 3])

[Table 3] Voyage recommendations specified in the towage certificate of "Samsung No. 1" for compliance by the Marine Spread

1	*Voyage undertow to commence within seven (7) days of Insurance Survey Certificate issue date.*
2	***Tow is to depart and arrive in daylight hours only.***
3	***Tow is not to depart if winds in excess of Beaufort scale force-5 prevail.***
4	***Length of towline is to be adjusted to suit weather and sea conditions. The towline is at all times to be kept clear of the seabed.***
5	*Maximum speed of tow to be at the Tug Master's discretion, but consistent with safety and the prevailing conditions.*
6	*If reduced visibility is encountered, tow line to be shortened.*
7	*Two tugs bunker consumption to be closely monitored and arranged so that the tug has a minimum of three (3) days bunkers upon arrival at destination and/or any bunkering intermediate ports.*
8	*Route is to be direct as navigation permits.*
9	*Regular communication to be maintained between the tug and tow.*
10	*Weather forecasts to be obtained prior to departure, and further obtained frequently by the tugs from Meteorological Authorities en-route.*
11	***In the event of the tug/tow meeting any major problems, i.e. failure of tow gear, engine or machinery malfunction of the tug/tow; listing of the tow due to leakage, and any deviation from the routing, both the Owners and BMT Marine & Offshore Surveys Ltd., Busan, are to be notified immediately, and further approval to be sought.***

Conclusion:	***From our survey attendance, we would consider the floating crane barge SAMSUNG NO. 1 to be suitable in all respects in tow of the tugs SAMSUNG T-5 and SAMHO T-3 to undertake the contemplated voyage from Geoje to Incheon, Korea, provided that our voyage recommendations are fully complied with.*** ***We were satisfied that the floating crane barge SAMSUNG NO. 1 was in good condition, as evidenced by the text of this report and does not present any risk not normally accepted by Underwriters.***

It is clearly evident from the wording on the extract from the insurance certificate that the surveyor was covering a single voyage from Geoje to Incheon, not the return voyage to Geoje. It can be seen in the first recommendation that this certificate was valid for a period of seven days after the issue date of the certificate for a single voyage from Geoje, the 26th November 2007. As such, this certificate has absolutely no validity for the return journey, and yet the IMST ignore this obvious fact.

B) *Towing equipment under "The Salvage Association Towage Approval Check List for Floating Crane Barge"*

On "The Salvage Association Towage Approval Check List for Floating Crane Barge" (hereinafter, "Towage Approval Check List"), which is a part of this survey report, as a condition of approving the towage survey results, the following was provided in detail: the particulars of the towing equipment to be used during the voyage, including the composition, length, quality, etc. of the towing lines of "Samsung T-5" and "Samho T-3," the method of towage connection, and the positions of the tugboats during towage. However, the lengths of the towing lines were allowed to be adjusted by the master of the tugboats based on item 4 of the above voyage recommendations, in accordance with the sailing conditions. According to the details provided in the Check List, the composition of the towing lines of the two tugboats is as follows.

From hereon, the IMST now use the wording of the insurance certificate as the basic instructions for the voyage. This is a fundamental misunderstanding of the role of the insurance surveyor and his certificate. The list tabulated above provides recommendations to the tow master, not instructions. This voyage insurance certificate forms part of a commercial contract between the assured and the insurers. If the tow master feels that it is not good seamanship to follow one of these recommendations in a particular circumstance, then all the insurers can do is cancel the insurance and pay no claims if they disagree. However, before taking such drastic action the insurers and their surveyor would investigate as to whether the tow master had valid reasons for not following the recommendations and may conclude that his actions do not increase the risk to the voyage. Therefore, to use the wording on the insurance certificate as instructions is wrong. As it states in the opening line of the attachment to the certificate these are voyage recommendations. Further, the IMO Guidelines for Safe Ocean Towing in section 4 states the following:

Quote

4.2 The towing operation should be in charge of a competent towing master, normally being either the master of the towing vessel or the master of the leading towing vessel, in case the towed object is towed by more than one towing vessel.

4.3 The towing master is responsible for the towing operation. In preparation for the towing operation, the towing master should consider these guidelines, as appropriate. The towing master should also consider what regulations are applicable during the towage, as well as ensuring that all relevant safety measures as he finds necessary are implemented.

4.4 Nothing in this section shall set aside or limit the towing master's/tug master's authority in accordance with maritime laws.

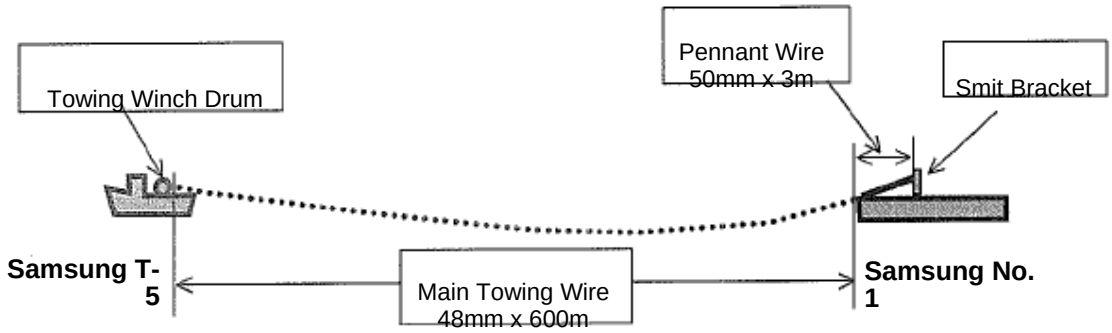
Unquote

(1) Towing equipment of "Samsung T-5": Lead tug ([Picture 12])

Main towing wire: Steel rope of 600 m in length, 48 mm in diameter, from the towing winch of the tugboat (hereinafter, "cable")

Pennant wire: Cable of 50 mm in diameter and 3 m in length connected to the smit bracket installed at the starboard stern of "Samsung No. 1" (port side based on the direction of movement)

Towing wire connection: Main towing wire and pennant wire connected with shackle for towage



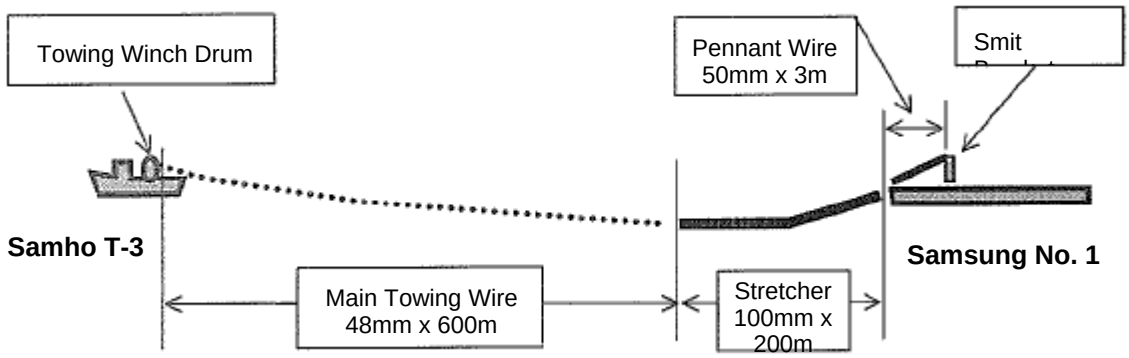
[Picture 12] Composition of the "Samsung T-5" towing line on the Towage Approval Check List. (The total length of the towing line is 603 m. However, given that the pennant wire is placed on the deck of the barge, the maximum length of the towing line that can be used is 600 m, and the actual length of the same during navigation may be adjusted by the master as he deems appropriate.)

(2) Towing equipment of "Samho T-3" ([Picture 13])

Main towing wire: Cable of 500 m in length, 50 mm in diameter, from the towing winch of the tugboat (hereinafter, "cable")

Pennant wire: Cable of 50 mm in diameter and 3 m in length connected to the smit bracket installed at the port stern of "Samsung No. 1" (starboard side based on the direction of movement)

Stretcher: Additional connection of synthetic fiber (hereinafter, "PP rope") of 100 mm in diameter and 200 m in length between main towing wire and pennant wire



[Picture 13] Composition of the "Samho T-3" towing line on the Towage Approval Check List. (Unlike the composition of the "Samsung T-5" towing line, a P.P rope is additionally connected between the main towing wire and the pennant wire to absorb tension impact. Given that the pennant wire is placed on the deck of "Samsung No. 1," the maximum length of the "Samho T-3" towing line that can be used is 700 m, and the actual length of the same during navigation may be adjusted by the master as he deems appropriate.)

The IMST are technically misleading the reader regarding the usage of the full length of the tow line on each tug. Even if the tow lines on each tug were 600m and 500m respectively, these full lengths could not be used. It is usual to retain a certain number of turns on the drum of each winch to ensure that the wire does not slip off. This, of course, will decrease the length of the tow line available.

It is noticeable that the arrangements for both tow tugs are different. That is, "SAMHO T-3" utilizes a 200m synthetic rope stretcher, whereas "SAMSUNG T-5" does not. The IMST does not comment on the adequacy of these towing arrangements, but accepts them because they form part of the insurance certificate, even if they do not comply with basic towing guidelines. Whereas these towing arrangements are satisfactory for in harbour work, for a voyage at sea, of about 4 days, in the winter in a temperate climate, I do not believe they are suitable.

A 3m wire pennant connected to the "SAMSUNG NO.1" smit brackets is asking for trouble. As the wire will chafe on the deck edge, the most suitable attachment is a chain to avoid the chafing damage that will occur in a seaway. At sea, when subject to the dynamic loads created by waves, tow masters increase the length of their tow line to provide a catenary to absorb shock loads, or "snapping" of the wire. Such loads, even on new wire, can be sufficient to cause a wire to part. However, the greater the catenary, the increased possibility of a tow wire contacting the sea bed in shallow water. Therefore, if a tow has to proceed in open exposed water, in an area of potential bad weather, in shallow water, then the tow line cannot be lengthened for fear of it being damaged on the sea bed. Therefore, if the line has to be kept well clear of the sea bed in shallow water, it must be shortened. In such circumstances it is then prone to suffering from shock loads unless a means of absorbing this shock load can be fitted. The common method is including a synthetic line stretcher in the tow arrangement as was done on "SAMHO T-3". It is noticeable that the tow line that parted was connected to the tug that had no stretcher.

However, to say that as this tow arrangement was accepted by the insurance surveyor and is therefore acceptable by the tug operators is fundamentally misunderstanding the role of the insurance surveyor.. As experienced operators/managers of tugs they had a statutory requirement to prepare this tow to meet all the weather and conditions expected on the voyage, not totally rely on the recommendations of the insurance surveyor. The insurance surveyor has no responsibility for the tow. Allowing the marine spread to depart with this inadequate tow arrangement was a severe failure on the part of the marine spread operators/managers and masters, not the insurance surveyor, particularly as the latter had never issued a certificate approving this particular voyage in the first place.

According to the Towage Approval Check List, the main engine power and towing capacity of "Samsung T-5" and "Samho T-3" are approximately 4,800 HP and 55 M/T, and 3,600 HP and 46.4 M/T, respectively. However, according to the towing capacity test conducted on "Samsung T-5" by Daesun Shipbuilding & Engineering Co., Ltd. ("Daesun Shipbuilding") on December 9, 1995, which is 12 years before the occurrence of this accident, the maximum value and average value are merely 57.84 M/T and 48.3 M/T, respectively ([Table 4]).

[Table 4] Summary table of the towing capacity test results for "Samsung T-5" conducted by Daesun Shipbuilding on December 9, 1995

Test No.	Number of rotation of main engine	Number of rotation of screw	BHP of main engine (PSI)	Towing capacity (M/T)	Coefficient of alteration	Altered towing capacity (M/T)
1	797	213	1215	33.94	1.0485	35.59
2	909	243	1745	44.79		46.96
3	965	257	2035	50.47		52.92
4	997	265	2210	55.16		57.84
Average						**48.32**

Increasingly in recent years, tug operators have been required to update the declared bollard pull of their tugs. Although bollard pull tests are conducted after construction there are a number of factors that can cause the power of the tug to decrease with age, e.g. an ageing engine. In the past, when calculating the bollard pull requirement for a particular tow, the age and condition of the vessel is looked at and an allowance made for the potential loss of power over the years. If, even with this allowance, the power of the tug is found to be close to the bollard pull requirement, it is now usual that the tug undergoes a bollard pull test to confirm its strength. All this illustrates that reliance cannot be made on the results of a bollard pull test made 12 years prior to the tow. However, the IMO Guidelines for Safe Ocean Towing, do not use an average of the bollard pull tests at different speeds but the continuous bollard pull at maximum continuous at full power. Therefore, the IMST, in using an average of bollard pull for their subsequent calculation, are misleading the reader. They should have used the valve of the continuous bollard pull at full power.

5) "Samsung No. 1" anchor

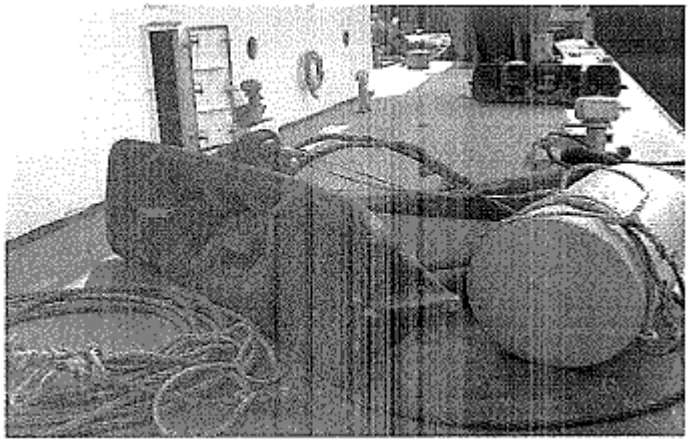
Prior to the collision between the barge "Samsung No. 1" and "Hebei Spirit," emergency anchoring was performed by "Samsung No. 1." In order to check the reasonable state of matters in this regard, the particulars of the anchor, anchor chain and the windlass that winds up the anchor chain are reviewed as follows.

A) *Mooring anchor*

Type: HHP (High Holding Power Type)
Weight: 19,700 kg
Diameter of anchor chain: 97 mm
Length of 1 shackle of anchor chain: 27.5 m
Weight of 1 m of anchor chain: 206 kg
Total length of anchor chain: 15 shackles (412.5 m = 27.5 m/shackle x 15 shackles)
Gross weight of anchor chain: 84,975 kg (= 206 kg/m x 412.5)

B) *Positioning anchor ([Picture 14])*

In addition to the mooring anchor, "Samsung No. 1" is equipped with four positioning anchors that are dropped in order to keep the vessel in place during crane operation. Unlike a mooring anchor, these anchors are not freefall-type anchors, but are dropped by being loaded onto an anchor boat such as "Samsung A-1" and transported to a pre-designated anchor-casting location. Therefore, it is impossible for a small vessel such as "Samsung A-1" of merely 25 m in length and 2.8 m in depth to approach "Samsung No. 1," which is 7 m in depth with an average draught of 3.35 m, to transfer and load these anchors and perform anchoring amidst waves of approximately 4 m in height.



[Picture 14] "Samsung No. 1" positioning anchor and yellow iron anchor buoy to indicate the location of the anchor

It is important to note that IMST have shown that the "SAMSUNG NO. 1" crane barge is rigged with a larger mooring anchor than the VLCC, 19.7 tonnes against 15 tonnes, and yet both are of a type that provides high holding power. Although the anchor chain on the VLCC is large in dimension than that on the crane barge, the latter has fifteen shackles, whereas the VLCC has 14 shackles. Whereas the fully laden VLCC has a deadweight of 258,068 tonnes, the crane barge is only 13,061 tonnes and yet both have similar anchor arrangements. In addition, as the IMST have described above, the mooring anchor on the crane barge is free-fall, that is, it is designed and should be relatively easy to release this anchor in an emergency. Therefore, the IMST reference to the difficulties that the "SAMSUNG A1" would have in deploying the positioning anchors for the crane barge in waves of 4m in height is irrelevant. The free-fall mooring anchor should be able to be deployed at any time without any need for tug assistance.

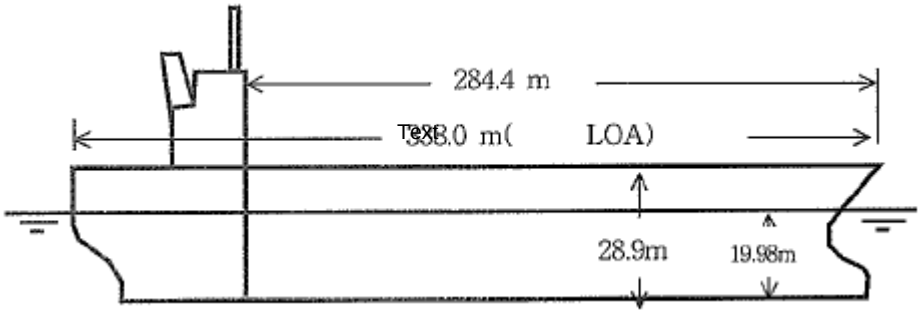
6) Responsibility for navigating and supervising the Marine Spread

During crane operations by "Samsung No. 1" within a port, the relevant party to this marine accident Yi Hyun Kim, who is the barge master and also the master of the Marine Spread, is in overall charge of the navigation of the Marine Spread. However, once the Marine Spread departs from the port after completing the construction work and sets sail under tow, the relevant party to this marine accident Seung Min Cho, who is the master of "Samsung T-5" which is indicated as the "Lead tug" on the "Towage Approval Check List," is responsible for the voyage and takes supreme command. The relevant party to this marine accident Gan Tae Kim, who is the "Samho T-3" master, assists with the towing by "Samho T-3," based on Seung Min Cho's instructions through high frequency wireless communication ("VHF") or hand signals. Therefore, since the duty officer of the assisting tug "Samho T-3" must constantly move according to the instructions of the main tug "Samsung T-5," he is passive, in contrast to the duty officer of "Samsung T-5," and thus his interest in the scheduled course or speed of the Marine Spread is relatively low.

B. Details of Oil Tanker "Hebei Spirit"

1) Particulars of the vessel

This vessel collided with the Marine Spread, which was approaching towards her bow, while at anchor. The particulars of the vessel must be looked at in order to clarify her distance with the approaching vessel in connection with the movements of "Hebei Spirit," which were undertaken to prevent collision. ([Picture 15])



[Picture 15] Figures from the particulars of "Hebei Spirit" that relate to its actions to prevent collision

2) Equipment

A) *Nautical equipment*

The major nautical equipment used during the course of this accident is as follows:

2 ARPA radars	*1 AIS*
2 GPS	*1 Automatic Chart Plotter*

The VDR (Voyage Data Recorder), which is a SVDR (Simplified VDR) initially installed on July 30, 2006, received an annual inspection by the Chinese Register of Shipping and Lloyd's Classification on June 17, 2007. It is connected to various equipment on the vessel and automatically enters and saves relevant data at regular intervals. The subject and type of data stored are the last 24 hours of minimum navigation data. ([Table 5])

[Table 5] Data stored in the VDR of "Hebei Spirit"

Type of data	***Equipment providing relevant data***
Position of vessel	*GPS*
Speed	*Doppler*
Direction of bow	*Gyro*
Depth of water	*Echo Sounder*
Communications	*VHF*
Phone calls and conversations within the vessel	*Microphone installed on the vessel*

The IMST have emphasized the presence of the VDR on the vessel and its inputs. However, it is worth noting that there are other instruments available on the vessel which also record specific information. For example, the course recorder trace maintains a record of the heading and rudder movements, the engine data logger records the engine movements, the engine room alarm logger records details of machinery alarms and even from the GPS's, historical positions of the vessel can be obtained. In addition, as this vessel was anchored within the coverage of Daesan VTS, VHF conversations were also recorded. Further, the tanker is fitted with an AIS that allows its position to be monitored and recorded by those with a suitable receiver. I understand that the Daesan VTS was able to maintain the AIS record of four of the five vessels involved in this incident ("SAMSUNG NO.1" being the exception). It is worth noting that VDR supplements other equipment information and is not designed to be totally relied upon as the following extract from SOLAS makes clear: -

Quote

SOLAS Ch. V - Regulation 20

Voyage Data Recorders

1. *To assist in casualty investigations (my underlining)*, ships when engaged on international voyages, subject to the provisions of regulation 1.4, shall be fitted with a voyage data recorder (VDR) ……..

Unquote

B) *Mooring equipment (anchor)*

Type: AC-14 (Stockless). Weight: 15,000 kg. Speed of windlass: 9 m/min
Length of 1 shackle: 27.5 m. Weight of 1 m of anchor chain: 270 kg.
Total length of anchor chain: 14 shackles (385 m = 27.5 m x 14 shackles). Gross weight of anchor chain: 103,950 kg

The IMST omit to highlight that the AC-14 anchor is a high holding power anchor. This is the same type of anchor as fitted on the crane barge, and these anchors are recognised as the high holding type. Please see the attachment from Danton's Theory and Practice of Seamanship, a publication that many seafarers have used in their training since it was first published in 1962:

Quote

ADMIRALTY CAST ANCHOR TYPE A.C.14

This anchor is fully illustrated in Fig. 1.2 and is now accepted as a warship bower anchor. It was tested in practically every type of sea-bed, including blue clay (a poor holding ground for stockless anchors), sand, shingle, soft mud, and hard rock covered with a thin layer of silt.

These proved it to be an anchor of great stability, having stabilising fins at the head extremities. It was able to change direction rapidly and without loss of pull. In almost all types of sea-bed it had a holding power of two and a half to three times that of a stockless standard anchor of equal weight.

52-cwt Listed below are some of the test results using a 2·5-tonne Type 5+-ton A.C.14 anchor with hollow flukes, and a 5·25-tonne standard stockless anchor in the same bed. The figures compared are maximum holding powers in terms of weight.

Sea-bed	*A.C.14*	*Standard stockless*
Red clay, sand, shingle, rocks .	10.0	3.9
Blue clay, thin layer of mud, sand.	13.6	3.1
Soft mud	8.2	1.6
Flat, smooth rock, thin layer of silt	2.8	1.9

Unquote

C) *Main engine and screw*

Manufacturer of main engine: MAN B&W
Generating power: 1 diesel engine of 20,594 kw (approx. 28,000 HP)
Screw: 1 fixed pitch propeller

The power and speed of the "Hebei Spirit" main engine by each phase of engine operation are shown in [Table 6].

[Table 6] "Hebei Spirit" main engine power and speed within a port when fully loaded

Position of main engine	*Screw rotation number per min*	*Speed (knots)*	*Power (M/T)*
Full ahead/astern	*49*	*12.0*	*48.6*
Half ahead/astern	*43*	*10.6*	*43*
Slow ahead/astern	*36*	*8.8*	*36*
Dead slow ahead/astern	*25*	*6.1*	*25*

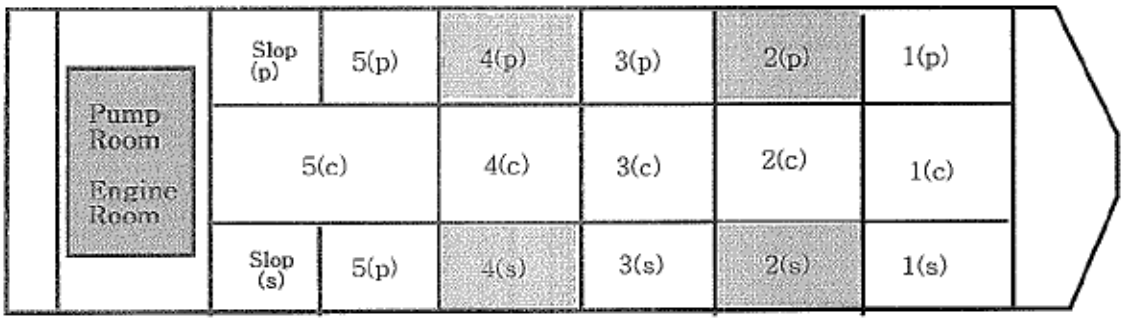
D) *Equipment for cargo management*

This vessel spilled into sea no less than approximately 12,547 kl of crude oil from damaged cargo holds due to the collision. Given that the cause that led to the excessive spillage of oil must also be identified in rendering a decision in this case, the necessary equipment for cargo management is observed below.

(1) Tank arrangement and capacity of fully loaded (98%) cargo holds

"Hebei Spirit" has 13 cargo tanks and 4 ballast water tanks. ([Picture 16], [Table 7])

As can be seen from the ships drawing the vessel actually has eight water ballast tanks, not four as the IMST have erroneously stated. The other ballast tanks are the fore peak, engine room side tanks (2) and the aft peak.



[Picture 16] Arrangement of cargo tanks and ballast water tanks

[Table 7] Capacity of 98% loaded cargo tanks

Cargo Tank No.	*98% Capacity (m^3)*	*Cargo Tank No.*	*98% Capacity (m^3)*
1 (Center)	*31019.2*	*1 (Port/Starboard)*	*43,641.4*
2 (Center)	*25653.5*	*3 (Port/Starboard)*	*58,455.2*
3 (Center)	*32983.1*	*5 (Port/Starboard)*	*43,643.5*
4 (Center)	*25653.5*	*Slop (Port)*	*5,409.1*
5 (Center)	*37306.2*	*Slop (Starboard)*	*5,409.1*
Total for 98% capacity of cargo tank		*309,173.8 m^3*	
Total for 100% capacity of cargo tank		*315,483.5 m^3*	
Difference between 100% capacity and 98% capacity		*6,309.7 m^3 (Total capacity of the upper space in the case of 98% loading)*	

"Hebei Spirit" is an oil tanker with a single hull structure, whose keel was constructed on November 16, 1992 (delivery of vessel was on October 7, 1993). It is a SBT+PL type vessel with a structure of "protection location of segregated ballast spaces" where the ballast pipe is completely separated from the cargo section. As an oil tanker whose keel was constructed on November 16, 1992 (vessel subject to Rule No. 20, Category 2 and Items 12 through 15 of Rule No. 18 (Protective location of segregated ballast spaces) of Annex I of the MARPOL 73/78), three cargo oil pumps with a discharge capacity of 4,500m^3/hr, which are installed in the pump room, are used to load and discharge the cargoes, and the capacity of the tank cleaning pump, which is connected to all of the cargo tanks, is 2,750 m^3/hr.

Inert gas is injected into the cargo tanks in order to maintain oxygen below the low explosive limit (LEL) at all times, and exhaust gas of a high temperature that is discharged from the engine room is desulfurized, completely exhausted and cooled down through a scrubber, after which it is blown into each cargo tank using two blowers. The P/V breaker (Pressure & Vacuum Breaker; "P/V valve") goes into operation when the cargo tank pressure becomes positive or negative based on a certain level

IMST are correct where they state that the cargo tanks are to be inerted at all times. To avoid the risk of catastrophic explosions when handling crude oil cargo, accepted tanker practice, as described in ISGOTT 5th Edition, requires VLCC to have their cargo tanks inerted at all times, which is shown by the following extract:

Quote

7.1.5 CARGO TANK ATMOSPHERE CONTROL

7.1.5.1 Inert Gas Operations

Tankers using an inert gas system should maintain their cargo tanks in a non-flammable condition at all times (my underlining). It follows that:

Tanks should be kept in an inert condition at all times, except when it is necessary for them to be gas free for inspection or work, i.e. the oxygen content should be not more than 8% by volume and the atmosphere should be maintained at a positive pressure.

The atmosphere within the tank should make the transition from the inert condition to the gas free condition without passing through the flammable condition. In practice, this means that before any tank is gas freed, it should be purged with inert gas until the hydrocarbon content of the tank atmosphere is below the critical dilution line (line GA in Figure 7.1).

When a ship is in a gas free condition before arrival at a loading port, the tanks must be inerted prior to loading. In order to maintain cargo tanks in a non-flammable condition the inert gas plant will be required to:

Inert empty cargo tanks (see Section 7.1.6.1).
Be in operation during cargo discharge, deballasting, crude oil washing and tank cleaning (see Sections 7.1.6.6. and 7.1.6.9).
Purge tanks prior to gas freeing (see Section 7.1.6.10).
Top-up the pressure in the cargo tanks when necessary during other stages of the voyage (see Sections 7.1.6.5 and 7.1.6.7).
It must be emphasised that the protection provided by an inert gas system depends on the proper operation and maintenance of the entire system.

Unquote

These types of vessel are designed specifically for that purpose ensuring that a positive pressure of inert gas is maintained in the cargo tanks to avoid any possibility of the dilution of the cargo tank inert atmosphere by oxygen to create a flammable mixture. If the crude oil vapour is ignited, then there is the possibility that there will be an explosion with catastrophic consequences such as loss of life, loss of the ship and extensive pollution.

Inert gas is introduced not as stated to 'maintain oxygen below the low explosive limit' but to reduce the oxygen content in the space to the industry accepted level of 8% oxygen or below. As inert gas (typically flue gas) is added to the hydrocarbon/gas/air mix in the space, the flammable range progressively decreases until the oxygen content reaches a level where no mixture can burn. This is generally accepted as 11% oxygen by volume. As this point is on the edge of the flammable envelope, industry requirements of 8% by volume give a good working safety margin for the tanker industry. Please see the following quote from ISGOTT 5th Edition:

Quote

The International Convention for the Safety of Life at Sea (SOLAS 1974), as amended, requires that inert gas systems be capable of delivering inert gas with an oxygen content in the inert gas main of not more than 5% by volume at any required rate of flow; and of maintaining a positive pressure in the cargo tanks at all times with an atmosphere having an oxygen content of not more than 8% by volume except when it is necessary for the tank to be gas free. Existing systems are only required to be capable of producing inert gas with an oxygen content not normally exceeding 5% by volume, and of maintaining the tank inerted at all times except when it is necessary for the tank to be gas free.

Unquote

There also appears to be a basic misunderstanding by IMST of what the P/V breaker is as it is referred to in this paragraph and called the 'P/V valve'. These are completely separate safety devices fitted on board the vessel. The P/V valve is mechanical safety device fitted individually to each cargo tank space on the vessel and is designed to control small space pressure variations caused primarily by thermal expansion and contraction of the atmosphere within that space. These are set to operate in advance of the P/V breaker.

The P/V breaker is a single device common to all the cargo spaces and is generally a liquid filled 'tank' on the main inert gas line discharge to deck, (not to be confused with the deck seal fitted at the primary outlet line to deck on the inert gas blower discharge side). The P/V breaker is set to operate at higher tolerances than the individual P/V valves above. This is clearly explained in the following extract from ISGOTT:

Quote

7.1.8 CARGO TANK PROTECTION

A number of serious incidents have occurred on oil tankers due to cargo tanks being subjected to extremes of over or under pressure. Whilst SOLAS Regulations have been modified to require tanks to be fitted with full flow pressure relief devices or individual tank pressure monitoring, it is still essential that venting systems are thoroughly checked to ensure that they are correctly set for the intended operation. Once operations have started, further checks should be made for any abnormalities, such as unusual noises of vapour escaping under pressure or pressure/vacuum valves lifting. Ship's personnel should be provided with clear, unambiguous operating procedures for the proper management and control of the venting system and should have a full understanding of its capabilities.

7.1.8.1 Pressure/Vacuum Breakers

Every inert gas system is required to be fitted with one or more pressure/vacuum breakers or other approved devices. These are designed to protect the cargo tanks against excessive pressure or vacuum and must therefore be kept in good working order by regular maintenance in accordance with the manufacturer's instructions. When these breakers are liquid filled, it is important to ensure that the correct fluid is used and the correct level is maintained. The level can normally only be checked when there is no pressure in the inert gas main line. Evaporation, condensation and possible ingress of sea water should be taken into consideration when checking the liquid condition and level. In heavy weather, the pressure surge caused by the motion of liquid in the cargo tanks may cause the liquid in the pressure/vacuum breaker to be blown out. This may be more liable to happen on combination carriers than on tankers.

7.1.8.2 Pressure/Vacuum Valves

These are designed to provide for the flow of the small volumes of tank atmosphere caused by thermal variations in a cargo tank and should operate in advance of the pressure/vacuum breakers. To avoid unnecessary operation of the pressure/vacuum breaker, the pressure/vacuum valves should be kept in good working order by regular inspection and cleaning.

Unquote

C. Circumstances of the Case

1) The Marine Spread

(1) Departure and passage through special area (from around 1450 hours to 2400 hours on December 6, 2008)

(2) Preparations for Navigation

Seung Min Cho, the master of the lead tug "Samsung T-5," which was in charge of the voyage of the Marine Spread, holds a second class officer license. He began commanding "Samsung T-5" as a master from November 18, 2003, and has 7 years experience of working as a master. After finishing the crane operations of "Samsung No. 1" at the construction site of Incheon Bridge, the master Seung Min Cho received weather information for the scheduled route from the field manager Gil Seong Tak of Boram and the barge master Yi Hyun Kim at around noon on December 6, 2007, for the purpose of sailing back to SHI located in Gohyun port, Geoje. According to him, it was broadcasted at around 0300 hours on December 7 that there will be an announcement of a wave warning for the areas far from the central part of the West Sea, accompanied by northwesterly winds of 12 to 16 m/s and winds of a height of 2 to 4 m.

The master Seung Min Cho thought that the weather forecast of Incheon Port would not affect the Marine Spread's voyage because (i) the wind at that time did not reach Beaufort Scale 5, in which case the recommendations set forth by the towage survey certificate would prohibit the departure, and (ii) while the strong wind warning announced for the distant parts of the West Sea was forecasted for the sea 20 miles from the shore, it was planning to navigate 10 miles away from the coast.

If this is what the "SAMSUNG T-5" master has said to the IMST then he is displaying a fundamental lack of understanding of the basics of maritime meteorology and coastal navigation. Any prudent master would have foreseen that at any point after passing south of 37º N latitude, his vessel would have lost any shelter afforded by the off lying islands and been subject to the effects of any weather from the west of his vessel. To disregard the forecast promulgated, as having no bearing on his complete voyage displays a singular lack of understanding of the marine environment on the part of this master.

Additionally, it seems that this master has also totally relied upon the insurance certificate as his instructions for the voyage, not his own qualifications and experience or instructions from his employers. If his employers have instructed him, or are in agreement for him, to totally rely upon the recommendations from the insurance certificate then they also have a lack of understanding of their basic obligation to provide vessels suitably equipped and crewed for the anticipated circumstances of the voyage.

So, he decided to leave the site without determining which port may be used for emergency shelter in the event that unexpected bad weather conditions are encountered.

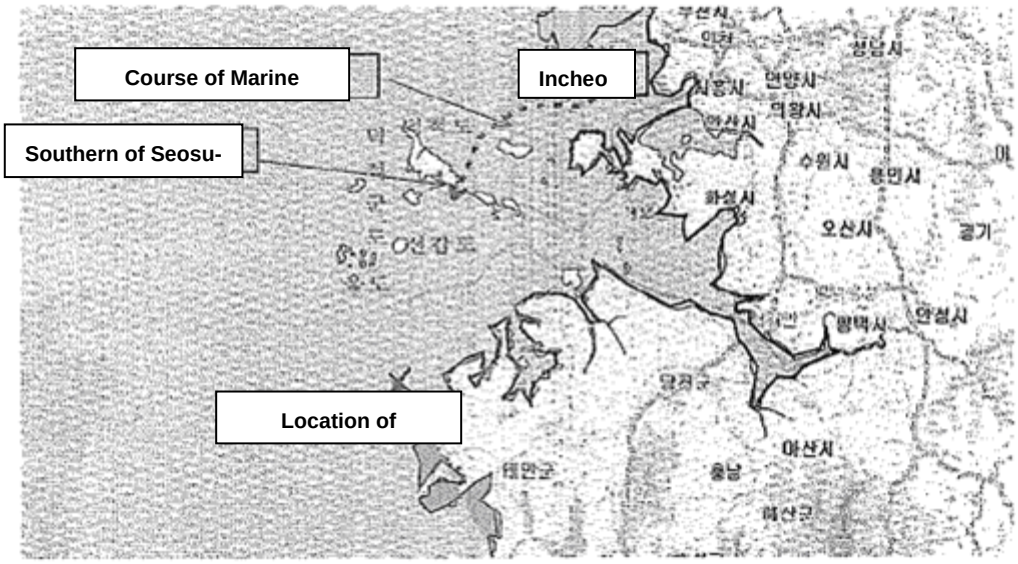
At the time of departure, the Marine Spread was comprised as follows: "Samsung T-5" and the assisting tug "Samho T-3" towed "Samsung No. 1" by its stern and respectively paid out cables of 47.5 mm and 48 mm in diameter from the towing winch drum by about 200 m in length, considering that it was sailing within the port. "Samsung A-1" was connected to the bow of "Samsung No. 1" (at the rear of the Marine Spread's sailing direction) with a cable of 48 mm in diameter and 150 m in length. The draft of "Samsung No. 1" was 4.2 m at the bow and 2.5 m at the stern, averaging 3.35 m.

After finishing the above preparations, the master Seung Min Cho departed from the port at around 1450 hours on December 6, 2007, leading the Marine Spread. From that point, "Samho T-3" maintained a regular distance from the starboard side of "Samsung T-5" by adjusting the course and speed according to directions received from "Samsung T-5" via VHF channel 15, whenever it was necessary, and assisted "Samsung T-5" with its towing voyage.

(2) Passing through a special area of Incheon Port and increasing the length of the towing line

After departure, when "Samsung T-5" was passing by Palmi-do while maintaining manual steering at a speed of 4 knots at around 1600 hours on the same day, the master Seung Min Cho made a report to the Vessel Traffic Service Center ("VTS") of Incheon Port. Thereafter, the Marine Spread proceeded south along Seosu-do, located in a special area of Incheon Port, and passed by Seosu-do at around 2030 hours on the same day. For sailing along the coast, "Samsung T-5" and "Samho T-3" each increased the length of their towing lines by 420 m and 400 m, respectively, and set their course to 206 degrees at a speed of 4.2 knots around the time of 2040 hours. At that time, the tugboats had switched on three towing lights, including the head light, the side light as a streaming light, and the white light. [Picture 17]

I assume that the length of the tow lines were increased to 400m and 420m, not by those lengths. In addition, the description of the navigation lights displayed shows that the tug masters did not consider the tow was in any way restricted in its ability to manouever.



[Picture 17] Track of Marine Spread's voyage to south of Seosu-do after departure from Incheon Port

While it was stated in the Towage Approval Check List for the Marine Spread that the length of towing line can be adjusted by the master of the lead tug at his discretion, the towing line for "Samho T-3," whose towing ability is relatively weak, was much longer, and furthermore, the Check List required that a stretcher for absorbing impact be connected. However, despite such unreasonableness, the master Seung Min Cho co-signed the towage certificate together with the inspector without raising any objections thereto. When increasing the length of the towing line before sailing along the coast, the master Seung Min Cho only used cables for both of the tugboats regardless of the above and made the towing line for "Samsung T-5" 20 m longer, despite the fact that the towing ability of "Samsung T-5" was much stronger. ([Picture 12] and [Picture 13]).

Once more the IMST are using the insurance certificate as the sole basis for their acceptance of the readiness of the marine spread for the voyage. As described previously, the towage certificate does not override the obligations of the operators/managers and masters of providing vessels fit for the voyage. Even so, it seems to me that the IMST are contradicting themselves here by saying that it was unreasonable for the insurance surveyor to recommend stretchers, when they later declare that a stretcher should have been fitted to the towline of "SAMSUNG T-5".

When the body of ship got pushed towards starboard at around 2130 hours on the same day, the master Seung Min Cho changed course to 202 degrees by decreasing it by 4 degrees. The sea was calm and a southwestern wind of Beaufort Scale 3 was blowing from the direction of the bow. The Marine Spread sailed a course made good at 208 degrees, which was not much different from the original course of 206 degrees, and continued to sail without listening to the broadcast of the wind warning announced for the distant parts of the West Sea at around 2240 hours on the same day.

For a marine spread that is weather dependant, not listening to a weather forecast when broadcast shows an appalling lack of understanding of the marine environment. Maintaining a proper lookout includes monitoring all weather data. I have included a quote from the Standards for Training, Certification and Watchkeeping (STCW) that clearly shows the factors to include whilst maintaining a proper lookout:

Quote

Lookout

13 A proper look-out shall be maintained at all times in compliance with rule 5 of the international Regulations for Preventing Collisions at Sea, 1972 and shall serve the purpose of:

.1 maintaining a continuous state of vigilance by sight and hearing as well as by all other available means, with regard to any significant change in the operating environment;(my underlining)

.2 fully appraising the situation and the risk of collision, stranding and other dangers to navigation; and

.3 detecting ships or aircraft in distress, shipwrecked person, wrecks, debris and other hazards to sate navigation.

14 The look-out must be able to give full attention to the keeping of a proper look-out and no other duties shall be undertaken or assigned which could interfere with that task.

Unquote

The IMST gloss over this admission by the tug and barge crews. And yet such a failing on behalf of the tug master in not following one of the basic statutory tenets of maintaining a proper lookout calls into question the fitness of this master for this voyage and the operation and management of the marine spread.

(3) Decline of ability to maintain course

From around 2330 hours on the day when the Marine Spread was passing by Ul-do, located in the southern part of the Deukjeuk Islands, at a distance 3.3 miles away from the starboard side, the course of the Marine Spread was suddenly changed by 20 degrees to the port side from a true course of 206 degrees, due to the wind and waves coming from the distant parts of the West Sea. While the Marine Spread was navigating at a course made good at 186 degrees at that time, the master Seung Min Cho went to bed after transferring duty to the chief officer, Sung Ho Kwak, without noticing the above change, and giving him the true course of 202 degrees at an average speed of 3.5 knots. ([Table 8] and [Picture 18])

Once more, given that the crew of the tugs have subsequently claimed that the tugs lost control of the tow, this action by the master of "SAMSUNG T-5" in ignoring the significant effect of the weather on the tow prior to handing over the watch to the Chief Officer shows that he was either not maintaining a proper lookout and/or was not concerned about the affects of the weather on the marine spread. This again shows a basic lack of understanding of the marine environment and calls into question his fitness for his position and the guidance and instructions provided by the managers and operators of the vessels in the marine spread.

[Table 8] Summary of weather conditions and sailing conditions from departure until midnight on the same day

Time	Wind		Wave Height (m)	Scheduled True Course	Lee Way (Declination, Drift Angle)	Actual Course (Bow Direction)	Course Made Good (Actual Track)	Average Speed (Knot)
	Direction	Velocity (Beaufort Scale)						
At departure (1450 hours)	Southwest	3	Calm	Change at any time	0	Change at any time	Change at any time	4.2 knot
Southern of Seosu-do (2030 hours)	Southwest	2	Calm	Change at any time	0	Change at any time	Change at any time	3.5 knot
Transfer of duty (2400 hours)	Southwest	3	Calm	206 degrees	-4	202 degrees	208 degrees	3.5 knot

It is not made clear where this data was derived from. If it is from the log books of the tugs, the available Korean marine forecast data and historical records for this area contradict the claimed weather conditions in the table above. At a minimum for example at 2400hrs the conditions in the area would have been NW to WNW force 6 to 7 from the forecasts, and yet the table shows a wind from the south west at Beaufort force 3. Beaufort force 3 does not result in a calm sea, the actual description of the sea in the Beaufort Scale is "large wavelets, crests beginning to break". It is accepted that the Beaufort Scale description is given for open water, but when experiencing a wind of force 3 it is impossible to be in a "calm" sea. Calm sea in the Beaufort Scale is described as "like a mirror", and as any seafarer will explain, mirror like sea surfaces do not exist with a force 3 wind. The fact remains that, as the IMST has stated, there was a wind warning forecast issued at 2240 hours which was available to the tug masters which showed deteriorating weather in the vicinity which should have been noted and precautions taken. The fact that this was ignored, illustrates the very poor lookout being maintained on the marine spread, and it follows that these vessels were not being operated and managed to a proper level expected of any vessel at sea.

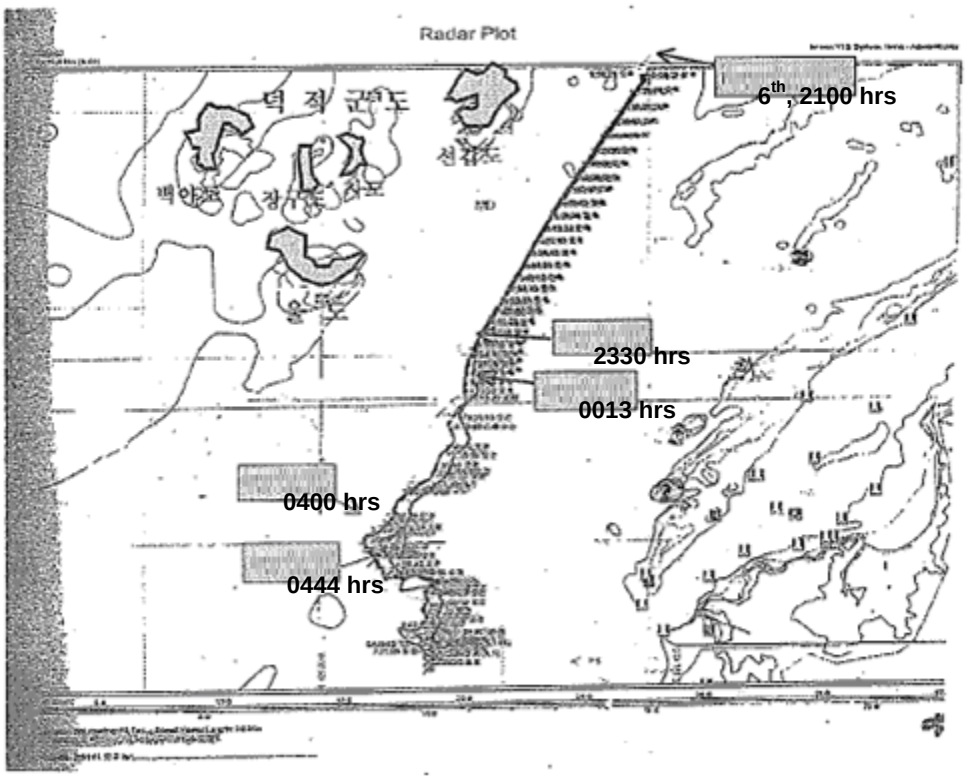
A) Deviation for sheltering due to decrease in towing ability resulting from worsening weather conditions (from around 0000 hours to 0400 hours of December 7, 2008) ([Picture 18] and [Picture 19])

When the master transferred duty to the chief officer, Sung Ho Kwak, the Marine Spread had already been exposed to the wind and waves of the distant sea and was being pushed on its port side. However, the chief officer, Sung Ho Kwak, failed to notice it and the Marine Spread continued to sail at the course made good of 186 degrees. Around 0013 hours on the next day, December 7, when navigation was set to automatic steering, the bow of the vessel yawed intensively and the speed was also rapidly decreased by 2 knots or so.

