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Australian Transport Safety Bureau

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REPORT 164

Independent investigation into the lifeboat incident on board the Maltese flag bulk carrier

Alianthos

at Geelong, Victoria
on 24 January 2001

COMMONWEALTH DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES

Department of Transport and Regional Services
Australian Transport Safety Bureau

Navigation Act 1912
Navigation (Marine Casualty) Regulations
investigation into the lifeboat incident on board the Maltese flag bulk carrier *Alianthos* at Geelong, Victoria on 24 January 2001

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***Alianthos* alongside in Geelong**

Summary

On 20 January 2001, the Maltese flag, panamax bulk cargo carrier *Alianthos* arrived at the anchorage in Corio Bay, Geelong, after an uneventful voyage from Shanghai, China. The ship was in ballast and intending to load a full cargo of grain at the Geelong grain loader.

On 23 January, the master made the decision to conduct an 'abandon ship' drill while the vessel was at anchor waiting to berth. The drill commenced at 1018 and was completed by 1140. The master was not satisfied with some aspects of the crew's performance during the drill. He ordered that all crew were to receive further instruction, and complete another 'abandon ship' drill, the following day.

The 'abandon ship' drill commenced at 1700 the following day. Both port and starboard lifeboats were prepared, lowered to the water and taken away from the ship by crews who had not been in one of the boats the previous day. The third mate was assigned as the officer in charge of the port lifeboat.

When the port lifeboat returned to the ship, there was some delay in reconnecting the falls to the boat's on-load release hooks. After some time, the third mate gave the order to raise the boat from the water. The crew then disembarked at the embarkation deck and the boat was raised and secured at the head of the davit.

At the master's request, the mate continued to instruct members of the ship's catering and engineering staff who were not conversant with some aspects of the operation of the lifeboats. Once the mate had finished instructing the crew, they prepared the empty port lifeboat for lowering to the embarkation deck.

At 1742, one of the motormen was instructed to operate the davit winch to lower the port lifeboat. The motorman, who had not operated the davit before, lifted the winch brake handle and started to lower the boat. The boat moved more quickly than usual down from the housed position, resulting in the davit cradles coming to an abrupt stop as they reached deck level.

When the davit cradles hit their stops, the boat was seen to jerk sharply. At this instant, the after fall released from its on-load release hook. The stern of the lifeboat fell, swinging on the remaining forward fall. As the weight of the whole boat came onto the forward davit cradle it buckled and the boat made hard contact with the side of the ship. The starboard side of the lifeboat was cracked and holed by the contact. The forward fall and hook continued to hold the weight of the lifeboat, which had come to rest with its stern above the port gangway. There were no crew inside the lifeboat and consequently no injuries as a result of the incident.

After assessing the damage to the lifeboat and its davit, the master instructed the crew to use the after stores crane to raise the stern of the lifeboat and secure it alongside the ship. *Alianthos* berthed on the morning of 26 January with the lifeboat still suspended in this fashion.

Sources of information

The master and crew of *Alianthos*

Shigi Shipbuilding Company Ltd

Australian Maritime Safety Authority

Marine Accident Investigation Branch, United Kingdom

Transportation Safety Board, Canada

References

Safety of Life at Sea Convention (SOLAS), International Maritime Organization

Narrative

Alianthos

Alianthos (formerly *Young Senator, Rubin Elegant, CS Elegant*) is a Maltese flag bulk carrier of 65 850 deadweight tonnes at its summer draught of 12.822 m (figure 1). The vessel is owned by the *Alianthos* Shipping Company and has undergone a number of name and management changes since entering service. The most recent was in November 1999 when the management was passed from Mitsui OSK to Acomarit (U.K.) with a change of flag State from Panama to Malta. The ship is classed with Nippon Kaiji Kyokai (Class NK) as a Bulk Carrier, Strengthened for Heavy Cargos, ESP[1].

