



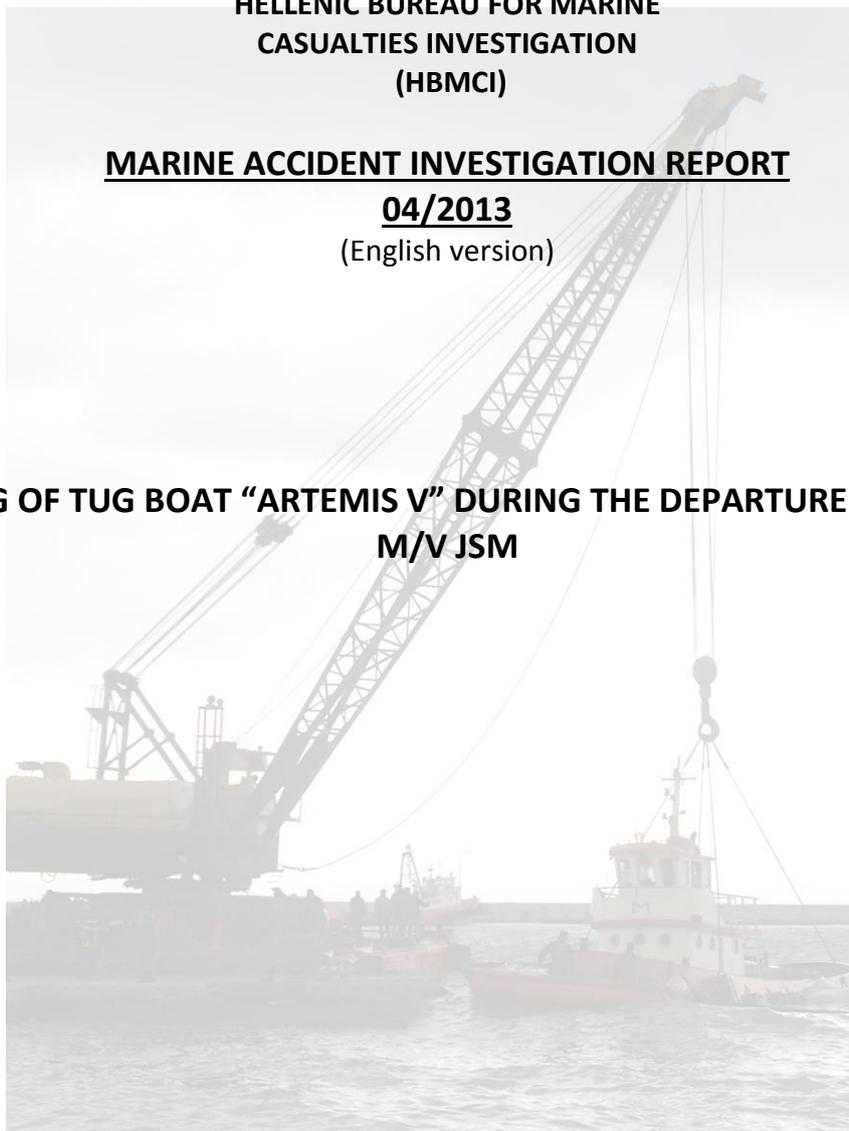
**HELLENIC BUREAU FOR MARINE
CASUALTIES INVESTIGATION
(HBMCI)**

MARINE ACCIDENT INVESTIGATION REPORT

04/2013

(English version)

**FOUNDERING OF TUG BOAT “ARTEMIS V” DURING THE DEPARTURE PROCEDURE OF
M/V JSM**



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ABBREVIATIONS

m: meters

S: South

n.m. : nautical miles

R.P.: Registry of Pireaus

T/B: Tug Boat

Bf: Beaufort (measurement unit of wind force)

BHP: Brake Horse Power

GRT: Gross Registered Tonnage

GT: Gross Tonnage

M/V: Motor Vessel

MSMAA: Ministry of Shipping, Maritime Affairs and the Aegean

RPM: Revolutions Per Minute

DEFINITIONS

For the purposes of this report shall be construed as :

1. Unmooring Procedure: all set of actions for the release of the mooring ropes of the ship
2. Departure procedure: all set of actions after the release of the mooring ropes for the removal of the ship from the pier and exit from the port.
3. Towing hook: hook in which the towline is placed.
4. Quick release mechanism: mechanical arrangement, by which the tow hook is placed in the open position and releases the towline. Used also in emergency situations.
5. Causal or accidental factors: acts, omissions or events i.e. factors without which the marine accident or marine-related adverse consequences associated with the marine casualty would not have occurred.
6. Aft spring line: ship mooring rope that prevents a ship from moving backwards.
7. Towline: rope or wire used for towing vessels. It can be given by the ship or tug.

FOREWORD

HBMCI

The Hellenic Bureau of Marine Casualties Investigation (HBMCI) was established by Law 4033 / 2011 (Government Gazette 264 A' / 22 December 2011), in the context of implementing EU Directive 2009/18/EC.

HBMCI conducts technical investigations into marine casualties or marine incidents with the sole objective and main task, to identify the contributing factors that caused it through the analysis of the examined occurrence, to draw useful conclusions and lessons learned that may lead if necessary to safety recommendations addressed to parties involved or stakeholders interested in the marine casualty, in order to take remedial actions aiming to prevent or avoid future marine accidents.

The purpose of conduct safety investigations into marine casualties and incidents is not to apportion blame or liability.

This report has been produced without taking into consideration any administrative proceedings, disciplinary, judicial (civil or criminal). Its purpose is the understanding of the sequence of the events that occurred on 20 February 2013 and resulted in the examined very serious marine casualty and aims to prevent and avoid reoccurrence.

Fragmentary or partial disposal of the contents of this report, for other purposes than those produced, may lead to misleading conclusions.

The investigation report has been prepared in accordance with the format in Annex I of the respective Law (Directive 2009/18/EC) and all times quoted are local times (UTC +2).

In this context the marine accident occurred on 20 February 2013 in Kiato Port, during departure procedures of M/V "JSM", under Moldavian Flag and resulted in the foundering of the Greek flagged T/B "ARTEMIS V", provided towing services in the abovementioned vessel and to the death of the T/B Skipper.

This report is mainly based on data derived from the interview process and information gathering from the parties involved in the marine casualty.

1. SUMMARY

At 15:30 on 20 February 2013, M/V JSM while berthed starboard side alongside at the dock of Kiato Port departing procedures were commenced. The weather conditions were good and the procedure would be assisted by T/B ARTEMIS V which received a towing line from the aft port quarter of JSM. No Port pilot was available and as a result the whole procedure was planned exclusively by the Master of the ship. JSM cast off her starboard bow from the pier handling her aft spring line and according to the plan stern would be cleared by the towing (pulling) of the T/B. However, according to the master of JSM, tug's maneuver was carried out with engine power applied more than expected and as a result the distance between JSM's stern and the dock became greater than the distance between her bow and the dock rendering ship's heading towards port exit hazardous and posing a risk of grounding or impacting on the breakwater of the fishing shelter inside Kiato Port. The maneuvering of JSM in order to avoid the dangerous situation and since ARTEMIS V did not release the towline, resulted in the progressive heeling over of the tug to starboard and in rapid foundering. JSM continued her maneuver and exited the port entrance after receiving her towline which was released from the hook of ARTEMIS V due to buoyancy. Two crew members of the Tug out of three abandoned her (Engineer and deck rating) while she was heeling over to starboard and were rescued. Following the foundering the Skipper was emerged on sea surface but lost his consciousness and shortly after it was determined he

had died. According to the postmortem examination conducted on 05 April 2013 by the Forensic Service of Patras it was determined that the cause of his death was due to drowning by seawater.