The Master and Chief Officer of "SAMSUNG T-5" here display a basic lack of understanding of marine navigation, by failing to note that the vessel was severely affected by set and drift. This is very basic navigation which should be second nature to any mariner. The fact that apparent severe yawing was experienced after engaging automatic steering should have immediately concerned the Chief Officer, yet it does not appear to have generated the slightest interest which suggests that the Chief Officer was either not competent or that the yawing was not as serious as the IMST suggest.

"Samsung No. 1," a large floating crane barge, was being towed by long towing lines of 400 m in length at dead slow speed, but due to the strong wind and waves from the starboard side, it started drifting towards a different direction from the tugboats' course. While the entire Marine Spread navigated to the direction of the course made good at 210 degrees alongside the intended route, it moved in a zigzag direction and was extremely unstable. Accordingly, the chief officer, Sung Ho Kwak, changed course to 230 degrees at around 0330 hours.

He believed that while the tugboats were sailing at a course of 230 degrees, the actual track of the course made good for the tugboats was 210 degrees, which was not much different from the scheduled course of 206 degrees, and told "Samho T-3" through VHF channel 15 that "… while we are sailing at a course of 230 degrees due to the bad weather conditions, we've taken the right course…" That is, he didn't realize the seriousness of the Marine Spread moving in a zigzag direction. ([Picture 18] and [Picture 19])



[Picture 18] At around 2330 hours, 30 minutes before when the master Seung Min Cho transferred its duty to the chief officer Sung Ho Kwak, the Marine Spread passed by Ul-do. From that time the tugboats were suddenly pushed to the south and the track of the Marine Spread became very unstable.

From Picture 18 in the IMST report, the track of the marine spread from 0013 hours to about 0400 hours was in the general south west direction the tow was planning to make. Certainly, the track of the spread prior to 0013 hours is a uniform south west track, but then the vessel was on hand steering and probably gaining some protection from the weather from the off lying islands to the west. However, once the vessel cleared the shelter and went onto automatic steering, it would be expected that the track of the vessel would then be less uniform than that shown previously. As long as the spread could be controlled by helm and engine movements to ensure that it followed the general track then there is unlikely to be a major concern. Certainly, there are no reports of the Chief Officer raising any concerns with the duty officer on "SAMHO T-3", those on "SAMSUNG No.1", the duty officer on "SAMSUNG A1", or even Daesan VTS, nor even displaying signals to show that the spread had problems. Consequently, there was no seriousness for him to realize as the IMST have assumed in hindsight.

At around 0400 hours on the same day, the barge master Yi Hyun Kim of "Samsung No. 1" was worried and asked the first officer Sung Ho Kwak "… whether there is any problem with sailing," but the answer was, "everything is okay." However, around that time, the master Seung Min Cho, who came up to the bridge after getting a report from the first officer Sung Ho Kwak that the Marine Spread was encountering bad weather, found that the speed had dropped to 1.7 knots and that the towing ability of the tugboats diminished a great deal. Accordingly, the master Seung Min Cho decided to take shelter at a suitable place near Incheon Port.

Prior to the departure from Incheon Port, the master Seung Min Cho had not decided on which port may be used for emergency sheltering in the event unexpected bad weather conditions are encountered. Furthermore, he failed to comply with the voyage recommendations set forth by the towing survey, which requires the shipowner and towage surveyor to be immediately informed of any deviation such as seeking shelter in the event of any problems arising with the Marine Spread and to take necessary measures. He instead acted in his own way. As a result, the Marine Spread was not able to get any help with safety measures, such as having the relevant authorities, including the VTS, send out early navigation warnings to other vessels nearby, etc. ([Picture 19])

Again the IMST are using the insurance certification as the final word on this voyage. This is a fundamental misunderstanding of the role of the insurance surveyor. The Master can take any action that he sees fit for the safety of the tugs and tow without prior reference to the insurance surveyor, had this surveyor issued an approval certificate for this voyage (which he had not done). To quote from the IMO Guidelines for Safe Ocean Towing:

Quote

4.2 The towing operation should be in charge of a competent towing master, normally being either the master of the towing vessel or the master of the leading towing vessel, in case the towed object is towed by more than one towing vessel.

4.3 The towing master is responsible for the towing operation. In preparation for the towing operation, the towing master should consider these guidelines, as appropriate. The towing master should also consider what regulations are applicable during the towage, as well as ensuring that all relevant safety measures as he finds necessary are implemented.

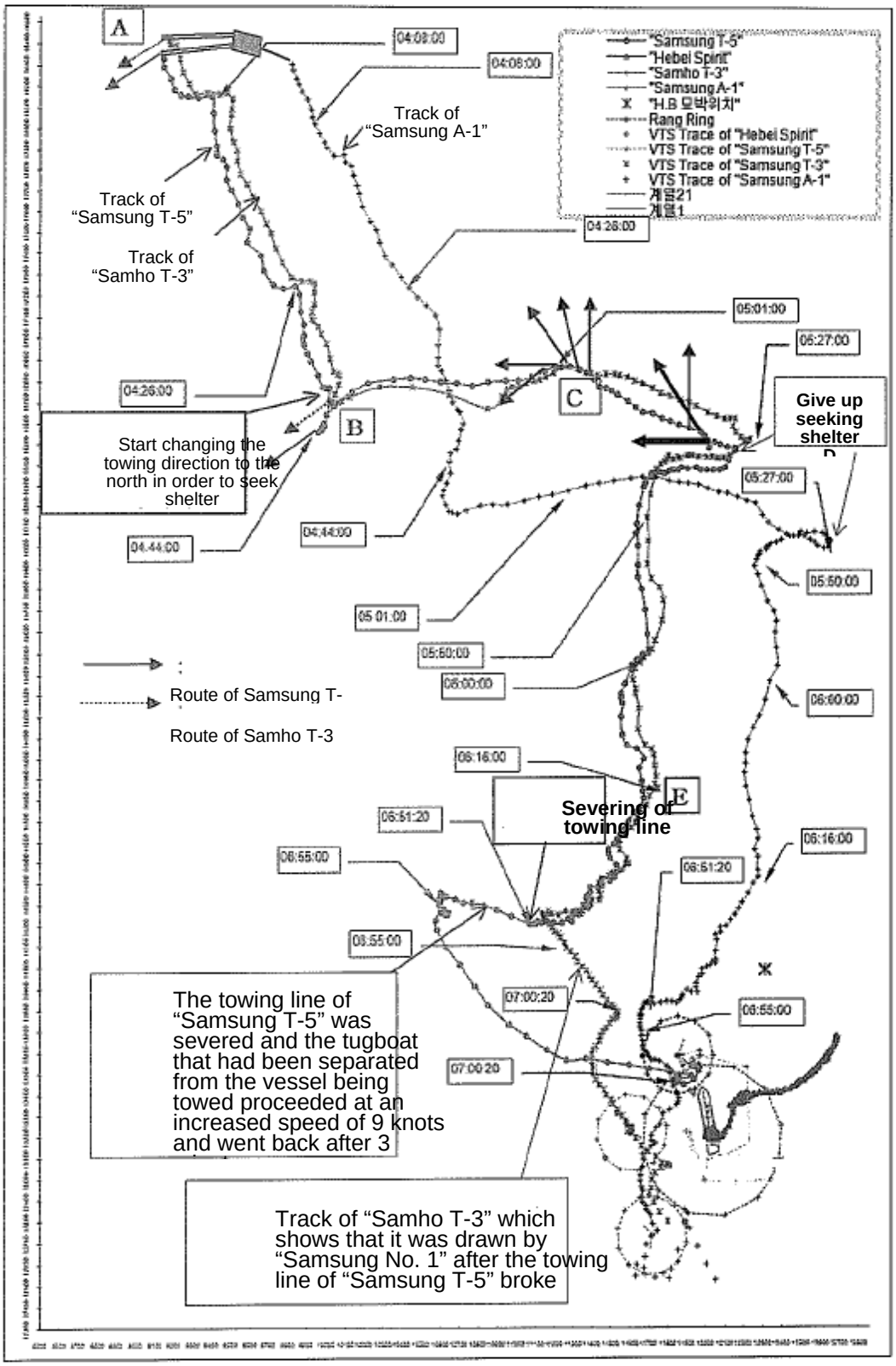
4.4 Nothing in this section shall set aside or limit the towing master's/tug master's authority in accordance with maritime laws.

Unquote

If time allows, a tow master can advise the insurance surveyor of his intentions if it is a fundamental deviation of this voyage. However, the IMST cannot critisize this master for not first seeking the approval of the insurance surveyor before deciding to seek shelter. In this case, the master should have made his decision and then informed his employers (first) then the insurance surveyor had he issued an approval for the voyage, which he had not done so. In fact, the insurance surveyor would not need to be one of the first to receive this decision. It should be very apparent to any prudent master in this situation that the first person contacted would be the Daesan VTS to update them on their intentions. As far as I am aware no such call was made or attempted.

B) Attempt to take shelter – Giving up on seeking shelter – Attempt to return to sche duled route (from around 0400 hours to 0517 hours on December 7, 2008) ([Pictu re 19])

While the Marine Spread was moving in a zigzag direction due to the wind and waves at around 0000 hours on the same day, it maintained the original route, generally taking a true bearing of 210 degrees until 0400 hours. However, while slowing down its speed in order to seek shelter at Incheon Port, the Marine Spread's track changed by almost 90 degrees from the southwest at around 0400 hours, and the Marine Spread was quickly pushed down towards the southeast direction for about one mile without any obstruction (from point "A" to point "B" in [Picture 19]). From around 0400 hours on the same day, the bow direction of the tugboats slowly made a turn towards a port direction, and the Marine Spread was again pushed towards the east. (Point "B" at [Picture 19])



[Picture 19] Voyage tracks of relevant vessels appearing on the radar screen of the Daesan VTS by adding the tracks of the tugboats and statements of the relevant persons.

It would seem from this description that an attempt to turn the tugs around to the north, clockwise, resulted in the marine spread first tracking to the south east, then tracking towards the east as the tugs approached a north heading, then west. Clearly, these significant changes of direction show that the tugs had a measure of control over the direction of the marine spread. That is, it did not uncontrollably drift in the wind and seas which remained reasonably constant throughout.

Despite the fact that the very large crude carrier "Hebei Spirit," loaded with dangerous materials, and a few other large vessels were anchored only two miles away [from the Marine Spread] on the southeasterly extended line of its voyage track from 0400 hours to 0444 hours on the same day, the master Seung Min Cho failed to inform the VTS or any other vessels nearby about the dangerous situation of the Marine Spread.

This is factually misleading. There were three other vessels apart from "HEBEI SPIRIT" anchored in the vicinity of the crane barge at this time. These vessels, "GLORY TIANJIN", "KEOYANG ORIENT", and "FORTUNE CARRIER", were anchored in an arc, anti- clockwise, from "HEBEI SPIRIT" respectively so that "GLORY TIANJIN" was actually east of the marine spread once the latter commenced moving east. All these anchored vessels, at some time or other, since 0400 hours were in the path of the track of the marine spread. However, what the IMST have correctly pointed out was that there was no warning of any difficulties whatsoever from the marine spread to the other vessels or the VTS.

Right after 0500 hours on the same day (Point "C" at [Picture 19]), the Marine Spread made a substantial change in course towards Incheon Port because of the tugboat over a few minutes of time, and it kept being pushed to the east. (From point "C" to point "D" at [Picture 19]) While the course of the tugboats had been changed to 000 degrees in order to take shelter towards Incheon Port, it failed to tug "Samsung No. 1." Rather, due to the wind and waves, "Samsung No. 1" kept being pushed towards the east and dragged the tugboats with her. Accordingly, the master Seung Min Cho gave up seeking shelter at 0517 hours. At that time, the master Seung Min Cho had not performed emergency anchoring because the substance forming the seabed was sand, and he was worried about dragging.

If the Master of "SAMSUNG T-5" really believed that the marine spread was in trouble and uncontrollable, he could have deployed the free-fall anchor on the "SAMSUNG NO.1", to arrest any uncontrollable movement, which could then have been assisted by the tow tugs to maintain its anchored position as the IMST later include themselves. If he discounted the possibility of anchoring because of the nature of the seabed, sand, this again shows his lack of understanding of marine matters and a lack of knowledge of the capabilities of the equipment available on the barge. A high holding power anchor with up to fifteen shackles of cable would hold extremely well in sand, particularly when supplemented by the pull generated by the tow tugs. Please see the following extract from the US Navy Salvage handbook.

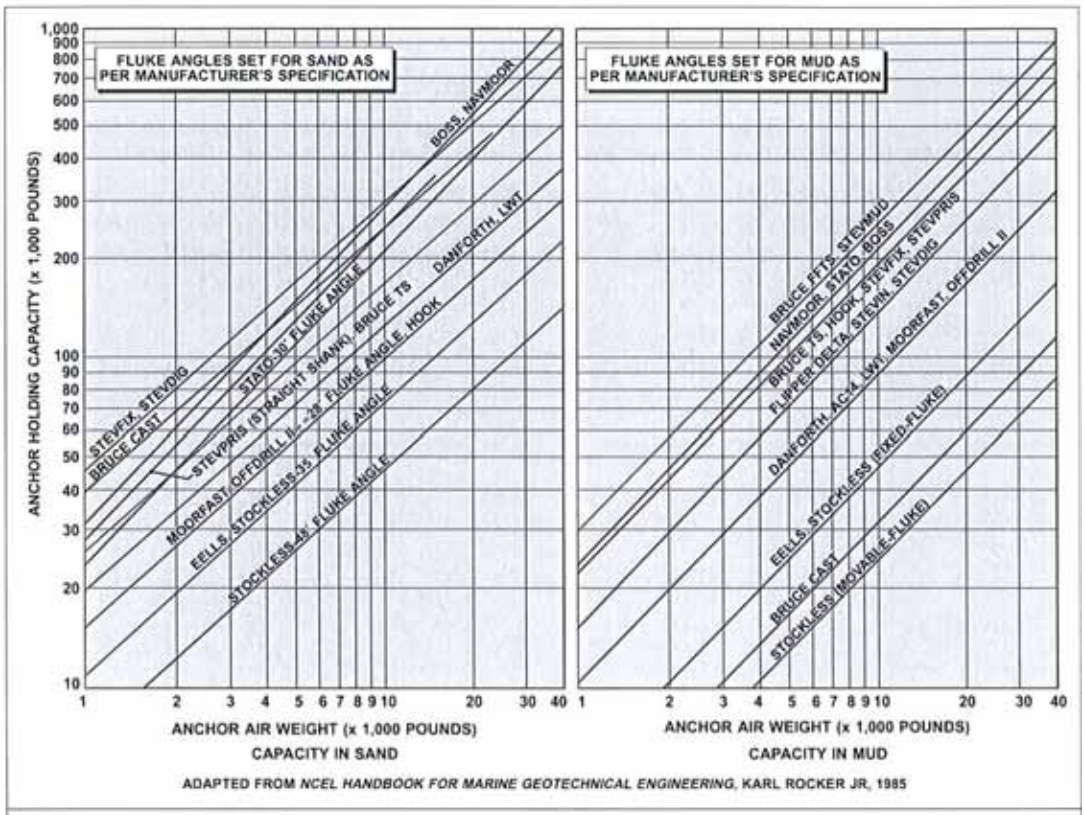


Figure G-7. Anchor Holding Capacity.

Instead, he again made a substantial change in course to 270 degrees towards port and started to tow "Samsung No. 1" in the direction of the original route. The Daesan VTS observed the tracks of the Marine Spread with suspicion and called "Samsung T-5" and "Samsung A-1" on VHF channel 16 at around 0523 hours. However, it failed to respond to such calls. (Between point "C" and point "D" at [Picture 19])

If the tow was in trouble there are no excuses for not attempting to anchor and even calling the VTS or the other anchored ships, which were lying to the east round to the south east. It astonishes me that if the VTS did call the marine spread because they were concerned at its movement at 0523 hours, they did not follow up on this call when they were not answered. All this indicates that those on the tow did not themselves believe they were in uncontrollable trouble, but it also shows that they were not maintaining a proper lookout by hearing as well as sight. Please see the extract from the IMO Guidelines from Safe Ocean Towing that explains what a tow master should do in an emergency:-

Quote

14 IN AN EMERGENCY

14.1 Should the tow present a direct danger to navigation, offshore structures or coastlines through breaking adrift or for some other cause, the master of the towing vessel is bound by SOLAS regulation V/2 to communicate the information by all the means at his disposal to ships in the vicinity, and also to the competent authorities at the first point on the coast with which he can communicate.

14.2 In all cases, the arrangements for recovering the tow, should it break adrift, should be made in accordance with good seamanship, bearing in mind the seasonal weather conditions and area of operation.

Unquote.

At that time, the bow of the anchored "Hebei Spirit" had a heading of 340 degrees, and the Marine Spread was approaching from a distance of 1.7 miles in a 190 degree direction. "Samsung No. 1" was located in a 25 degree direction from the starboard bow of "Hebei Spirit."

The heading of "HEBEI SPIRIT" is irrelevant at this time as the VLCC was safely and securely at anchor and the marine spread was underway, which is defined in the collision regulations as follows:

Quote

The word underway means that a vessel is <u>not at anchor</u> (my underlining), or made fast to the shore, or aground.

Unquote

C) Severing of the towing line and occurrence of collision while making attempts to return to original route (from around 0517 hours to 0706 hours on December 7, 2008)

(1) The master of "Samho T-3," Gan Tae Kim, coming up to the bridge (around 0530 hours)

The chief officer of "Samho T-3," Jong Chan Kim, who was on duty at that time, did not realize the seriousness of the situation until he received instructions from the master of "Samsung T-5," Seung Min Cho, to give up seeking shelter and to return to the originally scheduled route. So, he woke up the master Gan Tae Kim, who was asleep after his night duty, via speaker at around 0530 hours. The master Gan Tae Kim came up to the bridge and, for the first time, became aware of the fact that the Marine Spread had lost its towing ability and was facing a dangerous situation. (Right after passing through point "D" in [Picture 19])

I find it difficult to understand that the marine spread had been in severe difficulties as the IMST have said since 0013 hours and yet the seriousness of the situation had not been discussed between the two tow tugs, as well as those on "SAMSUNG NO.1" and "SAMSUNG A1". Even if it had not been discussed, although the alteration of direction decided by the "SAMSUNG T-5" must have been communicated, it also shows either appalling watchkeeping conducted on the other vessels or they did not believe they were in trouble, or both. It took over five hours to call the Master of "SAMHO T-3" to the bridge, so there was clearly no concern on this vessel. If this Master was then concerned at the situation why did he not call VTS or suggest anchoring, or even raise his concern with the lead tug. The reason is that he was not concerned, and neither was anyone on the marine spread at this time because they still had control of the tow.

(2) The Marine Spread's first communication with the outside (around 0617 hours) and recognition of "Hebei Spirit" (0627 hours)

Thereafter, the Marine Spread kept drifting towards the south and approached "Hebei Spirit," which was at anchor in the drifting direction. At around 0614 hours on the same day, the Marine Spread was approaching at a distance of 0.5 miles, and "Hebei Spirit," which perceived the danger of such an approach, called "Samsung T-5" and "Samsung A-1" on VHF channel 16. However, there was no response from the Marine Spread. The first communication with the outside was made at around 0617 hours only after the Daesan VTS called Seung Min Cho on his cell phone according to the request from "Hebei Spirit." (Near point "E" in [Picture 19])

This paragraph glosses over the stated fact that the first people to recognize that a situation was developing were the watch keepers on the anchored VLCC. At about 0605 hours the Chief Officer on watch in the wheelhouse of the "HEBEI SPIRIT" called the Master regarding the approach of the marine spread after he had been monitoring its movement and determined that the vessel would now be approaching dangerously close to the anchored VLCC. They initially contacted the VTS who advised that they would contact the marine spread. When those on "HEBEI SPIRIT" received no reply from the VTS, efforts were made to contact the marine spread directly from the tug names obtained from the AIS. Even though four attempts were made between 0613 and 0614 hours, again there was no reply. The IMST has stated that the VTS contacted the tug by cell phone at 0617 hours!

The IMST do not comment on this totally appalling watch keeping being undertaken on the tugs where the VHF is not listened to and cell phones are required for communication. That is, despite calls from the VTS and "HEBEI SPIRIT" over the accepted form of marine communication, VHF, a medium which those on the marine spread were required to monitor under SOLAS, it was only possible for the VTS to eventually get through to the tug by cell phone, apparently eight minutes after the call from the "HEBEI SPIRIT". This is absolutely shocking, and given that there were now both sets of masters and chief officers on the bridges of both tugs, there is no excuse for not one of the four (or even those on "SAMSUNG A1" and "SAMSUNG NO. 1") failing to respond to the VHF calls. This shows that no proper lookout was being maintained on either of these vessels and it is wrong that the IMST do not take issue with this fact as a key circumstance leading to the collision. Such a failing can be attributed to improper operation and management of these vessel, an area the IMST have singularly ignored during their investigation.

It was not until "Samsung No. 1" approached the bow of "Hebei Sprit," which was facing due north at that time, at a distance of 0.5 miles that Seung Min Cho informed the Daesan VTS about the state of the Marine Spread, which had difficulty sailing in a normal state due to bad weather conditions. The Daesan VTS first made notice of such fact to "Hebei Spirit" at around 0627 hours, 10 minutes after Seung Min Cho informed the VTS.

This paragraph is factually misleading. The course recorder trace from "HEBEI SPIRIT", always crucial evidence to obtain from a ship after a collision, shows that the heading of the VLCC never was north during this period, but at 0627 hours was on a heading of about 347º and oscillated around this heading before and after this time.

The IMST also fail to explain why it then took 10 minutes for the VTS to pass on any information they had obtained by cell phone to the "HEBEI SPIRIT" from the marine spread. In all, after the call from "HEBEI SPIRIT" at 0609 hours, which initiated the communications between the three parties, it took a further 18 minutes for a response to be passed back to the VLCC. Even though the marine spread was approaching the anchored VLCC slowly at this time, having to await a response for 18 minutes is just not acceptable in any marine environment. As it was, those on "HEBEI SPIRIT" had already commenced contingency plans as the transcript of the VHF clearly shows at 0627 hours:

02:27:05 (6:27am)

VTS: Hebei spirit. Hebei Spirit. This is Daesan VTS.
[stand by를 지시한 이후 본선에 지시하는 내용임]
HS: Roger sir. This is Hebei Spirit.
VTS: Captain, information. We have communicated with a vessel in vicinity of your position by telephone by telephone. *[예인선단이 STCW 상에 규정되어 있는 통신유지의 무를 위반한 것임]* She is [driving][?] now because of heavy weather. So she is approaching to you so you have risk of collision with the vessel. I expect this. *[충돌의 위험을 가능성으로 표현한 것임]* So adequate measure are required. *[만약에 충돌의 위험이 있었다면 immediate measure를 요구하였을 것임]* Over.
HS: Roger sir. I am already got my engine ready I am just trying to pay off more on my anchor cable now.
VTS: Very good captain.
[선장의 조치에 대해서 VTS에서도 상황에 따른 적절한 조치를 취한 것으로 보고,

(3) The Marine Spread and VTS repeatedly requested "Hebei Spirit" to take measures to avoid collision.

Two minutes after that, at around 0629 hours, while "Samho T-3" and "Samsung T-5" kept towing "Samsung No. 1" at a course of 270 degrees, "Samsung No. 1" approached the bow of "Hebei Spirit," which was facing due north, at a distance of 260 m (the distance on the radar on the bridge was about 3 cables (approximately 540m; [Picture 15]) and "Hebei Spirit" paid out the anchor in order to increase the distance by moving astern. On that point, the master of "Samho T-3," Gan Tae Kim, called "Hebei Spirit" on VHF and informed her that "… the anchor of your vessel is dragging…"

This paragraph again states that the "HEBEI SPIRIT" was on a heading of due north, but again this is factually misleading by the IMST. The course recorder trace show that the heading was never on north at any point during the timeline leading up to the accident.

The IMST have also taken a quotation from the agreed VHF VTS transcript and used it out of context. The full version is as follows:

02:28:59 (6:29 to 6:30 a.m.)

VTS: Hebei Spirit. Hebei Spirit.

Samho: This is Samho T3. How do you read me, over.

Navy: This is the Navy. Message understood.

HS: This is Hebei Spirit. Complete.

Samho: This is Samho T3. Please check anchor position. I didn't know your ship dragging (inaudible) anchor dragging anchor now.

HS: Yeah. Yeah. Yeah. Now I already checked already checked we checked the our anchor position.

삭제됨: changed

[우리가 paying off하고 뒤로 가고 있는 모습을 마치 dragging한다고 착각하여 교신한 내용임. 삼호 T3 선장은 정박선을 염두에 두고 자신들이 피해서 운항할 것을 예상하고 있었고, 불과 100미터 움직이는 유조선의 움직임을 일찌감치 면밀히 관찰하면서 운항하고 있었다는 것을 보여주는 것임. 또한 유조선이 dragging이 될 경우 자신들의 항행을 변경해야 할 필요성이 생길 수 있으므로 재삼 확인을 요청한 것임]

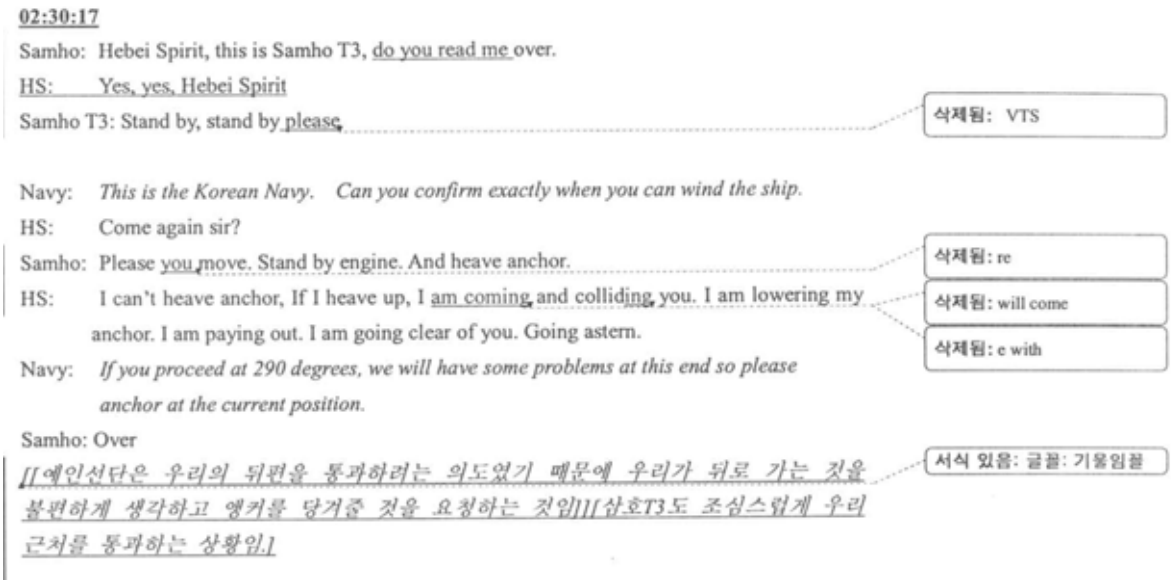
Samho: (inaudible) [ship dragging anchor now][?]

HS: (inaudible)

As the IMST has correctly pointed out, those on "HEBEI SPIRIT" had already commenced taking action by slacking off the anchor cable. "HEBEI SPIRIT" was never dragging her anchor, the movement referred to by those on "SAMHO T-3" refers to the movement of the VLCC in response to the lengthening the anchor cable by a further four shackles and the stretching of this cable by dead slow astern engine movements. The IMST, although they are aware of this action on "HEBEI SPIRIT", mislead the reader by not stating the obvious fact that increasing the anchor cable length and by going astern would move the VLCC away from its original position, which to those on the marine spread could be misinterpreted as dragging.

Soon after, at around 0630 hours, Gan Tae Kim again called "Hebei Spirit" in order to request that she prepare the main engine and move away by heaving up the anchor so that it could avoid collision. In addition, "Samho T-3" and "Samsung T-5" shifted its course to 300 degrees to increase the distance.

Once more, the IMST have omitted to include the full agreed text of the VHF conversation in order to suggest that calls were being made to the VLCC and no action was being taken on the tanker, only by the marine spread. This is factually misleading as the full transcript below shows:


02:30:17
Samho: Hebei Spirit, this is Samho T3, do you read me over.
HS: Yes, yes, Hebei Spirit
Samho T3: Stand by, stand by please.
삭제됨: VTS

Navy: *This is the Korean Navy. Can you confirm exactly when you can wind the ship.*
HS: Come again sir?
Samho: Please you move. Stand by engine. And heave anchor.
삭제됨: re
HS: I can't heave anchor, If I heave up, I am coming and colliding you. I am lowering my anchor. I am paying out. I am going clear of you. Going astern.
삭제됨: will come
삭제됨: e with
Navy: *If you proceed at 290 degrees, we will have some problems at this end so please anchor at the current position.*
Samho: Over
[[예인선단은 우리의 뒤편을 통과하려는 의도였기 때문에 우리가 뒤로 가는 것을 불편하게 생각하고 앵커를 당겨줄 것을 요청하는 것임]][삼호T3도 조심스럽게 우리 근처를 통과하는 상황임.]
서식 있음: 글꼴: 기울임꼴

What the Master of "HEBEI SPIRIT" has clearly explained to the "SAMHO T-3" in this VHF conversation is an obvious fact. If he attempted to heave up the 13 shackles of cable now deployed, it would be necessary to move forward to commence slacking the cable to allow it to be recovered, then breaking out the anchor from the sea bed. In doing so, the Master, as he pointed out at the time, would be creating the almost certainty of a collision. It is worth noting here that although the Master of "SAMHO T-3" is assuming that the engine on the VLCC should be put on stand-by now, the Master of "HEBEI SPIRIT" had already foreseen what was required and had his engine on stand-by since 0614 hours, in fact by the time of this call the Master had been using the engine astern.

At the same time, the Daesan VTS asked "Hebei Spirit" to prepare the main engine and move away by heaving up the anchor.
It again asked that she take all safety measures necessary for the prevention of a collision.

Again the IMST are omitting the full transcript of this particular conversation, which I have copied below:

02:31:17
VTS: Hebei Spirit.

02:31:19 (6:31 am)
HS: VTS. This is Hebei Spirit.
VTS: Hebei Spirit. This is Daesan VTS. I advise you to take best measure best measure for safety. For example, heave up anchor. And ready stand by engine, over.
HS: There is no time to heave up anchor. Because they are just three cables ahead of me. I am just lowering my anchor more. And I am going astern. To… so that they can clear my bow.
VTS: Message understood captain.
HS: Ok.
[HS에서 이미 최선의 조치를 수립하고 시행 중에 있었다는 사실을 VTS에 보고하고, VTS에서 조치내용을 이해하겠다고 답변한 것임.]

서식 있음: 글꼴: 기울임꼴
서식 있음: 글꼴: 기울임꼴

Whereas the IMST imply that specific advice was given to "HEBEI SPIRIT", the above transcript shows that the advice given was for best measures for safety, for example heaving up the anchor. The Master clearly responded by explaining what he was doing and intended to do to keep clear of the spread. As the final response from VTS shows, they fully understood his actions.

(4) Severing of the towing line of "Samsung T-5," anchoring of "Samsung No. 1" and the collision

At around 0630 hours, the heading of "Samsung No. 1" passed off "Hebei Spirit," which was facing due north, from her starboard to port side. At around 0640 hours, when "Samsung No. 1" reached a CPA of 0.3 miles with "Hebei Spirit" at a course of 345 degrees, Seung Min Cho started to use the engine at its maximum continuous revolutions due to the risk of collision.

Once more the IMST has stated that "HEBEI SPIRIT" was heading due north at 0630 hours, which from the course recorder trace it clearly was not. The heading at this time was 347º.

The IMST fail to appreciate the situation at this time. Because the Master of "HEBEI SPIRIT" had successfully deployed more cable and moved astern stretching this cable, the crane barge was now crossing from starboard to port and even though it was at a CPA of 0.3Nm, was now moving away from 0640 hours. That is there was no risk of collision. The determination of risk of collision in this case is covered in the Colregs, Rule 7 (d) which I have quoted in its entirety below:

Quote

In determining if risk of collision exists the following considerations shall be among those taken into account:

(i) such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change;
(ii) such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.

Unquote

The key word in this rule is "approaching". No collision will ever occur between two vessels if they are either on a steady bearing or there is an appreciably bearing change of a large vessel or tow, or at close range, if they are going away from one another. This is what was happening from about 0640 hours.

At 0652 hours, excessive tension was imposed on the towing line of "Samsung T-5" due to the load caused by the wind and waves, and as a result, the towing line broke in a place that was 50 m from the stern of the vessel.

What the IMST fail to mention is that the marine spread was now moving away from the anchored tanker and there was no need to increase the speed of the tug. Even so, they also imply that the dynamic loads on the tow wire of "SAMSUNG T-5" created by this increase of speed are the sole cause of the wire parting and, as described above, fail to take into account any possibility that the construction of this wire was flawed due to its design and use as a luffing wire, and its maintenance over a 12 year period. The operation and management of the marine spread were the key areas to investigate given that the parting tow line was the prime cause of the collision.

After the separation from "Samsung No. 1" due to the breaking of the towing line, "Samsung T-5" suddenly gained a speed of 9 knots and moved forward at a course of 300 degrees. The master Seung Min Cho, who became aware of this upon the roaring sound caused by the break, sailed back towards "Samsung No. 1" by making a substantial change in course to 130 degrees at around 0654 hours and contacted the barge master Yi Hyun Kim through VHF and said that "… the towing line became severed, so please take emergency measures…"

Right after receiving Seung Min Cho's instruction to take emergency measures, the barge master Yi Hyun Kim instructed the barge bosun, Soon Do Lee, to prepare for the anchoring of "Samsung No. 1." Accordingly, the barge bosun, Soon Do Lee, and 2 other crewmembers went out to the stern deck and completed preparations for anchoring by installing the stopper and windlass brake.

When the barge bosun, Soon Do Lee, reported the completion of the preparations for anchoring, he was directly given instructions to drop the anchor, and he then dropped the anchor at around 0700 hours on the same day, 6 minutes before the collision.

As I will explain below, the first contact between the crane barge and the anchored VLCC was shown by the evidence from the engine room alarms to have been just before 0700 hours. Therefore, if the anchor was dropped at this time, then it was far too late to be even remotely useful.

Anchoring took place 6 minutes after Seung Min Cho instructed to drop anchor.

Even though the IMST believe that the barge had been manouevering with difficulty since 0013 hours, they fail to take issue with the fact that the barge anchor had not been prepared previously. It is a standard marine practice to prepare the anchors to release in an emergency if there are problems with the vessel and anchoring is an emergency option. Had it been previously prepared then it could have been released as soon as the tow line parted. This must have formed part of the safety management system implemented on board the marine spread by its operators and managers. International guidelines always show that an anchor should be prepared for use if control of a marine vessel is lost, e.g. the ICS Bridge Procedures Guide has the following check list for the loss of a main engine:

Quote

CI MAIN ENGINE OR STEERING FAILURE

Action to be carried out:
Inform master
Take action to manoeuvre ship away from danger
Prepare for anchoring if in shallow water
Exhibit "not under command" shapes/lights
Commence sound signaling
Broadcast URGENCY message to ships in the vicinity, if appropriate Modify
AIS status message to communicate relevant information
Inform VTS or port authority if in controlled or similarly monitored waters

Unquote

Additionally, the guidance given in the IMO Guidelines for Safe Ocean Towing:

Quote

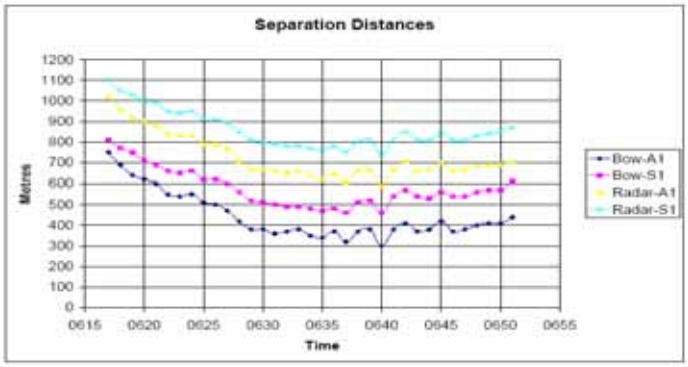
13.18 Towed objects should be equipped with an anchor, suitable for holding the towed object in severe weather conditions, that is securely attached to a chain cable or wire and is arranged for release in an emergency by persons on, or boarding the towed object, unless rendered impractical due to the design or conditions of the towed object.

Unquote

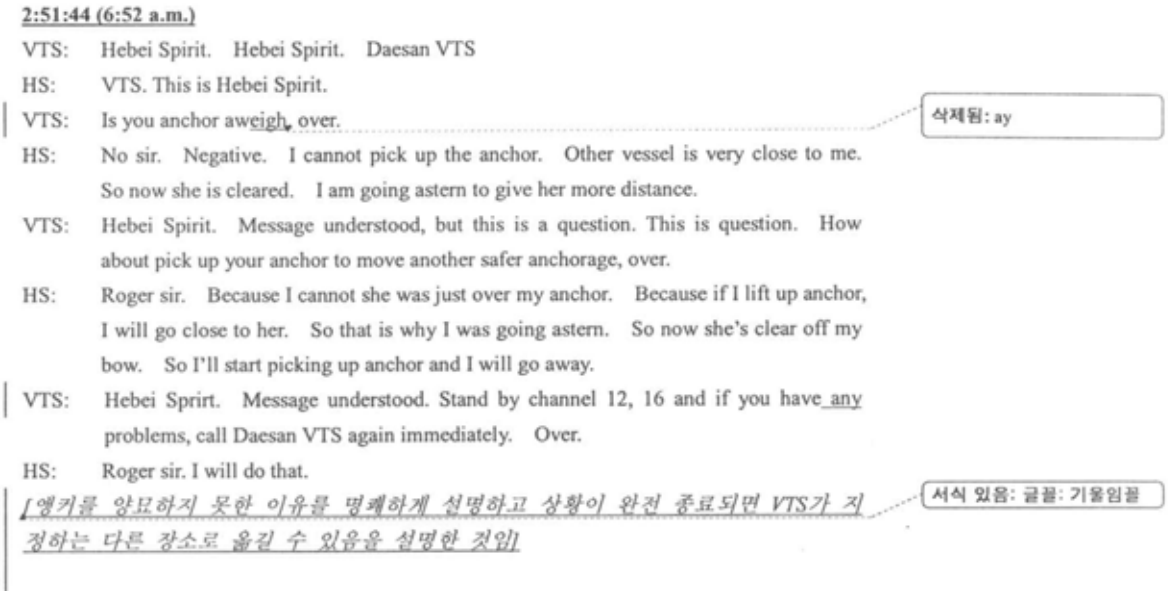
show that the anchor fitted on the barge should be used for this purpose and by not preparing this anchor earlier shows either a fundamental failure of the operation and management of the marine spread or the fact that the crews did not believe the marine spread was not controllable.

Meanwhile, as the distance between "Samsung No. 1" and "Hebei Spirit" did not increase, the Daesan VTS called "Hebei Spirit" by VHF at around 0652 hours, right before the severing of the towing line, to again ask about whether it is possible to move the vessel by heaving up the anchor, but her answer was that it was impossible.

This particular paragraph places emphasis on the request by VTS for "HEBEI SPIRIT" to heave anchor. At the time of this request the marine spread had passed the closest point of approach and was moving away, contrary to the claim in this paragraph that the distance was not increasing as can be seen from the attached diagram below.



It is necessary to look at the full transcript of what was said between VTS and the VLCC at this time:



2:51:44 (6:52 a.m.)

VTS: Hebei Spirit. Hebei Spirit. Daesan VTS

HS: VTS. This is Hebei Spirit.

VTS: Is you anchor aweigh, over.

삭제됨: ay

HS: No sir. Negative. I cannot pick up the anchor. Other vessel is very close to me. So now she is cleared. I am going astern to give her more distance.

VTS: Hebei Spirit. Message understood, but this is a question. This is question. How about pick up your anchor to move another safer anchorage, over.

HS: Roger sir. Because I cannot she was just over my anchor. Because if I lift up anchor, I will go close to her. So that is why I was going astern. So now she's clear off my bow. So I'll start picking up anchor and I will go away.

VTS: Hebei Sprirt. Message understood. Stand by channel 12, 16 and if you have any problems, call Daesan VTS again immediately. Over.

HS: Roger sir. I will do that.

[앵커를 양묘하지 못한 이유를 명쾌하게 설명하고 상황이 완전 종료되면 VTS가 지정하는 다른 장소로 옮길 수 있음을 설명한 것임]

서식 있음: 글꼴: 기울임꼴

Even given the above, had the request from VTS been carried out, the action of heaving anchor would have resulted in the forward movement of the VLCC and reduced the distance between the vessels which would negate the initial actions. That is why the master gave his explanation which was accepted by VTS.

Under the circumstances where the towing line of the lead tug had snapped, the towing ability of "Samho T-3" alone was not enough to tow such a large vessel, i.e., "Samsung No. 1," which was rapidly approaching "Hebei Spirit" due to the wind and waves. Gan Tae Kim and Seung Min Cho reported to the Daesan VTS the severing of the towing line of "Samsung T-5" at around 0655 hours and 0657 hours, respectively, when the collision with "Hebei Spirit" became imminent, and informed them that normal towing was impossible.

This is factually misleading. The VHF transcript does not show that they explained that they were having difficulty in towing. The full transcript at 0655 hours is shown below:

2:55:05

VTS: Samho T3 Daesan VTS. Samho T5. Please come on Channel 12.

Samho: *There is a problem. Hebei Spirit. Please heave up anchor and send them further away.*

VTS: Channel 12 please. Samho T3. Daesan VTS (NB: "*Samho T3. Daesan VTS*" repeated 3 times)

In response, the Daesan VTS again repeated its request to "Hebei Spirit" to move away from the area by using the main engine and heaving up the anchor at around 0658 hours.

Once more, IMST are misleading the reader, the actual transcript of this conversation is reproduced below:

2:57:31

VTS: Hebei Spirit Daesan *VTS.*

HS: Go ahead

VTS: Hebei Sprit. This is Daesan VTS. Now she can not yet clear. Not yet clear of you, so stand by your engine, and heave up your anchor please.

HS: Sir, I cannot. I am letting go my anchor from the bitter end. I am dropping my anchor from the bitter end. I am trying. There is some problem on my vessel.

[근접통과가 무사하게 진행된 후 뜻하지 않게 예인색이 끊어지고 상대선박의 베어링이 346도로 고정되었다가 서서히 표류하며 본선으로 다가오는 상황임;

선장은 bitter end pin을 뽑아 탈출하려 하나 선원들로부터 잘 뽑히지 않는다는 보고를 받았을 때임]

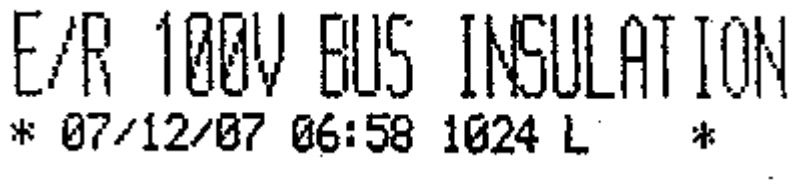
서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

It is clear from this that before 0657 hours the Master of "HEBEI SPIRIT" had recognized that something had happened to the marine spread and it was approaching rapidly. He had already instructed the Chief Officer, who remained on the forecastle to attempt to disconnect the bitter end of the cable, but that the Chief Officer was experiencing difficulty in this action. Removing the bitter end of an anchor cable is not an easy or usual operation as the IMST believe. I will show this in more detail below, but suffice to say here that removing a bitter end is difficult and this is what the master was referring to in the VHF message.

After the emergency anchoring, the barge master Yi Hyun Kim instructed the barge bosun to keep paying out the anchor chain. However, the distance between "Samsung No. 1" and "Hebei Spirit" had already narrowed to much, and the holding power of the anchor was not enough. In the end, these two vessels got closer to each other, and the hook located on the lower half of the boom of the crane of "Samsung No. 1" collided with the upper part of the mast located at the bow deck of "Hebei Spirit" at around 0706 hours on December 7, 2007, about 5.1 miles and 252 degrees from Shin-do lighthouse, Wonbuk, Taean, Chungnam (36-52.7N, 126-03.7E). ([Picture 20])

This timing is not correct. The first contact between the unsecured spreader beams on the falls of the crane contacted the fore mast damaging the navigation lights, creating sparks which were visually seen. The engine room alarm logger has the following alarm recorded at 0658 hours:

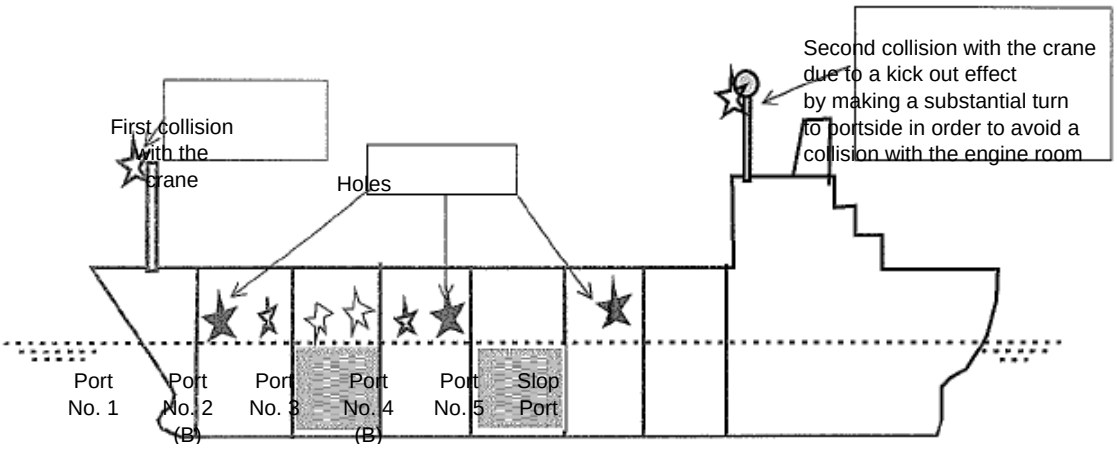


This alarm description is a leakage to earth (ships steel structure) of electricity from the appliances served by the 100 volt switch board. This is consistent with the damages to the electrical cabling and fittings on the foremast, including the lights, the sparking of which was visibly seen after the spreader beam of the crane barge contacted the foremast.

At around 0712 hours, the portside bow of "Samsung No. 1" collided with the upper part of the portside cargo tank no. 1 of "Hebei Spirit" at an angle of 20 to 30 degrees, creating holes and causing the crude oil carried by "Hebei Sprit" to spill from the vessel. Even thereafter, "Samsung No. 1" continued to hit the portside of "Hebei Spirit" and collided at 8 additional locations, thereby puncturing three holes at the portside cargo tanks no. 3 and 5 and causing a great quantity of crude oil to spill into the sea. ([Picture 20] and [Table 9])

Given the evidence from the engine room alarm logger, this timing of 0712 hours for the first contact with No.1 port cargo tank does not follow. It is more like 0706 hours, about 6 minutes after the first contact with the foremast.