2. FACTUAL INFORMATION

2.1 T/B “ARTEMIS V”

Flag: Greek

Port and registered number: Piraeus 2001

Gross Registered Tonnage: 54,35 (grt)

Length Overall: 20,00 (m)

Year of build: 1973

Propulsion engine – power: Lister
Blackstone – 495 (BHP)

Sailing area (according to the Protocol of General Inspection): Domestic Voyages and Towing up to 10 n.m from shore

Crew: 3

Ship owning – Managing Company: “AGIOS NIKOLAOS ANTIKYRA S.C.”

Certification Authority: Hellenic Republic

2.2 M/V “JSM”

Flag : Moldova

IMO No: 7615036

Gross Tonnage : 1667 (GT)

Length Overall: 65,55 (m)

Date of keel laid: 29 March 1977

Propulsion Engine – Power: MAK 8M452AK– 1103 (KW)

Sailing area (according to Safety Certificate): International Voyages

Minimum Safe Manning: 07

Crew: 11

Ship owning – Managing Company: TARTOUSI SHIPPING CO.LTD

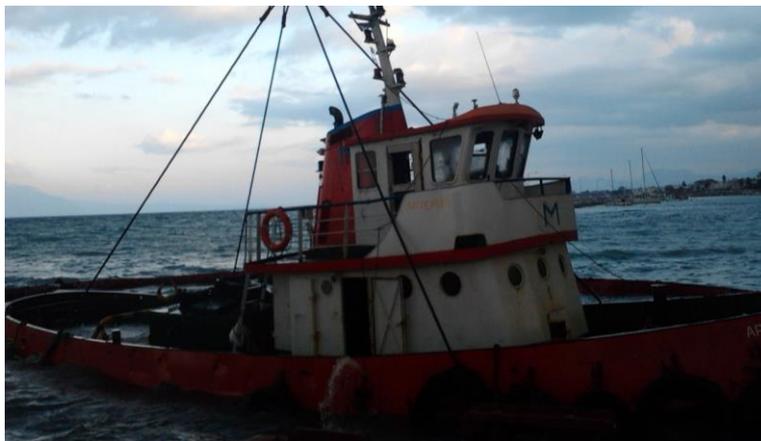


Figure 1: T/B “ARTEMIS V”, P.R.2001 During the refloating operation in Kiato Port.

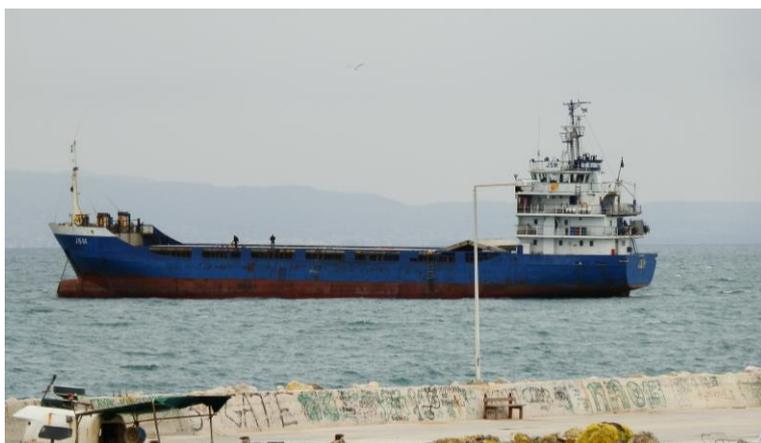


Figure 2: M/V “JSM”, Moldova Flag anchored outside Kiato Port.

Certification Authorities: Moldova Republic, Maritime Bureau of Shipping (MBS)

2.3 General Information of the Marine Casualty

The examined marine casualty occurred on 20 February 2013 in the Port of Kiato, during the departure procedures of M/V "JSM" under Moldavian Flag resulted in the foundering of the Greek Flagged T/B "ARTEMIS V", while providing towing services to the abovementioned ship and in the death of the tug's Skipper is classified as a very serious marine accident. The prevailing weather conditions in accordance with the official weather bulletin were good, with moderate South winds 3-4 Bf, slightly cloudy and visibility 3 to 5 nm. According to information from individuals involved in the marine casualty, weather conditions in the port of Kiato were very good with a gentle wind force 2-3 Bfrs towards the dock where JSM was berthed alongside, sea was calm with very good visibility.

2.3.1 M/V "JSM"

M/V "JSM", a general cargo freighter (General Cargo), was built in 1977. The commercial operation of the vessel, during 2012 and 2013, was related mainly to the transport of various cargoes in Mediterranean ports. It was her first call the port of Kiato with a cargo of potatoes. At the time of the marine casualty JSM was crewed with eleven (11) seafarers in total, two (02) bridge officers, including the Master, one (01) Engine Officer, five (05) as main deck crew, two (02) as Engine crew and one (01) Cook.

2.3.2 T/B "ARTEMIS V"

T/B "ARTEMIS V" was built in 1973 and at the time of the accident she was mostly operating in the sea area of Corinth Gulf (Corinth, Andikira, Kiato, etc.). Her propulsion system consisted of one diesel engine, a single shaft, one fixed propeller and one rudder.

The crew of the T / B had a total number of three seafarers (Skipper, Engineer and Deck rating).

2.4 Description of Kiato Port.

In Port of Kiato the construction of the breakwater of the inner fishing port and shallow waters close to berthing position of a ship, are considered to be particular geomorphic factors.

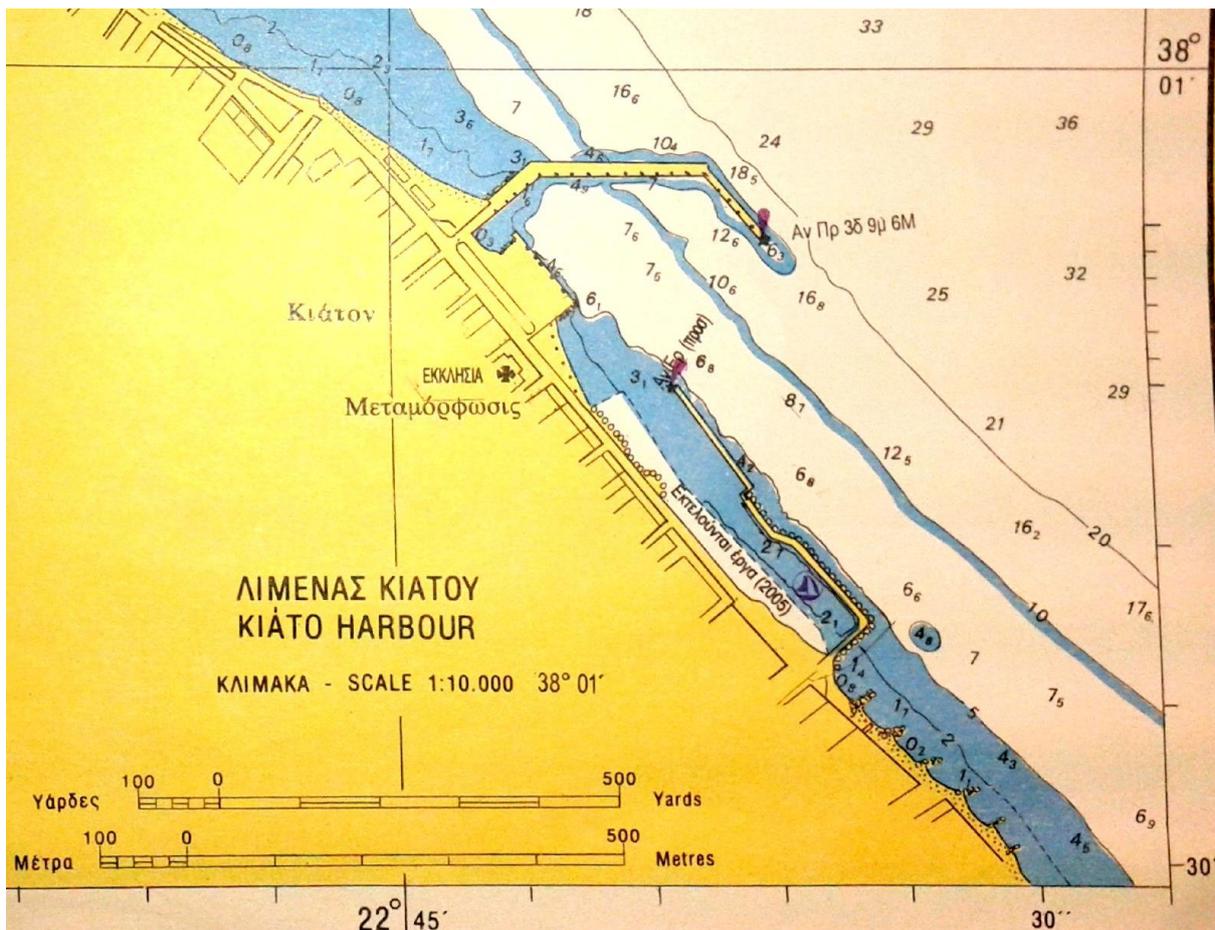


Figure 3: Detail of Port of Kiato

source: Hellenic Naval Hydrographic Service chart no.232)

3. DESCRIPTION OF MARINE CASUALTY

3.1 Arrival of M/V “JSM” at Kiato Port

On 18 February 2013 JSM arrived at Kiato port from Alexandria (Egypt), loaded with potatoes. JSM prior to her arrival had requested through appointed local agent the assistance of a tug for the mooring operations.

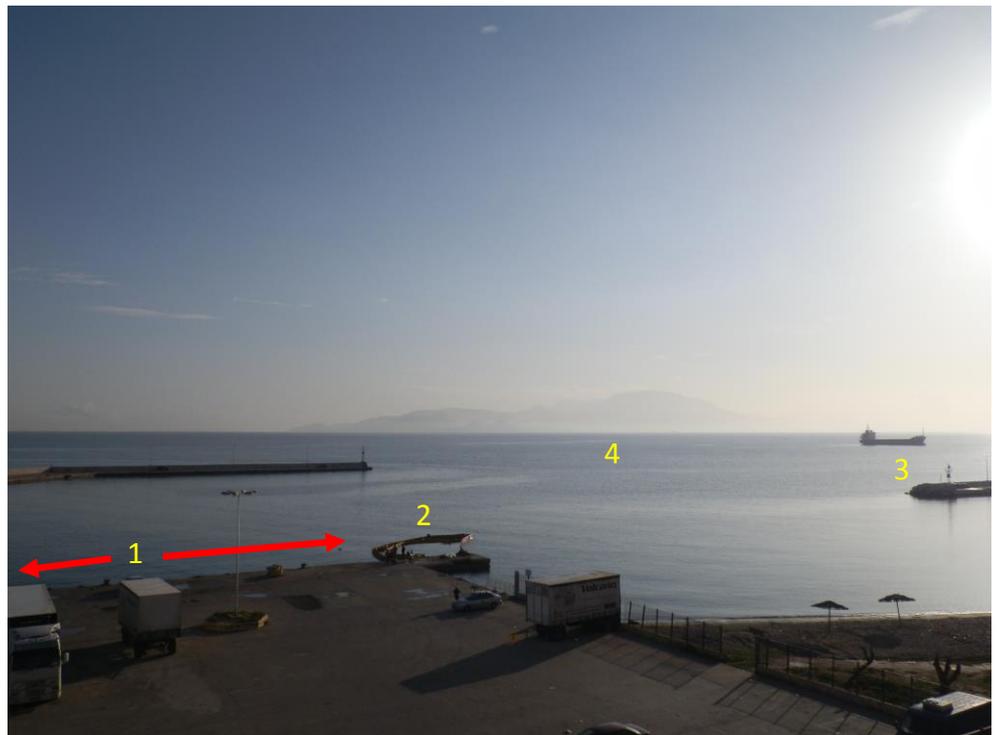
On 18 February 2013 the T/B “ARTEMIS V” arrived at Kiato Port, awaiting the arrival of the said vessel and upon her arrival assisted her mooring operation at the commercial dock. The involvement of ARTEMIS V in the arrival and docking procedures included pushing JSM laterally to the dock from amidships and no problems were reported. JSM was safely moored alongside the commercial dock of Kiato port with six mooring ropes three forward ropes and three stern ropes.

3.2 Departure of M/V “JSM” from Kiato

At 15:00 on 20 February 2013 while JSM was moored with her starboard side alongside port of Kiato dock the unloading cargo procedure completed and shortly afterwards the ship and crew came to departure preparedness (standing by). According to the JSM Master’s statement, the local agent was requested to arrange a pilot in order to assist the departure procedure, however as there is no Pilot Station in Kiato Port nor an appointed pilot for the port operations, this was not accomplished.

Figure 4: View of Kiato port.

- 1: Point of berthing of “JSM”
- 2: Point of sinking of T/B
- 3: End part of fishing vessel refuge
- 4: Port exit



Additionally, the Master of “JSM” requested towing assistance by the tug berthed at NW breakwater of the port of Kiato, awaiting the departure of the ship.

The planning of unmooring procedure and departure was carried out by the Master of JSM in cooperation with the Chief Officer and included the involvement of ARTEMIS V. The prevailing weather conditions according to the official weather bulletin were good, with moderate South winds force 3-4 Bf, slightly cloudy with visibility 3 to 5 nm. weather conditions in the port of Kiato were very good with a gentle wind force 2-3 Bfrs towards the dock JSM was berthed alongside, sea was calm with very good visibility.

At 15:00 the Chief Officer with the main deck personnel carried out the departure preparation and closure of openings ("hatches") of cargo spaces of the ship. At approximately 15:20 the Master informed the Chief Officer that the unmooring procedure would be operated without a pilot on board and only with the assistance of the tug.

The crew of JSM was set to unmooring and departure preparedness by order of the Master. The deck staff, in accordance with the practice followed by the JSM was divided into two teams and were deployed to the fore and aft unmooring stations respectively.

The deck teams of JSM were allocated as follows:

- Fore Team manned by the Chief Officer and two ABs. The Chief Officer carried a portable VHF for communication with the bridge.
- Aft Team manned by the Cook of the ship as the leader and two ABs. The Cook carried a portable VHF unit for communication with the bridge of the ship.

The Master of the ship located on the bridge had the general command and coordination using two VHF devices one for the communication with the unmooring teams at fore and aft stations of the ship and one for the communication with the tug. An AB was also on the bridge as a helmsman.

The communication between the Master of JSM and the deck staff was conducted in Arabic on VHF channel 10, while the communication between the Master and the Skipper of the tug was in English language on VHF channel 6.

The crew of the T/B, that had arrived almost one hour before was also standing by for the call and assistance request by the Master of JSM. The Master of JSM contacted the tug Skipper via VHF on channel 6, informing him to collect towing line from the aft port quarter of the ship and remain on standby with the towline fastened, awaiting instructions to commence towing and casting off JSM's aft from the dock.

At approximately 15:20, by Master's order to the Chief Officer the fore mooring lines of JSM were gradually slacked, and following verbal communication with the port mooring guy, they were released from the bollards of the dock. Then the same mooring guy proceeded to the aft of JSM and released the aft mooring lines, except for one aft spring line. The aft unmooring team heaved the spring line with the aft port mooring winch, a handling that casted off the ship's starboard bow from the dock.

At approximately 15:30, the tug approached JSM and her crew received the towline from the aft of JSM and secured it at the towing hook, awaiting for further instructions. The towing line length was estimated to be 25-30 meters for the needs of the planned operation. The communication between the crews of the two ships was conducted verbally in English and with the use of signs (signals).