After the first collision between the two vessels, Yi Hyun Kim discovered that the anchor chain of "Samsung No. 1" had been paid out 5.5 shackles (approximately 151 m), and thereafter, it continued to pay out 12 out of 14 shackles (approximately 330 m).



[Picture 20] Damage to "Hebei Spirit" due to the collision. There were a total of nine moments of impact and the puncturing of three holds. The gray parts are empty ballast tanks.

[Table 9] Size of the holes in "Hebei Spirit"

Oil Tank No.	*Distance between Holes and Upper Deck (m)*	*Size of Hole (mm) (Width × Length)*
1(p)	*Approx. 5.3*	*300 × 3*
3(p)	*Approx. 7.8*	*1,200 × 100 (Max.)*
5(p)	*Approx. 7.2*	*1,600 × 2,000*

As we will discuss below, we do not consider that these hole sizes reflect reality. The hole in No.1 port is far bigger than a 3mm, that is the size of a pencil lead, and we estimate its thickness to be 50mm, that is a total hole size of 130mm x 50mm.

At the time of the accident, strong winds of 15~18 m/s were blowing from the north/northwest (Beaufort scale 6 ~7), and the height of waves was 4 m or so. There was a southwesterly current of 2 knots, and visibility was good.

In my experience in the use of tugs I find it unusual that no attempts were made by "SAMSUNG T-5" and "SAMSUNG A1" to soften the impact between the barge and the anchored vessel. I also find it strange that the IMST have failed to comment on this lack of action by the attending tugs. Attempts to push and turn the crane barge to lessen the impact could have at least been attempted, but the IMST have totally ignored this point. Additionally, the IMO Guidelines for Safe Ocean Towing stipulate the following:

Quote

13.13 Emergency towing equipment should be provided in case of bridle failure or inability to recover the bridle. This equipment should preferably be fitted at the bow of the towed object and should consist of a spare bridle or towing pennant fitted with a floating rope and buoy allowing it to be picked up without any significant hazard.

Unquote

What the IMST have failed to examine is what was the emergency means of towing in place on the crane barge as recommended by these IMO guidelines, as they have subsequently shown that neither tug, individually, had the capability to tow the crane barge. Consequently, an emergency towing contingency should have been in place and known to all those onboard the spread. Again, this is the responsibility of the operators/managers and masters of the marine spread.

2) "Hebei Spirit"

A) Arrival at Daesan Port and Anchoring

"Hebei Spirit" loaded a total of approximately 263,944.5 M/T of crude oil at four ports, including Mina Al Ahamadi and Kafuji of Kuwait in the Middle East, Kharg Island of Iran and Zirku Island of U.A.E. 27 crewmembers (6 Indians, 16 Philipinos and 5 Chinese) including the marine accident related persons, the Indian Master Jasprit Singh Chawla (hereinafter, "Master Chawla") and the Indian Chief Officer Chetan Syam (hereinafter, "Chief Officer Chetan") were on-board and ["Hebei Spirit"] departed from Zirku Island of U.A.E. for Daesan, Chungnam, Korea at 1042 hours on November 16, 2007.

According to the planned voyage, this vessel sailed to the vicinity of Daesan in the afternoon of December 6, 2007, through the Indian Ocean and the East China Sea and was informed by the Daesan VTS through VHF channel 12 that she should drop her anchor outside the border of Daesan's harbour. The area was at the connection between the north gate of the TSS (Traffic Separation Scheme) of Heukdo Island and the passage for port entry to and exit from Daesan or Pyungtek, so shore-navigating vessels could have difficulties sailing. Nevertheless, Master Chawla had entered Daesan twice since boarding the vessel for the first time in Singapore on October 13, 2007, about two months ago. The anchoring location was almost the same as the very previous occasion, and thus, without a special examination of the sailing safety of the anchoring location, he made drafts of 19.98 m at the bow and stern with 8 shackles of the starboard anchor chain (8 shackles in the water and 9 shackles on deck) dropped at a depth of about 64 m at the location of Lat. 36°52.33' N Long. 126°03.17' E, which is approximately 4.4 miles off in a true bearing of about 254 degrees from Buoy No.1 of Daesan at 1918 hours on the same day.

Simply based on the fact that "HEBEI SPIRIT" anchored in almost the same location as on her previous visit to the port, does not give any credence to the implication made by the IMST that no safe planning of the location was carried out. The anchoring location was informed to the VTS who never advised those on the VLCC that it was unsafe. The fact that the "HEBEI SPIRIT" had anchored here on previous visits should be testament to the fact that this was for all intent and purposes as safe an anchorage spot for a VLCC as could be achieved and VTS obviously were in agreement.

From BA chart 1258 it can be seen that this is in good holding ground, clear of any dangers and shallows, has good holding ground of sand, is within easy reach of the pilot station, and is in an acceptable depth of water for a vessel drawing 20 meters draft.

A very large crude carrier at anchor and brightly lit, in an area where large vessels are known to anchor would pose no danger to the NE/SW flow of traffic in this area. It would be difficult to perceive that any competent mariner would disagree with this.

Moreover, in order to be brought alongside the SBM (Single Buoy Mooring) place of loading, around 20 miles northeast of this location, the vessel transitioned to an anchor duty system while waiting for the Daesan pilot who was scheduled to board at 1400 hours the next day. Master Chawla told the Chief Engineer, Chandok Anil Kumar, to have the engines ready for use at one hour's notice. Therefore, even while sailing, except for the engine room managed under an unmanned system, anchor duty was performed only on the bridge.

This latter statement by the IMST is irrelevant. The vessel is designed with unmanned machinery spaces and complies with all international regulations. Therefore, for the IMST to imply that watch should also be kept in the engine is wrong.

The weather at that time was B/F 5 with a northeasterly wind and a southwest current of two knots.

B) Night Anchor Duty (from 1918 hours on December 6, 2007, until the master went up to the bridge at 0606 hours the next day)

After dropping the anchor, "Hebei Spirit" was on anchor duty, which the Third Officer began to perform with one deck officer. Master Chawla went up to the bridge again at 2115 hours on the same day to keep the night order book and to go down to his chambers.

Chief Officer Chetan who went up to the bridge for anchor duty at 0400 hours on December 7, entrusted his duty to Chinese Cadet Xu Yang who was not yet experienced in navigating vessels without any duty officers.

There is no basis to state that the Chief Officer did not conduct the anchor watch. The anchor watch was conducted with three persons on the bridge. This is more than is usual for an anchor watch.

All bridge equipment was fully functional and in use. The GPS anchor watch facility was selected and functioning, the anchor position was regularly monitored and confirmed.

VHF communications were monitored as confirmed by the VHF VTS transcript.

When the movements of the marine spread were noted as being of concern, VTS were contacted to ascertain any information they may have about the marine spread. This notification was the first made by either party to the collision. Those on the tugs never responded to VHF calls made by the VLCC and VTS until they were contacted by cell phone by VTS. Therefore, to say that a proper lookout was not being maintained on "HEBEI SPIRIT" and then not take issue with those on the tugs who never responded to any VHF calls, that is, the evidence indisputably shows that they were not maintaining a proper lookout, clearly illustrates the impartiality displayed by the IMST. It is necessary to remind the IMST of Rule 5 of the Colregs:

Quote

Rule 5
Look-out
Every vessel shall at all times maintain a proper look-out by sight and hearing (my underlining) as well as by all available means appropriate in the prevailing circumstances and conditions so as to make full appraisal of the situation and of risk of collision.

Unquote.

The VTS VHF transcript evidence shows those on "HEBEI SPIRIT" were maintaining a proper look out, and those on the marine spread were not.

All of the foregoing disproves the claim that "HEBEI SPIRIT" was not conducting an anchor watch as required.

Being occupied with other things, Chief Officer Chetan did not make any systematic observations of the nearby vessels' movements via ARPA radar.

Therefore, lookout duty was not in fact performed at all, as the approximately 730 m long Marine Spread, including "Samsung No. 1," a large floating crane with several bright work lights displayed on the deck at night, was not detected. It was being towed by tugboats, and the two tugboats, which were towing the vessel by the barge's stern, were drifting towards "Hebei Spirit," losing towing ability under unfavorable weather conditions at a distance of only about 3 miles or so from the direction of the vessel's mid-bow, which was at a true bearing of approximately 310 degrees at that time. As such, anchor duty was not actually performed.

This is purely a twisted fabrication of the evidence. The crane barge was approaching the anchored tanker from about 0400 hours to about 0445 hours but its speed was slow. At 0430 hours, it would have only been a problem for "HEBEI SPIRIT" about 1.5 hours later. Therefore, to say that as those on "HEBEI SPIRIT" did not respond to this as evidence of not keeping a proper lookout fails to take into account any form of good seamanship practices. The watchkeepers would keep a periodic observation on the marine spread's approach by visual and radar observations. The lights it displayed gave no indication to any trouble with the marine spread, in fact the presence of three tugs would have given an observer confidence that the tow was under complete control.

Immediately it became apparent that the marine spread posed a risk, the Chief Officer called the Master to the bridge as per the Masters standing orders.

The claim therefore that the Chief Officer was negligent and failed to notice the marine spread is completely without basis.

The movements of the marine spread were being monitored, and the fact that prior to 0550 hours the marine spread posed no threat to the "HEBEI SPIRIT" is taken here as some kind of proof that its presence had not been noted. The Chief Officer monitored the approach of the marine spread after it again altered its track direction and once it became apparent that it was steady on its new track called the Master to the bridge, 53 minutes before the collision took place. This alone proves that he was carrying out his duties as required.

The claim also seems to be based around the fact that there was an officer cadet on the bridge during this period and undergoing instruction from the Chief Officer in the duties and responsibilities of being in charge of an anchor watch. It is normal practice for cadet officers to undergo instruction at such times and in fact this process leads to an increased awareness on the bridge as the officer giving instruction needs to ensure good watch-keeping practices are carried out at all times.

While the direction of the bow was yawing in starboard and port directions from the northwest on the wind side, the Marine Spread was being pushed for about one hour in a southwest direction toward the bow of "Hebei Spirit," as explained above.

This is factually misleading. The cause recorder trace shows that from 0400 to 0430 hours the bow of "HEBEI SPIRIT" only changed from 293° to 305° and from 0430 to 0500 from 305° to 315°. Yawing is a term that describes rapid and substantial changes of heading whilst at anchor. I have attached an extract from Danton's Theory and Practice of Seamanship to illustrate such a movement.

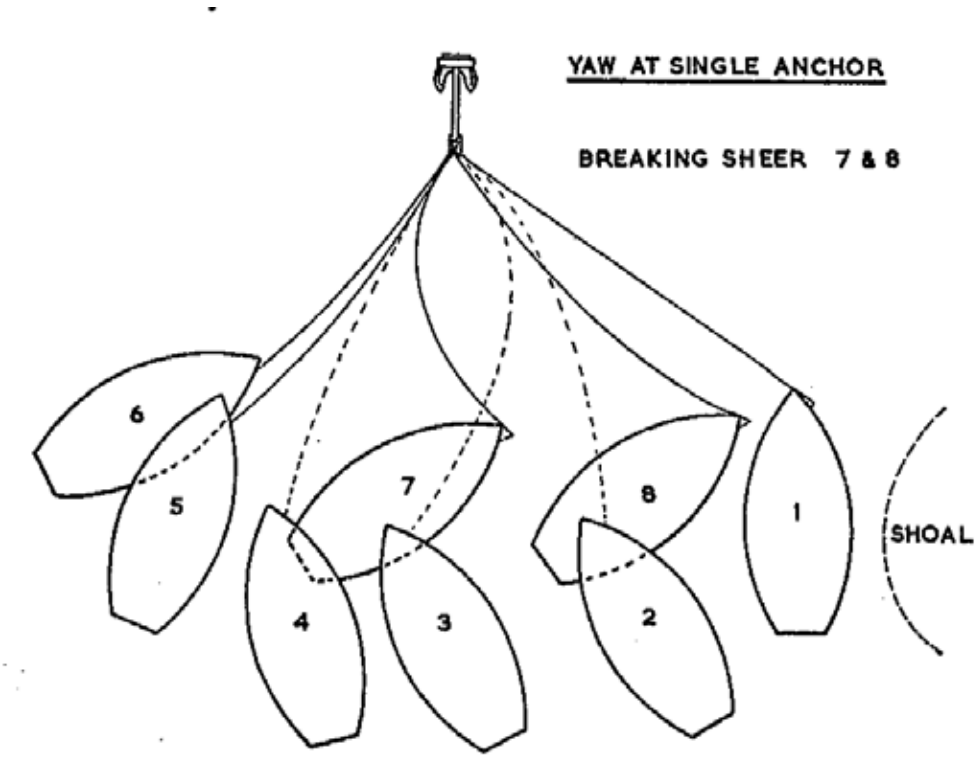


FIGURE I.7

It can be seen that the yawing illustrates substantial and rapid changes in the ships head. The course recorder trace shows the head of "HEBEI SPIRIT" never yawed like this throughout the time it was anchored.

Additionally, as the subsequent changes of track show, the marine spread was not out of control as the IMST have implied here, at the mercy of the wind and waves. If it was out of control, it would not have changed direction around an arc from west, via south, to east. These changes in direction were not because of a change in direction of the wind and waves, but an alteration of course by the tugs.

Then, from 0450 hours on the same day, the entire Marine Spread changed course by a wide angle of about 90 degrees and moved to the east. At 0530 hours on the same day, the large barge of the Marine Spread, "Samsung No. 1" neared a distance of about 1.5 miles from the starboard bow of "Hebei Spirit" at approximately 20 degrees, which was at a heading of 345 degrees. The Marine Spread continued such extremely unconventional navigation and was approaching "Hebei Spirit" gradually.

As described above, the wind, waves and current did not suddenly change at this time. The marine spread tugs altered course, so its track also changed. Therefore, the tugs retained a means of control over the marine spread that could be used to keep clear of the anchored "HEBEI SPIRIT" and the three other anchored vessels.

On the easterly track, the marine spread was in no way in risk or danger to "HEBEI SPIRIT"; it was tracking to the east. To say that this was "unconventional navigation" and was approaching "HEBEI SPIRIT" gradually is wrong and applied in hind sight. From the perspective of "HEBEI SPIRIT", the marine spread, was displaying numerous bright lights, had three tugs attached and was over 1.5Nm away and moving in a direction away from the anchored VLCC. Even if it was of any interest, which is doubtful given its track, an observer on the VLCC could not jump to a conclusion that the marine spread was in difficulty. It could have been anchoring, commencing work or anything. The fact is that, there were no calls or signals indicating that it was navigating in an unconventional manner or having problems, so there was no justifiable reason for those on "HEBEI SPIRIT" to think that was anything wrong at the time which could cause them concern.

The names of three of the Marine Spread vessels, such as "Samsung T-5," "Samho T-3" and "Samsung A-1," could have been identified through AIS (Automatic Identification System) information, appearing on the radar of "Hebei Spirit."

The "HEBEI SPIRIT" duty officer did identify the names of the attending tugs and did call them to ascertain what they were doing at 0613 hours when the marine spread altered its course again to approach the anchored VLCC. The fact remains that these calls were not answered, nor were they answered when apparently called by the VTS earlier. It needed the VTS to contact the marine spread by cell phone to force them to listen to the VHF. So for the IMST to imply that those on "HEBEI SPIRIT" could have contacted the marine spread at this time is bizarre. Not only was the marine spread of no concern to the anchored tanker at this time, but no one was maintaining a proper lookout on the tugs as VTS discovered but did not inform to any of the anchored vessels.

Nevertheless, Cadet Xu Yang, having been left alone on the bridge to work on behalf of Chief Officer Chetan from 0400 hours on the same day, altogether failed to recognize the seriousness of the situation, due to which he was not able to conduct a strict lookout, including calling them in advance on the VHF, asking the Dasean VTS, etc. or to determine a risk of collision. Basic anchor duty was not performed on this vessel. A cadet is not an officer in charge, and thus, it is more reasonable to conclude so.

There is no basis for this assertion. The Chief Officer was on the bridge from 0400 hours with the Cadet both maintaining a proper anchor watch, assisted by the duty sailor. It is astonishing that the IMST are saying that a proper lookout was not maintained on board the anchored VLCC on the basis that they never took any action to avoid collision from 0400 hours onward. From 0400 hours, the marine spread was approaching the anchored VLCC but was so far away that it would take about two hours before it achieved its position of closest approach on this track. In this case, a prudent watch keeper would monitor the situation. Then, at about 0445 hours, the marine spread abruptly changed its track and was moving away from the VLCC and was no threat whatsoever. It was, though, a threat to the other anchored vessels and I wonder whether the IMST investigated these vessels to see if they had called the spread on the VHF. The IMST again omit to mention here that the VTS apparently called the spread to determine their movements and did not get a reply. In fact, the person who initiated the communications on the approach of the marine spread to the anchored VLCC was not the tug crew or the VTS, but as the transcript shows, the navigators on the bridge of "HEBEI SPIRIT". Even though this initial call was made over 50 minutes before the collision, the VTS were unable to raise the tugs. It took an unacceptable 18 minutes for a response to the initial call to be received by those on "HEBEI SPIRIT". By this time, they were the only party to recognise the seriousness of the situation and were taking action.

From around 0530 hours, though the heading of the tugboats was northward, the entire Marine Spread was being pushed almost to the east, and the tugboats changed their course substantially to port, so that the bow was facing 270 degrees. Nevertheless, the Marine Spread was pushed to the south, facing the bow of "Hebei Spirit" again.

As a result, at 0600 hours on the same day, the Marine Spread approached approximately one mile from the bow of "Hebei Spirit," which had a heading of about 345 degrees, at a speed of about 1.5 knots.

It was only then that the Cadet Xu Yang perceived the danger and informed the Chief Officer Chetan of that. The Chief Officer Chetan reported to the master the seriousness of the situation at 0605 hours on the same day.

Once more, the IMST fail to understand this situation. At about 0530 hours, the tugs again altered the direction of the track of the marine spread. From heading east, the track went west then in a south direction towards the anchored "HEBEI SPIRIT" at about 0550 hours. At its slow moving speed it would take about one hour to close on the anchored tanker. At this speed the development of the new track would take time to assess to determine if a problem would develop. Therefore, this monitoring and assessment of the situation was in a timely manner, as was the calling of the Master at 0605 hours. As described above, those on the "HEBEI SPIRIT" were the first to recognise a developing problem and initiate action; neither the VTS or the tugs initiated any action at this time. Therefore, to say that a proper lookout on the VLCC was not being maintained belies the facts of this matter as evidenced by the VHF VTS transcript. Additionally, there was a prompt response which allowed sufficient time for the anchored VLCC to take action to avoid any contact with the crane barge. The collision occurred after the crane barge was manoeuvred clear from the anchored VLCC due to the sole reason that one tow wire broke.

C) Maneuvers to Avoid Collision by the Master Chawla (0606 hours on December 7, 2007, to 0706 hours on the same day)

(1) Initial observation of the Marine Spread and recognition of the circumstances by the Master Chawla

The Master Chawla received a phone report from the Chief Officer Chetan that the Marine Spread was approaching closely, and he went up to the bridge at 0606 hours on the same day. He watched the large barge, "Samsung No. 1," displaying several bright work lights from the direction of the bow port, which was being pulled by two tugboats at a distance of about 0.7 miles or so and at about 20 degrees from the starboard bow of "Hebei Spirit."

This statement fails to take into account the perspective from the VLCC and is written in hindsight. What could be seen from the VLCC by radar, AIS and sight would be three tugs. The Master would have no way of knowing that the "SAMSUNG A1" was unable to assist the tow.

At this time, the red light on the port side and three white lights, the tow lights of "Samsung T-5," and the red light on the port side of "Samsung A-1" were seen, but he was not able to identify the navigation lights of "Samsung No. 1" because the work lights on the deck were too bright.

Master Chawla measured the movements of "Samsung No. 1" using the ARPA radar, in order to ascertain the movements of the Marine Spread. It was found that, while the approximately 730 m-long Marine Spread was heading west, it was actually proceeding south diagonally towards the port side of "Hebei Spirit," crossing her bow at a speed of about 1.5 knots. Thus, he expected the Marine Spread would pass at about a CPA (Closest Point of Approach) of 0.3 miles from the port bow.

The IMST gloss over the fact that the Master was called from his sleep at 0605 hours, was on the bridge 1 minute later and made a call to the VTS only 4 minutes after being called. This rapid timing clearly shows that the Chief Officer had briefed the Master on the situation which the Master could then confirm by a glance to the ARPA. The implication from the IMST is that the Master commenced this assessment solely by himself whereas, in practice, he would be briefed by the Chief Officer, confirming what he was told by reference to the ARPA. This short time period shows that the Chief Officer had fully monitored and assessed the situation allowing the Master to be quickly briefed so that he could almost immediately decide on his actions.

(2) Confirming the identity of the Marine Spread while moving astern by putting the main engine to dead slow astern and paying out the anchor chain

After ascertaining the movements of the Marine Spread, Master Chawla called the Daesan VTS on VHF channel 12 at around 0609 hours to ask about the identity of the Marine Spread. But the VTS had also failed to make VHF communication with the tugboats and asked him to wait a while. Accordingly, in order to make the vessel move backwards and to increase the passing distance of the approaching Marine Spread, Master Chawla called the Chief Engineer at 0610 hours and asked him to prepare the main engine for use and ordered the Chief Officer Chetan to go to the bow and prepare to pay out the anchor chain.

Master Chawla called both "Samsung T-5" and "Samsung A-1" on VHF channel 16 at 0614 hours, but he also failed to receive any answer.

Once more, the IMST do not take issue with the fact that action was initiated by the VLCC and no response was received to calls from the anchored "HEBEI SPIRIT" to the tugs which had been identified by AIS. Consequently, by the failure of both the tugs and VTS to respond, the Master commenced taking action himself even though he was the anchored vessel, and the marine spread was underway without any indication broadcast that they were having any difficulty whatsoever in controlling the tow.

Almost at the same time, he was told that the main engine was prepared and did a trial run by putting the engine to dead slow astern only and stopping it at 0614.30 hours.

As the engine data logger shows, this was not a trial run of the engines. The engine room were testing the engines before handing control over to the bridge as this extract shows

	D.SLOW	-AH	C	06:14.5
@	D.SLOW	-AH	C	06:14.5
	STOP		C	06:14.5
@	STOP		C	06:14.5
	D.SLOW	-AS	B	06:17.0
	STOP		B	06:19.0
	D.SLOW	-AS	B	06:20.5
	STOP		B	06:23.0
	D.SLOW	-AS	B	06:26.0
	STOP		B	06:28.5
	D.SLOW	-AS	B	06:29.5

The engine room ran the engine ahead, not astern. The "C" stands for engine room control the "B" for bridge control. This is a standard marine practice.

Then, at around 0617 hours, while putting the main engine to dead slow astern, he ordered the Chief Officer who had gone out to the bow to start paying out the anchor chain.

At this time, the marine spread was about 0.5Nm away and had a CPA of 0.3 Nm. Therefore, the Master could not move ahead as this would reduce the distance between the VLCC and the marine spread increasing the possibility of collision. He therefore, paid out the anchor chain to increase this passing distance.

Then, at 0627 hours, when the 12 shackles on deck were paid out, which resulted by paying out three more shackles of the anchor chain, putting the engine to dead slow astern for about 7 minutes, and repeatedly stopping the engine three times, the VTS advised that the Marine Spread was having difficulty maneuvering and was drifting.

This is factually misleading. The Chief Officer paid out a further 4 shackles of cable until there was 13 shackles on deck, not 12. The engine movements astern increased the distance by stretching the cable, as shown by the AIS positions of the vessel at this time. What the IMST fail to point out is that at 0627 hours, when they called "HEBEI SPIRIT" to first notify the VLCC that the spread was experiencing difficulties, it was 18 minutes after the "HEBEI SPIRIT" had initiated the communications and already commenced taking action.

It was communicated through VHF channel 16 by Gan Tae Kim of "Samho T-3," who saw "Hebei Spirit" move astern at around 0629 hours, that "…your vessel's anchor is being dragged…"

Again, the IMST have taken part of the agreed VHF VTS transcript out of context. I have included the full part of the conversation below:

02:28:59 (6:29 to 6:30 a.m.)

VTS: Hebei Spirit. Hebei Spirit.

Samho: This is Samho T3. How do you read me, over.

Navy: This is the Navy. Message understood.

HS: This is Hebei Spirit. Complete.

Samho: This is Samho T3. Please check anchor position. I didn't know your ship dragging (inaudible) anchor dragging anchor now.

HS: Yeah. Yeah. Yeah. Now I already checked already checked we checked the our anchor position.

삭제됨: changed

[우리가 paying off하고 뒤로 가고 있는 모습을 마치 dragging한다고 착각하여 교신한 내용임. 삼호 T3 선장은 정박선을 염두에 두고 자신들이 피해서 운항할 것을 예상하고 있었고, 불과 100미터 움직이는 유조선의 움직임을 일찌감치 면밀히 관찰하면서 운항하고 있었다는 것을 보여주는 것임. 또한 유조선이 dragging이 될 경우 자신들의 항행을 변경해야 할 필요성이 생길 수 있으므로 재삼 확인을 요청한 것임]

Samho: (inaudible) [ship dragging anchor now][?]

HS: (inaudible)

The bodily movement of "HEBEI SPIRT" was consistent with the action taken by her Master to walk back the cable and run his engine astern, thereby increasing his CPA with the marine spread and reducing the risk of collision up to the point where the marine spread passed ahead and started to move away.

The increasing distance between "HEBEI SPIRIT" and the marine spread is simply the result of the VLCC coming astern on the engine, paying out 4 shackles of anchor cable, straightening the cable on the sea bed and stretching the catenary leg of the anchor system.

(3) Repeated requests by the Marine Spread and the VTS to heave up anchor and the collision occurred while dragging anchor

The Master Chawla was requested by Gan Tae Kim of "Samho T-3" at around 0630 hours to move the vessel by heaving up the anchor. At the same time, he was requested by the VTS to do the same and to take utmost measures for safety. However, he informed the VTS that it was impossible to move the vessel by heaving up the anchor, for there was concern that the vessel would move towards and collide with "Samsung No. 1" if the anchor was heaved up. As a result, while 12 shackles of the anchor chain was all paid out, leaving only two shackles, the barge "Samsung No. 1" was crossing at only about 300 m off the bow of "Hebei Spirit" toward the vessel's port side.

The VHF conversations have to be read in their full context as they clearly show that the Master explained his actions which were accepted by the VTS:

02:30:17

Samho: Hebei Spirit, this is Samho T3, do you read me over.
HS: Yes, yes, Hebei Spirit
Samho T3: Stand by, stand by please.

삭제됨: VTS

Navy: *This is the Korean Navy. Can you confirm exactly when you can wind the ship.*
HS: Come again sir?
Samho: Please you move. Stand by engine. And heave anchor.
HS: I can't heave anchor, If I heave up, I am coming and colliding you. I am lowering my anchor. I am paying out. I am going clear of you. Going astern.
Navy: *If you proceed at 290 degrees, we will have some problems at this end so please anchor at the current position.*

삭제됨: re
삭제됨: will come
삭제됨: e with

Samho: Over

[[예인선단은 우리의 뒤편을 통과하려는 의도였기 때문에 우리가 뒤로 가는 것을 불편하게 생각하고 앵커를 당겨줄 것을 요청하는 것임]][삼호T3.도 조심스럽게 우리 근처를 통과하는 상황임.]

서식 있음: 글꼴: 기울임꼴

02:31:17

VTS: Hebei Spirit.

02:31:19 (6:31 am)

HS: VTS. This is Hebei Spirit.
VTS: Hebei Spirit. This is Daesan VTS. I advise you to take best measure best measure for safety. For example, heave up anchor. And ready stand by engine, over.
HS: There is no time to heave up anchor. Because they are just three cables ahead of me. I am just lowering my anchor more. And I am going astern. To… so that they can clear my bow.
VTS: Message understood captain.
HS: Ok.

[HS에서 이미 최선의 조치를 수립하고 시행 중에 있었다는 사실을 VTS에 보고하고, VTS에서 조치내용을 이해하겠다고 답변한 것임.]

서식 있음: 글꼴: 기울임꼴

서식 있음: 글꼴: 기울임꼴

This point by the IMST is self contradictory and a circular argument, the claim being that the Master of "HEBEI SPIRIT" refused the request from VTS to heave his anchor, which led to the barge "SANSUNG NO.1" passing only 300mtrs ahead of the "HEBEI SPIRIT"'s bow.

As above, the action of the Master to go astern and pay out the cable was correct in this case. Heaving the anchor would undoubtedly have reduced the passing distance of marine spread at the least and could just as easily have caused a collision at that point in time.

The Master Chawla put the main engine at dead slow astern again for about two minutes from 0630 hours, and at 0632 hours, "Samsung No. 1" finished crossing off the vessel's bow. At around 0640 hours, the barge was passing at a CPA of approximately 0.3 miles at a true bearing of about 340 degrees, crossing towards the port side direction

Therefore, what the IMST do not highlight is that the action of the Master was correct, because it was successful.

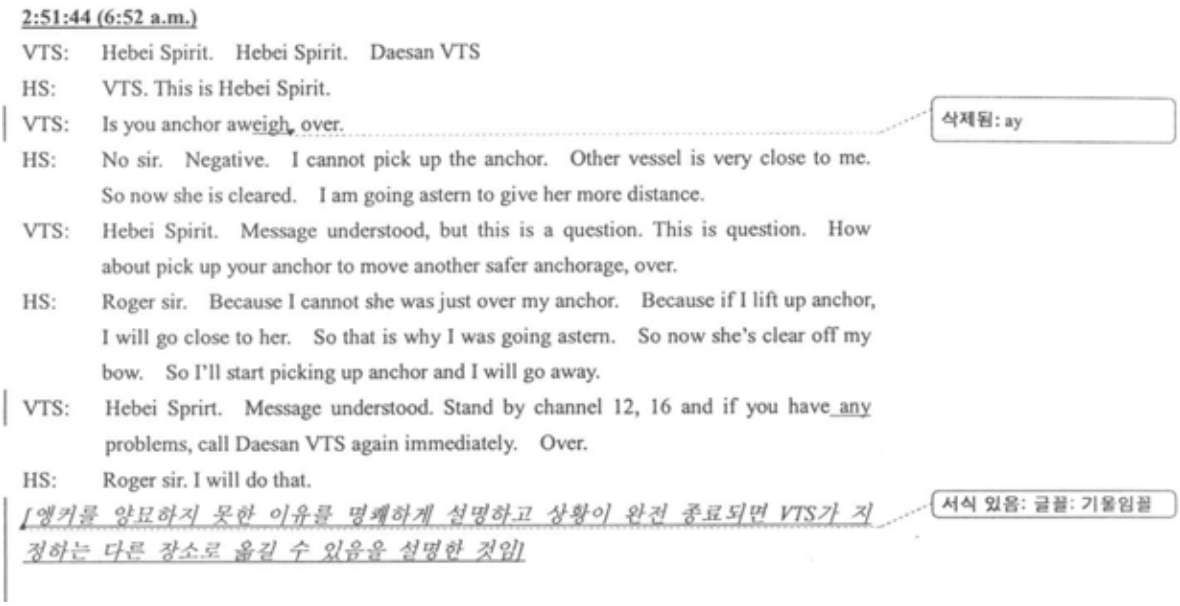
The Master Chawla did not use the main engine for about 14 minutes until about 0646 hours and waited until the Marine Spread passed and became more distant. Even though there were no more shackles to pay out, he put the engine to dead slow astern for about 8 minutes again and was then dragging the anchor to go astern.

The IMST fail to understand the Master's action here. He did not, and never attempted to, drag the anchor. The dead slow astern engine movement was purely to stretch the anchor cable to ensure that the distance from the marine spread did not close.

Additionally, the implication here is that the Master could have paid out more shackles. As described above, 13 shackles were now on deck, not 12, and there was only one shackle in the chain locker. Further, there was now no need to pay out anymore as the marine spread was passing clear.

While doing so, at 0652 hours, he was asked by the VTS if it would be possible to move the vessel by heaving up the anchor. At around 0654 hours, when he stopped the main engine temporarily, he saw "Samsung T-5" suddenly move forward, due to the towing line breaking, and then return to the side of "Samsung No. 1," but he did not know that it was due to the breaking of the towing line.

Once more the IMST have taken a particular VHF statement from the VTS out of the context of the overall conversation to imply that the Master was refusing VTS advice. I have again attached the full conversation below to show that the Master gave his reasons, clearly, which VTS understood:



2:51:44 (6:52 a.m.)

VTS: Hebei Spirit. Hebei Spirit. Daesan VTS

HS: VTS. This is Hebei Spirit.

VTS: Is you anchor aweigh, over.

삭제됨: ay

HS: No sir. Negative. I cannot pick up the anchor. Other vessel is very close to me. So now she is cleared. I am going astern to give her more distance.

VTS: Hebei Spirit. Message understood, but this is a question. This is question. How about pick up your anchor to move another safer anchorage, over.

HS: Roger sir. Because I cannot she was just over my anchor. Because if I lift up anchor, I will go close to her. So that is why I was going astern. So now she's clear off my bow. So I'll start picking up anchor and I will go away.

VTS: Hebei Sprirt. Message understood. Stand by channel 12, 16 and if you have any problems, call Daesan VTS again immediately. Over.

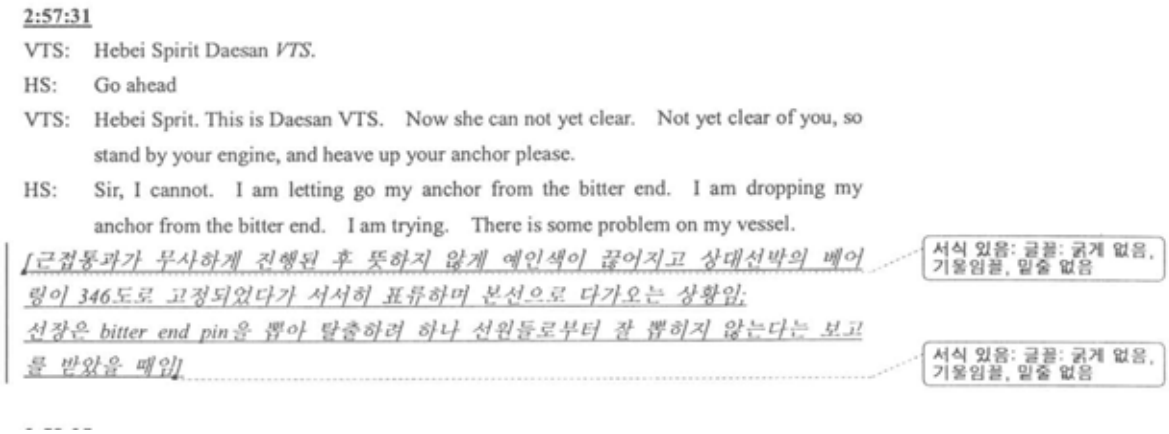
HS: Roger sir. I will do that.

[앵커를 양묘하지 못한 이유를 명쾌하게 설명하고 상황이 완전 종료되면 VTS가 지정하는 다른 장소로 옮길 수 있음을 설명한 것임]

서식 있음: 글꼴: 기울임꼴

However, "Samsung No. 1" approached the vessel again due to the severing of the towing line, and thus, at the time of putting the engine to dead slow astern, it was continuously requested by the VTS to heave up the anchor and use the engine to move the vessel.

Again, the IMST are taking the requests from VTS out of context as the above message shows. After the towline had parted, and after the Master had started taking action on the VLCC there was the following conversation with VTS:



2:57:31
VTS: Hebei Spirit Daesan *VTS.*
HS: Go ahead
VTS: Hebei Sprit. This is Daesan VTS. Now she can not yet clear. Not yet clear of you, so stand by your engine, and heave up your anchor please.
HS: Sir, I cannot. I am letting go my anchor from the bitter end. I am dropping my anchor from the bitter end. I am trying. There is some problem on my vessel.
[근접통과가 무사하게 진행된 후 뜻하지 않게 예인색이 끊어지고 상대선박의 베어링이 346도로 고정되었다가 서서히 표류하며 본선으로 다가오는 상황임.
선장은 bitter end pin을 뽑아 탈출하려 하나 선원들로부터 잘 뽑히지 않는다는 보고를 받았을 때임]

서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

This clearly shows that the Master of the VLCC had already instructed the Chief Officer to attempt to release the cable from its bitter end.

The situation then became urgent, and he put the engine to slow astern and half astern at 0658 and 0659 hours, respectively, so that the high temperature alarm of the C.F.W. outlet of the main engine, no. 3 cylinder, went off, and the main engine's revolutions went to automatic slow down so that it became hard to use the engine. Therefore, he informed the VTS that "…there is some problem on the vessel and it is not possible…"

As can be seen from the above conversation, this statement made by the Master referred to the difficulty in releasing the bitter end, not problems with the main engine, and was made before the times referred to by the IMST; 0658 and 0659 hours. As the engine room alarm records show, the collision occurred at about 0658 hours so the subsequent engine movements astern were attempted to limit the impact of the collision as absolutely nothing else could have been done.

"Hebei Spirit" used her main engine for approximately 21 minutes in total in trying to avoid collision during the period of 45 minutes and 30 seconds from 0614.30 hours on the day of the accident when the main engine was initially used until 0700 hours.

The total time of main engine use over the period before the collision is of no relevance. However, what is of relevance is the indication of how early "HEBEI SPIRIT" commenced taking action when there had been no response from the tugs or the VTS.

At around 0700 hours on the same day, "Samsung No. 1" was drifting toward the bow, and the Master Chawla then told the Chief Officer Chetan to break the bitter end pin of the anchor and to sever the anchor chain so that the vessel can move. However, it was too late for that to succeed, and at 0706 hours, "Hebei Spirit" collided with the barge "Samsung No. 1," as described above.

This again is factually misleading as the VHF VTS transcript shows. At 0657 hours, the Master had already explained to the VTS that they were trying to release the bitter end but were having problems. This means the action taken by the Chief Officer to release the bitter end, and to find it difficult, was made before 0657 hours, not at 0700 hours as the IMST have incorrectly stated here.

The Master Chawla succeeded in kicking out the stern by putting the rudder to hard a port and putting the engine to dead slow ahead at 0721 hours, in order to prevent a puncturing of the port side of the engine room, when "Samsung No. 1" continued to hit the vessel towards her stern, making holes on the port side of "Hebei Spirit." But as the stern of "Hebei Spirit" swung to the starboard side, the mast on the upper part of the bridge of "Hebei Spirit" hit the hooks of the "Samsung No. 1" crane. As a result, satellite communications was damaged and cut for about 6 hours.

It was reported to him at 0728 hours that the oil cargo was leaking, and he went out to the port wing deck to ascertain that the cargo was being spilt from the port cargo tanks nos. 1, 3 and 5.

Right before the first moment of impact, when the hooks of the crane boom hit the mast on the bow deck of "Hebei Spirit," the Master Chawla sounded the general alarm on-board the ship and ordered the crew to gather in front of the lifeboats in accordance with the emergency plan. He was informed of the oil spillage and made a marine pollution report to the VTS by VHF.

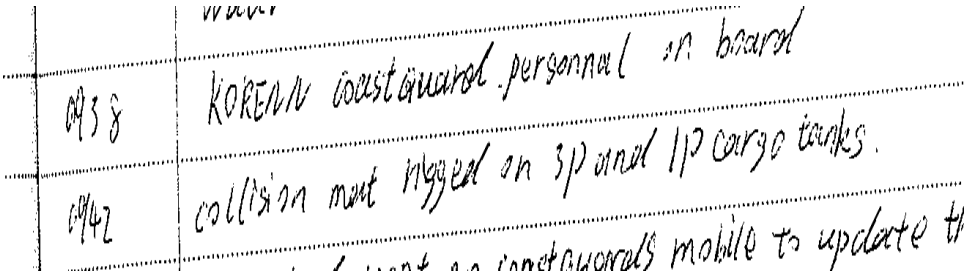
The IMST fail to congratulate the Master on this action in foreseeing a potential catastrophic disaster by ensuring his crew were up and available to abandon ship should it become necessary.

Afterwards, he ordered the Chief Officer Chetan to work on sounding the levels of all the cargo tanks, ballast tanks, empty spaces, engine room and all other tanks in order to ascertain whether the oil cargo or seawater was spilling out or in. The oil cargo spilt from the portside cargo tanks into the sea was spread by a strong wind against the port side, so the deck became slippery and the person in charge of sounding was being sprayed with the oil. Therefore, the sounding work was not completed until 0945 hours on the same day. In conclusion, he did not take any measures to prevent the oil from spilling out of the vessel for as long as three hours.

I have covered this in more detail below but it is suffice to say here that the Master correctly prioritised the requirements of his SOPEP, that is safety of life, the ship, then the environment. For the IMST to criticise the Master here by saying he took too long in responding to the spillage fails to take into account the internationally accepted practices for responding to accidents such as these. Additionally, this criticism has been done with the benefit of hindsight. At no time was there ever any criticism of the Master by the Korean authorities of his actions in the immediate aftermath of the collision.

At 0938 hours, when the sounding was almost completed, an officer from the marine police visited the site by helicopter. Only with his assistance were they able to start the work of tying collision mats over the holes in port tanks nos. 1 and 3, in order to prevent the oil from spilling.

This is factually misleading. The bell book records the marine police officer arriving on board at 0938 hours and the collision mats installed only 4 minutes later at 0942 hours, see below:



It would not be physically possible for the officer to land, issue instructions on the construction of these mats, and assist with their installation within 4 minutes. The construction of these collision mats commenced at 0750 hours and were concluded at the time the officer boarded and he was fortuitously there at the moment they were rigged.

The Chief Officer Chetan operated the IGS (Inert Gas System) and inserted inert gas into those tanks at 1000 hours on the same day in order to prevent negative pressure from being formed in the cargo tank from which oil was leaking, which resulted in air entering the cargo tank.

By operating the pump of the no. 2 tank, the oil cargo, which was spilling at a rate of 4,500m^3 per hour at only 1035 hours on the same day, when as much as three hours and thirty minutes had passed since the initial spillage of the cargo, this vessel began to transfer the oil cargo from the nos. 1 and 3 port cargo tanks to the nos. 3 and 5 central cargo tanks, where the upper parts were comparatively very empty. By inserting about 3,000 M/T of seawater into the starboard ballast tank from 1115 hours on the same day, the vessel was made to list to starboard by about 5 degrees. At 1150 hours, the oil cargo in the nos. 3 and 5 port cargo tanks was transferred to other cargo tanks.

This rate of spillage given here is exactly the same as the pumping rate of the cargo pumps which is too coincidental. I believe that this spillage rate has been confused with the pumping rate.

I will comment on the oil pollution in more detail below, but it is suffice to say here that the IMST are misleading the reader. To say that the upper part of the cargo tanks were comparatively very empty is misleading. Nos. 3C and 5C were loaded to 95.7% and 93.8% respectively, whereas the remaining cargo tanks were loaded to an average of 97.9% overall.

As a result, at 1100 hours the next day, the cargo in the nos. 3 and 5 port cargo tanks stopped leaking, and at 2030 hours on the same day, when the cargo in the no. 1 port cargo tank was divided and transferred to the nos. 1, 2, 4 and 5 central cargo tanks, spillage from the no. 1 port cargo tank stopped immediately.

This is factually misleading as I have detailed below. The hole in No.5 P was so large that its contents above the hole drained out in about half an hour. The leakage from No.3P concluded when the cargo pump was stopped after 1100 hours on the 7th December 2007. Our calculation of the rate of leakage below, clearly shows that this statement by the IMST is misleading. It is also implied above that the transfer from No.1 P was only started on the 8th December. This is also incorrect, the transfer from this tank was commenced during the afternoon of the 7th December 2007. I have detailed this further below. It is not mentioned here by the IMST, but vessels were promised to the Master during the morning of the 7th December 2007 to take off additional cargo that could not be transferred internally once the ullage spaces in the loaded tanks were filled, and expected to arrive that day, but only arrived after the cargo leakage had stopped.

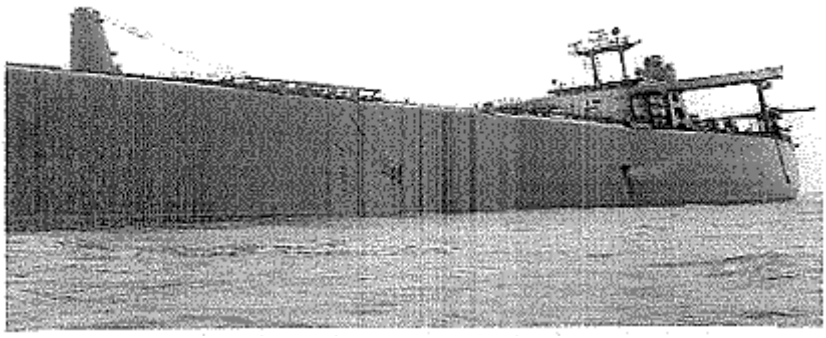
At this time, approximately 37 hours had passed since the accident occurred, and during that time, about 12,547 kl (about 10,900 M/T or about 78,918 bl) of crude oil was spilled, resulting in a large marine pollution accident causing severe crude oil pollution to Korea's central west coast. ([Table. 10])

At 0700 hours on December 9, when approximately 48 hours passed since the collision, the Master Chawla finished temporary repairs on the punctured cargo tanks using wood plates and cloth and reported to the marine police that the oil leakage was completely stopped

I have discussed the possibility of repairs to the tanks in my comments on the pollution response below.

[Table. 10] Calculation by KOMSA of the amount of oil cargo spilled, dated December 9, 2007, after the accident

Period of Measurement	Bbls	K/L	M/T
(A) At loading	1,903,553	302,640.780	263,944.577
(B) Quantity surveyed at the time of entering Daesan after the accident	1,799,328	286,070.327	249,544.411
(C) Amount discharged from the barge at Daesan after the accident	25,307	4,023.492	3,500.144
Difference (Amount spilled) ((A) - (B) - (C))	78,918	**12,546.**961	**10,900.**022



[Picture 21] The holes in the nos. 3 and 5 port cargo tanks of "Hebei Spirit" (the air [inside the cargo tanks] is leaking after the oil spillage)

This is not air, but inert gas billowing from the holes in the side shell plate.