3.3 Foundering of T/B "ARTEMIS V"

The Master of JSM set the main engine selector lever at "dead slow ahead" and the rudder 10° to port. At the same time he instructed the Skipper's tug to start towing (pulling) the stern of the ship, so as to cast it off from the dock. According to the Master of JSM at that time approximately 15:40 the tug moved ahead with considerable power, resulting in pulling the towing line and consequently the stern of JSM more than expected. As a result of this maneuver, the bow of JSM could not turn towards the intended course and direction to port and towards port exit. The Master of JSM stated that at this time he perceived the imminent and immediate danger of grounding on the shallow waters of the port or impacting to the breakwater of the fishing port inside the port of Kiato. The Master directly counteracting in order to avoid the possible risk of grounding ordered the helmsman to turn the rudder further to port while as according to his statement he did not increase the RPM of ship's main engine. However according to information provided by individuals watching the incident from the dock of the port at that time an increase in speed of JSM was seen with a parallel increase of the exhaust

gases from the ship's funnel. At the same time the Master of JSM, as he stated, immediately contacted more than once the Skipper of the tug through VHF in order to release the towing line without any response to his call or any actions for releasing the towing line.

The fact that the towing line was not released from the tugboat together with the increase of JSM's speed resulted in the development of athwartships forces on the tugboat (high risk situation "T" or "girting").

Specifically, the towing hook turned at an angle of more than 70° in relation to tug's centerline and consequently she rapidly lurched and heeled over to starboard driven laterally by JSM in less than 30 seconds.

The head of JSM's aft unmooring team informed the Master through VHF about the arisen situation. Nevertheless the ship in order to avoid the risk of grounding kept on with her maneuver while water started inflowing in tug's spaces as she was driven by JSM listing extremely and leading to her progressive sinking.

The Engineer and the deck rating of ARTEMIS V located on the deck, reacted immediately by abandoning the tug and jumped into the sea before sinking. The Engineer was recovered from sea by a nearby fishing boat while the deck rating swam to the dock. The Skipper located on the bridge, did not manage to get out and abandon during the abruptly heeling prior to the sinking. However after the sinking he managed to emerge on sea surface and kept himself on a lifebuoy. The deck rating of the tug and another person swam towards the Skipper in order to recover him however during this time he lost consciousness. The Skipper was taken ashore almost unconscious and later he was reported dead.

At approximately 15:46 the tug had sunk driven by JSM as the towline had not been disengaged from the tow hook. According to the findings, after touching the port bottom, ARTEMIS V was dragged for about 25 meters further before the release of the towline. The tug was sank 10 meters North of the eastern end of the commercial dock of the port at a depth of approximately 6 meters.

The towline was slacked by JSM's aft unmooring team of and heaved onboard post to its disengagement from tug's towing hook due to buoyancy as it had not been released. JSM finally left port and anchored at a close distance. The local Coast Guard Authority suspended JSM's sailing permit.

No injuries were reported on board JSM and no pollution occurred. However in the next few hours small leakages from sank tug's fuel tanks were detected and directly controlled with oil containment booms and anti-pollution materials.



Figure 5: Refloating of T/B ARTEMIS V in Kiato Port, by a heavy lift barge.

3.4 Underwater survey of T/B “ARTEMIS V”

At the next day following the casualty local Coast Guard Authority assigned the conduct of an underwater survey and filming of ARTEMIS V to an expert diver.

3.5 Refloating and inspection of T/B “ARTEMIS V”

The local Coast Guard Authority in collaboration with the Port Authority of Kiato took actions and made the necessary arrangements for the refloating of T/ B ARTEMIS V. On 02 March 2013 a heavy lift barge arrived at the port of Kiato and procedures for the salvage and recovery of the sunken tug initiated at early morning hours on 03 March 2013 and completed late afternoon hours on the same day.

An investigation team of HBMCI arrived at Kiato port and attended the salvage procedures. During the inspection conducted post salvage operation on ARTEMIS V the following findings were detected:

- The engine’s throttle lever of the tug was set at Stop position.
- The rudder was in position 20 ° to port.
- The quick release mechanism of the towing hook, consisted of a wire that led to a handle, inside the bridge area.
- the operation of the above mechanism was found in satisfactory condition following tests.
- The skylight hatches of the Engine Room and the weathertight doors of the superstructure were open.

3.6 M/V “JSM”

- On 20 February 2013 M/V a sailing permit had been granted to JSM by the Coast Guard Authority of Kiato. Following her involvement into the marine casualty under investigation, resulted in the sinking of T/B ARTEMIS V her sailing permit was suspended for the conduct of the administrative and criminal proceeding.
- Following the marine casualty many individuals involved or interested with the marine casualty applied for interim measures against JSM’s owning Company such as next of kin of the deceased, Master of JSM, crew members of JSM and owning Company of the T/B. By virtue of the preliminary ruling issued by The Court of First Instance of Corinth dated 21 March 2013 Coast Guard Authority of Kiato suspended the sailing permit of JSM.
- Following vessel’s detention and subsequent arrest, JSM was eventually sequestered due to seizure reports submitted by interested third parties and the date for the auction was set on 19 April 2013.
- Posterior to respective auction Messers of EAGLE EYE SHIPPING COMPANY S.A JSM have been awarded with JSM ownership based on and pursuant to Greek Public Law provisions and was renamed to M/V “CRISTINA”, under Moldavian flag.
- On 17 May 2014 a sailing permit for Piraeus Port was granted to JSM by the Coast Guard Authority.

4. ANALYSIS

The analysis of the marine accident under investigation aims to identify and determine the factors and causes contributed to the occurrence of the casualty, taking into account the sequence of events and the collection of investigation data focusing both on specific points of the temporal evolution of these, as well as to the root causes in order to draw useful conclusions leading to safety recommendations.

However, it is noted that during the investigation process the majority of the information derived from the interviewing process as the ship was not equipped with a Voyage Data Recorder (VDR) device as she was not required to.

4.1 Crews of ships involved

4.1.1 M/V “JSM”

The crew of the ship exceeded the requirements of the Minimum Safe Manning Document issued by the Flag of the Republic of Moldova. In particular, the requirement of Minimum Safe Manning included a total number of seven seafarers (including two Ordinary Seamen) while crew on board numbered eleven, that is, three more deck Seamen and a Cook than required.

The Master aged 48 had served in various types of cargo ships as a 2nd Officer and Chief Officer for eight (8) years in total. His first contract as a Master was in 2004 and he had apart from his 7-year prior experience in larger vessels, similar experience for at least 3 years in similar sized vessels. Since 2010 he had periodically served as the Master of JSM. At the time of the marine casualty he had been serving on said vessel for about three and a half months. During his Mastership he had many arrivals at Mediterranean ports. He had been working for the Managing Company of JSM for three and a half years.

The Chief Officer aged 28 took over duties for the first time in 2009. In JSM he had served for one year and two months, having worked with the Shipowning Company for 8 years.

The Cook 36 years of age had served in JSM for 3 years and 3 months, having another 2 years of experience on ships of the same company. According to Master's point of view he was an experienced Seaman well familiarized with the ship and beyond his duties as a Cook, he was assigned by Master's order as the head of the stern mooring-unmooring team of the ship.

4.1.2 T/B "ARTEMIS V"

The manning of Tugboats regarding the number and rankings is provided by the Hellenic Presidential Decree No. 232 of 15 November 2005 (Government Gazette A' 280) which is supplemented by the Circular of Marine Labor Directorate and Mariners' Education Directorate of the Ministry of Mercantile Marine, the Aegean and Island Policy with Ref. No.: 3511.1/09/2009/20-05-2009. For Tugboats with Horsepower of up to 500 BHP one Captain or Skipper, one Engineer or Motorman A' class and one Ordinary Seaman are required.