II. Evidence

A. List of Evidence

1) Notification of occurrence of maritime accident by General Information Center on Maritime Safety & Security

2) Notification of occurrence of collision by Taean marine police

3) Safety management certificate for "Hebei Spirit"

4) Cargo tank condition of "Hebei Spirit"

5) Report on the accident by Seosan meteorological administration
6) Lease agreement for "Samho T-3"
7) Equipment Management Service Agreement
8) Construction Equipment Management Service Agreement
9) Copy of the Marine Spread Lease Agreement
10) Copy of towage certificate
11) Three (3) copies of VTS video clips, sound recordings and track records from Daesan Port Vessel Traffic Service Center
12) VTS track chart from Daesan Port Vessel Traffic Service Center
13) Copy of meteorological data
14) Photographs of the hulls of "Hebei Spirit" (6 photographs) and "Samsung No. 1" (4 photographs)
15) Report on the accident by North China Shipping Holdings Co., Ltd.
16) Transcript of examination of Seung Min Cho, master of "Samsung T-5"
17) Sailing condition chart of "Samsung T-5" (submitted by Seung Min Cho)
18) Copy of the chart of the site of accident (indicating the location of the accident)
19) Transcript of examination of Gan Tae Kim, master of "Samho T-3"
20) Transcript of examination of Yi Hyun Kim, barge master of "Samsung No. 1"
21) Transcript of examination of Yong Hoon Park, president of Boram.
22) Transcript of examination of Min Suk Cho, head of marine department of SHI
23) Transcript of examination of Gil Seong Tak, field manager of Boram
24) Transcript of examination of Myeong Suk Choi, master of "Samsung A-1"
25) Sailing conditions of "Samsung T-5" (submitted by Myeong Suk Choi)
26) Transcript of examination of Soon Do Lee, barge bosun of "Samsung No. 1"
27) Transcript of examination of Sun Tae Kim, Daesan VTS employee
28) Copies of Daesan VTS transcript, and vessel traffic control logbook
29) "Hebei Spirit" engineer's logbook
30) "Hebei Spirit" voyage logbook
31) Copies of "Hebei Spirit" master's night orders, course recorder, working chart, telegraph logger record
32) Copies of "Hebei Spirit" anchor and anchor chain drawings, turning circle chart, and test run record
33) Copies of "Hebei Spirit" anchor windlass specification, and main engine information record

34) *Copies of "Hebei Spirit" navigation instrument list, ship's particulars, tank arrangement, and loading status of each tank*
35) *Copies of "Hebei Spirit" main engine and propeller specification, master's standing orders, cargo load quantity certificate, and discharge plan*
36) *Copies of "Hebei Spirit" capacity plan, diagram of freight oil and ballast lines*
37) *Copies of "Hebei Spirit" bellbook (wheel house, engine room), internal safety management procedure guidelines, SOPEP procedure guidelines*
38) *Transcript of examination of Chawla Jasprit Singh, master of "Hebei Spirit"*
39) *Statement of accident of Chawla Jasprit Singh, master of "Hebei Spirit"*
40) *Transcript of examination of Chandok Anil Kumar, chief engineer of "Hebei Spirit"*
41) *Transcript of examination of Chetan Syam, chief officer of "Hebei Spirit"*
42) *Copy of "Hebei Spirit" cargo inspection report*
43) *Boram's drawings of "Samsung No. 1" (center cross-sectional drawing), anchor drawing, anchor chain certificate, windlass specification), and of "Samsung T-5" (general arrangement, buoy mooring specification, tow wire certificate, result of bollard pull, ship's particulars)*
44) *Drawings of "Hebei Spirit" (general arrangement, external plating drawing, tank capacity)*
45) *Transcript of examination of Sung Hwan Choo, manager of purchasing team at Samsung Corp.*
46) *Transcript of examination of Jae Joon Byun, manager of engineering team for Samsung Corp.'s Incheon Bridge site*
47) *Copies of lease agreement, and the Marine Spread Lease Agreement*
48) *Copies of navigation logbook and engineer's logbook for "Samsung T-5" and "Samho T-3"*
49) *Transcript of examination of Joon Hyun Park, chief inspector of hull technical team at Korean Register of Shipping, and copy of towing ability examination result*
50) *Towing survey report for the Marine Spread since 2003*
51) *"Samsung No. 1" Operating Manual (part on towage)*
52) *Transcript of Examination of the Suspect Chawla Jasprit Singh, master of "Hebei Spirit"*
53) *Transcript of Examination of the Suspect Chetan Syam, chief officer of "Hebei Spirit"*
54) *"Samsung T-5" bollard pull certificate*

55) Towing Survey Report for 3,000 M/T floating crane marine spread

56) Research on the causes of collision between "Hebei Spirit" and the Marine Spread

57) Incheon Regional Meteorological Office's reply to inquiry dated February 25, 2008

58) Washington chain anchor, anchor manual

59) Chain locker drawing

60) "Samsung T-5" specification

61) "Samsung T-5" towage survey result

62) Stern photograph of "Samho T-3"

63) SOPEP

64) Shipboard Oil Pollution Emergency response Plan ("SOPEP")

65) Transcript of Public Trial for Case No. 2008Godan11 held at Seosan Branch of Daejeon District Court

66) Statement of Jong Chan Kim, chief officer at "Samho T-3"

67) Confirmation of snapped wire rope of "Samsung T-,5" measurement of the wire ropes of "Samsung T-5" and "Samho T-3"

68) Photographs of wire rope of "Samsung T-5" (12 photographs)

69) Record of Examination of Witness Tae Young Kim, engineer at "Samho T-3"

70) Copy of navigation log of "Samsung T-5"

71) Record of Examination of Witness Man Soo Choi, chief engineer at "Samsung T-5"

72) Reply to the request for inspection by the head of National Institute of Scientific Investigation

73) Transcript of inspection by the umpire (judge in charge)

74) Record of trial

75) VDR transcript of conversation between Filipino crew at "Hebei Spirit"

I have already mentioned above that the safety management procedures for the marine spread, including the periodic inspections of the tow line, were not included in this list of evidence above, and yet those for the VLCC were (see No.37).

Further, I find it appalling that although all parties involved in this Decision are all named above in the evidence, but only the Master and Chief Officer of the "HEBEI SPIRIT" are described as "Suspect"'s (No.52 and 53 above). I find this is consistent with the level of impartiality shown against the crew of the "HEBEI SPIRIT" by the IMST throughout this Decision.

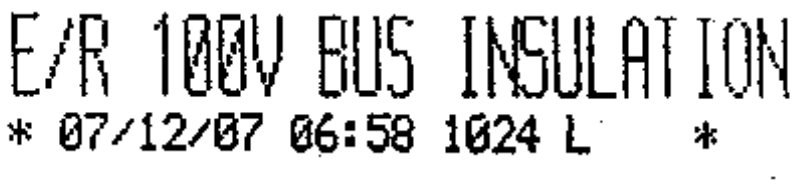
B. Explanation of the Evidence

An examination of the factual background of the accident was conducted reasonably during the trial procedure, except for some parts, because the circumstances of the collision in the present case are relatively simple and not much different from other collisions that occur among vessels sailing along the coast. However, since the cause of the accident is attributable to the composition of various factors and the result of the decision on the cause is expected to have considerable influence on the parties involved in the accident, we will focus on the analysis of the cause and determination thereof and limit the explanation of the evidence pertaining to the factual background to a simple explanation of the major facts.

1) Date and time of the collision

Various testimonies and other evidence all point to the fact that the collision occurred at or after 0700 hours on December 7, 2007. The time indicated by the "Hebei Spirit" master, who was able to vividly witness the collision, while paying out the anchor chain, from aboard the anchored vessel with the main engine put to astern, should be relatively more accurate than that found in the statements made by the masters of "Samsung T-5" or "Samho T-3," who would have been at their wits' end because the towing line had broken in rough weather. Further, according to the engine telegraph of "Hebei Spirit," the vessel had her engines at dead slow astern for the most part until 0705.05 hours and than changed to half astern for seven minutes after then. It would be reasonable to conclude that the vessel abruptly went astern because of the imminent danger. Therefore, it is found that the collision occurred initially at 0706 hours on December 7, 2007.

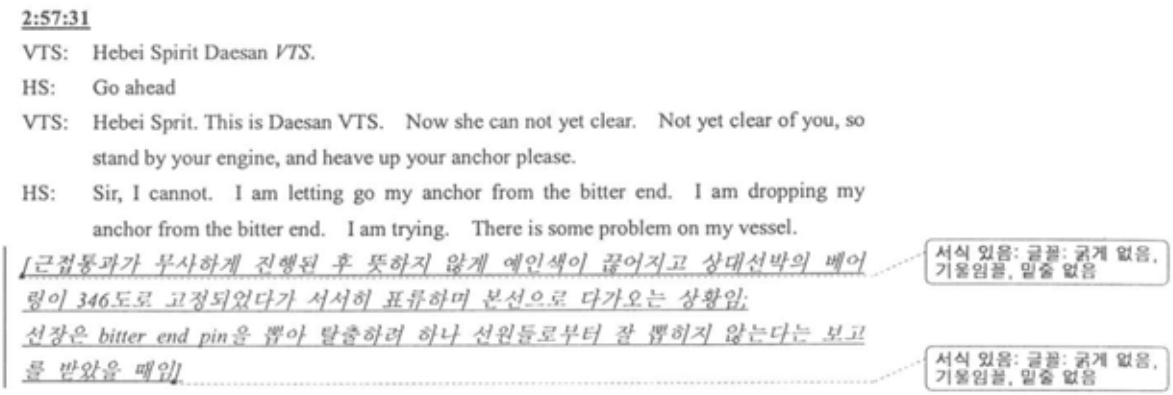
This ignores the evidence provided by the engine room alarm logger and the engine data records. See below:



and

STOP		B	06:54.0
D.SLOW	-AS	B	06:57.0
SLOW	-AS	B	06:58.0
HALF	-AS	B	06:58.5
D.SLOW	-AS	B	07:04.5
SLOW	-AS	B	07:04.5
D.SLOW	-AS	B	07:05.0
SLOW	-AS	B	07:05.0
HALF	-AS	B	07:05.5

This engine room alarm record shows that there was an earth at 0658 hours which is consistent with the lights on the foremast being struck by the crane barge spreader beam. Additionally, the engine room data logger shows that the main engines were first put at slow then half astern at 0658 hours, which is consistent with the actions taken by the Master at that time to limit the collision damage and the attempts to break the bitter end as shown on the VHF VTS transcript, below:



2:57:31
VTS: Hebei Spirit Daesan *VTS.*
HS: Go ahead
VTS: Hebei Sprit. This is Daesan VTS. Now she can not yet clear. Not yet clear of you, so stand by your engine, and heave up your anchor please.
HS: Sir, I cannot. I am letting go my anchor from the bitter end. I am dropping my anchor from the bitter end. I am trying. There is some problem on my vessel.

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선장은 bitter end pin을 뽑아 탈출하려 하나 선원들로부터 잘 뽑히지 않는다는 보고를 받았을 때임]

서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

서식 있음: 글꼴: 굵게 없음, 기울임꼴, 밑줄 없음

2) Collision Site

While the initial site of the collision is neither a factor that would largely influence the determination of the cause of the accident nor a major fact that requires proof, it is basically necessary to confirm the date and time of the accident. Therefore, based on the investigation report on the anchoring location made by the Taean marine police, it is found, in view of the distance "Hebei Spirit" moved to give way and the statements of the masters of each vessel, that the collision occurred at around 1918 hours on December 6, 2007, at LAT. 36° 52′ 07″ N, LONG. 126° 03′ 07″ E, at sea, approximately 5.1 miles at a true bearing of 252 degrees from the lighthouse at Shin-do Island, Wonbuk-myeon, Taean-gun, Chungnam, which is approximately 600 m to the south of the anchoring location, which is LAT. 36° 52′ 30″ N, LONG. 126° 03′ 00″ E, approximately 4.6 miles west from buoy no. 1 at Daesan port.

This paragraph incorrectly details that the collision happened at 1918hrs on the 6th December, when it occurred at about 0658 hours on the 7th December 2007. This statement also implies that "HEBEI SPIRIT" was underway and the "give way" vessel. This was not the case, the "HEBEI SPIRIT" remained anchored throughout and the marine spread were the vessels underway displaying navigation lights for vessels underway but displaying no signal lights to show to other vessels that they were restricted in any way.

3) Quantity of oil spilt

There are discrepancies among various statements and records regarding the cargo quantity at the time of departure from the final port of loading in the Middle East, e.g., 263,879.19 M/T according to the shipowner's "Report on Crude Oil Spillage of M/V "Hwabukjeongshin," and 263,541.4 M/T according to Chawla Jasprit Singh's Master's Statement.

Therefore, it is estimated at approximately 12,547 kiloliters in accordance with the final loading, and the remaining quantity is derived from the table for calculating the spilled quantity of cargo, as measured by Korea Marine Surveyors & Sworn Measurers' Corporation (KOMSA) on December 9, 2008, two days after the collision.

There are always discrepancies between the various cargo shipment calculations carried out at the vessels load-ports.

The vessel / owners surveyor / charterer's surveyor / shippers representative all make their own calculations based on the gauging surveys carried out on board and of the shore storage tanks from where the cargo is pumped.

The quantity shipped as per the bill of lading will not be the same as the quantity measured on board the vessel. This is termed the ship/shore difference and will be noted in protest by the vessels master at the load-port. As this is normal in bulk oil shipments the vessel will maintain a vessel experience factor (VEF), detailing the ship/shore differences at all load-ports visited. This factor is often applied to the cargo bill of lading figures by charterer's when determining instruction on whether the Master needs to note protest or not.

4) It is found that the Chief Officer Chetan Syam of "Hebei Spirit" was substantially not on anchor duty, based on the following reasons.

Because of the failure to perform night anchor duty by a responsible duty officer, "Hebei Spirit" did not recognize the serious risk of collision even when the Marine Spread, which extended more than 730 meters in length, with the very bright work lights displayed by "Samsung No. 1," approached it up to 0.7 miles after sailing in a zigzag motion and drifting at an angle of around 90 degrees from the direction of its movement.

I have explained above why the IMST are wrong in this assumption, but to summarise my views again. Up until about 0550 hours, the movement of the marine spread would be of no real concern to those on the VLCC. Whilst it was initially approaching the VLCC, its speed was slow and the distance so large that it would have taken about 2 hours for the vessels to meet. In these circumstances it is not necessary to take immediate action, just monitor the vessel. After 0445 hours the marine spread was then moving east and not approaching the anchored VLCC, then west, also not approaching the VLCC. Only after it eventually tracked towards the south after 0550 hours would it become a concern of the VLCC. However, the watch keepers then responded correctly.

Therefore, the Master Chawla, who received the report in a situation too imminent in danger, was at his wit's end and did not have time to carefully reflect on what the best method for seeking shelter was.

This is really a twisting of the facts. The Master arrived on the bridge at 0606 hours, called the VTS at 0609 hours and the tugs at 0613 hours, and failed to get a response to his request for information until 0627 hours; 18 minutes later. In the meantime he had taken the only sensible course of action open to him to avoid closing in on the marine spread which was approaching the fore part of the anchored VLCC. That is, slackening the cable and going astern to increase the passing distance. The tow line broke at 0652 hours and the collision occurred at 0658 hours, 47 minutes and 53 minutes after the Master was called. Therefore to say that the Master received a report too imminent in danger is plainly misleading and has been stated by the IMST to further their view in hindsight that the Master should have weighed anchor and moved away. Not in hindsight, the Master clearly explained his reasoning to the VTS at the time, which they responded by saying they understood. To expect a laden VLCC at anchor to weigh its anchor and avoid collision from a vessel underway and under control, displaying nor broadcasting anything to the contrary, shows a total lack of understanding of the application of the Colregs.

Such circumstances may be confirmed from the "Report on Crude Oil Spillage of "Hwabukjeongshin," which states that, "On December 6 at around 1936 hours … they fundamentally lacked the time to quickly move the vessel to avoid collision."

If this is an effort to imply that the VLCC required more time to respond to the approach of the marine spread because its main engine, after anchoring, was on one hour notice, the facts belie this. The main engines were available only 5 minutes after they were requested to be put on stand by, and thereafter they were used.

The specific reasons why the Chief Officer Chetan is found not to have been on anchor duty are as follows:

- *The fact that the Master was called on the brink of collision during anchor duty, rather than during navigation, shows that the anchor duty was not carried out in view of practical affairs of navigation.*

> *There can be no other explanation but that the anchor duty was not performed, given the practical matters and experience of navigating a vessel. This is based on the fact that the Chief Officer of a very large vessel, who could not have but known that, in general, the Chief Engineer has to be given prior notice one hour before the main engine of a large vessel at anchor can be used. He did not give the master sufficient time to take emergency measures by failing to take any measures until the Marine Spread, whose maneuverability was severely restricted and whose towing ability was lost even to the point where it was impossible to maneuver, approached the vessel up to a distance of 0.7 miles, and by reporting to the Master Chawla only once there was imminent danger, given the fact that the Master had ordered the Chief Engineer, immediately after lowering the anchor the day before the accident, to stop the main engine and instructed that he would be given one hour's notice for the use of the main engine.*

There are three points made here which are not supported by the factual evidence:

- The Master was not called on the brink of the collision, he was called 53 minutes before the collision took place.
- The one hour notice period is a standard and non-emergency instruction that allows time for routine checks of the machinery to be conducted at leisure. In an emergency all navigators know that they can call upon the engines immediately as was proven by the facts of this case. That is, the engine was available for use within 5 minutes.

- At no time prior to 0627 hours, and after the VLCC had commenced taking action, did the marine spread display any signals, broadcast any warnings or even respond to calls from the VTS and "HEBEI SPIRIT", to indicate that its maneuverability was restricted and towing ability lost. The change in track of the marine spread clearly shows that the tugs retained control over the crane barge and could have utilized such control to avoid the anchored laden tanker. The IMST believe that those on the VLCC should have assumed that the marine spread was in difficulty from its track movement. This is utter rubbish, and based only on hindsight. If the marine spread had a problem then there are mechanisms in the Colregs to provide such warning to other vessels. However, at the time there was no display of lights, or broadcasts from the marine spread to indicate that it was in trouble.

- *2 Dual signatures on the anchor watch is inexplicable and impossible.*

  While the Chief Officer signed the 5 o'clock entry for the anchor watch, the Chief Engineer made a second entry over the signature of the Third Officer for the 6 o'clock entry. It clearly shows, indelibly and undeniably, in terms of the practical matter of navigating a vessel, that the Chief Officer did not keep watch.

I find that the IMST are contradicting themselves. Earlier they say that the Chief Officer did not conduct the anchor watch lookout duty from 0400 hours, but now admit that he signed the anchor log at 0500 hours, which clearly indicates that he was on watch, undertaking anchor watch duties. At 0600 hours, it is obvious that the Chief Officer would be focused on the approach of the marine spread, monitoring it both visually and by ARPA. It is understandable that he did not sign this log at the very minute of 0600 hours. Thereafter, once the Master was on the bridge, the Chief Officer was instructed to go forward to standby the anchor. He remained there right up until after the collision had occurred. Consequently, he would not have had time to sign something as unimportant, relative to what was going on outside. The Third Officer signed the log for 0600 hours after he was mustered but the Chief Officer counter signed this afterward.

3 *Officers usually remember, even roughly, the first time they notice [a third object] as an occupational habit.*

The moment at which a duty officer first recognizes a nearby vessel, whether during navigation or at anchor, is a very important occupational matter that can never be missed. Professionally, one should remember the approximate time or the approximate number of minutes before or after a certain event, if not the exact time. However, the Chief Officer Chetan, who should have been on anchor duty, was even reprimanded during the hearing when he gave practically unacceptable answers such as, "I don't know because I did not have a watch." Further, it would be safe to conclude that the Chief Officer, who should have been on anchor duty on "Hebei Spirit," did not have a watch himself, but left it in the hands of a cadet who did not have sufficient experience. This is in view of the fact that the Master Chawla, who accurately described and stated, almost without exception, the time at which he took various measures, the fact that the Master failed to state the time at which the Chief Officer first observed the Marine Spread, which he could have estimated on his own, but had said that he does not know because he did not ask, and the fact that the Chief Officer himself also does not know the time he first recognized the Marine Spread.

This paragraph is really total rubbish and fails to understand what the Chief Officer was saying. He was saying that he did not have a watch in reference to a wrist watch, not the bridge watch! In any case, no navigator is likely to recall exact timings of the movement of ships that cause no problems to the vessel he is on. This was the case in this instance. Whereas the Master was recalling details of the approach of the marine spread when it was close to colliding with the anchored VLCC, the Chief Officer cannot be reasonably expected to recall similar timings of something that, at the time is not of concern. What the IMST are saying here has no factual basis.

④ The Tagalog conversation exchanged between the Filipino crew aboard "Hebei Spirit," which was recorded on the VDR after the accident, sufficiently supports the above explanation.

After the collision the Master omitted to turn off the VDR so that its records around the period of the collision were not retained. If the VDR is not immediately stopped after an incident, then it overwrites the data recorded. That is, the data is regularly updated by deleting previous data. What the IMST are referring to here is the tagalong conversations made on the wheelhouse after the collision, not before the collision.

5) Towing capacity of the Marine Spread

The bollard pull of "Samsung T-5" is 55 M/T and that of "Samho T-3" is 46.4 M/T, according to the Towage Approval Check List attached to the towage survey report. Therefore, the bollard pull shall be 48.3 M/T in view of the obsolete engine and aggravated weather conditions at the time of the accident, since the average towing capacity of "Samsung T-5" tested at Daesun Shipbuilding on December 9, 1995, about 12 years before the accident, was 48.3 M/T. Their towing power is proving to be far from sufficient due to such reasons during the course of analyzing and determining the cause.

I find it difficult to understand that the IMST state that the combined towing power of the tugs was far from sufficient for this tow and then not initiate an investigation as to why such marine spreads are being allowed to operate around the coast of Korea with insufficiently powered tugs. The reason they have not covered this in detail as part of their investigation will be expanded upon in detail below, but in summary it is because they lack an understanding of the purpose of a towage insurance certificate and, as such, revealed a fundamental flaw in their investigation.

6) The capacity level for each cargo tank of "Hebei Spirit," before the spillage, is based on "Cargo Tank Data. ARR. DAESAN," and is summarized below in Table 2-1.

7) The fact that the chief officer of "Samsung T-5" initiated automatic steering from around 0000 hours on the day of the accident is supported not only by the transcript of the examination of Seung Min Cho and trial records, but also by the abrupt change in course to starboard at the same time and location as shown in Picture 18.

[Table 2-1] Capacity level per tank upon arrival at Daesan Port anchorage (based on Cargo Tank Data. ARR. DAESAN)

Tank No.	Rate at the time of the accident (%)	Tank No.		Rate at the time of the accident (%)
1 (Center)	98	1	Port	96.9
2 (Center)	98		Starboard	96.9
3 (Center)	95.9	3	Port	98
4 (Center)	98		Starboard	98
5 (Center)	95.2	5	Port	98
			Starboard	98
Slop	Port	98		
	Starboard	98		

These figures cannot be used with accuracy. There was no reason for the Chief Officer to measure the cargo at the anchorage before the collision.

8) Signal lights of the tugboats

As for whether the tugboats displayed lights to signal a limitation in their navigational ability, the arguments of the relevant parties, both on the side of the tugboats and of the "Hebei Spirit" differ, without any positive proof or circumstantial evidences to support the same. Therefore, they should neither be adopted nor discarded.

I find it astonishing that the IMST did not investigate this aspect further and just dismiss this issue out of hand, given that it is central to the issue as to whether those on the considered that they were in difficulties or not. The VHF transcript shows that they never once contacted VTS or "HEBEI SPIRIT" prior to 0627 hours to advise of any emergency, in fact they were contacted by VTS by cell phone after those on the VLCC initiated the enquiry with VTS because no-one answered the VHF calls. The IMST have referred to the IMO MSC/Circ 884, IMO Guidelines for Safe Ocean Towing, in their Decision but never highlighted the following extract from it:

Quote

14 IN AN EMERGENCY

14.1 Should the tow present a direct danger to navigation, offshore structures or coastlines through breaking adrift or for some other cause, the master of the towing vessel is bound by SOLAS regulation V/2 to communicate the information by all the means at his disposal to ships in the vicinity, and also to the competent authorities at the first point on the coast with which he can communicate.

Unquote

There can be no disputing this guideline, it is clear and follows good seamanship, and yet prior to 0627 hours there was absolutely no indication from the marine spread that they were in difficulties. Additionally, the Colregs provide adequate mechanisms for the display of various combinations of navigation lights to indicate difficulties and restriction in maneuverability. However, none were displayed by the marine spread.

9) Explanation of other evidence pertaining to the factual background

As mentioned above, it is most important to analyze and identify the cause of this accident, and therefore, with respect to the key facts that require evidence, an evidence list is provided here instead of a detailed explanation of the evidence.

[Table 2-2] Explanation of other evidence pertaining to the factual background

No.	Proved Facts	Manner of Proof	
		Title of Evidence	No.
1	Ownership and operators of the vessels comprising the Marine Spread	Lease agreement for "Samho T-3"	6
		Equipment Management Service Agreement	7
		Construction Equipment Management Service Agreement	8
		Copy of the Marine Spread Lease Agreement	9
2	Towing equipment of the Marine Spread	Copy of towage certificate	10
		Towing Survey Report for 3,000 M/T floating crane marine spread	55
		Transcript of inspection by the umpire (judge in charge)	73
3	Manufacturer's test results for towing line of "Samsung T-5"	"Samsung T-5" bollard pull certificate	54
4	Towing survey	Towing Survey Report for 3,000 M/T floating crane marine spread	55
5	Bollard pull of the Marine Spread	"Samsung T-5" towage survey result	61
6	Liability in supervising the navigation of the Marine Spread	Transcript of examination of Seung Min Cho, master of "Samsung T-5"	16
		Transcript of examination of Gan Tae Kim, master of 'Samho T-3'	19
		Transcript of examination of Yi Hyun Kim, barge master of 'Samsung No. 1'	20
		Transcript of examination of Yong Hoon Park, president of Boram	21
		Transcript of examination of Gil Seong Tak, field manager of Boram	23
7	Full (98%) capacity of "Hebei Spirit" cargo tanks	Copies of "Hebei Spirit" navigation equipment list, ship's particulars, cargo tank arrangement, and loading capacity of each tank	34
		Copies of "Hebei Spirit" capacity plan, diagram of freight oil and ballast lines	36

No.	Proved Facts	Manner of Proof	
		Title of Evidence	No.
8	Preparations for navigation by the Marine Spread	Transcript of examination of Seung Min Cho, master of 'Samsung T-5'	16
		Transcript of examination of Yi Hyun Kim, barge master of 'Samsung No. 1'	20
		Transcript of examination of Yong Hoon Park, president of Boram	21
		Record of trial	74
9	Passage through the specific area near Incheon Port and letting out the towing line by the Marine Spread	Copy of towage certificate	10
		Three (3) copies of VTS video clips, sound recordings and track records from the Daesan VTS	11
		VTS track chart from Daesan Port Vessel Traffic Service Center	12
		Copy of meteorological data	13
		Transcript of examination of Seung Min Cho, master of "Samsung T-5"	16
		Transcript of examination of Gan Tae Kim, master of "Samho T-3"	19
		Transcript of examination of Yi Hyun Kim, barge master of "Samsung No. 1"	20
10	Fact that the chief officer of "Samsung T-5" initiated auto steering since around 00 hours on the day of the accident	Record of trial	74
11	Decrease in the Marine Spread's ability to maintain its course due to exposure to the wind and current	Three (3) copies of VTS video clips, sound recordings and track records from Daesan VTS	11
		VTS track chart from Daesan VTS	12
		Transcript of examination of Seung Min Cho, master of "Samsung T-5"	16
		Transcript of examination of Gan Tae Kim, master of "Samho T-3"	19
		Transcript of examination of Sun Tae Kim, Daesan VTS employee	27
		Copies of Daesan VTS transcript, and vessel traffic control log	28
		Record of trial	74

No.	Proved Facts	Manner of Proof	
		Title of Evidence	No.
12	1. Marine Spread begins to give way due to decrease in towing ability caused by aggravated weather 2. Marine Spread's attempt to find shelter – giving up on finding shelter – attempt to return to the planned course 3. Breaking of the towing line and collision during the Marine Spread's attempt to return to the scheduled course 4. First external communication of the Marine Spread and observation of "Hebei Spirit" 5. Repeated request for "Hebei Spirit" to heave anchor by Marine Spread and Daesan VTS	Three (3) copies of VTS video clips, sound recordings and track records from Daesan Port Vessel Traffic Service Center	11
		VTS track chart from Daesan Port Vessel Traffic Service Center	12
		Transcript of examination of Seung Min Cho, master of "Samsung T-5"	16
		Transcript of examination of Gan Tae Kim, master of "Samho T-3"	19
		Transcript of examination of Myeong Suk Choi, master of "Samsung A-1"	24
		Sailing conditions of "Samsung T-5" (submitted by Myeong Suk Choi)	25
		Transcript of examination of Sun Tae Kim, Daesan VTS employee	27
		Copies of Daesan VTS transcript, and vessel traffic control logbook	28
		Record of trial	74
13	Breaking of the towing line of "Samsung T-5," paying out of the anchor by "Samsung No. 1," and collision	Transcript of examination of Yi Hyun Kim, barge master of "Samsung No. 1"	20
		Transcript of examination of Soon Do Lee, barge bosun of "Samsung No. 1"	26
		Including all the evidences for No. 11 above	
14	Arrival of "Hebei Spirit" at Daesan Port and dropping the anchor	"Hebei Spirit" voyage logbook	30
		Copies of "Hebei Spirit" master's night orders, course recorder, working chart, engine telegraph records	31
		Statement of accident by Chawla Jasprit Singh, master of "Hebei Spirit"	39
		Transcript of examination of Chandok Anil Kumar, chief engineer of "Hebei Spirit"	40
		Record of trial	74

No.	Proved Facts	Manner of Proof	
		Title of Evidence	No.
15	Night anchor duty on "Hebei Spirit"	Transcript of examination of Chawla Jasprit Singh, master of "Hebei Spirit"	38
		Statement of accident of Chawla Jasprit Singh, master of "Hebei Spirit"	39
		Transcript of examination of Chetan Syam, chief officer of "Hebei Spirit"	41
		Transcript of Examination of the Suspect Chawla Jasprit Singh, master of "Hebei Spirit"	52
		Transcript of Examination of the Suspect Chetan Syam, chief officer of "Hebei Spirit"	53
		Record of trial	74

III. Cause

The collision falls under Article 2, Paragraph 1, Items B, D and E of the Act on the Investigation of and Inquiry into Marine Accidents.

Since the nature of the accident is serious, the Maritime Safety Tribunal, by analyzing the cause of the marine pollution resulting from the collision, should reveal all internal causes that contributed to the occurrence of the accident, including the cause of the pollution as well as that of the collision, and further clarify the causal relationship between the collision and the extensive marine pollution, so that no such extensive environmental pollution disaster occurs in the future.

In order to prevent re-occurrence of extensive marine pollution accidents, the cause of the collision and the cause of the marine pollution may be discovered by analyzing, in terms of vessel navigation and maritime technology, whether both parties have complied with relevant provisions for navigational safety and avoiding collision, whether they took other appropriate measures, and whether the massive spillage of cargo oil, which caused the secondary, expansive marine pollution, was unavoidable because of the collision or whether the oil spillage occurred due to negligence in performing the duty of care, although it could otherwise have been reduced through reasonable care.

Therefore, the analysis and judgment on the cause will be divided between the collision and marine pollution, which will be further classified into the subjects of what contributed to the cause, since a considerable part of the accident is inseparable with human negligence.

A. Cause of the Accident

1) The Marine Spread

We analyze below the causal relationship between the accident and various factors, including towing capability, towage survey, preparations for navigation, making external contact, the towing line break, emergency anchoring and navigating methods for the purposes of reviewing the direct and indirect causes of the accident. A significant part is related to the towage survey.

A) Towing Capability

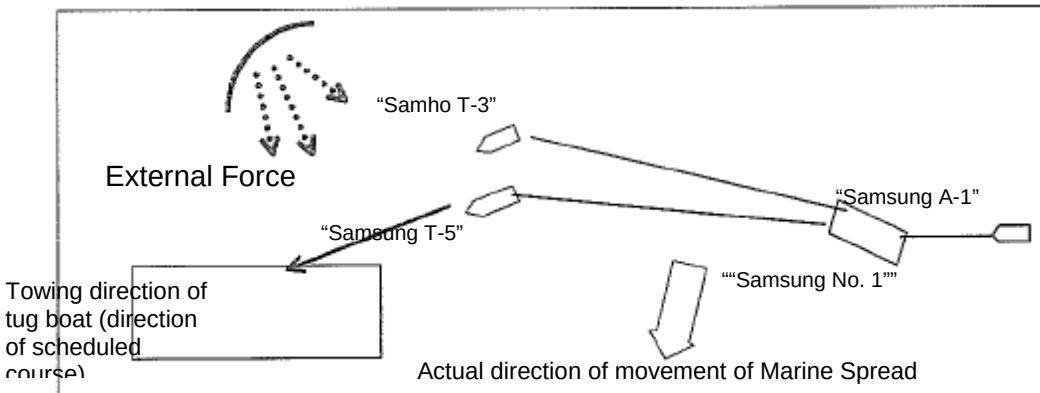
(1) Practical Review of Towing Capability Based on Navigation Conditions at the Time of the Accident

The towing capability of the Marine Spread's towboats is defined as the boats' ability to surge, sway and yaw according to the operator's intention along the predetermined navigation path not only in still waters but also under external forces such as waves, winds and tide. The boat's towing capability is assessed according to the bollard pull of the towboat and the total amount of resistance on the barge being towed.

In this case, the Marine Spread sharply moved to the left since passing Uldo at around 2330 hours on December 6, 2007, because of unchecked external forces from the distant seas to the right (Diagram 18). On 0013 hours the next day, the Marine Spread changed course from 202 degrees to 210 degrees, which was not far from the original route which was set at 206 degrees. However, as time progressed, the Marine Spread increasingly made sharper zigzags, and eventually at around 0200 hours, the Marine Spread lost its normal towing capability.

At around 0400 hours of the same day, when the decision to seek shelter was made, external forces on the barge "Samsung No. 1" was greater than the bollard pull of "Samsung T-5" and "Samho T-3" combined. "Samsung No. 1" therefore did not move in the direction it was towed but was pushed in the direction of the combined forces of the towing force and the external forces, and started pulling the tugboats. This resulted in almost a 90-degree angle drift between the towing direction and the route on which the Marine Spread actually moved (Diagram 18, Diagram 19 and Diagram 3-1).

[Diagram 3-1]



[Diagram 3-1] The barge failed to be tugged from behind the tugboats due to strong external force from around 0200 hours on the day of the accident and was pushed toward the port side, so that the boats of the Marine Spread had large declination (drifting angle) and the track appeared in big zigzags.

Such result means that the towing vessel lost its control over its navigating direction or positioning ability, making it impossible for the master to normally navigate the vessel, resulting in a loss in towing ability. The fact that the master of "Samsung T-5" had estimated at around 0400 hours on the day of the accident that normal navigation was impossible and therefore decided to seek shelter is evidence that towing ability was lost.

The latter statement is contradictory. If normal navigation was impossible, why did the master believe he could reverse his course to seek shelter. The subsequent track of the marine spread shows that its towing ability was not fully lost. If it had been fully lost, as described above then it would solely move in the direction of the environmental forces acting on the spread. Apart from minor changes, the environmental forces acting on the spread remained generally consistent throughout. That is, the wind was blowing from the west north west at about Beaufort force 7, generating 4m waves from that direction, in a current setting from the north east. And yet, the marine spread track changed substantially over the period. That is, it was first in a south east direction, then east direction, then west direction, then south direction then south west direction. In summary, the spread had the ability to cover any track from west, through south to east. Consequently, the facts show that it was not at the mercy of the environmental forces and had the ability to track in a large arc of directions.

(2) Theoretical Review of Towing Capability on the Day of the Accident

According to test results by Daesun Shipbuilding & Engineering Co., Ltd. on "Samsung T-5," the bollard pull of "Samsung T-5" is not 55 MT as stated in the towing approval inspection chart, but 48.3 MT, as we have seen above. The towing capacity of "Samho T-3" was 46.4 MT. The combined bollard pull of these two vessels was merely 94.7 MT.

The use of average values is inappropriate.

In order for the Marine Spread to have navigated normally under severe weather conditions on the day of the accident, the bollard pull needs to exceed the total resistance (external force) applied on "Samsung No. 1," the barge. We will proceed to confirm this by calculation.

According to Article 25 (Towing Wire), Paragraph 3 of "Standards for the Structure and Equipment of Barges," the total amount of resistance on the towing wire is the combined amount of the total resistance of "Samsung No. 1" and the additional resistance of the significant wave height (H1/3).

If we assume that the total resistance is R, total resistance of the barge Rt and additional resistance from significant wave height as Rs, R = Rt + Rs. The figures at the time of the accident are as follows:

R = Rf + Rw + Ra (MT)

Rf: friction, Rw: wave resistance, Ra: air resistance

Rf = 0.000136 × F1 × A1 × V²= 1.42 MT ----- ①

F1 = 0.8 (surface coefficient)
A1: surface area underwater (m²) = (average draft × ((length of vessel + width of vessel) × 2)) + (length of vessel × width of vessel) = (approximately 3.35 × ((106.6 + 45) × 2)) + (106.6 × 45) = 1015.7 + 4797 = 5,812.7 m²
V = approximately 1.5 knots (speed at the time of accident), if unknown, 7 knots

Rw = 0.014 × C × F2 × A2 × V² = 6.97 MT ----- ②

C = 1.2 (resistance coefficient in rough sailing conditions)
F2 = 1.0 (coefficient of Exhibit 2 based on the structure of the bow)
A2: 184.5 (area of vessel beneath the surface of water. m²)
V = approximately 1.5 knots (speed at the time of accident), if unknown, 7 knots

Ra = 1.95 × 105 × Cs × CH × A3 × (Vw + V)²= 72.16 MT ----- ③

Cs = 1.5 (Schedule 3 of the above Standards, coefficient of the structure of the bow facing the wind)
CH = approximately 1.3 (Schedule 3 of the above Standards, height from surface of water for center of the area facing wind)
A3 = 1,285 (total area above water exposed against the wind. If crane is approximately 40 degrees, actual area is 2,000 (total area. KR calculation) × sin40°= 2000 × 0.6428 = 1,285 m²
Vw = 36.93 (= approximately 19 m/s. Figure for surrounding seas derived from the chart on the above Standards according to area of sea. Knots)
V = approximately 1.5 knots (speed at the time of accident), if unknown, 7 knots
Rt = Rf + Rw + Ra = 1.42 + 6.97 + 72.16 = 80.55
Also, Rs = 5.5 MT (figure from Schedule 5 of the above Standards when effective wave height is 3) ----- ④

Therefore, the total resistance on "Samsung No. 1" R = Rt + Rs = 80.55 + 5.5 = 86.05 MT ----- ⑤

Therefore, bollard pull of T-3 and T-5, and the total resistance on "Samsung No. 1" at the time of the accident is:
Towing Capability (94.7 MT) > Total Resistance (86.05)

Therefore, the total resistance is approximately 90.8% of the bollard pull, with about 9.2% remaining.

However, considering that ① the bollard pull tests on "Samsung T-5" were conducted in December 1995, approximately 12 years ago, during which time the engines would have become worn down, resulting in a bollard pull significantly less than 94.7 MT; that ② more dynamic loads, which is shock loading on "Samsung No. 1," should have been considered due to its own movements such as rolling, heaving, pitching and surging, swaying and yawing; and that ③ although it is much less than the resistance on "Samsung No. 1" itself, the resistance on the towing vessels themselves must be added to the total resistance.
Therefore, the actual bollard pull and total resistance at the time of the accident is:

Bollard Pull ≒ Total Resistance

We know that the towing capability of the Marine Spread had started to decrease at around 0200 hours on the day of the accident and lost all towing capability at around 0400 hours when the decision was made to seek shelter. This means that the total resistance slowly increased to become similar to, and eventually exceeded, the amount of towing capability. Therefore, the towing capability and total resistance around this time was:

Actual Towing Capability = Combined Bollard Pull (94.7 MT) – Decrease due to Worn Main Engines *Actual Total Resistance = Total Resistance (86.05 MT) + Resistance of Towing Vessels + Dynamic Load*

Therefore, the towing capability of the Marine Spread at the time of the accident was almost the same as the total resistance. As such, the Marine Spread would not have been able to move or only able to move very slowly at approximately 1.5 knots. Then, when the winds became stronger and the total resistance exceeded the bollard pull, the towing vessels would be pulled towards the barge. This occurred several times, resulting in the zigzag route of the Marine Spread and its deviation from its original route. This theoretical analysis coincides exactly with the actual zigzagging path of the Marine Spread from 0030 hours on the day of the accident to the time of the accident (Diagrams 18 and 19).

This is a theoretical examination but the practical effects were shown in the varied track of the marine spread once the tugs deliberately altered their direction. Therefore, to say that the tugs fully lost their ability to control the tow is not supported by the facts.

One of the direct causes of the accident was the fact that the towing capability of the Marine Spread could not overcome the weather conditions at the time of the accident.
(Cause of Accident No. 1: Lack of Towing Capability of the Marine Spread. A Part of the Direct Cause)

Even though the IMST declare this as part of the direct cause, they do not investigate as to why two tugs, underpowered for this tow according to the IMST, were arranged by the operators and managers of "SAMSUNG NO.1" for this tow. As this is a direct cause then the reason for having unsuitably sized tugs is the major component of this direct cause. This is not the responsibility of the insurance surveyor but an obligation of duty on the part of the operators/managers of the marine spread.

(1) Purpose and Significance of the Towage Survey

SHI, to cover risks of towing "Samsung No. 1," asked the Hong Kong-based BMT to conduct a towage survey at SHI's expense in order to obtain insurance for the vessel. The surveys were then conducted by Hyopsung in Korea.

Marine insurance is an agreement between two parties. The towage survey serves as a safety check before obtaining insurance to ensure that a marine spread can successfully complete the navigation.

This is the fundamental flaw in the IMST's decision. Whereas they are correct in saying that the insurance is an agreement between two parties, they then hold up the towage survey as the final deciding factor in ensuring that the spread can successfully complete the voyage. This is an incorrect interpretation of an insurance survey. The insurance survey or does not override the tow master's and marine spread operator/manager's statutory obligations under international marine law to provide vessels and equipment, manned by competent crew, that are fit to meet the expected circumstances of the voyage. The insurance surveyor has no responsibility for the voyage.

The inspection certificate contains "Voyage Recommendations" for safe navigation, and approval of the survey is given under the condition that the responsible navigating master abides by these rules. Therefore, the towing equipment, usage of towing facilities, weather standards and period for seeking shelter described in the towage survey report and the Towage Approval Check List act as a source of navigational guidelines for the master.

A towage survey carried out prior to the commencement of the voyage cannot be cited as some form of passage plan, or rules to be strictly adhered to for the safe navigation for successful conclusion of a voyage. The safe navigation; planning and execution of the voyage, rests with the master of the vessel and in this case this is the master of "SAMSUNG T-5" as lead tug responsible for the marine spread.

The results of the towage survey thus act both as an insurance survey for the insurer, providing confirmation of the safety of the marine spread, and also as a navigational guideline for the master of the marine spread.

As I have stated above, the insurance certificate is not a statutory document and does not provide confirmation of the safety of the marine spread, it is a commercial agreement between the insurers and the assured. The confirmation of the safety of the marine spread is an obligation of the operators and managers of the marine spread, and finally the master of each vessel and the tow. The insurance surveyor will only have a snapshot of the vessel on a particular day, it is the operators/managers and master's responsibility to ensure that their vessels are fit to proceed to sea and they are in a far better position to do this through the correct application of their safety management systems.

Therefore, the inspector must confirm the buoyancy and stability of the barge and also test the stability and durability of the navigation equipment such as the towing line, the triangular plate, the stretcher and the pennant wire. The surveyor must also prepare a suitable set of voyage recommendations for the navigation on the basis of scientific reasoning and the relevant regulations so as to reduce risks at sea, and the navigating master must diligently follow the conditions under which the approval has been given and also the voyage recommendations, in order to ensure a safe voyage in unpredictable waters.

Again the IMST have misinterpreted the role of the insurance surveyor. The operators/managers and their masters must ensure that the vessels are correctly prepared for the voyage and that suitable navigation procedures are in place. This will then be presented to the insurance surveyor who will see whether the correct preparations have been undertaken. He can present his recommendations to the Master, but as I have explained above the Master is not required to diligently follow these if he finds that they increase the risk to the marine spread. The IMST have referred to the IMO Guidelines for Safe Ocean Towage (MSC/Circ.884) in their Decision, but they have ignored the following section on responsibilities:

Quote

4.2 The towing operation should be in charge of a competent towing master, normally being either the master of the towing vessel or the master of the leading towing vessel, in case the towed object is towed by more than one towing vessel.

4.3 The towing master is responsible for the towing operation. In preparation for the towing operation, the towing master should consider these guidelines, as appropriate. The towing master should also consider what regulations are applicable during the towage, as well as ensuring that all relevant safety measures as he finds necessary are implemented.

4.4 Nothing in this section shall set aside or limit the towing master's/tug master's authority in accordance with maritime laws.

Unquote

Nowhere in these IMO Guidelines is there any reference to the insurance surveyor, because the insurance survey is part of a commercial agreement between two parties, not the final safety requirement for the voyage.

However, the surveyor and the master of the Marine Spread in this case were significantly negligent regarding these aspects, as described below.

The surveyor has no responsibility for this, the full responsibility for not fitting the correct tow arrangement to the marine spread lies with the operators/managers and the master's of the tugs.

(2) Method of Towage Survey (Safety Inspection)

(A) Structure of the Towing Line (Diagrams 12 and 13)

According to the Towage Approval Check List of the towing survey, "Samsung T-5" was to use steel wire as its towing line, 48 mm in diameter and 600 m in length, while "Samho T-3" was to use steel wire 50 mm in diameter and 500 m in length, as well as PP rope 100 mm in diameter and 200 m in length as an added stretcher.

Since the stretcher was made of PP rope, which is more flexible than steel rope, it distributes shock loadings arising from towage voyages apply [on the towing rope] if used together with steel rope, and prevents the towing line from breaking. Therefore, if the stretcher is used together with a steel rope, it should have been used on the "Samsung T-5," which had a bigger bollard pull (there is a significant difference in the horsepower of the two towing vessels; however, there is not much difference in the actual towing power. Nevertheless, the towage survey assumed inaccurately that the towing power of "Samsung T-5" was significantly larger), or the total length of the "Samsung T-5" towing line should have been longer than the "Samho T-3" towing line in order to decrease tension. However, "Samsung T-5," which had a bit larger bollard pull was provided with a steel rope which did not have good capacity to absorb shocks and was shorter than the "Samho T-3" towing line. We cannot find any reasonable basis for the composition of the two tugboats' towing lines. Moreover, the master of the tugboats disregarded the composition or length of the towing lines, on the basis that the recommended lines were too long.

Again, whereas the IMST are correct in criticising the composition of the towing arrangement, this is not the responsibility of the insurance surveyor, but that of the operators/managers and master's of the tugs.

The voyage recommendations allowed for the master to adjust the length of the towing line. However, the towing survey provided for an unreasonable composition in the towing lines, which the master failed to follow. Therefore, one of the most important factors in ensuring successful navigation—the composition of the towing lines—was completely ignored.

The IMST are correct in criticising the tow line composition but fail to investigate the full reasons behind this failing, seeking only to rely upon the insurance survey.