The Skipper 65 years of age held a Skipper's A' class Diploma since 2000 and had an experience of many years on different types of Tugboats and Launch boats. He had been recruited on ARTEMIS V twenty days prior to the accident but he had also served on her in the past.

The 61 years old Engineer held a Motorman A' class diploma since 2007 and had an experience of many years on different types of ships and Tugboats. He had been recruited on ARTEMIS V since May 2012 and he had also served on it in the past.

The third crew member 24 years of age was recruited as an Ordinary Seaman and had a total service of 5 months of seagoing carrier, 3 of which were on ARTEMIS V.

4.2 Regulatory framework for the Operation of T/B

Tugboat "ARTEMIS V" was operating as a Port Tug under a license issued by the Central Port Authority of Elefsis, Greece. Aforementioned license was issued in 1992, under the tug's ex name ("ELISSAVET") but had not been updated since. The Tugboat's renaming was done on 16 December 2011.

In regard to tug services for vessels arriving or departing from a port no other license is required and no regulatory framework exists, concerning the required horsepower, the number of tug's main engines or any other structural parameters.

The Circular issued by the Merchant Ships' Inspection Directorate of the Ministry of Mercantile Marine with Ref. No.: 1421.ΓΝΓ/21/99/17-11-1999, refers to the required horsepower of the main engines of tugboats used for the towing of vessels from one destination to another and does not provide any obligations or requirements for the tugboat services to vessels for the procedures during their arrival or departure from a port.

4.3 Assistance in the process of arrival – departure of a ship.

Tug's assisting services to ships during the mooring or unmooring procedures in a port is not regulated by any national or international regulation. However, the International Maritime Organization in an

effort to strengthen safety in towing procedures within ports has issued circulars MSC / Circ.1101, MEPC / Circ.409, FAL / Circ.100.

The content of these three circulars is referred to the publication *“Tug use in port”* of The Nautical Institute 2003 which provides guidance on a wide range of practical and theoretical issues concerning the operation of Tugboats. With the above circulars Maritime Administrations of IMO Member States are encouraged to bring said publication to the attention of Port Authorities, port operators, pilotage services and tug services, in order to assist in the assessment of the adequacy of the tug services in ports.

The existence of an internal regulation of the shipping company or managing company of the Tugboat was not found during the investigation. Such a regulation is not required for this ship in accordance with the International Safety Management Code, as applicable, anyway.

Therefore, the appropriate maneuvers of the ship and the Tugboat depend on the seamanship and experience of the persons involved, as the Master of the ship, the Skipper of the Tugboat and the pilot, if a pilot is provided. The maneuvers performed by the ship or the Tugboat are decided and implemented as appropriate, taking into account a number of important parameters, which are briefly listed in a random and not exhaustive order, as follows:

- the type and size of the ship,
- the size of the ship, her condition (loaded-unloaded) and draughts,
- the size and depth of the port,
- the propulsion system, steering system and the existence of maneuvering aid system (thruster),
- the local weather conditions,
- the horsepower and the dimensions of the Tugboat,
- the possibility of using one or more Tugboats,
- knowledge of the port and any limitations.

4.4 Pilotage services of Kiato Port

According to the official publication of the Greek Pilots, for the port of Kiato, the use of a Pilot is not mandatory. In case of a Pilot request for boarding, one is deployed by the Pilot Service Station based at the port of Corinth, which is approximately 22 km away from the Kiato Port. According to evidence gathered, the Master of JSM, chose to sail from the port of Kiato without the assistance of a Pilot.

According to opinions of Tug Skippers received during the course of the investigation, in cases where no Pilot services are provided in a port, practically the Skipper of the Tugboat may take an advisory role for the procedure during the arrival or departure of a ship, provided that he is aware of the geomorphological elements and peculiarities of the port, the local weather conditions, etc.

4.5 Planning of the unmooring-departure procedure by the Master of “JSM”

The planning of the unmooring and departure procedure was conducted only by the Master of JSM, given the lack of a Pilot at the port of Kiato and his decision to sail without a Pilot on board. Thus the basic parameters taken into account by him were the condition of the ship and her maneuverability including his seamanship and experience.

4.5.1 Unmooring procedure of “JSM”

The planning of the unmooring procedure by the ship's crew is presumed that included three basic stages. Release of all fore mooring lines, release of all the stern mooring lines except from the stern spring line and heaving of the latter, in order to increase the angle between the dock and the longitudinal axis (centerline) of the ship, so as JSM could head safely towards to the port exit by her own means.

The procedure described above is a common practice of Masters of small ships not fitted with side thrusters, usually subject to the absence of external restrictions, such as port landforms, port depths, weather conditions and any other parameters which may limit the planned maneuvers of a ship.

4.5.2 Positioning of teams for the unmooring and departure

The positioning of the two teams at the forward and aft unmooring stations was performed according to the available staff and Master's judgment. The deployment of two ABs to the forward station led by the 2nd Officer and a team of three crew members to the aft station led by the Cook, was a usual practice of the Master and he had not detected any problems on the effectiveness of their performance during his service as the Master on JSM.

4.5.3 Positioning of the Cook as the Head of the team on the aft unmooring station

The positioning of the Cook as the Head of the aft mooring/unmooring team, according to the Master, served the need of covering the required positions for the mooring or unmooring procedures of the ship, since the Cook was the most experienced seaman on the ship, having served on JSM longer than the rest of the crew. However, he had not been recruited as deck personnel in order to be able to participate in the mooring or unmooring procedures of the ship as the head of the involved team, especially when such duties had not been assigned in writing in any manner through the internal procedures of JSM's safety management system. Moreover, no form regarding his familiarization with deck crew duties had ever been completed by him. The aforementioned facts do not seem to have been reported to the managing company of the ship.

The Cook stated that he had worked as an Ordinary Seaman for at least two years in the past, however on this ship he had been recruited as a Cook; during the investigation, it was not verified that prescribed certificates were held by the Cook in accordance with STCW in order to be formally included in the deck personnel.

4.5.4 Assistance of T/B “ARTEMIS V” in the unmooring procedure of M/V “JSM”

According to the planning of JSM's Master the operation involvement of ARTEMIS V in the unmooring procedure of JSM has been inferred that included three basic stages. The securing of the towline on the tug's towing hook given by the ship through a fairleader at her port aft quarter; the towing (pulling) of ship's stern in order to cast it off from the dock; and the release of the towline following communication established with JSM.

The main tasking operation of ARTEMIS V during the departure of JSM, involved the second stage of the procedure. However the adequate and desirable distance of JSM's starboard stern quarter from the dock had not been clearly predetermined by the Master and it had not been also taken into

account that although the tug pulling would cast off the stern starboard quarter of JSM from the dock, it could also cause a rapid turn of JSM bow to starboard and towards the dock, being unloaded, rendering ship's position in a hazardous situation in relation to her safe exit from the port.

Furthermore, it appears that although the abovementioned departure planning had been projected, there was not an in advance sufficient consultation between Tug's Skipper and JSM's Master. The only briefing that became known, involved the notice to the Tugboat of receiving the towline from the stern and standing by for instructions for the commencement of the towing operation without any further details.

It is noted that in the event of doubt on the adequacy of the departure planning and if the requested tug assistance poses risks to tug's and her crew safety the Skipper may decide to abort the operation of towing at any stage of the procedure (Article 104 of the Code of Public Maritime Law, Hellenic Legislative Decree No 187 of 3 October 1973, as amended).

4.6 Departure and Towing operational procedures

The departure and towing operational procedures of the two vessels are considered as major factors contributing in the sequence of events leading to the occurrence and therefore are examined separately for each vessel.

4.6.1 Operational procedures by M/V "JSM"

The Master of JSM while performing the plan for the unmooring and departure procedures acted according to his seamanship and experience.