Once more, the operation and managing of this tow was at fault, but the IMST are ignoring this in favour of an invalid insurance survey certificate. This is the fundamental flaw in their investigation.

As "Samsung No. 1" was towed towards the opposite direction of the stern, it could be interpreted that the side based on which the position of the Schmidt bracket was decided in the Towage Approval Check List (the side on which the towing line is attached) was written incorrectly. However, the surveyor himself confirmed that he had written the correct side. Therefore, the side on which the towing line was attached corresponds to the towage survey, but the composition of the towing lines was unreasonable and was not complied with during navigation.

Even if the towage survey is a matter of agreement between the parties, not mandated by law, and even if the Marine Spread did not comply with the composition of the towing lines, however unreasonable they may have been, the conditions set by the towage survey serve as safety guidelines for the master, and the towing survey in itself confirms beforehand whether the towing operations at hand would be safe. Therefore, not complying with the conditions removes the opportunity to eliminate risks before navigation and officially increases the risk of collision.

The IMST have finally recognized in this paragraph that the towage survey is not mandated by law, but then again place their total reliance on this survey as the final deciding factor on the ability of the spread to undertake the voyage ignoring the responsibilities of the operators/managers and masters of the marine spread. Additionally, as pointed out above, this insurance certificate was for one voyage only and was invalid for the voyage on which the collision occurred.

(B) Total Resistance of "Samsung No. 1"

When navigating through rough weather, changes in the tension caused by the dynamic loads on the towing line due to vessel movements in irregular sea conditions can increase dramatically. If such tension is not appropriately absorbed , the towing line may break. In order to prevent this, various conditions including the length and recommended breaking strength of the towing lines are provided in detail in the "Standards for the Structure and Equipment of Barges," KR's "Regulations on Towage Survey of Barges" and IMO's MSC/Circ.884 "Guidelines for Safe Towing at Sea."

When the dynamic loads in effect at the time of the accident, calculated according to the above "Standards for the Structure and Equipment of Barges" were applied on "Samsung No. 1," the total resistance exceeded 86.05 MT in heavy sea.

However, the calculation of resistance made at the time of the towage survey by Hyopsung was very different from the calculation method mentioned above. For example,

Pf = 0.01 × S × V2 Pd = 2.86 × Ks × Ad × V2

Pf: friction resistance (pounds) Pd: wave resistance (pounds)

S: area underwater Ks: 0.75 - 1.0 (underwater)

V: vessel speed (knots) Ad: underwater (ft2)

W = Z × A × Vw2

W: wind pressure

Z: 0.003 (wind pressure)

A: Area of clear wind pressure

Vw: wind speed (knots)

This is different from domestic regulations, but the elements included in the calculation, such as friction resistance, wave resistance and air resistance are the same. However, Hyopsung failed to include air resistance (air pressure), which is most affected by bad weather, and did not consider the effect of the waves.

Diagram 3-1 shows the calculations made by Hyopsung according to the standards set by The Salvage Association ("S.A.") in England. Although the navigating speed is 1.5 knots and the total resistance is 86.05 MT (excluding dynamic loads due to ship movements), the calculation below concludes that the total resistance is only 14 MT even when the speed is increased to 3 knots, which is a huge discrepancy from reality. Using these figures to decide upon the safety of the towing operations is therefore inappropriate.

[Table 3-1] Calculation of total resistance of "Samsung No. 1" by Hyopsung based on S.A. standards (The gray parts in the following table refer to total resistance based on the vessel's speed and the length of towing line.)

[Particulars of [Formula for Resistance] [Other Data] "Samsung No. 1"]

L : 348 ft Pd = 2.86 x Ks x Ad x V x V Length of towing line : 36 m

B : 148 ft Ks = 0.7-1.0 Towing Rope Breaking Load : 185 MT

D : 23 ft Ad = B x d (Projected Underwater Area) Tugboat's Bollard Pull : 50

S : 55223 sq.ft S = 1.7 x L x d + L x B x Cb

Ad : 969 sq.ft 1ton = 2205 lbs

Cb : 1

Ks : 1

Speed in knots	3	4	5	6	7	8
Pd (pounds)	24936	44330	69266	99743	135761	177320
Pf (pounds)	4970	8836	13806	19880	27059	35343
Pt (pounds)	29906	53166	83072	119623	162820	212663
Rt (MT)	14	24	38	54	74	96

Minimum tow line length	KMU/KR	Coastal	1.5 x (L1 x L2)	213 m
			3.5 x (L1 x L2)	497 m
	SA	L > 1800 x BP/BL		486 m

The inappropriate composition of the towing lines and miscalculation of the total resistance of the barge, both of which are important factors in deciding the safety of the towing operations and which resulted in an inadequate towing survey, cannot be said to have no relevance to the breaking of the towing line and was one of the direct causes of the accident.
(Cause of Accident No. 2: Inappropriate Towage Survey. A Part of the Direct Cause)

The IMST has cited the towage survey as part of the direct cause of the collision. This is a fundamental misinterpretation of the facts and calculations they have described above. The towage survey is a commercial agreement between the insurers and the assured and does not override the basic requirement of the operators/managers and masters of the marine spread to ensure that the vessels are fit for the voyage. Whatever mistakes the IMST have highlighted above are not the responsibility of the insurance survey company, but the operators/managers and masters of the marine spread. It was their requirement to ensure that the towline composition is correct. The towage survey was not inappropriate, the preparation of the vessels was. Finally, the insurance towage certificate was also invalid for this voyage.

(3) Non-compliance with voyage recommendations

As the towing survey certificate had voyage recommendations to ensure safe navigation, the head master of the Marine Spread should have abided by such rules, but he failed to do so.

Not only do the IMST ignore the fact that the towage survey was invalid for this voyage, the responsibility for safe navigation does not rest with insurance surveyor but solely with the master of the vessels following the safety management guidelines of the operators/managers. The IMST should be investigating the instructions given to the masters by the operators/managers rather than focussing on the insurance survey.

(A) Contact in the case of deviating from course to seek shelter

In the event of deviating from the set course during navigation, the shipowners and the surveyor are to be notified. This was not complied with in this case. Therefore, assistance from these parties, such as notifying on-shore authorities or the VTS or giving early notice to nearby vessels, was not done in this case.

(B) Failure to notify nearby vessels and authorities in advance

When the Marine Spread lost its navigation ability and started to drift, basic seamanship requires notification to [nearby ships] and the shore using all communication methods possible so that it can seek shelter. This is also in the above-mentioned IMO guidelines. However, no such measures were taken in this case, and there was no reply to the Daesan VTS's call 1.5 hours before the collision. Therefore, the vessel was negligent in notifying its surrounding parties of the situation.

Failing to notify the surveyor and shipowners in an emergency situation where there is deviation from course and loss of towing ability, which prevented them from taking safety measures against an imminent collision, is an indirect cause of the accident.
(Cause of Accident No. 3: Failure to Make Contact in Seeking Shelter. A Part of an Indirect Cause)

As the IMST have stated themselves, the IMO guidelines state that the tow master should contact all nearby vessels in cases of emergency. The failure of the tug masters not only to contact the VTS or "HEBEI SPIRIT", even when contacted themselves, shows that they were not maintaining a proper lookout and did not consider the situation an emergency until too late. Their inability to respond to calls and seek advice, cannot be considered such a minor part of an indirect cause of the collision by the IMST. This was a fundamental failure of the operation of the marine spread that had a direct consequence on the events leading up to the collision.

(C) Forecast of Weather and Time of Seeking Shelter

The weather forecast Seung-Min Cho received at the time of departing from Incheon provided that in 12 hours, i.e., at 0300 hours on December 7, a weather warning would be announced for the area 20 miles from the Central West Sea. He thought that the weather would not affect his vessel, which would be navigating within five miles of the shore.

As the vessel sailed through Uldo, south of Deokjeok Island, unfettered wind and waves from the distant seas suddenly arose, decreasing towing ability. This was when the master finished his watch and went to bed. The chief officer, who was on duty, had the obligation to call the master when winds exceeded BF 6, so that they can deviate from its course according to the voyage recommendations of the towage survey.

Again the IMST have placed reliance on the towage survey as the instructions for the voyage. That is, did they examine the tug master's standing and night orders? Were any in place? STCW requires watchkeeping officers to familiarise themselves with the masters standing orders before taking over a watch as shown in this extract from the STCW below:

Quote

21 Relieving officers shall personally satisfy themselves regarding the:

.1 standing orders and other special instructions of the master relating to navigation of the ship;

Unquote

That the IMST have not investigated this issue regarding the operation of the tugs in preference to their reliance on the towage survey shows their total lack of fundamentally understanding the role of the insurance surveyor and the requirement for basic navigation on board vessels.

But he failed to recognize the urgency of the situation and did not notify the master in advance. His late notification, which was given when towage ability was at its worst, after continued navigation, gave the master no time to seek shelter. The master therefore was late in his efforts to seek shelter and failed.

This may be attributed to the master's negligent supervision of his crew, but is not directly connected to the failure to conduct timely efforts to seek shelter. However, the fact remains that the vessel was late in seeking shelter. It may be said that it would be hard to foresee weather conditions in distant seas would affect the nearer seas when there is no structure that distinguishes the distant seas from the nearer seas, and such an abrupt change in weather is not uncommon at sea. It would therefore be difficult to expect the master to stay up all night on watch for such unforeseeable events.

This latter statement shows a basic lack of understanding of the marine environment that every seafarer should be aware of. If a vessel is on the west side of Korea and strong westerly winds are forecast 20 miles offshore, it should not take a great deal of understanding to realize that a track 10 miles off the coast will still be exposed to the effects of this wind. This is an astonishing admission by the IMST.

Since it was hard to foresee the weather conditions close to shore on the basis of weather forecasts for distant seas, and the vessel's towing ability had sharply declined due to unfettered winds from distant seas, and the officer on duty failed to promptly notify the master of the situation, it is hard to say that the belated measures to seek shelter were caused directly by the master's negligence. However, one cannot deny the fact that the measures to seek shelter contributed to loss in towing ability. Therefore, belated measures to seek shelter indirectly contributed to the accident. (Cause of Accident No. 4: Belated Measures to Seek Shelter. A Part of the Indirect Causes)

Contrary to this conclusion, the need to seek shelter was as a direct consequence of the tow masters negligence as a result of his inability to plan ahead for the voyage and failure to have an appreciation of the conditions his vessel was likely to encounter south of 37º N latitude. It also fails to mention the fact that no contingency had been put in place just for such an eventuality, e.g. port/anchorage of refuge, anchoring. Again, it calls into question the operation and management of the vessels in the marine spread, an area that any marine investigator would examine, but was singularly failed to be undertaken by the IMST.

D) Breaking Strength of Towing Line and Cause of Break

(1) Breaking Strength of the "Samsung T-5" Towing Line

The "Samsung T-5" towing line, which broke immediately before the accident occurred, was manufactured in 1995 and used as luffing wire for "Samsung No. 1" and stored in its storeroom. It was installed on "Samsung T-5" approximately five months before the accident, in June 2007. The required breaking strength according to the test reports of the manufacturer, the results of the breaking strength tests conducted by the National Institute of Scientific Investigation (NISI) after the accident, and the relevant regulations are described in Diagram 3-2 below.

[Diagram 3-2] Strength of the "Samsung T-5" Towing Line

Manufacturer's test results (breaking load): 217 tons
(safe working load): 99 tons
NISI's tests after the accident: 182.2 MT (16% reduction compared to when new)
Minimum breaking strength according to the "Standards for the Structure and Equipment of Barges": 136.9 MT

The tests conducted on the eight samples taken from the broken towing line by the NISI revealed that the breaking strength was 182.2 MT, which indicates about a 16% decrease in comparison to a new product. The minimum breaking load calculated according to the "Standards for the Structure and Equipment of Barges," based on the above 48.3 MT as the bollard pull of "Samsung T-5," is as follows.

Since the bollard pull (BP) is 40 =< BP >= 90,
Minimum Breaking Load = (3.8 - BP/50) × BP = 3.8 - 48.3/50) × 48.3 = 136.9 MT, which is significantly lower than the 182.2 MT tested by the NISI. Therefore, we find that there was no problem with the breaking strength of the towing line.

As the breaking strength of the broken towing line exceeds the minimum breaking load provided in the relevant regulations, it did not contribute to the breaking of the towing line. Therefore, it is irrelevant to the cause of the accident.
(Cause of Accident No. 5: Breaking Strength of Towing Line. Irrelevant to the Cause)

The towing line broke and therefore it cannot be claimed that the breaking strength of the wire is irrelevant to the cause. Apart from the break load test conducted on portions of the wire, no other investigations into the condition of the wire appear to have been conducted by the IMST. That is, were regular checks made on the wire and recorded, what was the usage of the wire and was this recorded. Again I will quote from the IMO Guidelines for Safe Ocean Towage (MSC/Circ.884):

Quote

12.17 Inspection of the towline should be carried out on completion of each towing operation. The results of the inspection should always be recorded as a basis for decision on future inspection programs. The inspection should also be noted on the towing log.

12.18 No part of any towline arrangement should be used for the towing operation if;

- the reduction in cross sectional area due to wear, abrasion, corrosion and broken wires exceeds 10% or there is severe kinking, crushing, or other damage resulting in distortion of the rope structure;
- end sockets or other towline terminations such as thimbles etc., are damaged deformed or significantly corroded.

Unquote

(2) Cause of the towing line breaking

No matter what the cause of the towing line breaking was, it is clear that the towing line broke because it could not withstand the tension applied to it. Under the circumstances of this case, the following explanations are possible: (a) the towing line was not bent, but subjected to a sudden application of dynamic load, which it could not bear, (b) the towing line was sharply bent at the stern choke or the cleat of the guide bar and was subject to a bending load that it could not withstand, or (c) the towing line was damaged by an object on the ship.

We will examine the first explanation.

(a) Dynamic load exceeding the tensile strength at the location of the break

The NISI determined that the tensile strength of the towing line at the location of the break was on average 182.2 MT, and the total resistance of the static load under the weather conditions at the time of the collision was 86.05 MT. In order for the towing line to have snapped, the dynamic load must have been greater than 96.15 MT, the difference between the tensile strength where the towing line broke and the total resistance.

The only force which could have been great enough to break the towing line connecting the tugboat and the barge is a sudden application of dynamic load.

The total resistance of the static load imposed on the towing line includes frictional resistance, wave resistance, air resistance and additional resistance from the current. As we have already demonstrated, air resistance or air pressure created by far the largest load of 72 MT, and the other loads did not exceed 10 MT. However, in view of the characteristics of air, air resistance could not have exerted a significant and sudden dynamic load to the towing line.

The only load left that could have been exerted on the towing line connected to "Samsung T-5," then, is the dynamic load from the weight of "Samsung No. 1" and/or "Samsung T-5," or the inertia force of the ship's movement. "Samsung No. 1" had a tonnage of 16,000 MT.

Therefore, dynamic loads exceeding 96 MT which was the residual breaking strength of the towing line must have been created by the force generated from the movements of "Samsung T-5" and "Samsung No. 1" in the current. It is not difficult to conclude that the greatest dynamic load was applied when the movements of the tugboats in waves were in dissonance. At the time of the collision, the sterns of "Samsung T-5" and "Samsung No. 1" were connected with a single towing line, and the tugboat bows were aligned in the same direction. Under the circumstances, the only force that could have been exerted on the towing line is the force generated by pitching.

As the Marine Spread navigated in harsh wind and waves, the irregular movements of the tugboats and the barge could have increased the dynamic tension amplification on the towing line to such a degree that the negative dynamic tension (tension applied in the direction of the towing line's contraction) exceeded the towing line's positive static tension. In such a case, the total tension could be zero or even negative, causing the towing line to form a catenary or become slack. If the towing line was then subjected to a positive tension within a short period of time, it could experience "snapping," resulting in a breakage or reduction of fatigue life. It appears that the towing line broke in this case because of this "snapping" phenomenon.

The dynamic loads on the towing line created by a "slack-and-snapping" phenomenon (relaxation followed by sudden tension) would best be analyzed by calculating the extreme tensions based on a mathematical model and numerical analysis, but we do not have the resources to do this. Since our goal is to verify the probability of the explanation we will use a more simplified form of calculation.

The dynamic load (DL) is the sum of the dynamic loads from "Samsung No. 1" and "Samsung T-5." The dynamic load from "Samsung No.1" (DLs1) is applied to the towing line through the Schmidt bracket:
DLs1 = m (mass of Samsung No.1) x ap (linear acceleration in the direction of the towing line by Schmidt bracket movement)
= 4,612 (MT)
The horizontal component is 239.8 MT.
The dynamic load from the pitching movement of "Samsung T-5" (DLT5) to the tow winch drum calculated in the same manner is:
DLT5 = m (mass of "Samsung No. 1") x ap (linear acceleration in the direction of the towing line from the winch drum movement of "Samsung No. 1")
= 207.2 (MT)
The horizontal component is 14.3 MT.
Therefore, the sum of the dynamic loads from both ships must be:
DL = DLs1 + DLT5 = 239.8 + 14.3 = 254.1 (MT)
As already explained, the critical dynamic load is 96.15 MT [182.2 (the maximum tensile strength as established by the NISI) – 86.05 (total resistance)], and the result of our calculation greatly exceeds this value.

If "Samsung No. 1" and "Samsung T-5" were pitching at 3 and 3.9 degrees, respectively, and if the pitching periods were in dissonance, this would create an additional sudden increase in dynamic load of approximately 254 MT. Even without the static load, this dynamic load alone exceeds the minimum breaking load (MLB) as calculated according to the method discussed above, and if the entire amount of such load is applied to the towing line, is great enough to break the towing line.

It should be pointed out that a towing line usually has a catenary or is slack where the center of the line falls below the sea surface, and it takes some time for the towing line to become straight. The sudden application of dynamic load for a short period of time is usually dispersed during this time.

The conclusion is that the towing line broke because "Samsung T-5" accelerated at full throttle to avoid colliding into "Samsung No. 1," causing the towing line to become almost straight. At this moment, a sudden dynamic load was applied to the towing line without any time for absorption and broke the towing line.

(b) The second explanation is less likely and less plausible than the first explanation.

The second explanation that the towing line broke due to frictional forces from the choke or the guide bar is not consistent with the fact that the location of the break was 60 m from the stern of "Samsung T-5," and the fact that the horizontal distance between the tugboats was not great enough to cause the towing line to bend at the choke or the guide bar. The frictional scratches observed on the choke or the guide bar are commonly found on other deck structures such as the fairleads, bitt, or bollard.

It is also clear that the bending load from the choke or the guide bar is still a dynamic load.

(c) The explanation that the towing line of "Samsung T-5" was damaged due to friction from the hull around the portside stern perpendicular, or from the propeller, is unlikely because the external plate of the hull formed a smooth curvature and the propeller was in a cylindrical duct.

The cause of the towing line breaking was the dynamic loads that were applied to the vessels within a short period of time and which exceeded the tensile strength at the towing line at the location of the break. It is not related to the breaking strength of the towing line. Another cause which contributed to the breaking was the composition (combination of materials, not length) of the towing line, which was not in compliance with the Towage Approval Check List.
(Cause of Accident No. 6: Cause of Towing line Breaking. One of the Direct Causes.

Not once do the IMST consider that the tow line might have been defective for other reasons than those described above. That is, did they investigate the maintenance of this wire, is usage and general condition at the time of the incident. I see no evidence to say that they did, they again rely upon the towage certificate which does not override the operators/managers and tug master obligations. This is highlighted in the IMO Guidelines for Safe Ocean Towing below:

Quote

12.17 Inspection of the towline should be carried out on completion of each towing operation. The results of the inspection should always be recorded as a basis for decision on future inspection programs. The inspection should also be noted on the towing log.

12.18 No part of any towline arrangement should be used for the towing operation if;

- the reduction in cross sectional area due to wear, abrasion, corrosion and broken wires exceeds 10% or there is severe kinking, crushing, or other damage resulting in distortion of the rope structure;
- end sockets or other towline terminations such as thimbles etc., are damaged deformed or significantly corroded.

Unquote

The breaking of the tow line was **THE** direct cause of the collision. Had the tow line not parted, there would not have been a collision as the marine spread was moving away from the anchored VLCC.

The towing line of "Samsung T-5" broke because of a dynamic load exceeding the breaking strength at the location of the break and not because of a defect in the composition materials with less-than-adequate strength. However, a dynamic load in excess of the maximum breaking strength at the location of the break would not necessarily cause the towing line to break, if the length of the towing line itself or the catenary is sufficient to extend the time period during which the dynamic load was applied and to distribute such load along the length of the towing line. In this regard, a factor that contributed to the breaking of the towing line was the failure to comply with the Towage Approval Check List, including the failure to use PP stretchers, which would have absorbed the force applied to the towing line, like a spring, and the failure to use a sufficient length of towing line.

However, if a towing line is too long, it becomes difficult to maneuver the ship. To comply with the Towage Approval Check List in terms of the towing line length, it was necessary to use more tugboats to ensure maneuverability.

Again the IMST are using the towing survey certificate as the final deciding factor on the towage arrangement, which is a fundamental misinterpretation of such a certificate. It is the responsibility of the operators/managers and masters to properly prepare the tow, not the insurance surveyor.

(3) The relationship between the towing line breaking and the collision

At the time the towing line broke at 0652 hours on the day of the collision, the distance between "Samsung No. 1" and "Hebei Spirit" was 0.4 miles. "Samsung No. 1" was gaining distance after the distance of closest point of approach ("DCPA") reached 0.3 miles, and would not have collided with "Hebei Spirit" if the towing line had not broken.

The towing line broke after the said DCPA, as the ships were moving away from each other, and the wind caused "Samsung No. 1" to collide into "Hebei Spirit."

The breaking of the towing line is one of the direct causes of the collision.
Cause of Accident No. 7: Towing line breaking. One of the Direct Causes.

Finally, the IMST have admitted that the breaking of the towline caused the collision recognise that the marine spread was moving away from the anchored VLCC prior to its breakage. As it would not have collided with the VLCC if the tow line had not parted, this is THE direct cause of the collision. And yet, the IMST have not fully investigated why this line could have broken and whose responsibility it was. When it is clearly a failure of the operation and management of the vessel in the marine spread

D) Emergency anchoring

"Samsung No. 1" conducted emergency anchoring immediately before the collision, but was not able to prevent the collision. We need to establish whether earlier emergency anchoring could have prevented the collision and also whether an emergency anchoring was possible in the bad weather.

(1) Whether "Samsung No. 1" could have anchored itself against the external forces

We shall calculate the anchor's holding power on the presumption that 13 out of 15 shackles (with two shackles as reserve) were lowered to attain maximum holding power.

Wa (Weight of the anchor) = 19.7 MT
Wa1 (Weight of the anchor in the water) = Weight of the anchor – (specific gravity x weight of the anchor / specific gravity of the anchor)
= 19.7 – (1.025 x 19.7/7.8) = 17.1 MT
Wc (Weight of 1 meter of the anchor) = 0.206 ton (total weight of the anchor = 84.975 MT)
Length of 1 shackle of the anchor = 27.5 m
h = 64 m (water depth) + 2 m (height from the surface of the hawser pipe) = 66 m
H = horizontal component of the tension on the anchor chain
Lc is the catenary length of the anchor chain under the weather conditions at the time of the collision.
Lc = [h{h+2(H/Wc1)}]1/2=[66{66+2(H/0.179)}]1/2

The total resistance applied to "Samsung No. 1" during navigation is the sum of Rf (frictional resistance), Rw (Wave resistance), Ra (Air resistance) and the additional resistance from the waves, as we have already analyzed towing capacity in accordance with the "Standards on the Structure and Equipment of Barges." However, the external force H is the sum of the wind pressure (Ra, air resistance), Rc (hydraulic resistance), and Rd (drifting resistance). (H=Ra+Rc+Rd)

We shall assume that the bow of "Samsung No. 1" was facing the wind after anchoring and that the current was at a speed of two knots and a direction of southwest.
For our purpose of verifying the probability of "Samsung No. 1" withstanding external forces, calculation of the exact value of the holding power of "Samsung No. 1" is unnecessary.

Applying the same formula we used for calculating the total resistance of Samsung No.1,

Ra – 1.95 x 105 x Cs x CH x A3 x (Vw +V)2 = 66.6 MT --------- (iii)
Cs = 1.5 (Same Rules Schedule 3, hull surface configuration coefficient)
CH = approx. 1.3 (Same Rules Schedule 3, height of the center of wind from sea surface)
A3 = 1,285 (total horizontal cross-section area of perpendicular top exposed to wind. If the crane angle is 40 degrees, the air pressure area is 2,000 (front side, KR calculation) x sin 40o=2000 x 0.6428=1285 m2
Vw= 36.93 (= approx. 10 m/s. Wind speed. Value for coastal sea in accordance with the Rules and the corresponding navigation area. Knots)
V=0 (anchored state)

Rc shall be the maximum crossway hydraulic resistance (Rc) to test the holding power under the maximum external force and shall be used as the horizontal component of the force on the anchor chain. This value shall be used to determine the efficacy of anchoring because the crew on the Marine Spread claims that anchoring would not have been effective because of strong external forces. We will simplify our calculation by assuming that the maximum external force, or total crossway hydraulic resistance, is applied to the anchor.

Rc=1/2 x ρw x cw x A x V2
= 1/2 x 0.1046 x 1.2 x 353.8 x 1 = 22.2 MT

Where
ρw : sea water density (0.1046 ton· sec2· m-4)
Cw : hydraulic coefficient (approx. 1.2)
A: hydraulic area (length x average sea draft = 105.6 x 3.35 = 353.8 m2)
V: flow velocity (approx. 1m/sec)

[Table 3-3] Drifting coefficient (R) in irregular sea passageway

Drifting coefficient R is a function of the wave number (k) and sea draft (d). Wave number is a function of wave frequency (w), which in turn is a function of the wave period (Tz). Calculation of their values is based on approximately 31 knots (15~18 m, average 16.5 m) for the wind speed.
Standard Wave Spectrum is used to express the condition of the Irregular Sea Passageway and is based on the Spectral Density formula of the ITTC (International Towing Tank Conference). The area of the spectrum sets the variance (mo), and the second and fourth momentum of the spectrum are abbreviated as m2 and m4 respectively. The surface condition is expressed as follows.

Significant wave height (H1/3) = 4.0 x mo1/2 = approx. 18.5 ft (= approx 5.6 m)
Average wave height (Haverage) = 2.5 x mo1/2 = approx. 11.67 ft (=approx. 3.6 m)

The average wave height is similar to the value reported by the crew involved in the collision and is consistent with the wind scale and wave height in Table 3-4 for the Beaufort scale.

Where
No = 1/(2/π) x (m2/mx)1/2 = 0.1132/sec, Tz = 1/no = 8.83 sec.
No: zero-up crossings per second
mo = 21.564 ft2 (integral of the wave spectrum)
m2 = 10.91ft2/sec2 (second momentum of the wave spectrum)
m4 = 9.52 ft2/sec2 (fourth momentum of the wave spectrum)

Now, therefore,

w (wave frequency) = 2 π / Tz = 0.711
k (wave number) = w2/g = 0.0052
k x d = 0.052 x 3.35 = 0.1742 (d: average sea draft)
The corresponding drift force coefficient on the drift force coefficient curve for this value is approximately 3.4.

[Table 3-4] Beaufort Scale Classification (the row in grey is the wind force at the time of the collision)

Scale	Wind speed		Average wave height	Name	
	knot	m/sec			(m)
3	7-10	2.4-5.4	Gentle Breeze		0.6
4	11-15	5.5-7.9	Moderate Breeze		1
5	16-21	8.0-10.7		Fresh Breeze	2
6	22-27	10.8-13.8		Strong Breeze	3
7	28-33	13.9-17.1		Moderate Gale	4

It is assumed that the ship is facing the waves after anchoring.

Rd = 1/2 x ρw x g x ζ2a x R2 x A x sin2α = 10.7

Where
ρw: sea water density (0.1046 ton· sec2· m-4)
g: gravitational acceleration (9.8 m/ sec2)
ζa: wave amplitude [Hw(wave height) x 1/2 = 2]
R: drifting force coefficient = 0.34 (Refer to Table 3-3)
A: width of the boat (45 m)
α: angle of incidence

Now, therefore, the external force (horizontal component) is equal to 99. 5 MT. (H=Ra + Rc + Rd = 66.6 + 22.2 + 10.7)

The reason why the external forces are greater during an anchored state (99.5 MT) than the total resistance during navigation (86.05 MT) is because we assumed the maximum hydraulic force.

The length of the catenary curve (Lc) may now be calculated.
Lc= [h{h+2(H/Wc1)}]1/2=[66{66+2(99.5/0.179)}]1/2
= [66{66+2x555.9}] 1/2= 77,7351/2 = approx. 278 m (approx. 10.1 shackles)

If "Samsung No. 1" lowered 13 out of 15 shackles (with two shackles on reserve), about 10.1 shackles (approx. 278 m) would form a catenary curve, and the rest (27.5m/shackle x 13 shackles) – 278 m = 79.5 m (approx. 2.9 shackles) would exert the holding power.

The total holding power (P) is the sum of holding power of the anchor (Pa) and the anchor chain (Pc).

$P = Pa + Pc = Wa \times \lambda a + Wx \times \lambda c \times Lp$

$= 17.1 \times 3.5 + 0.179 \times 1 \times 79.5 = 59.9 + 14.2 = 74.1$ MT

Where

Wa: weight of the anchor in the water

λa : holding coefficient of the anchor

Wx: weight of 1 meter of the anchor in the water,

λc: holding coefficient of the anchor chain

Lp: length of the anchor chain exerting holding power

Total external forces (wind, drift, and hydraulic forces) – 99.5 MT > holding power of 13 shackles – 74.1 MT

Only 2.9 shackles would exert holding power if 13 shackles were lowered, and the holding power would be short by 25.4 MT. However, the sum of the bollard pull of the two tugboats (86.06 MT) would provide 60.65 MT (86.05 – 25.4) of reserve holding power, and anchoring would have been possible. As explained earlier, the purpose of this simplified calculation is to determine the effectiveness of anchoring by comparing the external forces and the holding power. Even if the calculation is not accurate, the result of the comparison would not change, and the determination of probability would be reliable.

Therefore, we refute the claim that the holding power would not have been sufficient even if "Samsung No. 1" had conducted emergency anchoring. If the Marine Spread had anchored earlier when she lost her maneuverability, the collision could have been prevented.

(2) Feasibility of anchoring

After the towing line broke at 0652 hours on the day of the collision, Seung-Min Cho, the Master of "Samsung T-5," requested an emergency measure to Yi Hyun Kim, the Master of "Samsung No. 1" at 0654 hours. Yi Hyun Kim ordered Soon-Do Lee, the bosun, and two other crewmembers to lower the anchor, and they began lowering the anchor at 0700 hours. Only 5.5 shackles had been anchored at the time of the collision at 0706 hours.

It is clear that it took only six minutes for the bosun to begin lowering the anchor, once he received instructions from Yi Hyun Kim, who had been warned by Seung-Min Cho.

The average freeboard at the time was about 3.65 m (average draft of about 3.35 m), and "Samsung No. 1" did not have any rails. With wave heights reaching four meters, it would not have been easy to go out on the deck. Nonetheless, it took only six minutes to lower the anchor after the breaking of the towing line, and 5.5 shackles (ultimately 12 shackles) were released in the following six minutes, even if we do take into account the fact that the towing line broke. If only Seung-Min Cho had the will, early anchoring would not have been impossible.

"Samsung No. 1" did not conduct emergency anchoring, probably because Seung-Min Cho did not recognize the danger of the situation, or because he was too busy trying to maneuver the Marine Spread after losing control.

(3) Failure to recognize the risk of taking prevention measures against the wind, following the failure to conduct emergency anchoring. (The circumstances are similar to those in the case of "Sea Prince").

Also, he should not have tried to sail windward towards "Hebei Spirit" and should simply have let "Samsung No. 1" drift leeward towards the starboard of "Hebei Spirit," keeping a safe distance from other tugboats. The decision to sail windward, together with the decision not to conduct emergency anchoring at the point of abandoning avoidance maneuvers, was a major judgment in error. These circumstances are very similar to those of the "Sea Prince" incident in 1995. The ship's master in that case should have continued sailing, even if the drift angle was large, but he decided to change course near Jak-do and sailed windward towards the east of Jak-do. The ship was pushed towards Jak-do.

The fact that the anchor was not lowered at an earlier stage and the decision to sail windward towards "Hebei Spirit" are one of the direct causes of the collision.
(Cause of Accident No. 8: Failure to conduct early emergency anchoring. One of the Direct Causes)

The IMST are correct in their conclusion of this part. The marine spread was equipped and it was feasible to drop the free-fall anchor on the crane barge at any time before the collision to stop the movement of the marine spread if it was deemed necessary. The fact is it was not considered because, apparently, the tug master thought the holding ground was not suitable displays the incompetence of this master and those who employed him. Sand is a good holding grand for a high holding power anchor as illustrated in the US Navy Salvage handbook below:

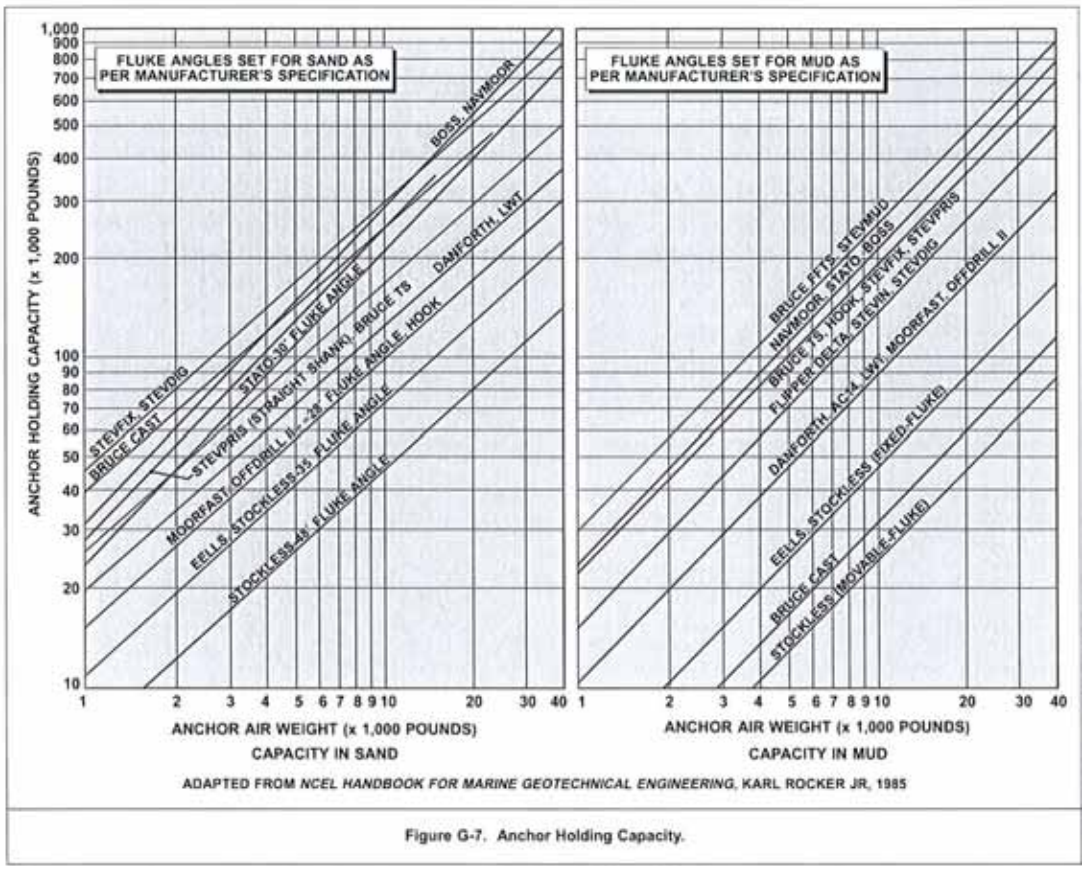


Figure G-7. Anchor Holding Capacity.

What IMST has also failed to include is why the marine spread tracked to the windward side of the "HEBEI SPRIT" when it could have easily tracked to the leeward side. By tracking to windward, the parting of the tow line allowed no time for the anchor to be deployed, although it had not even been prepared at this time belying the control difficulties said to have been experienced. This factor was never included in the IMST Decision and yet this, and the lack of preparation for anchoring, again illustrates the lack of basic knowledge of the marine environment displayed on the marine spread, and calls into question the operation and management of the marine spread.

E) Navigation

(1) Navigational status of the tugboats

According to our above analysis of the Marine Spread's towing capability, the Marine Spread was exposed to wind and wave forces, which were similar to or greater than the towing capability of the tugboats. At some points, the tugboats could have resisted the external forces and pull of "Samsung No. 1," but at other points the wind and waves were too strong or the dynamic loads would become too great, and "Samsung No. 1" would pull the tugboats. In the end, the external forces prevailed over the towing capability of the tugboats, and the tugboats could no longer maneuver to follow their set course.

Apart from the issue of whether the tugboats had sufficient capability to withstand the weather conditions at the time of the collision or whether they lost the timing for taking prevention measures, it is necessary to confirm the navigational status of "Samsung T-5" and "Samho T-3" in order to analyze the cause of the collision.

According to Item 6 of Article 2 (Definition) of the Sea Traffic Safety Act, "a vessel with no maneuverability" refers to a ship with no maneuverability, which cannot avoid other ships due to any reason. According to Item 7 of the same, "a vessel with restricted maneuverability" refers to a ship, which due to the nature of her work, is restricted in her ability to maneuver and is therefore unable to keep out of the way of another vessel.

According to Item (f) of Rule 3 (Definition) of the COLREGS, "A vessel not under command, (formerly the N.U.C vessel)" means a vessel, which through some exceptional circumstance is unable to maneuver as required by these Rules and is therefore unable to keep out of the way of another vessel, and the definition for "a vessel restricted in her ability to maneuver" is the same as that in the Sea Traffic Safety Act.

Before running into severe winds and waves around Ul-do, the tugboat were following its set course of 206 degrees after leaving Incheon Port and could be described as vessels restricted in their ability to maneuver. However, after they passed Ul-do and up to when they began prevention measures at 0400 hours the next day, the voyage track of the Marine Spread zigzagged considerably. The maneuverability of the tugboats was significantly diminished.

After that, at 0527 hours of the same day, when the vessels gave up trying to seek shelter and returned to their original course, the towing direction was west, from the moment that the tugboat turned to 270 degrees to the moment of collision. However, the voyage tracks were directed towards "Hebei Spirit," and the vessel was being pushed south at a drifting angle of almost 90 degrees. However, the ship changed course by 300 degrees at 0630 hours of the same day when the ship had crossed off the bow of "Hebei Spirit" from her starboard to portside, and the Marine Spread passed by the portside of "Hebei Spirit" to pass the CPA point and was moving further away, even though it was at a dead slow speed. As such, it is hard to say that the Marine Spread was in a situation where it had no any navigation capacity, such as the breakdown of the main engine or steering gear.

Although it is generally accepted that cases where navigation is restricted due to internal causes of the ship, such as cases where the main engine has broken down, or the anchor has been let down, or no holding power was created, or navigation is made while dragging the anchor for the navigation of the ship, and where navigation is restricted due to external causes of the ship, such as cases where a ship "heaves to" (navigational technique for bad weather whereby the ship receives enormous waves at the portside or starboard side of the bow at 30 degrees and the speed moving forward is kept at almost 0) in bad weather, or the ship stops because there is no propulsion power due to a lack of wind, the vessel is experiencing a loss of navigational capacity.

The points listed by the IMST as generally accepted cases where navigation is restricted due to internal causes of the ship are, in fact, not generally accepted. Navigation while dragging the anchor is not a usual practice, if a deliberate practice at all. The dragging of an anchor is something that sometimes occurs but not as a deliberate means of navigation unless what they are referring to is using an anchor to moor a ship. This practice is usually a short term use of the anchors when the vessel is under propulsion. In these cases, there does not have to be a loss of navigation capacity, in fact, mooring a ship with the anchor down, the vessel has increased navigation capacity, not less. I have included an extract from Danton's Theory and Practice of Seamanship which maybe what the IMST are referring to and have misinterpreted:

DREDGING DOWN

A vessel is said to *dredge* when she moves under the influence of the tidal stream but with her anchor held at short stay so that it drags along the bottom. Her speed over the ground is therefore retarded and is not so great as the rate of the stream. She therefore has headway through the water. Her rudder may be used to steer her. A strong tidal stream is necessary for her helm to be sensitive.

If a vessel, when dredging, puts her rudder to port, the vessel will remain parallel with the stream direction but will gradually move diagonally across it towards her port hand. She will dredge similarly to starboard. In each case the most efficient movement is achieved by using the anchor on the side opposite to that in which she wishes to dredge, i.e. it is preferable to use the starboard anchor if dredging to port under port helm. A vessel which is dragging, therefore, can, by putting her helm over, avoid other vessels, provided the stream is fast enough to make her steering sensitive. Also, the operation of dredging can be modified somewhat in the case of a ship at anchor which sees another dragging towards her. By surging her cable rapidly and using bold helm, she may be able to sheer away from the line of drag and bring-to on the other anchor. The first one is liable to be fouled, but this is of small moment in the circumstances. In both these latter cases there must, of course, be a stream.

23

It can be seen here that the vessel at anchor is described as having the option of surging its cable and using its helm on a stern to move the anchored vessel clear from the approaching vessel. This is what the master of "HEBEi SPIRIT" did, paying out more cable and then trying to swing the vessel stern away from the marine spread by using the, transverse thrust of the vessel at half astern.

In general, it is hard to say that the Marine Spread was in a state of "loss of navigation capacity" within the scope described above. This is because if it had been pushed in a direction it did not intend, it might have been deemed to be at a loss of navigation capacity, but as it was moving and attempted to seek shelter, even though the direction was a deviation from the intended course, it is hard to say that the ship was in a state of "loss of navigation capacity" rather than a state of "limited navigation capacity."

Therefore, the tugboats of the Marine Spread had become a vessel severely restricted in her ability at around 0200 hours on the date of collision, and it is the common opinion of the umpires that they were "severely limited in its navigation capacity and close to a loss of navigation capacity," although it was not strictly at a "loss of navigation capacity."

This argument on the loss of navigation capacity fails to take into account the facts. Those on the marine spread never broadcast or signalled that they were restricted in any way until 0627 hours. The facts show that they has a measure of control of the spread to move through directions from west via south to east and had the capability to release and hold the spread on their free-fall high holding power anchor. But they did not do so. So the loss of navigation capacity or even severely restricted in their navigation capacity was not an issue. They had a number of options to take very early on before the collision. That they failed to take these cannot be attributed to any loss in maneouverability.

However, it was a ship in "loss of navigation capacity" after the breaking of the towing line of "Samsung T-5" at 0652 hours.

(2) Status of "Hebei Spirit" according to navigation rules

The ship was paying out the anchor chain and dragging anchor, but this is a situation that arose in the midst of deliberate actions to avoid imminent collision. Therefore, the mere fact that it was dragging her anchor does not mean that the ship was unable to navigate (dragging for the purpose of navigation). Also, it had paid out nine shackles of anchor chain from the day before the collision and the dragging was for the purpose of avoiding collision. Therefore, it cannot be disputed that the ship was at anchor according to the navigation rules.

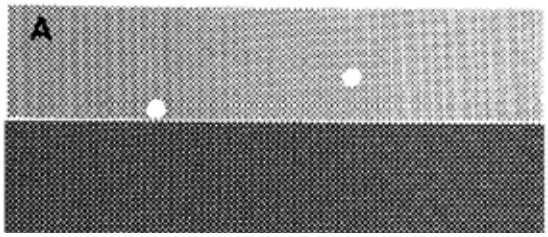
"HEBEI SPIRIT" was never dragging its anchor. This anchor held. The only evidence that the IMST has for the dragging of this anchor was the call made to the "HEBEI SPIRIT" by the "SAMHO T-3" at 0629 hours where they thought the VLCC had dragged. At this time the VLCC had paid out additional anchor cable and was going astern to stretch the cable. All this could have indicated to the marine spread that the VLCC was dragging. But it was not.

As I have said above, there is no such common practice as the IMST seem to believe of dragging an anchor for navigation. This was not a planned action on the VLCC, the vessel was securely anchored throughout its period at the anchorage. The anchor never dragged.

Additionally, as the VLCC was at anchor it was not the give way vessel when a power driven vessel underway is approaching. This is a basic understanding of the collision regulations as illustrated in the following extract from "A Seaman's Guide to the Rule of the Road: A publication used by many aspiring navigators to learn about the necessary actions to take at sea.

You sight these lights on a steady bearing at a range of about a mile inside a harbour.

1. (a) What kind of vessel is signified in (A)?
   (b) After deciding what you have sighted, what should be the purpose of any action you take?



1. (a) A vessel at anchor: the length may be over, or under, 50 metres. (Remember that, unlike the positioning of masthead lights when under way, the after anchor light is lower than the forward anchor light.)
(b) To keep clear.

Then, after all this talk of dragging anchor for navigation, the IMST then contradict themselves by concluding that the vessel was, in fact, at anchor.

As the tugboats were severely restricted in their navigation abilities and "Hebei Spirit" was a vessel at anchor, the responsibilities between vessels according to the navigation rules for vessels in sight of each other cannot be applied to the two ships. Therefore, as they are in a situation where both must do their best to avoid collision under special circumstances, this point will be reviewed for the determination of whether the actions by "Hebei Spirit," which was at anchor, to seek shelter was appropriate.

This shows a complete misunderstanding of the Colregs. Both vessels fall within the steering and sailing rules, not outside them as a special circumstance. "HEBEI SPIRIT" was anchored, displaying the correct navigation lights. The marine spread was underway, displaying the lights for such a tow. At no time did those on the marine spread display any other lights that indicated to other vessels that they were in any way restricted or in trouble. Never did they contact the nearby ships or the VTS to advise of any troubles until 0627 hours, after they had been called repeatedly by VTS and "HEBEI SPIRIT", and after those on the anchored VLCC had already taken the only action they could. It therefore means that those on the anchored VLCC had to have such foresight that they recognised all the problems on the marine spread. This is plainly foolish, particularly as the tugs are not displaying lights or broadcast messages to indicate their problems; if they had any. Consequently, the IMST have taken this view purely with the benefit of hindsight.

(3) Application of navigation rules

The rules for navigation which shall be applied to "Samsung T-5" and "Samho T-3," whose navigation abilities were severely restricted, "Samsung No. 1," which was being tugged by them, and "Hebei Spirit," will be analyzed.

(A) Navigation rules and lookout for vessels within sight of each other

Seung-Min Cho, the master of the tugboat "Samsung T-5," decided to return to the port to seek shelter at 0400 hours, as the towing ability of the Marine Spread had severely decreased, and the time at which it actually changed course to seek shelter was 0444 hours. The course of the Marine Spread was contrary to the intentions of the navigator from this point on, and it was easy to see with the naked eye that 3 large sized vessels, including "Hebei Spirit," loaded with dangerous materials, were at anchor within 2 miles south.