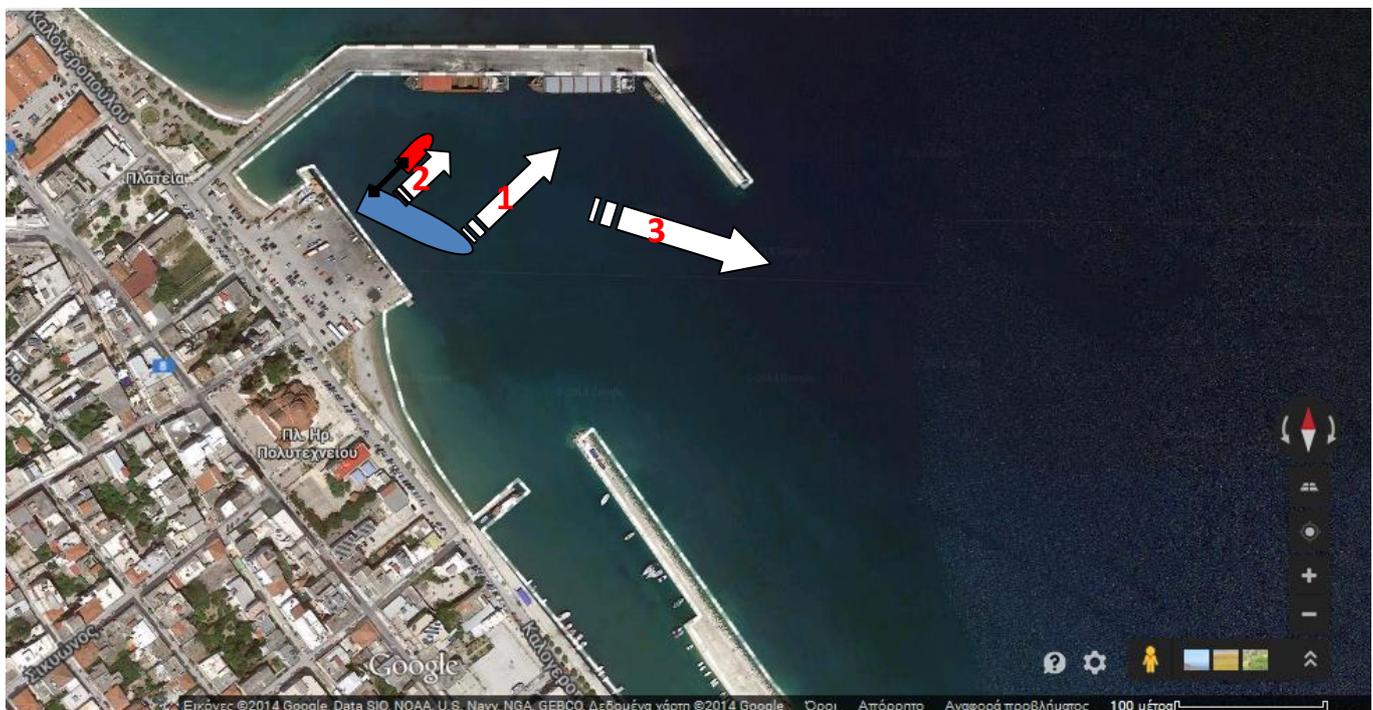


Figure 6: Schematic illustration of the maneuvering as planned by the Master of JSM (blue vessel):

- (1) casting the bow off the dock by vessel's lines,
- (2) sheering vessel's stern off the dock by ARTEMIS (red boat), so that JSM was able to bound to port exit,
- (3) JSM exit from the port with her means.

(The dimensions of vessels and towline are not scaled. Map Source: Google Maps, <http://maps.google.com/>)

Having all the mooring lines released and considering vessel is in a good position with intended safe course towards the port exit, he set the main engine control selector lever of the ship in position "Dead Slow Ahead" and the rudder 10° to port, while instructing the Skipper of the Tugboat to proceed with the towing (pulling) of the stern of JSM, without providing any more details.

According to the Master, forces developed and pulling by the Tug were greater than expected and resulted in turning JSM bow to starboard and towards the dock. The rendering position of JSM could no longer ensure keeping a safe course towards the port exit while the ship was already underway (main engine at "Dead Slow").

The actions that followed were not part of the Master's planning and could only be considered as instinctive counteract actions for the avoidance of the inherent risk of Ship's impact or grounding, which eventually led to the foundering of the ARTEMIS V.

As it was derived by witnesses' statements shortly before the sudden list of ARTEMIS V a large amount of smoke was seen from the exhaust the funnel of JSM and a simultaneous acceleration of ship's speed.

The conduct or the Risk Assessment Process would probably have prevented the actions and maneuvers carried out by which although JSM managed to sail outside of the port however contributed to the foundering of the ARTEMIS V.

Nevertheless it is noted that JSM's exit from the port of Kiato was not only a result of the instinctive maneuvering counteracted by the Master but additionally two major factors were also identified that contributed to the ship's maneuvering and safe exit from port:

- The increase of ARTEMIS V weight, as her heeling over to starboard and capsizing allowed vast quantities of water ingress to inflow into accommodation spaces and other compartments and consequently increase friction resistance while she was laterally being drifted by JSM.

- The friction that the sea bed bottom applied to the tug while she was being entrained by the towline of “JSM” and being dragged thereon for approximately 25 meters, until the moment the towline was released from the tow hook.



Figure 7: Schematic illustration of the maneuvering of JSM (blue vessel):

- (1) casting JSM bow off the dock by vessel aft spring line,
 - (2) sheering JSM stern off the dock by ARTEMIS V (red boat), causing a rapid turn of JSM bow to starboard and towards the dock, rendering ship's position in a hazardous situation in relation to her safe exit from the port.
 - (3) JSM exit from the port with her means while pulling ARTEMIS V as she was being dragged on sea bed.
- (The dimensions of vessels and towline are not scaled. Map Source: Google Maps, <http://maps.google.com/>)

It follows that the friction (contact) of the dragged Tug on the sea bed of the port bottom acted as a rotating lever to the maneuvering of M/V JSM, contributing to the avoidance of grounding on the shallow waters or impacting on the breakwater of the fishing shelter of the port.

It is therefore concluded that ARTEMIS V being submerged and dragged acted as a drag force, practically as an anchor, to the relative motion (heading) of JSM for a period of approximately 40 seconds, slowing down her speed, which would have been significantly greater without the submerged and dragged tug.

It is noted that at the critical point at which there was a clear assessment by Master that immediate actions had to be taken, taking into account prevailing weather conditions in port, it is estimated that the setting of JSM engine control lever to “Stop” and possibly slightly to “Dead Slow Astern” would not probably had led to the occurrence of the marine accident.

4.6.2 Towing handling by T/B “ARTEMIS V”

Tugboat ARTEMIS V having received the towline from the port stern quarter of JSM remained on standby mode having the towline slacked (relaxed) pending JSM Master's instruction.

Following JSM Master's instruction, the Skipper of the Tugboat proceeded to the commencement of the towing. The duration of the maneuvering could not be determined by technical means however investigation data led to the conclusion that it lasted for a very short period of time. This conclusion can be strengthened by the fact that during the underwater survey engine control selector lever was found to be set at "Stop" position. Otherwise the bow of JSM would have probably turned significantly to starboard, approaching the dock without being possible for JSM to maneuver.

4.6.3 Best recommended practices for departure and towing operations under the tow configuration of the occurrence

During the investigation process efforts were undertaken for the evaluation of the departure and towing planning in order to seek for a potential alternative proper plan.

In this direction HBMCI investigation team held meetings with a number of Tugboat Skippers well experienced in towing operations in ports. During the meetings the actual parameters of the occurrence were given to the extent practicable, including the type, size and condition of JSM (unloaded), her berthing position, type and size of the Tug, port landforms, weather conditions, time of the accident and the absence of a Pilot. The result of the established consultation highlighted that the procedure followed had gaps or shortcomings in the original planning as has been evaluated following its consequences.

In cases when a tug is towing (pulling) the stern of a vessel best towing practice requires the tug to be able to follow the vessel at all towage stages so as to avoid hazardous situations known as "T" (developments of forces transversally to the tug) either by following ship's stern and moving astern or by moving alongside the ship till the final release of the towline.

In a similar case to the investigated occurrence a planning option of the departure procedure may include the following steps:

1. Securing of the Tugboat at the bow of the vessel.
2. Casting off vessel's bow from the dock either by heaving a stern breast or a short stern spring line or by towing (pulling) the vessel's bow so as the conceivable angle between her centerline and the dock is close to 20° or 30°.
3. Setting the vessel's engine control lever selector at "Dead Slow Ahead" for a very short period and directly to "Stop" position with the rudder hard to starboard, in order to cast off vessel's stern from the dock.
4. Towing of the vessel towards the port exit and if necessary maneuver could be assisted by vessel's propulsion.

4.7 Risk Assessment

According to international legislation (Chapter IX of Safety of Life at Sea Convention 1974, as amended – SOLAS '74 in combination with the International Safety Management Code), the Owning or the Managing company of a ship and the ship herself are obliged to conduct the risk assessment procedure prior to performing seaborne operations in order to identify the potential risks that may endanger the safety of persons on board a ship, the ship or the environment.

The unmooring and departure procedure of a ship is a seaborne operation and therefore the conduct of a risk assessment process is required, in order for the possible hazards to be identified and by controls or appropriate measures applied either to reduce the likelihood of occurrence of an adverse event or to reduce the severity of the consequences to prevent a marine casualty.

The Safety Management Manual of “JSM”, provided that a risk assessment process has to be conducted before certain procedures onboard, such as the departure or the arrival. The potential hazards that may occur are identified through the process and preventive measures are applied. The conduct of such a process which was part of the duties of the 2nd Officer was not evident to have been executed.

4.8 Bridge lay out – communication between “JSM” and “ARTEMIS V”

The communication between JSM and ARTEMIS V during the unmooring and departure procedures was conducted via VHF on channel 6.

4.8.1 VHF units arrangement of “JSM” and “ARTEMIS V”

JSM was equipped with two installed VHF units one mounted at the center of the console near the steering wheel and the other at console’s right side close to the starboard engine control lever selector. Additionally the ship was equipped with three portable VHF units for the internal communication onboard (mooring teams - bridge). The Master was communicating with the Tugboat by using the permanent right mounted VHF unit while in parallel he was communicating with the deployed unmooring teams through a portable VHF device.

During the unmooring and departure procedures the Master of JSM was standing at the starboard side of the bridge console, where the starboard control lever selector of the engine propulsion located. His position hindered his direct monitoring of the site and status of ARTEMIS.

The Master’s overview of the performance and development of the towing procedure by the Tugboat was mainly based on verbal reporting of the head of the aft unmooring team (the Cook) and on the direct communication with the tug.

An AB was also located on the bridge with helmsman duties following the Master’s commands.

ARTEMIS V was equipped with one permanently installed VHF unit. The Skipper of ARTEMIS V was using that device.

4.8.2 Communication between “JSM” and “ARTEMIS V”

The communication between a tug and a ship under towage in port, must be constant and prompt and in any case any information and confirmation regarding the intentions and maneuvers must be prior to their execution by any part in order to avoid any operation or maneuver that could endanger the safety of the vessels involved. A relevant reference was made in the Safety Management Manual of JSM (Ch. 5.2).

No prior communication was carried out by the Master of JSM to the Skipper of ARTEMIS V regarding his intention to set the engine of JSM to “Dead Slow Ahead” position while the towline was under tension.

Furthermore there was no adequate notice and communication during the towing (pulling) maneuvering by the Tugboat which resulted in the alternation of JSM direction and in the potential risk of her grounding.

No communication was carried out by ARTEMIS V in order to inform about the extremely dangerous situation she had got into since her heeling over to starboard and capsizing were so sudden.

The information regarding the heeling and capsizing of the Tug to the Master was carried out by the leader of the aft unmooring team of JSM. Subsequently the attempt of the Master to contact the Tug in order for releasing the towline was ineffective probably due to the extremely arduousness situation ARTEMIS V was already involved in.

In regard to the above can be concluded that the communication between ARTEMIS V and the JSM during the towing procedure was incomplete and insufficient.

4.9 The quick release mechanism of tugs used in ports

The arrangement and operation of the towline's quick release mechanism on Tugs used in Ports are not governed by specific national or international regulations. Said issue is regulated by general rules of Recognized Organizations or rules issued by Administrations' Inspection and Certification Services, responsible with the task of monitoring the construction and the operation of a Tugboat.

In such a framework specifications or standards for the arrangement or the operability of a quick release mechanism for a certain range of loads and angles or for the activation modes of the system, the inspections and tests of its operation and their frequency may be included.

It is noted that in the context of the investigation process the appointed investigation team visited and examined tugs of various sizes and ages with different towline release mechanisms (mechanical, hydraulic, electrical). It was found that for safety reasons the arrangement of towline release mechanism is configured with two or three alternative (backup) releasing modes and consequently the arrangement could be operated by respective activating locations so that an authorized crew member other than the Skipper would be able to immediately release the towline in an emergency.

4.9.1 The quick release mechanism " ARTEMIS V"

The arrangement and operation of the towline's quick release mechanism of ARTEMIS V is mechanical and provides only one mode of activation. More specifically, it consists of a jointed arm coupled to the base of the towing hook which is connected with a wire that passes through two metal buckles towards the bridge where it enters through a simple hole on the superstructure and ends to a handle mounted above the aft port window of the bridge of the Tugboat. (fig. No 8 and 9).

The handle is not supported by a permanent arrangement and simply remains hanging by the wire, practically as a pendulum, next to the port aft window of the bridge superstructure.



Fig. 8: Arrangement of the quick release mechanism of ARTEMIS V. The releasing phases prior to activation (on the left) and past activation (on the right). 1: Hook fastening arm, 2: Towing hook, 3: Release wire from the coupled jointed arm to the bridge.

The release handle arrangement was not ergonomically designed and mounted so that the Skipper is able to immediately operate it, particularly in emergency situations of heeling or listing. The release handle's mounting was almost two meters away from the maneuvering position and the engine's lever controller which was actually the position of the Skipper during the towing and maneuvering procedure. Aforementioned arrangement may be described as a simple construction with no specific technical safety standards for its sufficient operation at all potential dangerous situations due to heeling such as the one in which the ARTEMIS V got into. Additionally said arrangement could not



Fig. 9: The quick release activation handle inside the bridge of ARTEMIS V.

facilitate the direct and prompt activation from the navigating position.

According to the evidence gathered it was concluded that Skipper's response in activating the towline release mechanism was incomplete under the arisen circumstances at the time of the marine casualty as no preventive measures were taken such as assigning the activation of the release mechanism to a crew member of the Tug.

4.9.2 Testing of the quick release mechanism of “ARTEMIS V”

The operation of the quick release mechanism was inspected after the salvage of ARTEMIS V and it was found to be functioning adequately. However the testing was not performed with the towing hook under tension due to the condition of the Tugboat.

As already mentioned a regulatory framework for the testing procedures for the operation of the quick release mechanism does not exist. Furthermore it was resulted that similar internal procedures which could be followed by ARTEMIS V and respectively recorded were not drawn up by owning company. However such a procedure is not compulsory for tugs under 500 gt according to national and international legislation.