The Marine Spread, although it was in a dangerous situation where it could not control the drifting and collision was possible, "Samsung T-5" and "Samho T-3" did not notify the nearby ships of this danger and did not even answer the VHF call from the Daesun VTS at 0523 hours of the same day, as they were not on lookout of the situation for practical purposes.

The marine spread was not totally out of control as the facts show. The vessel could change direction between west, via south, to east, and had the ability to anchor. The IMST are then correct in stating that the marine spread also should have contacted the VTS and nearby ships but failed to do so.

As such, it did not provide "Hebei Spirit" with time to seek shelter earlier. It is understandable that the tugboats were having difficulties towing and focused on towing "Samsung No. 1," and as a result, they were negligent in taking caution.

However, Article 2(2) of COLREGs states that such circumstances do not exempt a ship from responsibility for a collision.

Therefore, the actions of the tugboats would constitute negligence in its lookout duty.

The negligence in lookout duty by the Marine Spread formed a part of the direct cause of the collision.
(Cause of Accident No. 9: Negligent lookout by the Marine Spread. A part of the direct causes.)

The IMST fail to go into the reasons as to why such an incompetent lookout was being maintained, in particular why no-one on four vessels failed to respond to VHF calls from the VTS and "HEBEI SPIRIT", and had to be alerted by cell phone following the alarm being raised by the "HEBEI SPIRIT". The operation and management of these vessels needed to have been investigated more thoroughly as this lack of proper lookout on four vessels of the same operators/managers indicates a serious defect in their management systems.

(B) Navigation rules and responsibilities between vessels within sight of each other

The Marine Spread was limited in its navigation abilities and "Hebei Spirit" was a ship at anchor. Thus, it is hard to apply the clause on the responsibilities between vessels (Article 26 of the Sea Traffic Safety Act, Article 18 of the COLREGs) under the navigation rules applicable to vessels in sight of each other, which classifies the obligation to seek shelter according to superior navigation abilities. However, when a rule is not specified in the Sea Traffic Safety Act, it should be governed by the relevant provision in the COLREGs. Therefore, Article 2 of COLREGs (Responsibility) should be considered here in determining the obligation to seek shelter and whether it was appropriate to do so.

This illustrates a misinterpretation of the COLREG's by the IMST. At no time did the marine spread even signal or broadcast that it was limited in its navigation abilities. Therefore, those on the marine spread were required to observe Rule 2(a), that is:-

Quote

Rule 2
Responsibility

(a) Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

Unquote

(C) Special Circumstances

According to Article 2 (Responsibility), Paragraph (a) of the COLREGs, responsibility for the results of collision cannot be exempted if the collision was caused by negligence in complying with the COLREGs or negligence in taking the precautions required by the ordinary practices of seamen or under special circumstances, thereby imposing a comprehensive responsibility. According to Paragraph (b), due caution is required in the interpretation and performance of the COLREGs, concerning all special circumstances including risks of navigation and collision and limitations in the navigation abilities of relevant ships. It further stipulates that the COLREGs may be disregarded in the event of risk or special circumstances in order to avoid imminent risk, which signifies that a ship may depart from these rules if it is done to avoid risks in navigation and the risk of collision. In other words, in the event there is imminent risk, the first part of the COLREGs stipulates that the collision must be avoided through all necessary measures, whatever they may be.

Rule 2 has been misquoted above. The full paragraph of Rule 2(a) is given below. That is, nothing can exonerate the neglect <u>to</u> comply with the Rules, not negligence in complying with the Rules.

Quote

Rule 2
Responsibility

(a) Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

Unquote

If so, a situation in which tugboats become limited in their navigation abilities in bad weather and begin drifting and approach a ship at anchor is a "special circumstance" arising from "some exceptional circumstance," as provided in the COLREGs. Against this backdrop, the appropriateness of the actions by "Hebei Spirit" must be judged in consideration of the special circumstances it was subjected to, in order to correctly apply the rules of navigation. This will be dealt with in more detail when we analyze below the cause of the collision with respect to "Hebei Spirit."

In part A, Rule 1(a) of the Colregs it states that

Quote

'These rules shall apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels'.

Unquote

This applies to the marine spread.

In part C, Rule 24 defines the lights and shapes to be displayed by a vessel engaged in towing operations.

Rule 27 defines the lights and shapes to be displayed by vessels not under command or restricted in their ability to maneuver.

Rule 30 defines the lights and shapes to be displayed by vessels at anchor.

From the Colregs, the marine spread was displaying the lights for a power driven vessel underway and engaged in a towing operation.

The "HEBEI SPIRIT" was displaying the appropriate lights for a vessel of her size at anchor.

The only responsibilities which can therefore be claimed when citing the Colregs are those appropriate to these facts above.

It has no bearing on the case to claim in retrospect that the marine spread was restricted in her ability to manoeuvre, or any other restriction, if she did not display the lights required for such a vessel or even make the necessary broadcast to warn other vessels. It then follows that at that time, and by definition of the Colregs, "HEBEI SPIRIT" was under no obligation to take action, until required to do so to try and avoid a collision where the vessel obligated to take action is not doing so, in other words the marine spread.

Even to allow, if as claimed, that the marine spread was restricted in her ability to manoeuvre, then she wilfully neglected to comply with the Colregs and for whatever reason failed to display proper signals, then as per rule 2,

Quote

Nothing in these rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these rules…..

Unquote

2) "Hebei Spirit"

In order to analyze and determine the causes that directly and indirectly affected the collision, the appropriateness of the anchoring location, the appropriateness of the watch duty performed by the person on duty, and the appropriateness of the Master's actions to seek shelter will be reviewed in turn.

A) Appropriateness of the anchoring location

The anchoring location, which the ship in question chose at its own discretion outside the port boundaries upon receiving information from the VTS while approaching Daesan harbor the day before the collision, was at LAT. 36°53'06"N, LONG. 126°03'12" E, which was 4.6 miles west from the No.1 buoy of Daesan port, and the location the anchor was actually dropped was LAT. 36°52'33"N, LONG. 126° 03'17"E, which was 254 degrees and 4.4 miles west from the No.1 buoy of Daesan port.

This location is 64 m deep and the seabed is mainly composed of sand, and it is an open sea area where the current flows in a northeastern direction and the current speed is the greatest at high tide and where the current flows in a southwestern direction and the current speed is the greatest at low tide. Therefore, looking at its natural conditions, there is no problem for a large ship 323.8 m length with a 20 m draft to pass through, even though the water may be slightly deep and the conditions may not be ideal.

However, as it is situated on the sea passageway along the coastline, which connects the northern exit of the traffic separation scheme of Heuk-do and the traffic separation scheme of Janganseo, there is a high risk of collision with ships sailing along the coastline, which have exited from the northern exit of the traffic separation scheme of Heuk-do and are moving north towards Pyungtaek port or the eastern exit of Incheon port, and this is especially true when visibility in the area is limited by fog or bad weather.

Lowering an anchor here has a high possibility of breaching Article 30, Paragraph 88 of the Sea Traffic Safety Act, which provides that "a ship shall not anchor (including being tied to a ship at anchor) near the traffic separation scheme or its exits," and Chapter 8, Part 2 of the voyage planning under the STCW, which provides that the planned route in a voyage plan shall be reviewed based on information on navigational limitations and hazards.

However, while the location where the ship was anchored was near the passageway connecting the northern exit of the traffic separation scheme of Heuk-do and the routes into ports such as Pyungtaek port, the Marine Spread's intended course was not toward the northern exit of the traffic separation scheme of Heuk-do, but toward the northern entrance. Therefore, depending on the perspective, it could be assumed that the Marine Spread was moving south towards the northern entrance and had lost its navigation abilities, thereby intruding into the northern exit. In other words, if a ship lowered its anchor in line with the northern exit of the traffic separation scheme of Heuk-do and a marine spread moving north towards Incheon port exited the northern exit of the traffic separation scheme and collided with the anchored ship while moving north, the choice of an anchoring location might be an issue. However, it cannot be said that a ship moving south from Incheon port and entering into the northern entrance is the same case as this case, where a ship invaded the passing route of the opposite side. In this case it can only be said that the marine spread was pushed to the passing route of the opposite side because it was seriously limited in its navigation abilities. Therefore, the assertion that the choice of anchoring location was faulty is an overstatement.

The point of such interpretation will become clearer if we assume, in comparison, that "Hebei Spirit" directly entered the passage moving north within the traffic separation scheme and lowered its anchor. Although the anchoring location was generally an unsafe place, it is difficult to apply such a fact to this case, especially in the case of a ship moving north along the traffic separation scheme.

The choice of anchoring location by "Hebei Spirit" cannot be seen as a direct cause of this collision and was only a remote, indirect cause. However, this is only true in this specific case, as it is still true that it is a dangerous spot for ships moving north along the traffic separation scheme.

Contrary to the assertions in this paragraph, "HEBEI SPIRIT" anchored in this position at the line with previous visits to the port, which was accepted by VTS when they obviously were aware of it.

It can be seen from referencing the appropriate chart, that this was in fact as good an area as any other, if not the best place for a loaded VLCC to anchor. For example:-

The depth is good for a loaded VLCC drawing 20m draught.
The nature of the bottom being sand affords good holding ground.
The position is clear of obstructions and at least 2.5 miles from the nearest dangerous shallows in the area.
The position is within easy reach of the pilot station.
The position is 7 miles away from the noted TSS, this is not 'near' by any definition.

It should also be noted that the argument put forward against this anchoring position was the danger posed from vessels passing along the NE/SW route to and from the distant traffic separation scheme.

The issue becomes irrelevant since any shipping on his route passed clear of "HEBEI SPIRIT". The marine spread was not in actual fact navigating this 'shipping route' and so the claim that "HEBEI SPIRIT" was anchored on the marine spread's route is null and void.

(Cause of Accident No. 10: Anchoring location of "Hebei Spirit." A part of a remote and indirect cause)

For the reasons explained above this is not a part of remote or indirect cause. It has the same weight as saying that had "HEBEI SPIRIT" not gone to Korea, there would be no collision.

B) Person in charge of the anchor

There was no officer in charge of the anchor during the night on "Hebei Spirit." Though the Marine Spread had lit a bright working light on "Samsung No. 1," and the Marine Spread 730 m in length moved in a zigzag formation and drifted at a derivative angle of 90 degrees to its course, "Hebei Spirit" did not perceive the risk of collision until the Marine Spread approached within 0.7 miles.

Therefore, the Master Chawla who received the report in such an imminent situation did not have enough time to try and figure out the best method to seek shelter. The urgency felt by the Master Chawla is also shown in his report on the resulting oil spill, which reads, "December 6, 19:36…they basically did not have enough time to swiftly move the ship and avoid collision." The fact that the Chief Officer of "Hebei Spirit" did not perform his lookout duty during anchoring is a very important fact and has been sufficiently explained in the explanation of the evidence.

Therefore, the fact that the duty officer of "Hebei Spirit" did not perform his duty to keep watch during anchoring provided a cause for the collision in a substantial way.

(Cause of the Accidnet No. 11: Non-performance of lookout duty by "Hebei Spirit" while at anchor. A substantial part of the direct cause.)

There is absolutely no justification in weighing the cause of the collision in the manner the IMST have done in this summary. The prime cause of the collision was the breaking of the tow line. Had it not broken, there would no collision or pollution as the marine spread had cleared. The duty officer called the master in ample time, there was no reason to do so earlier. The master was able to make decision that successfully reduced the possibility of collision in the time he had. Only the failure of the tow line caused this collision.

C) Master's navigation in seeking shelter

The collision occurred at 0706 hours on the date of collision, and the time at which the Master of "Hebei Spirit" went up to the bridge, upon the report of the Chief Officer Chetan, was 0606 hours, which was one hour before the time of collision.

Not withstanding the factual evidence which shows the collision occurred at about 0658 hours, the IMST advised that the collision occurred at least 1 hour after the master was called. This illustrates that those on the VLCC responded in time to the unfolding events.

Master Chawla did not respond to numerous requests made by the Marine Spread and the VTS to heave up her anchor and move, but went against such requests by paying out more anchor chain and continuing to move astern using its main engine.

I have covered this argument in detail above by including the extracts from the VHF VTS transcript which clearly shows the reasons the master gave to VTS for not weighing anchor at that time, not in hindsight. As the transcript shows, the VTS understood the master's reasoning. Therefore, the IMST cannot in hindsight claim otherwise.

At 0614.5 hours on the same day, when the engine was put to dead slow for the first time, up to the time of collision, which was at 0706 hours of the same day, for the 51.5 minutes during which the main engine was operated, the engine was put to dead slow astern for 17.5 minutes and from then until the point of collision, the engine was put to dead slow astern, slow astern and half astern for nine minutes. However, at 58 minutes and 59 minutes of the same hour, when the engine was put to slow astern and half astern engine instead of slow astern, which was the setting until then, as the collision was then imminent, the alarm for the main engine rang and the power of the engine was automatically reduced, producing abnormalities in the main engine. It was then difficult to actively seek shelter.

The alarm for the main engine is an M/Eng #3 Cyl. C.F.W. outlet high temperature alarm, and this must have resulted because the #3 cylinder was repaired the night before the accident when the anchor location was reached, but the repair was incomplete, or because the test run after the repair, in order to check for normal operations, was not carried out properly. The fact that the test run was only carried out with the engine on dead slow for only a few minutes, while normally in the case of a repair of the main engine, the test run is carried out not only at dead slow, but also at slow and half astern settings, shows that this is true.

Furthermore, if the engine started operating after four minutes had passed from the order given by the Master Chawla to make emergency preparations for the main engine on the day of the collision, this means that the main engine of the large ship was used in a state where full preparations, including preparatory heating, were not carried out. Therefore, it is only logical that "Hebei Spirit" could only put the engine to dead slow astern. Furthermore, the reason for the alarm ringing just before the collision when the main engine was put to dead slow astern and then full astern and for the speed being automatically reduced seems to be because of the #3 cylinder, which had been repaired the night before. This shows that the repair was not complete.

The basis of this claim is completely fallacious and is based on a misunderstanding that the vessel will always need exactly one hour to 'warm up' the engine for full operational use. It is obvious in any case from the engine data logger that "HEBEI SPIRIT" used more than 'dead slow astern' as claimed.

The operational preparedness of "HEBEI SPIRIT" main engine was in effect an instant readiness, to this end it can be seen that the engineers in this case had not shut down systems they would normally have shut down had the vessel been for instance moored alongside a berth. For example :-

Air cooler cooling water pump
EGE feed pump
M/E aux blowers

M/E indicator cock were kept closed
All drain valves were kept closed
Engine fuel system oil kept warm
Start air compressor kept running in auto

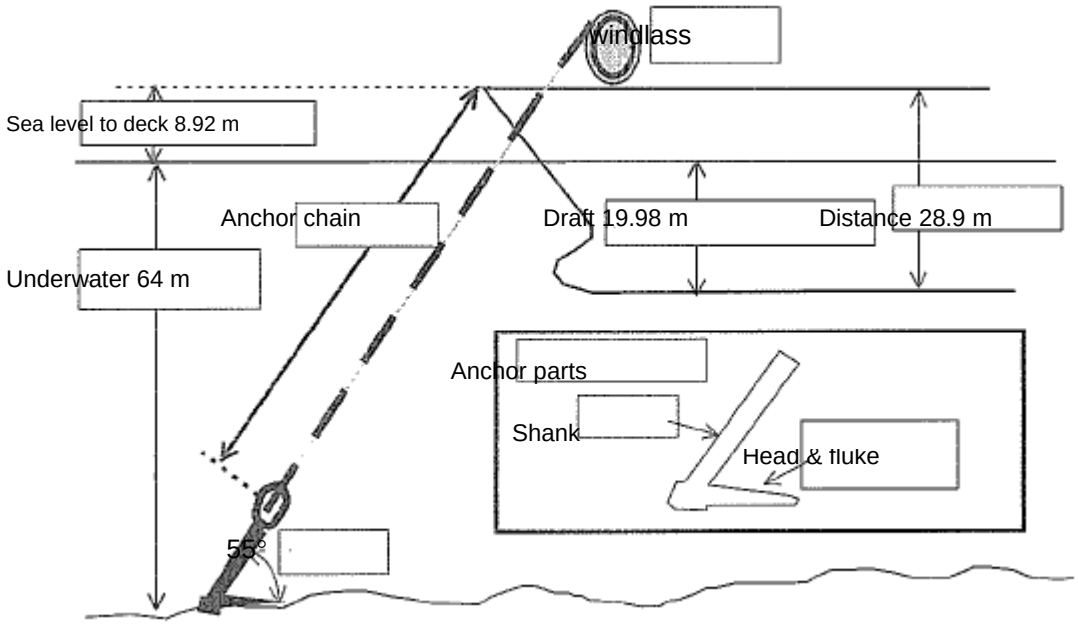
Next, we will look at whether the actions of Master Chawla to seek shelter were appropriate.

Determination of whether it was possible for the Master to wind up the anchor chain and move at the time, depends on the time it took to heave up the anchor chain and the danger such action might have caused.

Although eight shackles of the anchor chain were submerged in the sea, as the line was probably lengthened due to the strong wind, it is necessary to calculate the length of the line in order to review the condition of the anchor chain under the water at the time.

[Diagram 3-2] is presented for the purpose of calculating the minimum length of the anchor chain at which the anchor head would leave the seabed and the holding power becomes zero (short stay situation), when heaving up the anchor in a sea of the same depth and at the same distance from the sea level to the deck as those at the time of collision, even if external forces are not very strong when heaving up the anchor and the catenary is not separately formed due to such external forces, and the length is calculated as follows.

Windlass
Length from the water to deck at bow – 8.92 m
Depth of water 64 m, Length of anchor chain, Bow draft 19.98 m, Depth 28.9 m
Name of anchor parts (Shank, head or fluke)
Approximately 55 degrees
Underwater



[Diagram 3-2] In the sea depth such as that at the anchoring location of "Hebei Spirit" and where the external forces are weak due to the structure of the hull of the ship, the length of the anchor chain is approximately 85 m (3 shackles) at the point where the anchor head has just left the seabed and holding power becomes zero (short stay situation). At that time, the strong wind probably caused the anchor chain to lengthen, and therefore, the length of the anchor chain floating above the sea bed is probably longer than this.

If the distance from the upper deck to the seabed is H m,
H = Depth of water + Distance from the water level to deck at the bow = 64 + 8.92 = 72.92 m
Angle of the head of anchor and shank = approximately 55 degrees
Length of the pillar of anchor: Ls = 3.96 m
Therefore, if the length of the anchor chain at the point the anchor head has just left the seabed is Lc m,
The distance between the deck and the lower pillar of the anchor is L = Lc + Ls (m)

Therefore, H = L x Sin55 degrees = L x 0.8195 = (Lc + Ls) x 0. 8195 = (Lc + 3.96) x 0. 8195
If H = 72.92 id inserted on the left side,
72.92 = (Lc + 3.96) x 0. 8195
Therefore, Lc = (72.92/0.8195) – 3.96 = approximately 85 m

According to this calculation, the length of the anchor chain is approximately 85m (3 shackles) at the point where the anchor head has just left the seabed and the holding power becomes zero, in a situation where external forces are weak.

However, at the relevant time, winds were blowing at 15~18 m/s, as well as strong north-northwestern of BF 6-7, and waves were 4 m high. Therefore, "Hebei Spirit" probably was experiencing substantial external forces, and at least 2 shackles of the anchor chain were probably paid out in addition, even without specific calculations. (The anchor chain of "Samsung No. 1," the barge-carrying, large size floating crane was 214 (7.8 shackles) when calculated under the same speculative conditions as above. However, the holding power varies as the capabilities of the anchor chains are different.)

If so, at least 5 shackles of the anchor chain were probably out of the seabed, and the length of anchor chain required to be heaved up onto the ship which was experiencing tension was only less than 4 shackles, which is 5 shackles which was not experiencing tension subtracted from the 9 shackles paid out when the ship set anchor. Therefore, heaving up the anchor chain in only 12 minutes (4 shackles x 3 minutes (time it takes to heave in 1 shackle)) would have allowed the anchor to drag for navigational purposes, and even when considering the resistance caused by the wind and waves, in 20 minutes the holding power of the anchor and anchor chain would have become zero. In other words, if "Hebei Spirit" had heaved up less than 4 shackles of anchor chain in 20 minutes, the holding power of the anchor would have become zero. Therefore, it would have been possible to seek shelter without any problems even when moving full astern while dragging anchor.

The IMST theory fails to take into account that by shortening the cable the VLCC would have moved towards the approaching marine spread, that is increasing the risk of collision.

Apart from the above, using the main engine and steering simultaneously while dragging the anchor of the ship, when it is necessary to make a rapid turn, is a very useful navigation technique and commonly used among captains and sailors in narrow seaways. Furthermore, since the anchor let down by the ship in question was on the starboard side, if the starboard anchor is heaved up using the forward main engine and steering is set to starboard, the ship will rapidly turn to starboard and could have avoided having the Marine Spread approach her portside.

This description by the IMST does not make sense. They are saying that if the engines were put ahead, the starboard anchor cable shortened and the helm put to starboard a collision would have been avoided. If the master followed these actions, this is what would have happened. The starboard anchor and starboard helm would cause the VLCC to initially move forward, then turn its bow to starboard presenting its full port side to the oncoming marine spread. In this situation collision would have been inevitable, with far greater losses of oil, as the impact would have been greater (vessels moving towards one another).

These very useful techniques alluded to, turning short round for example may have some relevance to a small coaster, but will certainly have no relevance whatsoever to a loaded VLCC where the stresses on the anchoring systems would be so excessive as to cause major damage to these systems. I have never heard of a VLCC Master trying to employ small ship-handling techniques on board a loaded tanker of this size. Deliberately dragging the anchor to avoid collision is not common as the IMST are stating. The practice is used to assist in mooring a vessel not avoiding collision.

As such, whether it was possible to seek shelter after heaving up the anchor does not need to be theoretically proven, as other evidence shows that the hull of "Hebei Spirit" was already moving in such a direction.

There is no such evidence. By slacking off cable and using the engines astern throughout, with the wind, current acting in a direction forward of the beam, there is only one direction the VLCC would go, astern.

Chief Officer Chetan of "Hebei Spirit" reported to the Master Chawla at 0627 hours that there was no more anchor chain to pay out, in order to avoid losing the anchor, as 3 shackles of the anchor chain were already paid out, making 12 shackles in total, and then set the engine to astern at various speeds sporadically for 20 minutes out of the 39 minutes leading up to the collision.

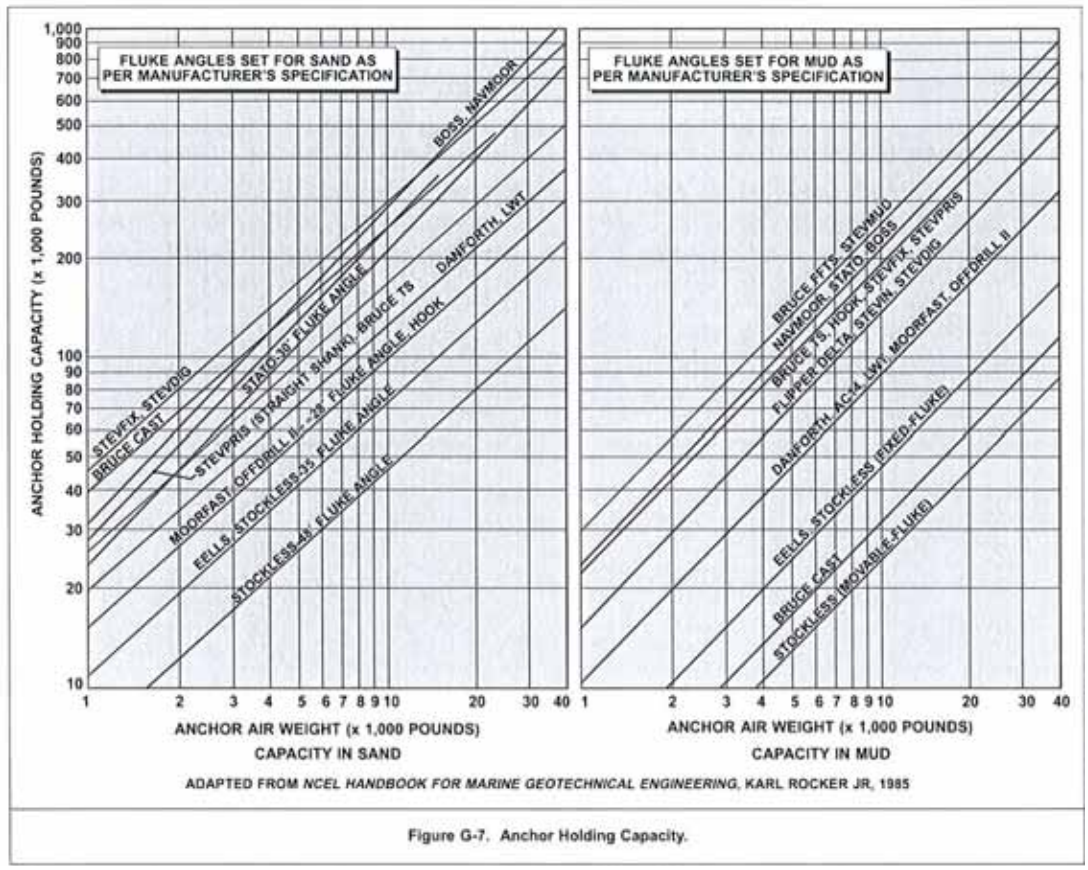
This is not correct. The chief officer paid out an additional four shackles, making 13 shackles deployed. The setting of the engine speed was all astern movements to stretch the cable.

This means that the ship kept moving astern while dragging its anchor for 20 minutes in a state where 12 shackles of the anchor chain were paid out, and this is proved through the fact that when Gan Tae Kim, master of "Samho T-3" notified him through the VHF that the anchor of "Hebei Spirit" was dragging, and the Master Chawla, replied that he already was aware of it. As such the ship only set her engine to dead slow astern, even while seeking shelter and dragging its anchor, and the fact that the main engine broke down when the ship was moving astern at slow and half speeds arouses suspicion that the main engine could not have been set at speeds other than dead slow. However, this cannot be proven.

The vessel never dragged its anchor, and the IMST have again misled the reader. The slacking of the cable and stretching it will move the VLCC astern. The engine was also used at more than dead slow astern as the engine data logger shows.

Even if the body of the ship had moved forward while winding up the anchor chain of less than 4 shackles due to the holding power, which might bring it closer to the Marine Spread and increase risk, if the ship had put her engine to full astern soon after moving approximately 100 m forward and continued to seek shelter, it would have succeeded with no problems. This was possible as the seabed was composed of sand, which offers low holding power, and not mud.

Moving the VLCC forward would have brought it closer to the marine spread, not might have, therefore the collision risk will increase. The seabed was sand, which was high holding power as shown in the extract from the US Navy salvage handbook below:



ADAPTED FROM *NCEL HANDBOOK FOR MARINE GEOTECHNICAL ENGINEERING*, KARL ROCKER JR, 1985

Figure G-7. Anchor Holding Capacity.

In conclusion, under the circumstances where it was possible to wind up the anchor chain and seek shelter by moving full astern, or to seek shelter by moving forward and turning to starboard using the forward main engine and steering to starboard, which would take place when heaving up the starboard anchor, the ship did not attempt any such methods and only continued to take passive and careless measures by moving astern at a dead slow speed and paying out its anchor chain. This cannot be deemed as an action to seek shelter under special circumstances.

The careless actions of "Hebei Spirit" to seek shelter upon finding the Marine Spread to have limited navigation abilities, under the circumstances where quick avoidance was necessary, is a substantial part of the direct cause of collision.

Cause of Accident No. 12: Inappropriate actions of "Hebei Spirit" to seek shelter. Substantial part of the direct cause.

The claim that "HEBEI SPIRIT" actions were passive is patently incorrect. The Master of "HEBEI SPIRIT" took action as soon as became obvious that a risk of collision existed, if "HEBEI SPIRIT" had taken no action whatsoever that would be deemed passive.

Therefore, the conclusion that "HEBEI SPIRIT" actions were careless and a substantial part of the direct cause of the collision are completely without merit, and the claim that there is a commonly used method of manoeuvring a laden VLCC in such circumstances is erroneous.

Such analysis is not an ex post facto criticism on what could have been done in hindsight, but the navigation by the Master Chawla is pointed out as being inappropriate on the grounds that the method was a simple one commonly used by captains in the practice of ship navigation.

This is total rubbish, particularly for VLCC's. The method they describe is not given in any seamanship publication because it is fraught with danger and the unknown. The methods the IMST are restricting relate to "dredging" of the anchor when mooring. This is a practice undertaken on smaller vessels but not VLCC's. They are misleading the reader.

3) Boram

Although Boram executed management agreements for "Samsung T-5," "Samsung No. 1" and "Samsung A-1" with SHI, safety management in accordance with the service agreements was to be carried out according to the regulations of SHI, and the operation of the Marine Spread, together with the work schedule of "Samsung No. 1," was to be in accordance with the directions given by SHI, when necessary, as well as the management of crew, simple management, repairs and provision of work. With respect to the operation of the Marine Spread, Boram was directed and supervised by SHI with the comprehensive participation of SHI.

However, Seung-Min Cho who was directly directed and supervised by Boram did not follow the composition of towing lines designated by the Towage Approval Check List, though he had co-signed the towage certificate with the surveyor. Nor did he implement a mutual contacting system when the Marine Spread was seeking shelter in bad weather, thus failing to perform his obligations and rendering the towing survey and its implementation as mere formalities. Because of him, the Marine Spread missed its chance to seek shelter, could not drop anchor in advance, which in turn caused the towing line to break, and ended up causing in collision. This is because he lacked knowledge of the navigational risks when sailing along the west coast of Korea in winter, where bad weather is not uncommon, and this provided an indirect cause for the collision.

The basis of the claim here is that the marine spread could not have dropped anchor prior to the time when the tow line parted, this is based on the position that it was not planned for in advance. This is a ridiculous argument, and goes against all accepted seamanship practice. Anchors are there to be used, and if they are not used just because they were not included in any planning shows the incompetence of the masters and crews on the marine spread.

Lack of preparation and support on the part of Boram partially and indirectly contributed to the cause of the collision.
(Cause of the Accident No. 13: Boram's lack of safety management, part of an indirect cause.)

We have commented on this section on Boram in a combined comment on both Boram and SHI after the next section. Therefore, these comments are applicable to both. However, after deciding that the marine spread could have anchored earlier, then saying "HEBEI SPIRIT" was at fault for not dragging their anchor shows that the IMST are clearly impartial. Dropping an anchor to avoid an emergency is a common seamanship practice. Deliberately dragging an anchor to avoid collision is not a common practice, particularly on a laden VLCC. However, even though one action is common, but was not undertaken the party who was expected to do an uncommon action, suffers the greater blame according to the IMST. This is clearly a case of impartiality against the "HEBEI SPIRIT".

4) SHI

SHI, which operated "Samsung T-5," "Samsung No.1" and "Samsung A-1," comprising the Marine Spread, executed service agreements for the management of the said ships. However, SHI was in a more important position with respect to the actual safety management of the Marine Spread, as safety management pursuant to the service agreement was to be carried out in accordance with the regulations of SHI, and the towage insurance survey for "Samsung No. 1," which was being towed in the current case, was paid for by SHI.

The operation plan of the Marine Spread was wholly in accordance with the work schedule of "Samsung No. 1," and as the work schedule of "Samsung No. 1" was decided by SHI and directions were given to Boram in regards to the towing voyage, Boram only provided simple services for the management and repair of the above ships and work, and SHI was the one participating entirely in the operation of the Marine Spread and providing directions and supervision. However, SHI, with its many employees and vast data on ship construction and ship navigation, did not pay any attention when Boram repeatedly left such important matters to the discretion of the captains of the tugboats regarding the composition of towing lines indicated in the towing surveyor report—a matter of life and death for a Marine Spread, which is to tow a large crane barge off the west coast in winter where bad weather can be expected—as well as basic navigation planning, such as measures to be taken when seeking shelter, and the choice of shelter in an emergency. Such factors could potentially decide the safety of the navigation.

This is deemed to be caused by a lack of knowledge of the risks of the sea and lack of a safety management system while at sea.

SHI's lack of knowledge of the risks of the sea and lack of a safety management system at sea is a part of the indirect causes of the collision. Cause of Accident No. 14: SHI's lack of a safety management system at sea. Part of an indirect cause.

SHI, chartered all three vessels for a long term contract from Samsung Construction, and entered into a "Equipment Management Service Agreement" with Boram on March 1, 2007, in order to entrust the management of these vessels for one year from the said date until February 29, 2008. According to the Agreement, Boram shall be in charge of operating the marine spread, the construction plan, the hiring of additional tugboats needed for SHI to carry out the construction work, and safety inspection and management of the construction necessary for the management and maintenance of the equipment, etc. In particular, with respect to safety management, Article 4 of the said Agreement provides that, while Boram shall be responsible for the safety management, it shall comply with SHI's safety management regulations.

The towage approval survey is a pre-departure survey carried out for the purposes of insurance, it will include recommendations and broad guidelines for the voyage to be undertaken. It is not an all encompassing voyage passage plan to be rigidly adhered to by the master, and does not in any way remove the obligation of the owners to provide a system of management to ensure through policy and procedure a safe and seaworthy vessel for the voyage, nor does it relieve the master of his obligation to safely plan and execute the voyage.

To claim the towage contract as a rigidly enforceable plan which the Master cannot deviated from is in contravention of SOLAS Chapter V Regulation 34 below:

Quote

Regulation 34
Safe navigation and avoidance of dangerous situations

1 Prior to proceeding to sea, the master shall ensure that the intended voyage has been planned using the appropriate nautical charts and nautical publications for the area concerned, taking into account the guidelines and recommendations developed by the Organization.

2 The voyage plan shall identify a route which:

.1 takes into account any relevant ships' routeing systems;

.2 ensures sufficient sea room for the safe passage of the ship throughout the voyage;

.3 anticipates all known navigational hazards and adverse weather conditions; and

.4 takes into account the marine environmental protection measures that apply, and avoids, as far as possible, actions and activities which could cause damage to the environment.

3 The owner, the charterer, or the company, as defined in regulation IX/1, operating the ship or any other person shall not prevent or restrict the master of the ship from taking or executing any decision which, in the master's professional judgment, is necessary for safe navigation and protection of the marine environment.

Unquote

Therefore, the actions of the master do not relieve the operators/managers (Boram and SHI), from their responsibilities and duties for the safe management and operation of their vessels as illustrated in Regulation 34.3 above.

In the absence of a defined safety management system as required by SOLAS Ch IX for other vessels defined under Regulation 2, Boram were contractually required to comply with SHI's safety management regulations, regardless of their responsibility for the otherwise safe management of the marine spread.

The operation plan of the marine spread was wholly in accordance with the work schedule of "Samsung No. 1," and as the work schedule of "Samsung No. 1" was decided by SHI, directions were given to Boram in regards to the towing voyage. By definition of article 4 of the management service agreement, between SHI and Boram, SHI as operators of the vessels were in a more important position with respect to the actual safety management of the marine spread, as safety management pursuant to the service agreement was to be carried out in accordance with the regulations of SHI, and by the imposition of their management regulations are responsible parties to the safe operation and management of the marine spread and the foregoing equally applies.

The lack of safe operation and management of the marine spread is a direct and substantial cause of the accident.

B Causes of the Large Scale Marine Environment Pollution

The marine pollution is physically and timely connected with the initial accident. Given the nature of complex incidents, it is important to confirm the causal relationship between the collision and the pollution. In other words, it should be verify whether the initial accident wholly contributed to the secondary accident (marine pollution) or whether the initial accident only triggered the secondary accident and some other cause was the main cause of the secondary accident. Such verification is important, considering that the extent of the secondary damage is incomparable to the extent of the initial damage.

To verify the cause of this accident, it will be most appropriate to assess it from a maritime affairs perspective. In other words, it should be examined whether "Hebei Spirit" faithfully observed the SOPEP procedures prescribed in Article 31 (Management of the Pollution Emergency Plan) of the Act on Marine Environment Management and Charter 5, Rule 37 of Appendix 1 of the 73/78 Marine Pollution Prevention Convention, which are standard action plans vessels must observe when emergency situations (such as marine pollution) occur. An assessment of whether the large scale marine pollution is attributable to the negligence of "Hebei Spirit" to take reasonable due care—immediately executing SOPEP procedures in order to mitigate the amount of spillage, after colliding with the Marine Spread and the initial spillage of oil—will reveal the nature of the causal relationship between the initial collision and the secondary marine pollution due to the vast oil spill.

In this introductory, the IMST are referring to various international regulations that require every ship owner to develop and prepare a Shipboard Oil Pollution Emergency Plan (SOPEP) for each individual vessel in their fleet. Any starting point for this topic in the international marine community is the Marine Pollution Prevention Convention 73/78, commonly known as MARPOL. Regulation 37 of MARPOL (Edition 2006) describes the general outline of what such a plan should include. The extract from MARPOL that refers to SOPEP is reproduced below.

And the key point is that the plan is prepared in accordance with guidelines developed by the organization. These guidelines are referenced as a footnote describing the resolutions adopted MEPC 54(32) and MEPC 86(44). Detailed guidelines for these resolutions are given in the IMO Sales Publication, IMO – 586E, that is Guidelines for the Development of Shipboard Marine Pollution Emergency Plans. Consequently, when preparing a detailed SOPEP for an individual ship, these guidelines should be followed. ISMT have subsequently linked the application of "HEBEI SPIRIT"'s SOPEP to the resulting spillage of oil as follows.

1. Shipboard Oil Pollution Emergency Plan (SOPEP)

According to SOPEP, the emergency measures a vessel must employ when an oil spill occurs are listed in two categories: first, cases where the oil spill occurs during transfer (loading or unloading); and second, cases where the oil spill is attributable to damages to the ship's hull.

Ensuring the safety of human lives and the vessel itself and preventing marine pollution are the foremost measures the shipmaster must employ when marine accidents accompanying damages to the ship, as in this case, occur. The key measures that should be procured in order to prevent a further spread of the pollution, when "oil and/or hazardous liquid materials" leak, are as follows:

- *Sealing the area of oil leakage*
- *Transferring oil from the damaged tank to an undamaged tank*
- *Dropping the internal pressure of the leaking tank*
- *Prevent additional leakage by procuring measures such as adjusting the balance*

Such measures should be executed, not only to guarantee the safety of human lives and the vessel, but also to protect the marine environment. The actual measures taken by "Hebei Spirit" in that respect shall be discussed below

In the second paragraph of the above extract, IMST are correct in stating that the Master should ensure that the safety of human lives is the paramount requirement in such incidents, followed by the safety of the vessel and then pollution. However, IMST then state their own key measures that they believe should have been undertaken in order to prevent a further spread of the pollution, listing four methods to combat leakage. What they have significantly ignored are the Master's immediate priorities which are clearly stated 2.5.3.1 in the Guidelines for the preparation of a SOPEP as follows:-

Quote

"Priority actions: this section provides some general considerations that apply to a wide range of casualties. The Plan should provide ship-specific guidance to the master concerning these broad topics.

.1 In responding to a casualty, the master's priority will be to ensure the safety of personnel and the ship and to take action to prevent escalation of the incident. In casualties involving spills, immediate consideration should be given to measures aimed at preventing fire, personnel exposure to toxic vapours, and explosion, such as altering course so that the ship is upwind of the spilled cargo, shutting down non-essential air intakes, etc. If the ship is aground, and cannot therefore manoeuvre, all possible sources of ignition should be eliminated and action should be taken to prevent toxic or flammable vapours entering accommodation and engine-room spaces (see 1.4.7). When it is possible to manoeuvre, the master, in conjunction with the appropriate shore authorities, may consider moving the ship to a more suitable location in order, for example, or to reduce the threat posed to any particularly sensitive shoreline areas. Such manoeuvring may be subject to coastal State jurisdiction…".

Unquote

In "HEBEI SPIRIT"'s SOPEP, under Section 3, Steps to Control Discharge, the guidance to the Master in this particular incident will come under the sub-heading 3.3.3 Collision with Fixed or Moving Object. In the first line, the Master's priorities are stated as;

- The extent of injuries to personnel.
- The damage to both parties.
- The necessary steps taken to safeguard both vessels and crew.
- Minimize damage to the environment.

These clearly mirror the Guidelines for the Development of Shipboard Marine Pollution Emergency Plans and accepted international marine practice. Therefore, it is quite clear in what the Master's priorities are, safety of the crew and vessel from the key danger of such an incident; fire and explosion. It should be noted that these are the immediate considerations to be taken by a Master. Whilst IMST have said their listed key measures should be executed to guarantee human life, they miss the point that fire is the immediate main hazard to human life on a fully laden tanker in such a collision. Tankers are designed and constructed to reduce the inherent risk of fire associated with the carriage of oil to an absolute minimum because of experience from previous catastrophic losses caused by such incidents as the following examples illustrate:

- Collision between the Korean tanker "SEA STAR" and Brazilian tanker "HORTA BARBOSA" in the Gulf of Oman on 19th December 1972 resulting in fire and explosions on both vessels causing their loss and a spillage of 115,000 tons of crude oil.

- Collision between the ferry "DONA PAZ" and the laden tanker "VECTOR" off the Philippines in December 1987 resulting in a fire that killed over 4,000 people. The worst maritime disaster ever outside of war in terms of loss of life.

- Collision between the anchored crude oil laden tanker "AGIP ABRUZZO" and ferry "MOBY PRINCE" off Livorno, Italy in April 1991 resulting in a fire on both ships and the loss of 140 lives on the ferry.

- Collision between the Khafji crude oil laden tanker, "NAGASAKI SPIRIT" and container ship "OCEAN BLESSING" in September 1992 in the Malacca Straits causing an explosion and fire on the tanker causing the loss of life of all the crew on both ships except two, and the spillage of 13,000 tons of crude oil.

- Collision between the crude oil laden tanker "MAERSK NAVIGATOR" and the ballasted tanker "SANKO HONOUR" in January 1993 in the Andaman Sea causing a fire on the laden tanker spillage of about 25,000 tons of crude oil.

In addition, because of the inherent risks of carrying highly inflammable oil cargoes, tanker crews undergo mandatory training on these hazards and are not allowed to take senior positions on such a vessel unless they have the requisite tanker training. I have reproduce below an extract of the international Standards for Training, Certification and Watchkeeping (STCW) that covers the syllabus for tanker familiarisation (please note that such specific training is not required for all types of vessels only those that are at risk from the nature of the cargoes carried, e.g. tankers).

Hazards

4 An explanation of hazards, including:

.1 explosion and flammability hazards, flammability limits and sources of ignition and explosion;

.2 health hazards, including the dangers of skin contact, inhalation and ingestion; oxygen deficiency, with particular reference to inert gas systems; harmful properties of cargo carried; accidents to personnel and associated first-aid do's and don'ts;

.3 hazards to the environment, covering: the effect on human and marine life from the release of oil, chemicals or gases; effect of specific gravity and solubility; danger from vapour cloud drift; effect of vapour pressure and atmospheric conditions;

.4 reactivity hazards; self-reaction; polymerization; effects of temperature; impurities as catalysts; reaction with air, water and other chemicals; and

.5 corrosion hazards, covering: the dangers to personnel; attacks on constructional materials; effects of concentration and evolution of hydrogen.

It will be noted that the first topics discussed refer to the safety of human life. A tanker fire not only puts the crew lives at risk, but it also can lead to an escalation of an incident that includes the loss of the ship and increased pollution. This is why fire on a tanker is continually at the forefront of international regulations in respect of tankers. For IMST not to mention this in the above paragraphs covering their description of measures to take after a collision is misleading the reader as they well know.

2. Countermeasures for the damage

A) Sealing the area of leakage

"Hebei Spirit," at 0706 hours on the date of the accident, should have immediately investigated the extent of damage and blocked the opening by wooden wedges or collision mats to prevent further marine pollution. The holes in the no. 1, 3 and 5 port side cargo tanks were 5 to 7 meters above the sea and the holes in the no. 1 and 3 tanks were each 300 mm x 3 mm and 1,200 mm x 100 mm in size, which were quite small ([Table 9]. [Picture 20]). If "Hebei Spirit" had been slightly aware of the seriousness of the marine pollution, it could have turned the punctured side of the hull leeward and performed temporary measures to block the holes, without many difficulties, even though there were strong winds and tides at that time. However, "Hebei Spirit" performed no measures until the marine police arrived two and a half hours later, and the leakage lasted for 37 hours.

Firstly, the timing given for the collision in the above paragraphs is misleading. It is my understanding that the first contact between the crane barge and the bow of "HEBEI SPIRIT" was about 0658 hours on the morning of the 7th December 2007. No.1 port cargo tank is close to the bow of the tanker, and thereafter the crane barge then banged its way slowly down the long port side of the anchored VLCC causing damage not only to the side shell, but also to fittings on the main deck. Analysis of the collision data shows that its final contact of the crane hooks with the fittings on the compass deck (above the wheelhouse), on top of the accommodation, was at about 0725 hours. Therefore, between 0658 hours and 0725 hours the crane barge intermittently contacted the side shell of "HEBEI SPIRIT". As No.5 port cargo tank is closer to the compass deck than No.1 port cargo tank, the breach in this former tank would not have been made at about 0706 hours, but closer to 0725 hours, with No.3 port breach occurring sometime in between these two logged times.

Consequently, for IMST to say that the crew should have immediately investigated the extent of damage and blocked the side shell openings is unrealistic. As the crane barge was still smashing its way down the side of "HEBEI SPIRIT" about 25 minutes after the first contact, releasing highly flammable oil and toxic vapours, severing electrical cables creating sparks, decapitating No.1 starboard PV vent riser to expose the contents of that tank as well, and almost certainly creating sparks due to the metal to metal contact, it is understandable that the crew did not immediately investigate the damage and block the openings as IMST suggest. What the crew did at the approach of the crane barge was follow the correct procedures in sounding the alarm to muster the crew to ensure all were safe then, after the crane barge had moved away, begin investigating the extent of damage. Again I have quoted below, the second part of section 2.3.5.1 of the Guidelines for the Development of Shipboard Marine Pollution Emergency Plans that outline the Master's priorities:

Quote

"Prior to considering remedial action, the master will need to obtain detailed information on the damage sustained by the ship. A visual inspection should be carried out and all cargo tanks, bunker tanks and other compartments should be sounded. Due regard should be paid to the indiscriminate opening of ullage plugs and sighting ports, especially when the ship is aground, as loss of buoyancy could result."

Unquote

Again this is mirrored in section 3.3.3 of the vessels own SOPEP and this is what the Master instructed his crew to undertake. These activities of course, are being undertaken by the majority of the crew, both deck and engine room. At this time, the Master would have no clear information as to the status of his ship, whether it had been breached below the waterline or in other spaces. This was essential to determine, and at the same time, as flammable material was exposed, all crew members had to be extra cautious in not inadvertently causing a spark that could result in the key hazard in such an incident; a catastrophic fire/explosion.