During the investigation process and following a series of interviews with tugs' crew members it was highlighted that testing procedures for the operation of quick release mechanism are included to practical inspections' methods. More specifically inspections are carried out by securing the towline on a dock bollard and by setting the engine throttle and selector lever at more than 50% of its maximum efficiency. Additionally it was reported that the quick release mechanism may malfunction and fail to release the towline if unexpectedly excessive stresses are applied to the towing hook.

Such excessive stresses may be developed when the vessel under towage accelerates while the prior release of the towline from towing hook. This finding takes account of the assumption that the failure of the releasing operation of the mechanism of a tug is likely to happen when the forces developed and applied on the towline are caused by the vessel accelerating under towage.

4.9.3 Alternative mode (back-up) and activation location of the release mechanism

The arrangement of the towline release mechanism on ARTEMIS V provided only one activation mode located on the bridge and in the usual manner was triggered by the Skipper.

The potential setting of a second arrangement located on the deck would allow activation by the crew of the Tug and might had led to the early release of the towline provided that a crew member would be standing-by for this action.

Additionally given the absence of a back-up towline release mechanism, as mentioned above, the presence of a crew member on the bridge of the Tug assigned by the Skipper to activate the towline release mechanism on an emergency situation if ordered, could have contributed to the immediate counteract when the Tugboat suffered of the sudden heeling.

4.10 Watertight and weathertight openings of “ARTEMIS V”

The watertight and weathertight openings of a Tugboat must be closed operations to ensure its watertight integrity. The investigation process found that the watertight and weathertight openings of ARTEMIS V ie skylights and superstructure's doors were open during the towing (Fig. 10 and 11).

Said fact contributed to the rapid inflow of sea water below the main deck and in the superstructure compartments following the tug's heeling over to starboard and capsizing.

The large volume of the inflowing sea water increased the weight of ARTEMIS V while at a large inclination that could not be counterbalanced because of the continuous tension applied by JSM.

The ongoing tension applied by the towline to the Tug via its towing hook, caused a rapid and increasing list until the submersion of the deck edge. From that point onwards, given the inflow of seawater by the openings as mentioned above, there was a rapid change of the displacement and therefore a shift of the center of gravity of the Tug, which resulted to the loss of her stability and her foundering.

From the above it follows that the foundering of the Tugboat was imminent and immediate, both because of the external constant force applied by the “JSM” and because of the massive flooding of accommodation spaces, engine and rudder compartments which considerably reduced the counteract time of the Skipper and the crew.



Fig. 10 (port): picture of the sunk Tugboat. The starboard watertight door (red arrow) provided access to the engine room through a staircase was found in open position.

Fig. 11 (starboard): The Tugboat ARTEMIS V submerged. The starboard weathertight openings on top of the engine room (skylight) were found in the open position (inside red circle).



4.11 “JSM” and “ARTEMIS V” crew fatigue

The investigation process showed no records or evidence of overwork or lack of rest for the crew of JSM and ARTEMIS V.

4.12 Certification of involved vessels

From the examination of vessels’ certificates it was seen that both vessels had their seaworthiness certificates and other required documents in validity. However it is noted that the Classification Society

which was responsible for the certification of JSM is not a Recognized Organization, based on the criteria of Regulation No 391/2009 of the European Parliament and the Council.

The following conclusions, safety measures and safety recommendations should not be taken as a presumption of blame or liability under any circumstances. The juxtaposition of these should not be considered with any order of priority or importance.

5. CONCLUSIONS

The conduct of the safety investigation into examined marine accident and its analysis, has highlighted contributing factors and conclusions as listed below:

5.1 Conclusions which led to safety recommendations

1. The planning of unmooring and departure procedure of JSM was insufficient (§4.5).
2. The jointly planning of departure procedure was inadequate and there was lack of information and consultation and between the Skipper of the Tug and the Master of JSM (§4.5.4).
3. The head of the aft unmooring team on JSM was the Cook of the vessel (§4.5.3).
4. The risk assessment procedure for the departure was not conducted by JSM (§4.7).
5. The communication between the Master of JSM and the Skipper of ARTEMIS V prior to and during the unmooring and departure procedure of JSM was insufficient (§4.8.2).
6. No alternative (back-up) arrangement and location for the towing release existed onboard ARTEMIS V (§4.9.3).
7. The towline release arrangement of the Tug was not ergonomic particularly for activation under heeling or listing emergency situations (§4.9.1).
8. The weathertight – watertight openings of ARTEMIS V were open during the towing operation (§4.10).
9. The release of the towline was not triggered when the Tug was rapidly heeling over to starboard and dragging by JSM (§4.9.1).
10. A permanent Pilot service is not provided at Kiato port and as a result during the departure procedure of JSM no Pilot got onboard (§4.4).
11. The bollard pull of ARTEMIS V is not required to be calculated for its certification according to current regulatory framework (§4.2).
12. According to the existing legislation there is no provision for required horsepower of the main engines in relation to the bollard pull of a Tug for use in ports (§4.2).

5.2 Conclusions which did not led to safety recommendations

1. ARTEMIS V had a license for a Port Services issued in 1992 under the Tugboat's ex name ("ELISSAVET") which had not been updated since (§4.2)

6. SAFETY RECOMMENDATIONS

Taking into consideration the analysis and the conclusions derived from the safety investigation conducted the following recommendations are issued:

6.1 The competent authorities of the Ministry of Shipping Maritime Affairs and the Aegean (Merchant Ships' Inspection General Directorate / Design and Construction Directorate - Merchant Ships' Inspection Directorate) are recommended to:

18/2013: Consider the need for setting up a regulation with respect to:

- regulating issues relating to the operation of the towline release mechanism on Tugs used in Ports, its testing methods and frequency.
- compulsory provision of an alternative arrangement and location for the handling of the towline release mechanism.

6.2 The competent authority of the Ministry of Shipping Maritime Affairs and the Aegean (Merchant Ships' Inspection General Directorate / Design and Construction Directorate) is recommended to:

19/2013: Consider the need for issuing a regulation with respect to:

- The ergonomic arrangement for the activation of the towline release mechanism of Tugs used in Ports.
- Regulating the operational capabilities Tugs used in Ports in relation to their required technical characteristics (engine power, towing force, etc.) and measures concerning the maintaining of watertight and weathertight openings in a closed position during towing operations as well as relevant marking.

6.3 The competent authority of the Ministry of Shipping Maritime Affairs and the Aegean (Hellenic Coast Guard/ Safety of Navigation Directorate) is recommended to:

20/2013: Recall to the appropriate recipients Circular of 08 September 2003 of the Maritime Safety Committee (MSC), Marine Environment Protection Committee (MEPC) and Facilitation Committee (FAL) IMO MSC / Circ.1101 - MEPC / Circ.409 - FAL / Circ.100, on the publication "Tug Use in Ports – A Practical Guide" by The Nautical Institute, 2003.

6.4 The Port Authority of Kiato is recommended to:

21/2013: Implement the provisions of Article 185 of the Code of Public Maritime Law, as amended, for the cases when the deployment of a Pilot from the Pilot Station of Corinth is not possible.

6.5 The Tugboat and Salvage Associations are recommended to:

22/2013: Inform their members regarding the importance of keeping watertight and weathertight openings of Tugboats in the closed position when engaged in towing operations and advise the conduct of tests of towline release mechanism by the Tug's crews prior to towing operations.

6.6 The Managing Company of T/B "ARTEMIS V" is recommended to:

23/2013: Provide “ARTEMIS V” with an alternative arrangement for the towline release at a location other than the bridge and also on other Tugs under its management which do not have such an arrangement.

6.7 The Managing Company of M/V “JSM” is recommended to:

24/2013: reassess the implementation of procedures of the Safety Management Manual of the ship and in particular:

- Analysis and risk assessment when a Tugboat is used in port.
- Instructions of Chapter 5.12 regarding the use of Tug in ports.

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