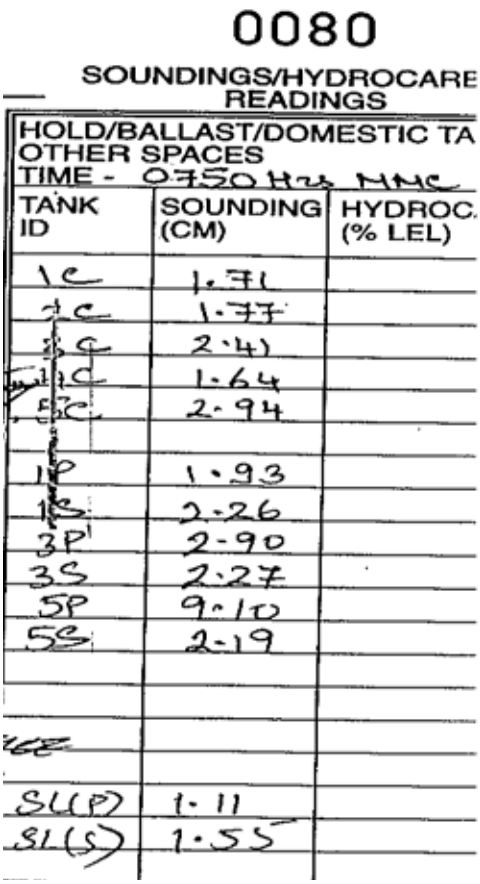
The IMST then provide the size of the three holes in the side shell, and remark that those in No.1 port and 3 port cargo tanks were "quite small". In fact, the width of the hole in No.1 port is given in the Decision as 3mm. This is remarkably small, and given that other observers estimated the size of this particular hole as 200mm x 400mm, the difference is significant. As such, we have examined the photographs of the holes in the three tanks taken both shortly after the collision, and after temporary repairs were carried out, and used the dimensions of the ship side framing to determine the size of the holes. From this, the hole sizes were found to be as follows:-

No.1 port	–	130mm x 50mm
No.3 port	–	1300mm x 45mm
No.5 port	–	1200mm x 1200mm

The suggestion to plug the holes with wooden wedges within the first two and a half hours is ambitious and disregards crew safety. The operation to plug such big holes with crude oil gushing out of them is no easy task. Firstly to access the overboard area would involve rigging a ladder and a working platform from where the crew can work. Rigging of one such platform takes about 45 minutes to 1 hour in normal circumstances. Add to that the working conditions on the deck of the "HEBEI SPIRIT" i.e. crude oil spraying on already slippery decks, the vessel's listing and in near gale force winds. It is also important to note that the curve of the vessel's side shell in way of No.1 port cargo tank approaching the bow would have made matters worse in accessing the leak of that tank and that the crew would be expected to work on a fragile oil contaminated platform, over the side, in near gale force winds above a polluted heavy sea that has a strong current running. Please note that to limit the risk to the crew doing this job they would have to wear breathing apparatus and chemical suits which would increase the difficulty of their movement.

Hypothetically, if the crew did manage to rig the arrangement, plugging the leak would require the hammering in of wooden wedges in the holes leaking hazardous and inflammable crude oil directly on the crew. This would have endangered the crew member's life due to toxic vapors of the crude and inert gas, the possibility of creating a spark which could ignite the oil, as well as the risk of falling overboard/getting injured due slippery working area in near gale winds over a strong current. In my opinion the Master took the right decision not to endanger his crew by trying to plug the holes hanging them over the side in a flow of toxic crude oil and near gale winds. Instead he mobilized the Bosun and other crew to commence to prepare to rig collision mats at about 0750 hours while other crew members commenced taking soundings of all spaces, starting with the damaged tanks. I note that the IMST have said that the commencement of rigging the collision mats only started after the Korean marine police officer boarded the vessel at 0938 hours. However, these mats require to be constructed before they are lowered over the side. They were positioned in way of No.1 port and 3 port at 0942 hours. Therefore, the Korean marine policeman did not initiate the preparation of these collision mats as implied in the IMST report; he was only there when they were lowered over the side.

It should be noted that the crew only commenced rigging two collision mats, one for No.3 port cargo tank, the other for No.1 port. This is because about 0750 hours, the huge hole in No.5 port had allowed the contents of this tank above the hole to drain out of the tank rapidly. Therefore, there was no need to rig a collision mat for this tank. The ullage recorded for No.5 port in the deck log book, see below



0080

SOUNDINGS/HYDROCARE READINGS

HOLD/BALLAST/DOMESTIC TA OTHER SPACES
TIME - 0750 Hrs NMC

TANK ID	SOUNDING (CM)	HYDROC. (% LEL)
1C	1.71	
2C	1.77	
3C	2.41	
4C	1.64	
5C	2.94	
1P	1.93	
1S	2.26	
3P	2.90	
3S	2.27	
5P	9.10	
5S	2.19	
SL(P)	1.11	
SL(S)	1.55	

timed at 0750 hours, is 9.1m. This was the first tank to be sounded by the crew after the collision. The approximate quantity drained from this tank to achieve the 9.1m ullage (uncorrected for whatever list and the 1.2m head trim experienced at the time and compared with corrected load port measurements) is about 6,300 cubic meters. I will discuss flow rates later on in this report, but suffice to say here, is that within about half an hour after contact in way of No.5 port, nearly all the contents of this tank above its hole had been already lost over the side. Similarly, due to the size of the hole in No.3 port cargo tank, the majority of the contents of this tank above its hole that were subsequently lost overboard were also quickly lost shortly after the collision. Shortly after 0750 hours, the ullage reading of this tank is already at 2.9m from its original loaded ullage of load port ullage of 1.75m, that is, an approximate loss of 1000 cubic meters in about three quarters of an hour. It is accepted that the temperature, in transit losses, list and trim would affect such readings, as well as the physical difficulty in taking the ullage readings at this time but, even so, the substantial changes in the ullages in Nos. 3 port and 5 port recorded at 0750 hours in the deck log book illustrate clearly the rapid flow from these tanks.

B) Transferring oil from the damaged tank to an undamaged tank

"Hebei Spirit" started to transfer the oil in the punctured cargo tanks to other undamaged cargo tanks three and a half hours after the accident because the Master Chawla gave an order to sound the cargo tanks, ballast tanks and other empty tanks before the transfer.

The first task on any collision checklist would be to sound the tanks so as to ascertain which compartments of the vessel are breached. This is done for the vessel's safety and stability. Again, I have quoted the second priority action included in the Guidelines for the Development of Shipboard Marine Pollution Emergency Plans, as clearly the IMST do not believe that fully assessing the situation is important:

Quote

"Prior to considering remedial action, the master will need to obtain detailed information on the damage sustained by the ship. A visual inspection should be carried out and all cargo tanks, bunker tanks and other compartments should be sounded. Due regard should be paid to the indiscriminate opening of ullage plugs and sighting ports, especially when the ship is aground, as loss of buoyancy could result.."

Unquote

Once more, this is also covered under the ship's SOPEP plan for a collision between a fixed or moving object.

Visually the crew could see three tanks leaking but at that time they had no other means of finding out which other tanks were leaking except by sounding all tanks. There is always a possibility of underwater damage to the hull in such a collision and to keep the vessel afloat and stable would have been at the forefront of a prudent Master's mind. Therefore, ullages are not the only measurement required, but also water dips, soundings of ballast tanks, void spaces, etc. Taking soundings of the tanks on a deck covered in oil, now listing and trimming by the head, would not only be nerve wracking (because of the potential for fire and explosion caused by a single spark) but also time consuming given these physical limitations. It should be noted that the automatic gauging system on the vessel was inoperable at this time due to the damage caused by the crane barge when its hooks contacted and destroyed the main deck fittings forward causing some of the automatic to give erroneous readings. Consequently, the chief officer currently did not rely on them, so only manual gauging could be undertaken.

It was only after the soundings had been taken that the vessel could ascertain which tanks were leaking and that the vessel was not taking in water in any other tanks/compartments. I would not expect the Master to start transfer of cargo in any tank without knowing if they were structurally intact or not. This action is also highlighted in the third priority action for the Master given in section 2.3.5.1 of the Guidelines for the Preparation of Marine Pollution Emergency Plans, as follows:

Quote

"Having assessed the damage sustained by the ship, the Master will be in a position to decide what action should be taken to prevent or minimize further spillage. When bottom damage is sustained, hydrostatic balance will be achieved fairly rapidly, especially if the damage is severe, in which case the time available for preventive action will often be limited. When significant side damage is sustained in way of oil tanks, cargo or bunkers will be released fairly rapidly until hydrostatic balance is achieved and the rate of release will then reduce and be governed by the rate at which oil is displaced by water flowing in under the oil. When the damage is fairly limited and restricted, for example, to one or two compartments, consideration may be given to transferring oil internally from damaged to intact tanks."

Unquote

As I have explained above, the damage to No.5 port and to a lesser extent to No.3 port, was above the water line and was not limited or restricted. The contents in No.5 port had been lost very rapidly and had finished at the time the bosun was preparing the collision mats for the remaining two tanks. Similarly, the hole in No.3 port cargo tank also released a large amount shortly after the collision.

The Master did take the decision to transfer the cargo once he had thoroughly assessed all the data supplied to him by the various crew members. However, transferring the cargo from the breached tanks to almost full other tanks has to be carefully planned and actioned. Firstly, the propulsion system for the pumps has to be prepared, as does the Inert Gas system. The boilers for the steam turbines would require about one hour to be warmed up sufficiently to operate the cargo pumps. Given that the engine room crew, straight after the collision, would also be determining the status of the engine room and its many tanks, as well as securing the inlets against the released oil on the sea surface, as well as ensuring that there was no possible source of ignition apparent, they would not be able to start these preparations as immediately as IMST have implied.

The commencement of the internal transfer started at 1035 hours on the 7th December 2007, which is not three and a half hours after the breaching on the final tank, No.5 port. As I have described above, this tank was struck at around 0725 hours. Therefore, commencement of the transfer was only about three hours after the conclusion of the collision. In the interim, apart from the difficulty of trying to ascertain the status of the vessel in increasingly worsening conditions on the main deck, and the hazards this entails for crew safety, the Master was also concerned, rightly, in the potential for a spark to ignite the flammable liquid now exposed not only in Nos. 1, 3 and 5 port cargo tanks, but also from No.1 starboard cargo tanks breached PV (pressure/vacuum) vent riser. As a necessary precaution against fire and explosion, the greatest risk on such a vessel as I have highlighted above, the crew also prepared the Inert Gas plant during this period before the cargo transfer commenced in order to ensure that the atmosphere of the four breached cargo tanks remained inert as a precaution against fire.

The late transfer was also limited to transfers to the no. 3 and 5 central cargo tanks, which were less than 98% full. If the leaked oil had been transferred to the other tanks which were 98% full, so that these tanks could be filled up to 99~99.5%, a significant amount of pollution could have been prevented.

This statement is factually misleading. Whereas the initial transfer of cargo commenced from No.3 port into No.3 and 5 C, it also was pumped into No.3 S. The oil stopped leaking from No.3 port, at about 1145 hours. Thereafter, the transfer from No.1 port was into cargo tanks Nos. 1C, 2C, 4C, 5S.

Cargo tanks on tankers are filled to about 98% full in normal circumstances to primarily to take into account any fluctuations of increased volume due to temperature changes, and also to prevent spillage through vents due to the movement of the vessel in a seaway. Care has to be taken to load to such a level to avoid spillage, the possibility of spillage/transfer through vent lines in a seaway, as well as over pressurisation of the tanks. Over pressurisation of cargo tanks is caused by the compression of the ullage space due to the inadequate release of vapour or by the overfilling of the tank. The consequences may result in serious deformation of the tank structure and its peripheral bulkheads or catastrophic failure which can seriously affect the structural integrity of the vessel and could lead to fire, explosion and pollution. Cargo tanks can be filled to almost 100%, but great care is needed to avoid spillage particularly with the likelihood of the air locks being created between the under deck framing in the tank. That is, once the liquid level reaches the bottom of, say, longitudinal under deck frames, the air it displaces will not be forced to the vent lines through open areas as it had previously done, but through the much smaller holes, mouse holes and scallops that are cut into the under deck framing for weld access. Consequently, if this air cannot be displaced in time, the level in this particular under deck bay would not rise. However, as the cargo is still being pumped into the tank, the level has to increase somewhere. The creation of these air locks potentially can cause a greater increase of the liquid height in way of the vents openings and/or cause over pressurisation. Therefore, even if the ullage readings still show that there is space remaining in the tank, this may be only at the particular location of the measuring point. If air locks are created, cargo could then spill forcibly out of the vent lines or, in the case of the IG lines, transfer from one tank to another. Consequently, even in a normal upright, even keel, loading operation at a berth, such a practice is not encouraged for these reasons, i.e. spillage/over pressurisation, unless extreme care and control is taken.

What is being suggested here by IMST is that the cargo should have been transferred from the port side to the starboard and centre tanks on this vessel so that they were almost 100% full, rapidly. Firstly, the loss of cargo from the port tanks, and any transfer from these tanks to the starboard and centre tanks, would cause an increasing starboard list. As described above, great care is required for such an operation even in a load port, when conditions are ideal. What is required here is for the crew to manually and carefully monitor this transfer on a listing deck, covered in very slippery oil, with the vessel moving in a seaway in near gale force conditions. Whereas the individual vent pipe openings for the PV risers and IG vents are on the port side, forward, of the starboard wing cargo tanks, and in the centre of the centre tanks, a starboard list would leave an air gap beneath these openings, although this would be reduced by the head trim – 1.2m at 0750 hours on the 7th December 2007. However, the trapping of the air within the under deck framing would be unpredictable, and the possibility of air locking and increasing the rush of cargo through the vent lines exists, with the potential for further spillage and over pressurisation. Also, at this time on the main deck, the crew would be working in an increasingly dangerous environment.

Therefore, any filling to almost 100% would increase the risk of spillage on the main deck, therefore increasing the risk to the crew. The Chief Officer did transfer the oil from the breached tanks to the starboard and centre tanks without spillage and, given the increasing starboard list which made it difficult to ascertain the success of the transfer, believed he had filled the receiving tanks to more than 99%. For this he used the cargo tank calibration tables, but these, are only calibrated for lists of less than 4 degrees and only stern trims.

The vessel was initially about 1.2m by the head after the collision and during the loss of cargo and transfer, developed a list of about 6º to starboard. The Chief Officer tried to extrapolate the cargo quantities for greater lists and head trim but as the vessel was almost fully laden, such calculations will become inaccurate given the build up of cargo against the deck head (i.e. it is not now a uniform rectangular cubic space). Consequently, determining the cargo quantities in the individual tanks becomes unpredictable, and so he worked upon his percentage fill calculations. His subsequent calculations made on the 7th December 2007 show that the tanks used for transfer, were invariably more than 99%.

However, once the vessel was upright, the cargo level in these tanks was shown not to be as high as he believed they were at the time, due in part to the inaccuracies of the tank capacity calibration at excessive lists, and also the drop in cargo temperature measured at this latter time, when compared with that measured after the collision. A colder temperature will reduce the volume of the cargo, increasing the available ullage space, but this was not known until after the vessel was closer to an upright condition. At the time of the transfer, he could only work with the information he had available at the time.

The aggregate volume of the cargo tanks of "Hebei Spirit" is about 315,483.5 kL ([Table 7]), and the volume of cargo at the time of departure from the last loading port was around 302,640 kL ([Table 10]). Therefore, the empty space in all the tanks was around 12,843 kL. Considering that the empty space in the no. 1, 3 and 5 port cargo tanks was around 1,733 kL ([Table 2-1]), there was a total of 11,110 kL of empty space in the undamaged tanks. The amount of cargo leaked during the oil spill was around 12,547 kL ([Table 10]). If the oil in the 3 leaking cargo tanks had been fully and immediately transferred to the other tanks, the actual leakage would have been only around 1,437 kL (12,547-11,110). It is true that filling the other tanks up to 100% is practically difficult. However, if these tanks were filled up to only 99.5%, a considerable amount of leakage could have been prevented, and the small remaining amount could have been transferred to other spaces, such as the ballast tanks.

The 11,110 kL calculated above, of course is a simple calculation based on the empty space at the top of the cargo tanks. Since the calculation also assumes that the transfer commences right after the collision, there will be practical differences from what may actually happen. A precise calculation would have considered the time to prepare the transfer and the overall situation. Such a calculation would have produced the transfer speed by applying the Liquid Cargo Handling Simulation, which considers the volume of cargo and the incline of the hull. Still, it is obvious that a significant amount of oil was spilled into the sea due to the premature measures taken by "Hebei Spirit."

The above calculations are based on the reports which were available *AFTER* the incident happened. As said earlier, it would not have been possible for the crew on board to ascertain which tanks were leaking without taking the soundings. It is very important so I will stress this fact again that the crew had to ascertain which tanks had lost structural integrity and a quick damage assessment done in order for them to determine if the vessel had residual stability and longitudinal strength and which tanks were intact so that cargo could be transferred to them. This is a priority action highlighted in section 2.5.3.2.1 of the IMO's Guidelines for the Development of Shipboard Marine Pollution Emergency Plans.

Additionally, the IMST assessment of the available space and that actually transferred fails to take into account the rapidity of the loss from No.5 port and 3 port cargo tanks. I have described this above using the record of the tank ullages in the deck log book for 0750 hours. From these, the contents of No.5 port above the hole have almost gone at this time. Similarly, the quantity lost from No.3 port at this time is also large, indicating a rapid initial out flow.

The quantity estimated as lost over the side for each breached tank is listed below:

Tank No.	Internally Transferred	Leaked to Ballast Tank	Lost overboard
No.1 Port	1,322 cubic metres		2,899 cubic metres
No.3 Port	3,745 cubic metres	343 cubic metres	2,962 cubic metres
No.5 Port	0		6,874 cubic metres
Totals	5,067 cubic metres	343 cubic metres	12,735 cubic metres

This total lost overboard is broadly comparable with the total amount lost as recorded by the IMST.

Using these figures, as a separate calculation, we have determined the hole sizes by inspection (see above), and calculated the flow rate through these hole sizes. However, to summarise, the flow rates calculated have the lost quantities from above the holes draining out in the following time periods:

No.1 port – 34.4 hours
No.3 port – 3.86 hours
No.5 port – 0.40 hours.

At this timing, assuming the tanks were breached one after the other during a period from about 0706 hours to 0725 hours, the tanks would effectively stop continual leaking at the following approximate times:

No.1 port – 0706 + 34.4 hours = 1730 hours on the 8th December 2007
No.3 port – 0715 + 3.86 hours = 1105 hours on the 7th December 2007
No.5 port – 0725 + 0.40 hours = 0749 hours on the 7th December 2007

The time recorded for the stoppage of the continual leakage from No.1 port was 2000 hours on the 8th December. As a comparison, we have also used the same method to calculate the outflow from No.1 Port cargo tank assuming the hole size in this tank was 300mm x 3mm as recorded in the IMST report. The time taken for this is calculated as 248 hours, that is, more than 10 days, which is clearly not what happened.

The Chief Officer stopped the transfer of No.3 port once he was aware that no further continual leakage was taking place. He recorded this at 1145 hours on the 7th December 2007. The transfer from No.3 port was started at 1035 hours on the 7th December and completed at 1145 hours. As discussed above, the ullage of No.5 port at 0750 hours indicates that the tank had drained to the level of the hole at around 0750 hours on the 7th December 2007, that is, it was not now leaking and therefore not transferred to other tanks as the IMST state.

The photographs I have seen taken during the 8th December also show that the continual leakage from No.3 port and 5 port had stopped by this date (inert gas can be seen billowing from the opening). Consequently, as the out flow from Nos. 3 port and No.5 port was rapid, particularly No.5 port, there was no time to transfer the quantities from these tanks to other tanks even if the Chief Officer believed there was space remaining. Therefore, for IMST to calculate the preventable loss of oil as a comparison of the available space against the total quantity lost is not valid, as the factors such as out flow rates, and the available response time, has also to be considered, which IMST did not. Before anything could be done, as the 0750 hours ullages show in the deck log book, there had already been a loss of over 7,300 cubic metres, that is, 57% of the total amount lost.

The inference by IMST is also that the crew on "HEBEI SPIRIT" should have used the full rate of the cargo pumps to transfer the oil as quickly as possible from the breached tanks to the other cargo tanks. I have the following comments:

- Almost all the contents of cargo in No.5P above the hole were lost from the ship within about half an hour after the collision took place. This did not allow any time to prepare for the transfer of cargo from this tank. Therefore, only No.3P and 1P could be transferred, provided that there was sufficient space available to internally transfer the cargo.

- The cargo tanks at the load port were all almost fully loaded to the normal 98% filling. Only Nos. 3C, 5C, 3S, Slop Port and 1S (outside of the breached tanks) were below the 98%.

- Consequently, as described above, any transfer of cargo to these almost full tanks would be categorised as topping off the tanks beyond the standard filling with the inherent risk of spillage through air locks and over pressurisation. All tankers should have on board, and all tanker crews should be aware of, the International Safety Guide for Oil Tankers and Terminals (ISGOTT) (the current edition is the fifth) and its guidance for the safety of all operations on board a tanker. This document is specifically raised to provide operational advice to crews and terminal personnel for the safe carriage and handling crude oil and petroleum products on tankers. To quote from ISGOTT (paragraph 11.1.6.16) regarding the topping off of cargo tanks:

Quote

The ship should advise the terminal when the final tanks are to be topped off and request the terminal, in adequate time, to reduce the loading rate sufficiently to permit effective control of the flow on board the ship.

Unquote

And,

Quote

Where possible the completion of loading should be done by gravity. If pumps have to be used to the end, their delivery rate during the "standby" time should be regulated so that shore control valves can be closed as soon as requested by the ship.

Unquote

In effect, these statements put into words the standard sensible and safe practice of reducing the rate whilst topping off during loading. In fact, the Ship/Shore checklist, that must be completed at every port on a tanker, has a specific check item to complete regarding the cargo handling procedures being agreed such as the initial maximum loading rates and topping off rates. The reason for the reduction in rates during the topping off is the high risk of spillage due to such effects as air locks in the tanks as well as over pressurisation of the tanks which, as I have described above can lead to structural damage, therefore possibly fire/explosion and more pollution. In summary, ISGOTT says that for topping off, there should be a reduction in the rate. This, of course, is a recommendation for a normal loading operation.

In the Ship /Shore exchanges of information for load ports visited by "HEBEI SPIRIT" before the incident it shows the usual topping off rate of between 3,180 cubic metres to 3,975 cubic metres for normal loading operations.

What occurred during this incident is that the transfer of cargo was taking place when the vessel was listed to starboard, the transfer increasing this list, with the decks covered in oil, with oil continually being sprayed over the deck. Not ideal conditions, in fact downright dangerous for the crew working on deck during their monitoring of the cargo. Therefore, in order to avoid a worse situation, and keep control of the transfer within the physical and safe limits of what the crew could manage in these conditions, the maximum discharge rate of all the three cargo pumps would have been extremely foolish to use, if this is what IMST believe. As all the cargo tanks were full, there would be no contingency of slopping to a spare tank if a spillage occurred. Each main cargo pump is rated at 4,500 cubic meters/hour. So if the IMST believe that at least two of these pumps could have been used at one time, the potential discharge rate would be 9,000 cubic meters/hour into tanks that are already topped off and full, on a ship with an increasing starboard list, on a deck covered in oil where the crew have to work to monitor the tank levels. In these circumstances it would be a very brave and careful person to try to increase the contents of the tanks beyond the 98% filling even at the normal topping off rate in ideal conditions. In actuality, the Chief Officer did initially use the normal topping off rate for the transfer from No.3 port cargo tank by one pump, that is, about 3,200 cubic metres/hour, but this was into No.3C, 5C and 3S; the tanks with the greater ullages. Therefore, once the transfer from No.3 port had started then it was undertaken rapidly. The rate was reduced considerably for the transfer from No.1 port shortly afterwards, to about 770 cubic metres/hour, because the receiving tanks (Nos. 1C, 2C, 4C and 5S) were fuller than the previous recipient tanks, Nos.3 C, 5C and 3S, as more care was needed to avoid spillage and over pressurisation.

Therefore, to say that commencing a transfer immediately after the collision using the full rating of all the cargo pumps fails to take into account the rapid loss of the cargo from No.3 port and 5 port, the essential requirement to determine the status of the vessel, the listing and trimming of the vessel coupled with the physical limitations of working on oil contaminated decks, and the care necessary to safely top off listing tanks to avoid further spillage and over pressurisation; escalating the seriousness of the situation.

IMST have also said that cargo should have been transferred to ballast tanks. A simple inspection of the ships cargo diagrams will show that the ballast system is totally separate from the cargo system. They cannot be simply joined together. However, below IMST give their views on how this could be done and I have provided my comments on this inherently dangerous suggestion.

In addition, one of the reasons "Hebei Spirit" hesitated to implement an immediate transfer of the cargo was a fear of cargo contamination, due to the hybrid composition of the cargo (4 kinds of cargo were loaded). However, the damage a cargo contamination can cause is incomparable to the economical and environmental damages a marine pollution can cause.

This is factually incorrect. The first cargo transferred on board was from No.3 port cargo tank to No.3C, No.5C and No.3S. No. 3 port and starboard contained the Keco crude oil. The cargo in No.3C was the Iranian Heavy parcel, and the cargo in No.5C was the parcel of Khafji and Upper Zakum crude oil. Similarly, the cargo in No.1 port was the Upper Zakum crude and this was transferred to No.1C (Khafji crude), No.2C (Keco crude), No.4C (Khafji crude) and No.5S (Iranian Heavy crude). A simple inspection of the cargo papers will show that this accusation has no merit whatsoever.

Moreover, "Hebei Spirit" has a SBT + PL structure, whose ballast tanks and cargo tanks are completely separated. Although it would have been impossible to transfer the cargo in the damaged cargo tanks to the empty ballast tanks using the normal pipelines of the vessel, if there had been a slight awareness of the seriousness of the marine pollution, the deck cargo manifold and the deck manhole of the starboard ballast tanks could have been connected through a duct, and the cargo could have been transferred thereafter. Since the starboard ballast tank's volume was around 46,000m^2, the oil spill could have been prevented with such measures. Also, the transfer of cargo between the tanks would have facilitated if the tank cleaning line was used.

IMST are correct in that there is total separation between the ballast and cargo systems on this tanker so they are suggesting that a hose be rigged between the cargo manifold and dropped into the ballast tank, i.e. loading the ballast tank over the top. Not only is this not possible on a vessel with no cargo hoses, it is a downright dangerous suggestion. In ISGOTT (the International Safety Guide For Oil Tankers & Terminals) there are two short sections that specifically discuss loading overall as this operation is known. Under the heading of "Free Fall in Tanks", (paragraph 3.3.3) in the section titled "Other Sources of Electrical Hazards", there is the following statement:

Quote

Loading or ballasting overall delivers charged liquid to a tank in such a manner that it can break up into small droplets and splash into the tank. This may produce a charged mist as well as increasing the petroleum gas concentration in the tank. Restrictions upon loading or ballasting overall are given in Section 11.1.11.

Unquote

In section 11.1.11, there is the following highlighted statement under the heading of "Loading Overall (Loading from the Top): -

Quote

Volatile petroleum, or non-volatile petroleum having a temperature higher than its flash point minus 10 C, must never be loaded from the top into a non-gas free tank.

Unquote

This shows just how this dangerous practice is considered by all official bodies associated with tanker operations.

ISGOTT defines volatile petroleum as "Petroleum having a flashpoint below 60 deg C as determined by the closed cup method of test". From the Material Safety Data sheets for three of the crude oils their flash points are as follows:

Flash Point of Iranian Heavy: >-17 deg C
Flash Point of KECO: < 0 deg C
Flash Point of Zakum Crude Oil: -6 to +32 deg C

Therefore, all the three crude oils in No.1, 3 and 5 port cargo tanks have a flash point below 60 deg C and are hence 'Volatile' by definition.
As soon as the cargo is pumped into the ballast tank over the top, through a hose that will be difficult to secure in the tank (increasing the risk of a spark), the tank atmosphere would become flammable with the increased possibility of a source of ignition (charged mist, open ballast tank opening, loose cargo hose). This suggestion by IMST is almost like a basic method of Crude Oil Washing (COW) and ISGOTT goes to great lengths to highlight the hazards associated with COW and the following mandatory precaution:

Quote

Control of Tank Atmosphere
The oxygen content of the tank must not exceed 8% by volume as described in section 7.1.6.9.

Unquote

Section 7.1.6.9 states the following:

Quote

"…The oxygen content and pressure of the inert gas being delivered during the washing process should be continuously recorded.

If during washing:

- The oxygen level in the tank exceeds 8% by volume, or
- The pressure of the atmosphere in the tanks is no longer positive,

Washing must be stopped until satisfactory conditions are restored. "

Unquote

What IMST are suggesting is that volatile crude oil is loaded over the top into a non-inerted tank which creates a flammable atmosphere, possibly containing some water, through an open tank lid in an area where there are numerous examples of the use of non-intrinsically safe cameras, mobile phones, helicopters hovering over the vessel apart from the numerous boats alongside with plenty of sources of ignition. Further, the loose hose and charged mist generated during the operation increase the risk of creating a source of ignition in a flammable atmosphere. This should never be considered. Section 11.1.11 of ISGOTT clearly forbids loading ***volatile*** petroleum "over the top in a non gas free tank", and it illustrates a total lack of knowledge of safe tanker practice by IMST and their ignoring of the priority actions a Master must observe; safety of life, then vessel, i.e. avoiding the main hazard, fire and explosion.

C) Dropping the internal pressure of the leaking tanks

"Hebei Spirit" should have lowered the internal pressure of the cargo tanks and maintained negative pressure in order to constrain the spill of the cargo. Nevertheless, "Hebei Spirit" instead injected inert gas and maintained positive pressure, from around 1000 hours on the accident date. This facilitated the spill. The Chief Officer of the vessel, who was in charge of managing the cargo, might have been worried about explosions being caused by the injection of air induced by a negative internal pressure. However, in such cases, all of the valves interconnecting the cargo tanks, such as the inert gas valves, should have been blocked, and the P/V valve lines should have been joined thereafter, in order to maintain negative pressure in the tanks.

The decision to inject inert gas into the tanks where cargo was leaking was definitely not a measure in accordance with SOPEP procedures.

The IMST's argument here appears to be two-fold:

1. That negative pressure in the breached tanks would have assisted in holding the oil in, and

2. That positive pressure in the breached tanks forced more oil out.

Taking the latter point first, the IG was started at 1000 hours on the 7th December 2007 into all cargo tanks, that is, not only the three breached and leaking tanks, but the breached No.1 S and all the non-breached tanks as well. The IG lines on deck had been contacted by the crane during its movement down the port side, there were holes in No.1 P, 3P and 5P, and the PV riser had been severed at No.1S, so it would be obvious that the pressure in the common IG system would be lost and air would be drawn in to replace the displaced cargo, diluting the inert atmosphere in these tanks. Consequently, ensuring that all cargo tanks retained an IG atmosphere in the space above the cargo was essential to avoid any risk of fire, if not; the tank atmospheres could enter the flammable range where a fire could be supported.

The purpose of IG is to inert any atmosphere in cargo tanks to reduce the oxygen in the tank atmosphere to a level that does not support a fire even if there are the other two factors that are required for a fire existing; i.e. flammable gas and a source of ignition. Inert gas in cargo tanks is recognised by all parties associated with tankers as the main reason for the reduction in the catastrophic losses of tankers in recent years. In this incident the oil cargo was highly flammable and exposed. The collision had resulted in damage to the vessel including the severing of live electrical wires that could have created a potential source of ignition. Not only that, but shortly after the collision the Master advised that the vessel was visited by numerous boats and helicopters, with personnel on board using non-intrinsically safe hand phones, cameras etc, all potential sources of ignition. ISGOTT specifically highlights the dangers of this type of equipment on board a tanker in the presence of inflammable gases which I have quoted below. As a result of the breached tanks, these sources of ignition, and the exposed cargo, the Master made the entirely correct decision to reduce the risk of fire and explosion by activating the IG system and running it into all the cargo tanks, breached or not.

The Chief Officer advises that the normal pressure used on the IG system during discharge of cargo is between 600mm and 800mm water head (these equate to 0.0588 bar and 0.07845 bar, or 0.058 and 0.0774 atmospheres). An IG system is designed to ensure at least a minimum pressure of 200mm water head (0.0196 bar or 0.0193 atmosphere). The Chief Officer operated the IG plant into all tanks at this time at a pressure of 100mm water head (0.00981 bar or 0.0097 atmospheres). That is, hardly any pressure, only ensuring that the IG was available within the system to replace the volume of displaced cargo

In addition, as described above, by 1000 hours, the cargo quantity in No.5 port (the tank with the largest opening) above the hole had been lost overboard. Therefore, the IG would have absolutely no affect on the amount of cargo lost from this tank. Additionally, the PV vent riser at No.1S cargo tank had been severed in the collision resulting in that tank being open to the atmosphere. Consequently, the IG being injected into all tanks at a low pressure would be flowing out of these two holes. It was the path of least resistance. Therefore, the IG would not be forcing the liquid out of No.3 or No.1 port as IMST have suggested, it would only replace the displaced atmosphere to try to ensure that no flammable atmosphere existed in these tanks. As the cargo leaked out of these tanks, the increased air space would draw the IG in, but it would be impossible to force the liquid out due to the other openings on the IG system. Photographs clearly show the IG billowing out of No.5P hole, No.3 P hole and the open vent riser at No.1 S cargo tank.

Our flow calculations are broadly consistent with the ullage reading taken of No. 3 Port cargo tank from 0750 hours which showed a rapid initial out flow. Therefore, at about 1000 hours, that is about 2.75 hours after the collision, a substantial quantity of that which was lost from No.3P had been already lost; about 2,500 cubic metres. Therefore, as described above the effect of the IG pressure on this tank and No.1P would have been non-existent as the IG system was open to the atmosphere via Nos. 1S and 5P. It therefore could not have facilitated the spill as IMST suggest.

As the hole was smaller in No.1 Port than in the other tanks, the leakage from this tank was actually continuous for about 37 hours. IMST suggest that the leakage from this tank could have been reduced by creating a negative pressure (i.e. vacuum) in blocking off the atmosphere inlets into the tank, that is, the IG inlet and the PV valve. Had the PV valve been sealed and the IG inlet valve closed, it would not stop the initial leakage. The pressures generated by the head of the oil, the atmosphere in the tank and external pressure would only come into equilibrium after a significant amount of cargo leaked from this hole. Thereafter, there are a number of factors that would allow further leaking of the oil from this hole, such as the sloshing affect created by the movement of the vessel in a seaway, wave impact causing momentary pressure differentials, any changes in trim, list and temperature, and the orientation of the hole (any vertical split will create changes in pressure at different levels along the split). In following such a method, the key factors the Master must have to consider are, firstly, that the initial inflow of air could dilute the inert atmosphere in the tank creating a flammable atmosphere, and this will worsen with air being drawn into the hole thereafter by the factors given above. As previously described, the prevention of a fire and explosion on this vessel is the priority action.

Secondly, he should consider whether the creation of a vacuum in the tank, even temporarily, would result in a structural failure or collapsing of the tank. ISGOTT warns tanker crews of this danger, highlighting that structural damage can be caused by not allowing inert gas, vapour or air into a tank whilst liquid is being discharged. The relevant section of ISGOTT is quoted below.

7.2.2.1 General

Over-pressurisation of cargo and ballast tanks is due to compression of the ullage space by the inadequate release of vapour or by the overfilling of the tank. Under-pressurisation can be caused by not allowing inert gas vapour or air into the tank when liquid is being discharged. The resulting over or under-pressure in the tank may result in serious deformation or catastrophic failure of the tank structure and its peripheral bulkheads, which can seriously affect the structural integrity of the ship and could lead to fire, explosion and pollution. (See also Section 7.1.8.)

Structural damage can also be caused by not allowing inert gas, vapour or air into a tank whilst liquid is being discharged. The resulting under-pressure in the tank can result in deformation of the ship's structure, which could result in fire, explosion or pollution.

It should be noted that because of the frequency of over and under pressurisation of cargo tanks on tankers, it is deemed necessary to include a separate section covering this topic in ISGOTT.

What IMST are suggesting is that the crew of "HEBEI SPIRIT" deliberately seal the inlets into No.1 port (i.e. the PV valve and inert gas inlet). In doing so, the liquid will still initially leak from the tank through the hole which is a good depth below the pre-collision level of oil in the tank. This will create a vacuum. All tanker crews are acutely aware of the dangers of over/under pressurisation.

Tanker safety device settings for the control of pressure and vacuum levels in cargo spaces can be briefly summarised as follows.

The first line of safety consists of visual and audible pressure alarms in the vessels cargo office, these being duplicated on the vessels bridge. This enables the close monitoring and timely control of the tank pressures by the vessels Chief Officer.

As a second line of safety, in case the above alarm systems fail or are not monitored or acted upon for any reason, each cargo tank is fitted with an individual pressure/vacuum relief valve. These devices are mechanically failsafe. On this vessel they were set to operate as follows :-

1400mmWG (0.1373 bar or 0.1355 atmospheres)
-350mmWG (-0.0343 bar or – 0.0339 atmospheres)

A third failsafe defence is the pressure /vacuum breaker, which is common to all tanks. The vacuum pressure for which we are particularly interested here is set at :-

-700mmWG (-0.0686 bar or – 0.0677 atmospheres)

It can be nothing other than apparent from the fore-going that, the dangers associated with uncontrolled tank atmosphere pressures, outside of the tightly controlled parameters, are considered to be of the utmost importance within the tanker industry.

Even though we know in reality this would not be the case, if we assume that the tank could be sealed in the manner claimed, without the introduction of air, the initial loss of oil to the theoretical point of equilibrium would create a vacuum within the space of approximately **-3200mmWG (-0.3138 bar or -0.3097 atmospheres).**

We know generally that vessel tanks are tested in the region of +2500mmWG (0.245 bar or 0.2418 atmospheres) positive pressure and that the safety parameters on the vacuum side provide protection at approximately 25% of these positive pressure acceptances.

The negative pressure build up to the theoretical equilibrium point, where it is claimed that the outflow would have stopped, the negative pressure at this point is seen to be far outside the safety limits as previously quoted. The theoretical negative pressure is **9 times** more than the p/v valve settings, and nearly **5 times** more than the p/v breaker setting, and even exceeds the maximum positive pressure test point.

We know this tank had been breached and could therefore no longer be considered structurally sound. It can therefore be reasonably argued on the above basis, that had the Master taken the decision to bypass all the vessels safety devices, he would have invited the very real risk of potential disaster arising from a cargo tank implosion in No. 1P cargo tank, and the real possibility of additional oil spill from all the adjacent cargo tanks.

At this time, the Master would be unaware of the full structural extent of damage to this tank and had no means to determine it at the time. He would have been aware that cargo tanks on tankers are prone to collapse if a vacuum is created in such a tank by blocking a PV valve. The unknown weakening of the structure at the collision damage area could accelerate such a collapse.

It must also be noted that, had this space been sealed as above; and in the event of a fire breaking out in this space, the Master would not have had the option of trying to suppress the fire by means of pumping inert gas into the ullage space. In other words, a critical safety tool would have been wilfully bypassed in a critical situation.

Consequently, for the reasons described above, cargo would still leak from the hole until it could be removed from above the hole. Transfer internally was not an option for the reasons discussed above (the Chief Officer believed that he had almost filled the tanks). Increasing the list could reduce the amount, but this would then preclude any further work on the main deck which I have discussed below. The best and safest option would be to transfer the cargo to another vessel.

The leakage of the cargo from No.1P concluded at about 2000 hours on the 8th December. Even though a major incident had occurred and requests for vessels to take some of the cargo had been made shortly after the collision, I understand the first vessel that came alongside to undertake a ship to ship transfer was on the 10th December 2007. Therefore, even if any inlet into this tank had been closed, leakage would still occur, and cargo would still leak until the first STS vessel was alongside on the morning of the 10th December 2007, more than 72 hours (3 days) after No.1 port was holed. Further, as leakage would still occur through the hole in these circumstances air, and not IG, would be drawn into the tank, which would gradually increase the oxygen level in this tanks atmosphere. Therefore, the Master would have to balance the loss of this oil against the risk of fire. As his priority must be avoiding a fire, then his action in letting IG into the tank was correct.

It is also worth remarking that the Master was advised by Korean coastguard personnel who were on board at 1100 hours on the 7th December 2007 that barges had been mobilised to off load cargo from No.1 and 3 P cargo tanks and these vessels would be alongside in about two hours. Consequently, the safest option for the Master was to transfer the cargo from No.1 port to barges, not increasing the risk to the crew by attempting to plug the hole in this tank, or other equally risky operations such as transferring cargo to ballast tanks overall.

D) Prevent additional leakage by employing measures such as adjusting the ship's balance

"Hebei Spirit" should have injected ballast water into the opposite ballast tank in order to list the vessel to the starboard side and mitigate the leakage from the portside cargo tanks. However, only a minimal amount of ballast water was injected to protect the safety of the crew, and the vessel maintained only a 5-6 degree list, which was almost the same degree as that caused by the cargo spill. Such measures were also far from what SOPEP stipulates doing.

I understand that the vessel was eventually listed to 5º to 6º to starboard (ullage reports) on the 7th December 2008. This list was as a result of the loss of cargo from No.1P, 3P and 5P cargo tanks, the transfer of cargo from these tanks to the starboard cargo wing tanks, and the filling of ballast into No. 4S water ballast tank. As ballast space in the starboard water ballast tanks still remained (Nos. 2S and 4S), it was possible to fill these even further to create a 10º starboard list. I have not undertaken any stability calculations regarding the creation of such a list, but the vessel in its loaded condition (single hull) is inherently stable, so increasing the list to 10º should be possible.

However, whether this should have been done is a different matter. Their reasons for listing the vessel to, say, 10º to starboard is, I assume, to remove as much head of liquid cargo as possible from the holes in the port wing cargo tanks, therefore theoretically reducing the rate of outflow. If so, there are a number of points in this regard:

- The loss of oil from No.5P was very quick because of the size of the hole, about half an hour (described above). Similarly, the loss of oil from No.3P, possibly only took about 4 hours, but the initial flow rate meant that the majority of the cargo leaked from this tank within the first couple of hours (see attached flow rate calculation). The only leak that was time extensive was No.1P, but the loss of oil from this tank was small when compared with the total amount, i.e. about 23% of the total lost.

- The main reason against listing to 10º is crew/personnel safety. The pictures show that the main deck was extensively contaminated with the very slippery oil cargo throughout its length. With such a list it would be very dangerous for personnel to even walk, let alone work, as the crew had to, on such a listed oily deck. A 10º list is not minor. Even if the main deck was clear of oil, it would be extremely difficult to walk and work on this deck at this angle, but with oil contamination, no-one would be able to walk/work particularly in near gale force winds and sea spray/oil washing over the decks.

- If the assumption in listing the ship is that it should have occurred as soon after the collision as possible, then the necessary attendance of the crew on the deck to carefully monitor cargo transfers, ullaging, etc would become almost impossible.

- Additionally, a lot of this work would be necessary on the starboard side of the vessel. As the main deck has a designed camber of about 2.4º, that is, in the upright condition it slopes downwards from the centre line to the starboard outboard side, the actual slope of this starboard deck with an induced 10º list would be much worse, 12.4º, increasing the danger to the crew. It should be noted that the crew would be working on the starboard tanks during cargo transfer. This can also be seen clearly in the photograph of the main deck taken on the 8th December 2007.

- The Master has advised that a Marine Police Officer boarded the vessel when it was only listed about 2º to starboard. He said to the Master that this was dangerous and required assistance from the crew in walking on the deck. This illustrates how difficult it would be to work on this deck with a 10º starboard list (and even greater on the starboard side, 12.4º).

- The paramount action by the Master has to be crew safety. Increasing the starboard list to 10º would have put the crew at increased risk of injury and potentially loss of life on such a slippery surface.

3) Conclusion (the cause that aggravated the situation to a marine pollution)

In the case of a maritime accident, the order of priority is human lives, the vessel and then the cargo. If the accident involves the leakage of hazardous materials such as oil, measures to mitigate the leakage in order to protect the environment also must be employed.

This is the spirit of the SOLAS and MARPOL, the two most important international conventions, signed in order to protect the environment and ensure safety at sea. Neither of these two can be overlooked when an accident occurs. The lack of a basic awareness to protect not only human lives and the vessel, but also to protect the marine environment, contributed to all of the passive measures or inaction by "Hebei Spirit," as described above.

In conclusion, the initial cause of the marine pollution is the collision, and the Marine Spread can therefore be primarily blamed for this. However, all collisions involving vessels carrying hazardous material do not always develop into large scale pollutions. The consequences may vary depending on the efforts to mitigate leakage. Whether or not the extent of pollution increased due to the lack of efforts to mitigate the leakage must be additionally assessed.

Such assessment must be based on a real time and accurate calculation as mentioned above. If such considerations are ignored in future cases and the initial collision is deemed the direct cause of large scale marine pollution, there will be no effective measures to prevent increasing the marine pollution caused by the inaction to mitigate the leakage.

The IMST in their conclusion have correctly pointed out that the key priority for the Master of a fully laden VLCC involved in a collision is the safety of human life, the safety of the vessel, then protection of the environment. However, in their discussion on the actions taken by the Master, they then only concentrate on the protection of the environment, not the first two aspects. They, of course, have looked at this in hindsight, as I have, but it must never be forgotten that the Master of a tanker, fully laden with a highly flammable cargo, will always have at the forefront of his mind the safety of the crew and his vessel and the inherent risks apparent on such a vessel; fire and explosion. The IMST have made reference to an unsupported claim that all collisions involving hazardous material do not result in major pollution. However, I believe that the examples of catastrophic collisions I have given above clearly illustrates the risk to both life and vessels, as well as the environment, that a Master of a tanker must have at the forefront of his mind in incidents such as this.

IMST have attempted to show that the Master and his crew did not take sufficient action shortly after the collision to limit the leakage of the cargo from the breached tanks. However, they have simply used a comparison of the available tank space on the vessel and the quantity lost over the side to show what they think should have been done. What they singularly fail to take into account is the rapid loss of the cargo from No.5 and No.3 port cargo tanks which is illustrated by the ullages of these tanks taken at 0750 hours, and our calculated out flow rates. That is, the majority of the cargo was lost before any safe and reasonable actions could be taken. Thereafter, the status of the vessel was such that the crew lives, the safety of the ship and the remaining cargo, were always at risk due to the prevailing conditions on board which made any activity fraught with danger, therefore undertaken with caution. According to the Master, at no time did any of the various authorities both on board and over VHF conversations complain, at the time, that the Master and his crew were not doing enough to mitigate the loss of oil. Therefore, for the IMST to now criticize the Master and crew, in hindsight, is not justified.

C. Cause of the Accident

Considering all of the causes of the accident mentioned during the hearings, the collision was caused by the following: 1) While towing "Samsung No. 1," "Samsung T-5" and "Samho T-3" did not take early measures against the deteriorating weather and faced bad weather conditions in which maneuvering the vessels was rendered impossible; 2) The Marine Spread drifted with the wind and waves after losing its towing ability; 3) Signals were not transmitted to nearby vessels, and safety measures such as emergency anchoring were not performed while the Marine Spread was drifting; and 4) The towing line of "Samsung T-5" broke while the barge was too close to "Hebei Spirit" and eventually caused the collision. Nevertheless, 1) the fact that "Hebei Spirit" did not discover the approaching Marine Spread early, while anchored near a frequently used route, due to the lack of due care, 2) the subsequent passive measures performed by "Hebei Spirit" to seek shelter, such as putting the engine to dead slow astern, and 3) the fact that emergency countermeasures were not properly implemented due to the lack of awareness of the seriousness of marine pollution all contributed to the pollution.

The IMST has weighted the causes of the accident and its aftermath which I have summarised and commented on as follows:

For the marine spread.

1) The marine spread did not take early action due to the deteriorating conditions.

   I agree with this, but also believe that the IMST has failed to take into account the results of their investigation that the marine spread was not fit for this voyage in respect of its tugs and towing arrangement and yet do not criticise the operators and managers severely for this failure.

2) The marine spread drifted uncontrollably.

   This is not proven by the evidence. The marine spread direction was went from west, via south, to east when the tugs altered their course. Therefore, it did not drift with the wind and seas.

3) No signals were broadcast or emergency measures taken on the marine spread.

   The IMST are correct, and this failure by those on the marine spread is shocking. This failure is a reflection on the operation and management of the vessels in the marine spread.

4) The tow time of "SAMSUNG T-5" ported.

   This is the prime cause of the collision, but the IMST have not delved into the circumstance surrounding the use and maintenance of the wire.

For "HEBEI SPIRIT"

1) Those on the VLCC anchored on a frequently used route and never maintained a proper lookout.

The anchoring location was agreed with the VTS almost 12 hours before the collision. A proper lookout was being maintained, which is shown by the fact that the master was called nearly one hour before the collision and that those on the VLCC were the first to realise the danger of the approaching marine spread by attempting to contact both VTS and the tugs. It took 18 minutes for a response to be given to the VLCC's calls, and by that time the only actions possible had commenced on the VLCC.

2) Only passive measures were performed.

Despite the fact that no-one responded to the calls from the VLCC, the master started his engine, used the engine and slacked off his anchor cable to increase the passing distance. Passive measures are not doing anything. The master undertook measures that safely avoid any close contact. In this he was successful. The parting of the tow line caused the collision.

3) Emergency countermeasures were not properly implemented due to a lack of awareness on the VLCC.

The crew were mustered for their safety before the collision occurred. Thereafter, the actions taken by the master follow all accepted international marine priorities in such incidents, that is the safety of life, safety of the vessel, then minimise damage to the environment. The master cannot be criticized for prioritizing his actions as he did in accordance with all international practices.

IV. Acts by the Relevant Persons

A. Seung-Min Cho

Seung-Min Cho, master of "Samsung T-5," had the responsibility to tow the barge safely. He should have verified the contents of the towage survey thoroughly and observe them prudently, when towing the barge in the West Sea, where bad weather conditions are frequent. However, he co-signed the inappropriately prepared towage survey certificate even though the towing ability of the tugboats was unclear and insufficient, and the composition of the towing lines was different from what was described in the survey. After departing, he reacted late to the changing weather and faced bad weather, which made the tugboats lose their ability to tow the barge. Moreover, if he failed to seek shelter, he should have notified such problems to the nearby coastal authorities and anchored at an appropriate place. However, such measures were not implemented, and the Marine Spread approached "Hebei Spirit" too closely. The towing line broke and the barge "Samsung No. 1" drifted and collided with "Hebei Spirit." The collision made holes in the cargo tanks of "Hebei Spirit," and the oil cargo spilled into the sea, causing marine pollution. In that regard, Seung-Min Cho neglected his duty of care to prepare for the voyage thoroughly and safely navigate the vessel, and this caused huge social and economical damages.

Pursuant to Article 5, Paragraph 2 and Article 6, Paragraph 1, Item 1 of the Act on the Investigation of and Inquiry into Marine Accidents, Seung-Min Cho's second officer license shall be revoked.

If a towage approval survey had been conducted for this voyage, it would be a pre-departure survey carried out for the purposes of insurance, it would have include recommendations and broad guidelines for the voyage to be undertaken. It would not have been in any way, an all encompassing voyage passage plan to be rigidly adhered to by the master, and would not have removed the obligation of the managers or the master to safely plan and execute the voyage.

There was no towage approval survey conducted for the voyage in question.

B. Gan Tae Kim

Gan Tae Kim, master of "Samho T-3," who towed the large crane barge with "Samsung T-5," did not object to the inappropriateness of Seung-Min Cho's preparations. After departure, he slept and did not act jointly, despite the suddenly changing weather. He woke up as the Marine Spread lost its towing ability and started to drift, with a risk of collision. In that regard, he neglected his duty of care as master of the auxiliary tugboat to thoroughly prepare for the voyage, to safely navigate and to assist Seung Min Cho, master of the lead tugboat. Such negligence eventually caused a large scale accident.

Pursuant to Article 5 Paragraph 2 and Article 6 Paragraph 1 Item 2 of the Act on the Investigation of and Inquiry into Marine Accidents, Gan Tae Kim's second officer license shall be suspended for a period of 12 months.

C. Yi Hyun Kim

Although he is not responsible for navigation, Yi Hyun Kim, the master and manager of the barge towed by "Samho T-3" and "Samsung T-5," should have actively requested that the master of the main tug boat, Seung-Min Cho, rectify the situation upon discovering the lack of due care, such as insufficiently preparing for navigation and not acting against the deteriorating weather. In that regard, Yi Hyun Kim has neglected his duty of care to perform his best efforts to assist with the safe navigation.

Pursuant to Article 5, Paragraph 3 of the Act on the Investigation of and Inquiry into Marine Accidents, a reprimand is recommended to Yi Hyun Kim.

D. Boram

Boram, trustee and manager of "Samho T-3," "Samsung T-5" and "Samsung No. 1," should have practically assisted and supervised the towing operations of the Marine Spread. However, even though the towage survey was conducted only as a formality, and there were inconsistencies between the survey and the actual situation, Boram did not indicate such issues to the Marine Spread and let the Marine Spread depart. After departure, the Marine Spread did not implement the towage survey navigation recommendations, such as contacting and aiding each other while seeking shelter. After the Marine Spread lost towing ability in the bad weather, supportive measures, such as contacting the coastal authorities or nearby vessels, were not performed. In that regard, Boram has neglected its duty of care as vessel managers to ensure the safe navigation of the vessel, and this negligence contributed to the accident.

Pursuant to Article 5, Paragraph 3 of the Act on the Investigation of and Inquiry into Marine Accidents, Boram is recommended to make improvements.

Boram and SHI entered into a "Equipment Management Service Agreement" on March 1, 2007, and management of the marine spread was entrusted to Boram for one year from the said date until February 29, 2008.

According to the Agreement, Boram shall be in charge of operating the marine spread, and in particular, with respect to safety management, Article 4 of the said Agreement provides that, while Boram shall be responsible for the safety management and shall comply with SHI's safety management regulations.

The towage approval survey if conducted for this voyage, would be a pre-departure survey carried out for the purposes of insurance, it would have include recommendations and broad guidelines for the voyage to be undertaken. It would not have been an all encompassing voyage passage plan to be rigidly adhered to by the Master, and would not have removed the obligation of the managers or the Master to safely plan and execute the voyage.

There was no towage approval survey conducted for the voyage in question.

Regardless of the foregoing, the actions of the Master do not relieve the company (Boram), from their responsibilities and duties for the safe management and operation of these vessels. The lack of safe operation and management of the marine spread is a direct and substantial cause of the accident.

E. SHI

Although SHI, the charterer and operators of "Samsung T-5," "Samsung No. 1" and "Samsung A-1," has entered into a service agreement to entrust the management of the said vessels to Boram, the agreement stipulates that the safety management of the vessels must comply with SHI's rules. The towage survey fee for "Samsung No. 1" was also paid by SHI, and it can therefore be said that SHI was comprehensively involved in and supervised the navigation. In that respect, SHI had a duty to establish a safety inspection system to constantly verify whether the towage surveys were sincerely performed and observed. However, SHI neglected such duties and contributed to the accident in which "Samsung No. 1" collided with "Hebei Spirit," due to a lack of awareness of the natural dangers of the sea and mismanagement of the marine safety management system.

SHI, chartered all three vessels for a long term contract from Samsung Construction, and entered into a "Equipment Management Service Agreement" with Boram on March 1, 2007.

In particular, with respect to safety management, Article 4 of the said Agreement provides that, while Boram shall be responsible for the safety management, it shall comply with SHI's safety management regulations.

In the absence of a defined Safety Management System as required by SOLAS Ch IX for other vessels defined under Regulation 2, Boram were required to comply with SHI's safety management regulations, regardless of their responsibility for the otherwise safe management of the marine spread.

The operation plan of the Marine Spread was wholly in accordance with the work schedule of "Samsung No. 1," and as the work schedule of "Samsung No. 1" was decided by SHI and directions were given to Boram in regards to the towing voyage. By definition of article 4 of the management service agreement, between SHI and Boram, SHI as operators of the vessels were in a more important position with respect to the actual safety management of the marine spread, as safety management pursuant to the service agreement was to be carried out in accordance with the regulations of SHI, and by the imposition of their management regulations are responsible parties to the safe operation and management of the Marine Spread and the foregoing equally applies.

The lack of safe operation and management of the marine spread is a direct and substantial cause of the accident.

Pursuant to Article 5, Paragraph 3 of the Act on the Investigation of and Inquiry into Marine Accidents, SHI is recommended to make improvements.

F. Jasprit Singh Chawla

Jasprit Singh Chawla, master of "Hebei Spirit," which was anchored near a frequently navigated traffic separate scheme at night, had a duty to supervise the ship's anchor duty so that there is strict observation of the codes of anchoring. Nevertheless, Jasprit Singh Chawla did not implement such measures and was consequently notified too late that a brightly lit Marine Spread, which lost its towing ability, was approaching. While facing such a dangerous situation, Jasprit Singh Chawla, as [the master] of the vessel loaded with hazardous material, had a duty of seamanship to avoid a collision with the Marine Spread, by rationally assessing the situation and using the main engine and rudder in order to drag the anchor. Nevertheless, he only paid out the anchor chain while putting the engine to dead slow astern and did not comply with the requests to change the anchoring location sent from the Dasean VTS and the Marine Spread. Due to such lack of due care, "Hebei Spirit" collided with the drifting "Samsung No. 1."

Moreover, he should have ordered his crew to execute the SOPEP procedures to immediately stop the leakage of oil cargo, right after the puncturing of the tanks. This negligence also contributed to the occurrence of the very large scale accident in the West Sea.

'HEBEI SPIRIT' anchored with the agreement of VTS and in line with previous calls to the port. This was in fact a good area for a loaded VLCC to anchor. The depth is good, the nature of the bottom affords good holding ground, the position is clear of obstructions and at least 2.5 miles from the nearest dangerous shallows in the area and is 7 miles away from the noted traffic separation scheme, this is not 'near' by any definition.

Up until about 0550 hours, the movement of the marine spread would be of no real concern to those on the VLCC. In the circumstances it was not necessary to take any immediate action apart from simply monitoring the vessel. After 0430 hours the marine spread was then moving east and not approaching the anchored VLCC, then west, also not approaching the VLCC. Only after it eventually tracked towards the south after 0550 hours would it become a concern of the VLCC and the watch keepers thereafter responded correctly.

The argument that the Master of "HEBEI SPIRIT" simply could have dragged his anchor and moved out of the way has been made. Heaving the anchor in the given situation, and without shortening the cable to approximately 5 shackles on deck, he would not have been able to successfully drag her anchor astern. However, if he had attempted this action the VLCC would have moved towards the approaching marine spread, therefore making the possibility of a collision almost a certainty.

This foregoing also implies that "HEBEI SPIRIT" was the "give way" vessel. This was not the case, the "HEBEI SPIRIT" remained anchored throughout and the marine spread were the vessels underway displaying navigation lights for vessels underway but displaying no signal lights to show to other vessels that they were restricted in anyway. "SAMSUNG NO. 1" was not drifting but as the direction of its track show, controllable by the tugs.

That the Master was consequently notified too late is plainly misleading and has been stated by the IMST to further their view in hindsight that the Master should have weighed anchor and moved away. The Master clearly explained the reasoning of his actions at the time to the VTS, and they responded by saying they understood.

The IMST fail to observe the priority actions that a master of a laden VLCC should follows in such an incident. These are laid down in all international rules, guidelines and publications. The IMST has solely concentrated on minimizing pollution, whereas safety of life and the vessel are the first priorities.

Pursuant to Article 5 Paragraph 3 of the Act on the Investigation of and Inquiry into Marine Accidents, Jasprit Singh Chawla is reprimanded.

G. Chetan Syam

Chetan Syam, the anchor duty officer of "Hebei Spirit," which was anchored near a frequently navigated traffic separation scheme at night, had the professional duty to thoroughly observe the movements of nearby vessels, to immediately performing emergency measures if the risk of collision increased, and to notify the master thereafter. However, he was occupied with other matters while on duty at the bridge and was practically not performing his anchor duty. Consequently, he did not notice the approach of the brightly lit Marine Spread, which lost its towing ability. This caused him to report the approach too late. The master, who was notified too late, performed inappropriate measures and eventually could not avoid the collision with the drifting "Samsung No. 1."

In addition, he should have executed the SOPEP procedures in order to immediately stop the leakage of oil cargo, as soon as the holes were made. This negligence also contributed to the extraordinarily large scale accident in the West Sea.

Pursuant to Article 5, Paragraph 3 of the Act on the Investigation of and Inquiry into Marine Accidents, Chetan Syam is reprimanded.

'HEBEI SPIRIT' was anchored 7 miles away from the noted traffic separation scheme, this is not 'near' by any definition.

The Chief Officer was on the bridge from 0400 hours with the Cadet both maintaining a proper anchor watch, assisted by the duty sailor. It is astonishing that the IMST are saying that a proper lookout was not maintained on board the anchored VLCC.

Those on the "HEBEI SPIRIT" were the first to recognise a developing problem and initiate action; neither the VTS nor the tugs initiated any action at this time. Therefore, to say that a proper lookout on the VLCC was not being maintained belies the facts of this matter as evidenced by the VHF VTS transcript. Additionally, there was a prompt response which allowed sufficient time for the anchored VLCC to take action to avoid any contact with the crane barge. The collision occurred after the crane barge was manoeuvred clear from the anchored VLCC due to the sole reason that one tow wire broke.

V. Implications

A. The Importance of the Towage Survey

Towage surveys are insurance surveys performed for the purpose of insuring the towed object. The survey verifies the safety of the towing of the Marine Spread, and the accuracy of the survey is a critical part that affects the safety of human lives and the vessel.

Therefore, the survey must not end as a formal procedure, and the terms and conditions prescribed in the survey must be observed. The survey itself should be adhered to strictly and rationally in accordance with the relevant rules, and the Marine Spread must thoroughly observe the conditions stated in the survey.

The IMST are using the towing survey certificate as the final deciding factor on the towage arrangement, which is a fundamental misunderstanding of such a certificate. The operators/managers and masters have to properly prepare the tow, not the insurance surveyor.

The towage survey is a commercial agreement between the insurers and the assured and does not override the basic requirement of the operators/managers and masters of the marine spread to ensure that the vessels are fit for the voyage. Whatever mistakes the IMST have highlighted above are not the responsibility of the insurance survey company, but the operators/managers and masters of the marine spread. It was their requirement to ensure that the towline composition is correct. The towage survey was not inappropriate, the preparation of the vessels was. Finally, the insurance towage certificate was invalid for this voyage.

Not only do the IMST ignore the fact that the towage survey was invalid for this voyage, the responsibility for safe navigation does not rest with insurance surveyor but solely with the master of the vessels following the safety management guidelines of the operators/managers. The IMST should be investigating the instructions given to the masters by the operators/managers rather than focussing on the insurance survey.

B. Interpretation and Use of the Weather Information

The master of the Marine Spread determined that the heavy sea warning, which would be effective as of the next day for the central part of the distant west seas, would not affect the Marine Spread, since it was planning to navigate 5 miles off the coast. However, since the distant west seas start from a point only 20 miles off the coast and since there are no barriers dividing the distant sea and the near sea, it was likely that the warning for the distant west seas would affect the near sea. If such conditions continued to last for a long time, the bad weather in distant seas could reach the near sea. The master should have considered such possibilities while planning the voyage.

The actions and considerations of the Master of the marine spread display a basic lack of understanding of the marine environment that every seafarer should be aware of. If a vessel is on the west side of Korea and strong westerly winds are forecast 20 miles offshore, it should not take a great deal of understanding to realize that a track 10 miles off the coast will still be exposed to the effects of this wind.

C. Early Warning and Emergency Anchoring in the case of Seriously Restricted Maneuverability

In this case, despite the fact that the tugboats were practically drifting, as they were almost impossible to navigate due to a loss of towing ability in the bad weather, they did not give notice to nearby ships or the coastal port authorities, so that such ships did not have time to take early preventive measures. Furthermore, tugboat masters on a towing voyage must keep in mind that if it is difficult to navigate based only on the towing ability of the tugboats, it is possible to cope with drifting by having the towed barge perform emergency anchoring simultaneously with the towing by the tugboats.

The IMO Guidelines for Safe Ocean Towing state the following:

Quote

13.18 Towed objects should be equipped with an anchor, suitable for holding the towed object in severe weather conditions, that is securely attached to a chain cable or wire and is arranged for release in an emergency by persons on, or boarding the towed object, unless rendered impractical due to the design or conditions of the towed object.

Unquote

Even though the IMST believe that the barge had been maneuvering with difficulty since 0013 hours, they fail to take issue with the fact that the barge anchor had not been prepared previously. It is a standard marine practice to prepare the anchors to release in an emergency if there are problems with the vessel and anchoring is an emergency option. Had it been previously prepared then it could have been released as soon as the tow line parted.

Additionally, the guidance given in the IMO Guidelines for Safe Ocean Towing: show that the anchor fitted on the barge should be used for this purpose and by not preparing this anchor earlier shows either a fundamental failure of the operation and management of the marine spread or the fact that the crews did not believe the marine spread was uncontrollable.

D. Preventive Measures while at Anchor

When a ship whose maneuverability is severely restricted approaches a ship at anchor, the ship at anchor must take all possible measures, depending on the situation, to avoid collision pursuant to Article 2(a) and (b) of the COLREGs. In this case, "Hebei Spirit" attempted to keep its distance with the approaching Marine Spread by putting her main engine to dead slow astern while merely paying out the anchor chain, but failed. Since the ship was already dragging, other more active measures should have been taken earlier, such as moving astern well in advance by using more engine power and setting it to slow or half astern, rapidly winding up the anchor chain that had been extended considerably due to the strong winds and waves, and moving to another location using the main engine and rudder, or disconnecting the bitter end pin of the anchor chain at the ship's end and moving to another location, etc.

Both vessels fall within the steering and sailing rules, not outside them as a special circumstance. HEBEI SPIRIT was anchored, displaying the correct navigation lights. The marine spread was underway, displaying the lights for such a tow. At no time did those on the marine spread display any other lights that indicated to other vessels that they were in any way restricted or in trouble. Neither did they contact the nearby ships or the VTS to advise of any troubles until 0627 hours, after they had been called repeatedly by VTS and HEBEI SPIRIT, and after those on the anchored VLCC had already taken the only action they could.

The Colregs provide adequate mechanisms for the display of various combinations of navigation lights to indicate difficulties and restriction in manoeverability. However, none were displayed by the marine spread.

HEBEI SPIRIT was never dragging its anchor. This anchor held. The only evidence that the IMST has for the dragging of this anchor was the call made to the HEBEI SPIRIT by the "SAMHO T-3" at 0629 hours where they thought the VLCC had dragged. At this time the VLCC had paid out additional anchor cable and was going astern to stretch the cable. All this could have indicated to the marine spread that the VLCC was dragging. But it was not.

Because the Master of "HEBEI SPIRIT" had successfully deployed more cable and moved astern stretching this cable, the crane barge was now crossing from starboard to port and even though it was at a CPA of 0.3Nm, was now moving away from 0640 hours. That is there was no risk of collision. The determination of risk of collision in this case is covered in the Colregs, Rule 7 (d).

E. Establishment of SOPEP Implementation Readiness

Recently, collision accidents in Korea's coastal waters involving marine spreads have been increasing rapidly, and while the collision in this case may only be one of these many cases, the marine pollution as a secondary accident was on such a massive scale that it became a major incident.

Since it has come to light in the Cause of Accident portion of this decision that the failure by "Hebei Spirit" to faithfully implement SOPEP greatly contributed to the development [of the oil spill] into a major marine pollution, it should be emphasized repeatedly to tanker crewmembers that, in the event of marine pollution due to an oil spill from a vessel, efforts to prevent marine pollution should be taken simultaneously with measures to secure the safety of human lives, the ship and its cargo.

This statement denies the facts of the matter. The master exemplary followed the international guidelines in responding to such an accident. The majority of the oil leaked from the vessel before anything could be even started. It leaked because the crane barge contacted the VLCC because its tow line parted. The IMST fail to take into account that vessels were requested to offload the cargo as early as the morning of the 7th December, but they never arrived until 3 days later despite the master being advised that they would arrive within hours. At the time of the incident, the Korean authorities at no time criticised the master for his actions.

F. Confirmation of Towage Survey Details by the Marine Insurance Company

Towage surveys are undertaken to survey the safety of the towage before insuring the towed object, so the fact that a decision of suitability was obtained in such a survey means that the surveyor confirmed that the Marine Spread in question is able to navigate safely, on the assumption that the Marine Spread complies with the conditions on the survey report. Therefore, the Marine Spread must comply with the conditions or voyage recommendations provided for in the towage survey, and the insurer must also confirm the departure preparations or navigation safety compliance of the Marine Spread. If the towage survey is conducted cursorily or the Marine Spread is negligent in complying with the survey conditions, it becomes difficult to expect safe navigation on the part of the Marine Spread, so the insurer must always keep this in mind in order to efficiently operate and achieve the purpose of the marine insurance.

The operators/managers and masters have to properly prepare the tow, not the insurance surveyor. The towage survey is a commercial agreement between the insurers and the assured and does not override the basic requirement of the operators/managers and masters of the marine spread to ensure that the vessels are fit for the voyage. Whatever mistakes the IMST have highlighted above are not the responsibility of the insurance survey company, but the operators/managers and masters of the marine spread. It was their requirement to ensure that the towline composition is correct. The towage survey was not inappropriate, the preparation of the vessels was. Finally, the insurance towage certificate was invalid for this voyage.

We enter our decision accordingly.

Sept. 4th, 2008

Chief Adjudicator	*Adjudicator*	*Young-Dae Cho*
Assigned Adjudicato	*Adjudicator*	*Yong-Bum Huh*
	Adjudicator	*Sang-Soo Kim*
Non-permanen	*Adjudicator*	*Yong-Hwa Cho*
Non-permanen	*Adjudicator*	*In-Young Gong*

"Parties related to the marine accident or inspectors can appeal to the Central Maritime Safety Tribunal (through our tribunal) within 14 days of receipt of the officially certified copy of the decision if they disagree with this decision."

Recommendation

Incheon Maritime Safety Tribunal Special Panel No. 2008-23
Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)

Party related to the marine accident

Yi Hyun Kim (680724-1347519)
Gyungsang-Namdo, Gujae-Si, Shinhyun-Eup, Sangdong-Ri 72 Gujae-Shinhyun SK View Apartment Building 101, No. 502

As the fleet master and person in charge of the towed barge "Samsung No. 1" during the towing voyage, even if you were not responsible for the navigation per se, if navigational negligence on the part of the master of the lead tugboat, who is responsible for the towing voyage, comes to light, such as improperly handling the installation of towing equipment before departure in contravention of the towage survey details or reacting late to weather conditions, you had the duty to provide the good and faithful assistance necessary for safe navigation, such as requesting a rectification of the situation, as you are the fleet master with the overall management responsibilities for the Marine Spread's voyage. It has been determined that you contributed to the occurrence of this accident, due to your failure to fulfill your duties.

Therefore, in order to prevent the recurrence of a similar accident, we request that you take active measures to implement the corrections recommended pursuant to Article 5(3) of the Act on the Investigation of and Inquiry into Marine Accidents.

Sept. 4th, 2008
Incheon District Maritime Safety Tribunal
Special Panel Chief Adjudicator Adjudicator
Young-Dae Cho

Recommendation

Incheon Maritime Safety Tribunal Special Panel No. 2008-23
Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)

Party related to the marine accident

Boram Co., Ltd. (Representative Yong-Hoon Park)
Gyungsang-Namdo Gujae-Si, Shinhyun-Eup, Jangpyung-Ri 530

Despite being responsible for commanding, supervising and providing front-line assistance for the towing voyage as the trusted manager of "Samsung T-5," "Samho T-3" and "Samsung A-1," you allowed the Marine Spread to depart without pointing out that the towage survey had been performed cursorily and that its details were not faithfully complied with. Nor did you carry out the voyage recommendations in the towage survey, such as receiving reports from the master of the lead tug and taking appropriate assistance measures when they were seeking shelter upon meeting bad weather after leaving the port. As a result, it has been determined that you contributed to the occurrence of this accident by being negligent in managing the safety of the Marine Spread due to a lack of awareness of the dangers in navigating off the western coast of Korea in the winter, where ships frequently meet with bad weather. For example, you failed to quickly grasp the situation and to request that nearby ships or the coastal port authorities take necessary measures, while the master of the lead tug had to makes decisions on his own and was in an extremely dangerous situation fighting to seek shelter after losing towing ability in the bad weather and eventually resulting in the collision accident..

Therefore, in order to prevent the recurrence of a similar accident, we request that you take active measures to implement the reforms recommended pursuant to Article 5(3) of the Act on the Investigation of and Inquiry into Marine Accidents.

Sept. 4th, 2008
Incheon District Maritime Safety Tribunal
Special Panel Chief Adjudicator Adjudicator
Young-Dae Cho

Recommendation

Incheon Maritime Safety Tribunal Special Panel No. 2008-23
Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)

Party related to the marine accident

Samsung Heavy Industries Corporation (Representative Jing-Wan Kim)
Seoul, Seocho-Gu, Seocho-Dong 1321-15

As the charterer and operator of the "Samsung T-5" tug, "Samsung No. 1" and "Samsung A-1," you executed a service agreement with Boram Co., Ltd. Entrusting to them the management of these vessels, but took the initiative in commanding, supervising, and comprehensively taking part in the navigation of the Marine Spread in order to ensure the actual safety of the Marine Spread, such as by having the safety management under the service agreement follow your rules and regulations and soliciting the towage survey at your expense in order to insure the towed barge "Samsung No. 1." It has been determined that you contributed to this collision. However, by allowing Boram Co., Ltd., which was subject to your comprehensive command and supervision, to leave everything to the judgment of the tug master in making the voyage, in spite of the incompleteness of the important departure preparations that could affect the success and safety of the towage voyage, such as the proper composition of the towing line for a marine spread that would tow a massive crane barge in Korea's western seas in the winter when bad weather is common, the guidelines for seeking shelter, and the selection of emergency shelter locations.

As this is recognized as being due to deficiencies in the marine safety management system such as inadequate response systems for marine dangers, we request that you take active measures to implement the reforms recommended pursuant to Article 5(3) of the Act on the Investigation of and Inquiry into Marine Accidents in order to prevent the recurrence of a similar accident.

Sept. 4th, 2008
Incheon District Maritime Safety Tribunal
Special Panel Chief Adjudicator Adjudicator
Young-Dae Cho

Correction Order

Incheon Maritime Safety Tribunal Special Panel No. 2008-23

Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)

Party related to the marine accident

Jasprit Singh Chawla
Seoul, Jongro-Gu, Naeja-Dong, 223 Seyang Building Kim & Chang Law Offices

Despite having the responsibility to command and supervise the crewmember on anchor duty, as the master of "Hebei Spirit," which was a massive oil tanker anchored at night near the traffic separation scheme that has a high volume of ship traffic, you were negligent in this respect, and since the crewmember on anchor duty did not effectively perform his duty, surveillance of a major marine spread, which was approaching at night with its lights brightly on and whose maneuverability was severely restricted, as it was almost impossible to navigate due to a loss of towing ability, was not performed, and you only received a report in a close quarters situation when the risk of collision was imminent. You contributed to this collision, however, by insisting on preventive measures inappropriate to the situation such as only paying out the anchor chain while going dead slow astern and not accepting the multiple requests from the Daesan VTS and Marine Spread to change anchoring locations, following which the main engine itself broke down and resulted in a collision with the drifting "Samsung No. 1." This is despite the fact that, if you were late in ascertaining the dangerous situation, you should have calmly taken stock of the situation and taken actions in conformity with good seamanship in order to avoid a collision with the Marine Spread whose maneuverability was seriously restricted, such as performing emergency measures under special circumstances by utilizing the main engine and rudder, dragging anchor, etc.

Furthermore, as a large amount of oil cargo was spilt into the sea from the punctures in the cargo tanks caused by this collision, you were responsible for directing the crew under your command to take the necessary SOPEP (Shipboard Oil Pollution Emergency Plan) measures in order to quickly stop the spill, but by being grossly negligent in this regard and allowing the crude oil to leak unnecessarily, you contributed to the development of a marine pollution disaster of massive proportions in the western coastal region of the Korean peninsula.

Therefore, in order to prevent the recurrence of a similar accident, we request that you take active measures to implement the improvements ordered pursuant to Article 5(3) of the Act on the Investigation of and Inquiry into Marine Accidents.

Sept. 4th, 2008
Incheon District Maritime Safety Tribunal
Special Panel Chief Adjudicator Adjudicator
Young-Dae Cho

Correction Order

Incheon Maritime Safety Tribunal Special Panel No. 2008-23
Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)

Party related to the marine accident

Chetan Syam
Seoul Jongro-Gu, Naeja-Dong, 223 Seyang Building Kim & Chang Law Offices

You contributed to this collision because, despite having the obligation to thoroughly monitor nearby navigating vessels and to take emergency measures where there is a risk of collision before reporting to the master as the nighttime anchor duty watchman of the massive oil tanker "Hebei Spirit," which was anchored at night near the traffic separation scheme where there is a high volume of ship traffic, you did not perform your watch duties and left it to a cadet, so that you were not at all aware that a large marine spread was approaching in the night with its lights brightly on and whose maneuverability was seriously restricted as it was almost impossible to navigate due to a loss of towing ability, and only made a report to the master when it was already a close quarters situation. As a result, the master, who was informed too late of the dangerous situation, took inappropriate preventive measures, due to which a collision arose with the drifting "Samsung No. 1."

Furthermore, as a large amount of cargo oil was spilt into the sea from the punctures in the cargo tanks caused by this collision, as the officer in charge of cargo management you were responsible for taking the necessary SOPEP (Shipboard Oil Pollution Emergency Plan) measures in order to quickly stop the spill, but by being grossly negligent in this and allowing crude oil to leak unnecessarily, you contributed to the development of a marine pollution disaster of massive proportions in the western coastal region of the Korean peninsula.

Therefore, in order to prevent the recurrence of a similar accident, we request that you take active measures to implement the corrections ordered pursuant to Article 5(3) of the Act on the Investigation of and Inquiry into Marine Accidents.

Sept. 4th, 2008
Incheon District Maritime Safety Tribunal
Special Panel Chief Adjudicator Adjudicator
Young-Dae Cho

This is an officially certified copy.

Sept. 4, 2008

Incheon District Maritime Safety Tribunal

Attending clerk Yong-Woo Lee

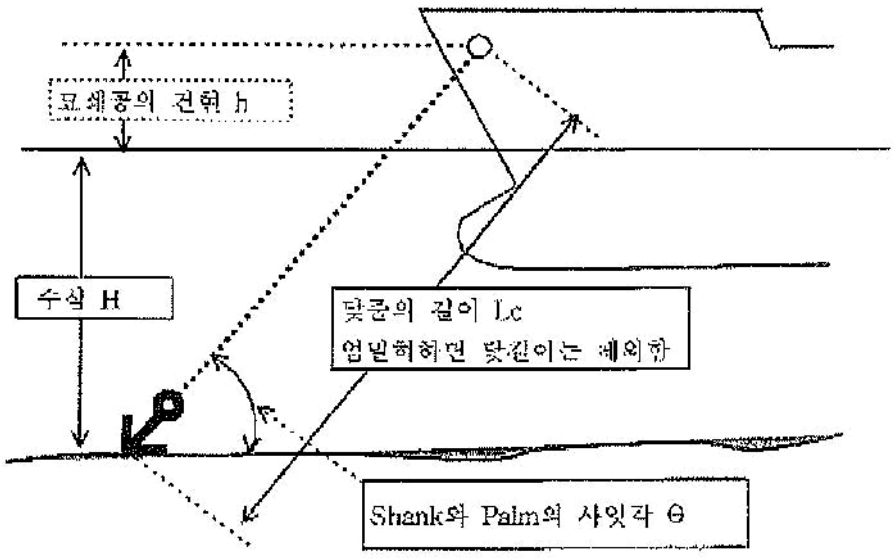
Summary of Decision

Decision No. (Date of Decision)	*Inhaeshim No. 2008-23 (2008.9.4.)*	*Tribunal*	*Judge in charge* — *Presiding Umpire Yeong Dae Cho* *Umpire Yong Beom Heo* *Umpire Sang Soo Kim* *Non-standing Umpire Yong Hwa Cho* *Non-standing Umpire In Young Gong*
Name of Case	*Marine pollution caused by the collision of Samsung T-5 (tugboat), Samho T-3 (tugboat), Samsung No. 1 (barge) and M/V Hebei Spirit (oil tanker)*		
Parties to the Case	*Seung Min Cho (Samsung T-5, Master), Gan Tae Kim (Samho T-3, Master), Yi Hyun Kim (Samsung No. Barge master), Boram Co., Ltd. (Representative, Yong Chun Park), Samsung Heavy Industries Co. Ltd. (Representative, Jeong Wan Kim), Chawla Jasprit Singh (M/V Hebei Spirit, Master), Chetan Syam (M/V Hebei Spirit, Chief Officer)*		
Summary of Case	*The tugboats, Samsung T-5 and Samho T-3, towed the large floating crane Samsung No. 1 together. After the departure from Incheon, the marine spread encountered bad weather during the voyage towards Geoje. While the marine spread attempted to seek shelter, it lost its towing ability in the process, and this resulted in the collision with the very large crude carrier, M/V Hebei Spirit, which was at anchor and standing by outside the port of Daesan for entry into the port. As a result, the oil tanker discharged 12,547kl of crude oil it had on board into the ocean.*		
Order	*The marine pollution due to the collision of this case ("Marine Pollution") was caused by the following: The tugboats, Samsung T-5 and Samho T-3, failed to take early actions in response to the weather changes while it was performing the towing operation for the barge Samsung No. 1. The marine spread encountered bad weather and lost its towing ability to the extent that it was impossible to navigate the vessels as intended. However, the marine spread continued to navigate without taking any safety measures, such as warning the other vessels nearby or performing emergency anchoring, etc. In the end, the towing line of Samsung T-5 broke under the circumstances where the marine spread had approached too closely to the anchored vessel, M/V Hebei Spirit, and Samsung T-5 drifted towards M/V Hebei Spirit. The following contributed to the Marine Pollution due to the collision: Despite that M/V Hebei Sprit was anchored in an area frequented by sailing vessels and had a duty of care, it was negligent in performing its duty and failed to notice the marine spread early. Under the circumstance where it had to belatedly*		

	avoid the collision, M/V Hebei Spirit could not but move dead slow astern because it didn't have its main engines fully prepared. In addition, after the occurrence of the collision, it failed to actively perform responsive measures under the Shipboard Oil Pollution Emergency Plan because it lacked understanding of the seriousness of the Marine Pollution. *(Disciplinary actions and recommendations for the relevant person of the Marine Pollution, etc. are omitted.)*
Summary of Decision	*1. The marine spread (tugboats), which lost its towing ability and was adrift, is a vessel restricted in her ability to navigate to the extent that it is impossible to navigate due to the loss of towing ability.* *Most of the marine spread's tugboats, which tow large vessels, are vessels restricted in her ability due to the towing operation. If a vessel loses its towing ability due to the bad weather condition and becomes placed in the situation where it can neither leave its route nor avoid other vessels, it shall be deemed a vessel restricted in her ability.* *2. Navigating between the vessel restricted in her ability and the anchored vessel* *In the case of the vessel that is restricted in her ability to the extent that the navigation of vessel is impossible, that drifted towards the anchored vessel due to the bad weather, and where there is a risk of collision between two vessels, the responsibility between the vessels to give way cannot be determined based on the vessels' ability to navigate. Therefore, in such special circumstances, a vessel is required to avoid the collision by taking all the possible measures by applying Article 2 (Responsibility), Paragraphs (a) and (b) of COLREGs 72. When it is necessary, departure from the COLREGs is also allowed.* *3. If the marine spread lost its towing ability due to the bad weather conditions, it shall immediately alert the nearby vessels and the port authority in this regard and take necessary measures at an early stage for the prevention of a collision or stranding.* *4. If an oil spill into the sea occurs due to a marine accident such as a collision between vessels loaded with toxic substances or dangerous materials, it should work for the safety of human life, the vessel and cargo in accordance with the International Convention for the Safety of Life at Sea ("SOLAS"). Additionally, in consideration of the importance of the marine environment, it shall* ***exert its best effort to prevent the oil spill in accordance with the Shipboard Oil Pollution Emergency Plan ("SOPEP")*** *for the precaution of environment pollution under the MARPOL '73/78.*

Lesson	*1. Importance of a towage survey* *The towage survey is an insurance survey for the purpose of insuring the vessel being towed. Although it is a contract between private persons, it is to confirm the safe navigation of the marine spread, and therefore, the accuracy of the towage survey is a very important part that can affect the safety of human lives and vessels of the marine spread. For such reason, the towage survey shall not be conducted merely as a formality for the insurance, and the marine spread shall not fail to comply with the conditions and guidelines determined by the survey. Not only shall the survey method and its contents be strictly scientific and reasonable in accordance with the relevant regulations, but the marine spread shall also comply with the conditions determined as a result of the survey.* *2. Interpretation and use of weather information* *The master of the marine spread in this case reached the conclusion that the strong wind warning, which was announced for the distant parts of the West Sea early in the morning of the next day of departure, would not affect the marine spread because it was planning to navigate 5 miles away from the coast. However, considering that the distant part of the West Sea is only 20 miles and there was nothing to divide the distant parts and near parts of the West Sea that can block the winds and waves, the warning of bad weather condition for the distant parts would affect the near parts to some extent. Also, if the situation lasts for a long time, it is highly possible that the bad weather condition would directly affect the near parts of the West Sea. Therefore, the master should plan on the navigation by taking the above into consideration during the voyage.* *3. Early alarm and emergency anchoring when the vessel is restricted in her ability to navigate* *Despite the fact that the tugboats of this case went adrift because it was seriously restricted in her ability to navigate due to the bad weather conditions, it failed to alert the nearby vessels and the port authority in this regard and gave no time for the opposing vessel to move away.* *Also, even if the tugboat is restricted in navigation due to the lack of ability to tow, it could deal with the drifting situation by using the emergency anchoring of the vessel being towed while it continues its towing operation. Therefore, the master of the tugboat shall keep the above in mind.* *4. It is required to take active collision preventive measures under the special circumstances while the vessel is at anchor.*

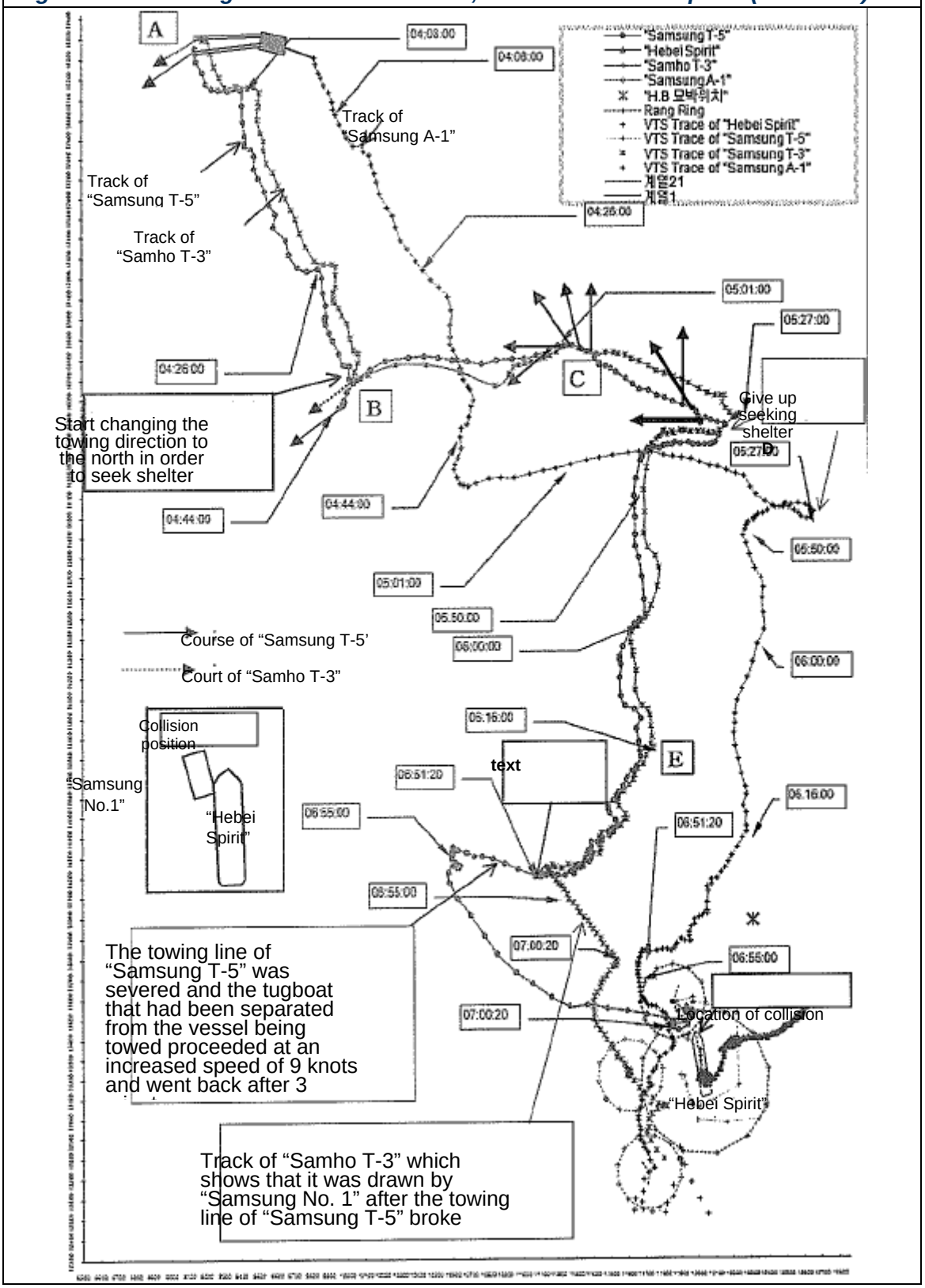
	In the event a vessel that is seriously restricted in her ability to navigate approaches a vessel at anchor, the anchored vessel shall take all possible measures to avoid the collision in accordance with Articles 2 (a) and (b) of the International Rules for Preventing Collision at Sea ("COLREGS"). In this case, M/V Hebei Spirit tried to secure distance with the marine spread that was approaching from the front direction by having the anchor chain paid out and putting the engine to dead slow astern, but failed to do so. In this case, considering that it was possible to move backwards while dragging the anchor, M/V Hebei Spirit should have taken more active measures at an early stage, such as moving backwards far away a bit earlier by putting the main engine at slow or half astern, moving away from the area by using the main engine and steering after quickly heaving up the anchor chain that was suspended due to strong winds, or moving away by breaking the end link of the anchor, etc. *5. Establish readiness for the implementation of SOPEP* *Recently, collisions involving marine spreads have rapidly increased on the coast of Korea. The collision of this case itself can be deemed as just one of many similar accidents, but the marine pollution, a secondary accident caused by the collision, made this case a very serious problem.* *In the course of investigating the cause of this accident, it turned out that M/V Hebei Spirit failed to implement the SOPEP faithfully and it affected greatly and worsened the situation to causing a very serious oil spillage. Accordingly, it should be known to the crew of the oil tanker that in the event of an occurrence of a marine pollution due to oil spillage, they should make efforts to prevent the marine pollution as well as to secure the safety of human life and cargo.* *6. Check the contents of the towage survey conducted by the marine insurer* *The towing survey is conducted for the purpose of examining the safety of the vessel being towed before the insurance is secured. If it is determined to be suitable for towing through the survey, it means the inspector confirmed that the marine spread is able to make a safe voyage under the assumption that the marine spread complies with the conditions of the inspection report. Accordingly, the marine spread must comply with the conditions or recommendations set forth through the towing survey, and it is also necessary for the insurer to check on the marine spread's preparations for the departure or safe sailing. If the towing survey is conducted as a formality or the marine spread is negligent in performing the conditions set in the survey results, it is hard to expect the safe sailing of the marine spread. Therefore, the insurer should always take the above into account in order to meet the purpose of the marine insurance and for effective operations.*

Subject	*Towing ability, restriction of ability to navigate, vessel restricted in navigation ability, giving way during the voyage, emergency anchoring, SOPEP*
Reference	*1. Distinction between the distant sea and near sea (weather forecast)* *There are some cases where a distinction is made between the distant sea and the near sea when forecasting the weather in Korea. In such cases, the distance for determining whether it is distant or near is 20 miles from the shore in case of the West Sea and 10 miles in case of the South and East Sea.* *2. Length of anchor chain at short stay* *Every stockless anchor maintains a certain degree of angle between the shank and palm (normally 46~55 degrees). Therefore, the anchor cannot have holding power right after it is dropped to the bottom of the sea. Rather, a certain length of the anchor chain should be paid out so that the arm of the anchor can get into the seabed, and it can create holding power. (See the picture below). In the opposite situation of heaving up the anchor chain, the holding power of the anchor shall become 0 from the time when the above-mentioned length of chain is left in the sea and the hull of the vessel can be moved freely. Therefore, the master of an anchored vessel should always keep in mind the length of the anchor chain in a state of short stay because he can freely move the vessel to another area without dragging the anchor.*  *Lc × Sinθ = H = h* *Length of anchor chain at short stay* *Lc - (H + h)/ Sinθ*

	Therefore, the hull becomes adrift not long after heaving up the anchor chain because the catenary is large when heaving up the anchor chain of the anchored vessel.

This summary of the decision is prepared only to enhance the parties' understanding of the case, and thus, has no legal effect.

Marine pollution caused by the collision of "Samsung No. 1" (barge), towed by tugboats "Samsung T-5" and "Samho T-3," and M/V "Hebei Spirit" (oil tanker)



This report is based on documentation received and is issued in good faith and without prejudice to any or all parties concerned

For And On Behalf of
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