Alianthos was built in 1989 by Namura Shipbuilding Company at Imari in Japan. The ship has an overall length of 225.78 m, a moulded breadth of 32.2 m and a moulded depth of 17.8 m. Propulsive power is provided by a 6-cylinder Mitsubishi-Sulzer 6RTA62, single acting, direct reversing 2-stroke diesel engine of 7 838 kW. The main engine drives a single fixed-pitch propeller, which gives the ship a service speed of 14.0 knots.

The ship is of standard bulk carrier design with seven cargo holds located forward of the accommodation superstructure.

At the time of the incident, *Alianthos* had a crew of 19, comprising a master and three mates, chief and three engineers, boatswain and five deck ratings, three engine room ratings and two catering staff. The master held a foreign-going master's certificate of competency and had 37 years experience at sea, the last 12 in command. He had previously completed a six month contract on the vessel and was two and a half months through his current contract. The third mate had been at sea for three years and on the vessel for the previous three months. All of the crew were Ukrainian nationals.

Lifeboats

Alianthos is equipped with two 27-man totally enclosed lifeboats. The lifeboats are both type SZ-65BR constructed by Shigi Shipbuilding Company in Osaka, Japan. Each lifeboat is stowed in a gravity davit on the port and starboard sides of 'A' deck, the first deck of accommodation above the main deck. The port lifeboat is the designated rescue boat.

The lifeboats are constructed of fibre-reinforced plastic and each boat is 6.5 m in length, has a breadth of 2.6 m and a depth of 1.1 m. The unladen weight of each boat is 2 380 kg with a fully laden design weight of 4 640 kg. Their internal configuration is typical of many modern totally enclosed lifeboats. The coxswain's thwart is located at the stern and is raised to allow all-round vision from a small 'conning' bubble in the top of the canopy. All of the lifeboat's controls are accessible from this position, including the davit winch brake remote release cable and the on-load hook release lever. Seating for the rest of the crew is provided around the periphery of the boat with some seating also provided along the centre-line forward of the coxswain's position. There are hatches located midships on the inboard side of each boat for boarding the crew and additional hatches at the forward and after ends of the cabin to allow the crew access to the on-load release hooks.

Propulsive power is provided by a Daihatsu CLMD-25 4-stroke diesel engine, which gives each boat a fully laden speed of 6.23 knots.

The on-load release system

Both of *Alianthos*' lifeboats are fitted with an SZK-5 on-load fall release system designed and manufactured by the lifeboat builder, Shigi Shipbuilding Company. The system is designed

[1] Enhanced Survey Programme

to be operable by one person with the simultaneous release of both hooks occurring when actuated. The system is not fitted with an hydrostatic interlock.

The main components of the SZK-5 on-load release system are the operating mechanism located on the starboard side of the engine housing, the forward and after hooks and their associated locking mechanisms, and flexible cables which connect the operating mechanism to the two hooks.

The operating mechanism is shown in figure 2. It is depicted in both states ie. the tripped and reset positions. The main components are the operating lever, the quadrant plate, safety pins and the operating quadrants. The procedure to trip the hooks is sequential and involves removing the operating lever safety pin, raising the operating lever and engaging the socket. The safety pin in the quadrant plate is then removed and the operating lever is moved aft which moves the after hook's operating quadrant forward. At the same time the forward hook's operating quadrant, which is driven by the gear attached to the quadrant plate, also moves aft.

Resetting the system involves inserting the safety pin in the resetting pin hole and then moving the operating lever back to its original position. This action causes each hook operating quadrant to move towards its respective hook until it reaches the original position. The safety pin is then returned to the original position which locks the quadrant plate, the lever is then folded and its safety pin inserted.

The main components of each hook mechanism (figure 3) are the hook, link stopper, side plates, base plate, bracket and the no. 1, no. 2 and no. 3 hook bearers.

When the operating lever is moved to trip the system, each operating quadrant moves away from its respective hook. The teleflex cable transmits this motion to each hook mechanism rotating the no.3 hook bearer cam downward. The no.2 hook bearer moves down as the no.3 hook bearer cam rotates, which allows the no.1 hook bearer to also rotate downward. Once the no.1 hook bearer has rotated sufficiently, the toe of the hook is freed, the hook opens and the fall suspension ring is released.

FIGURE 2:
Operating mechanism

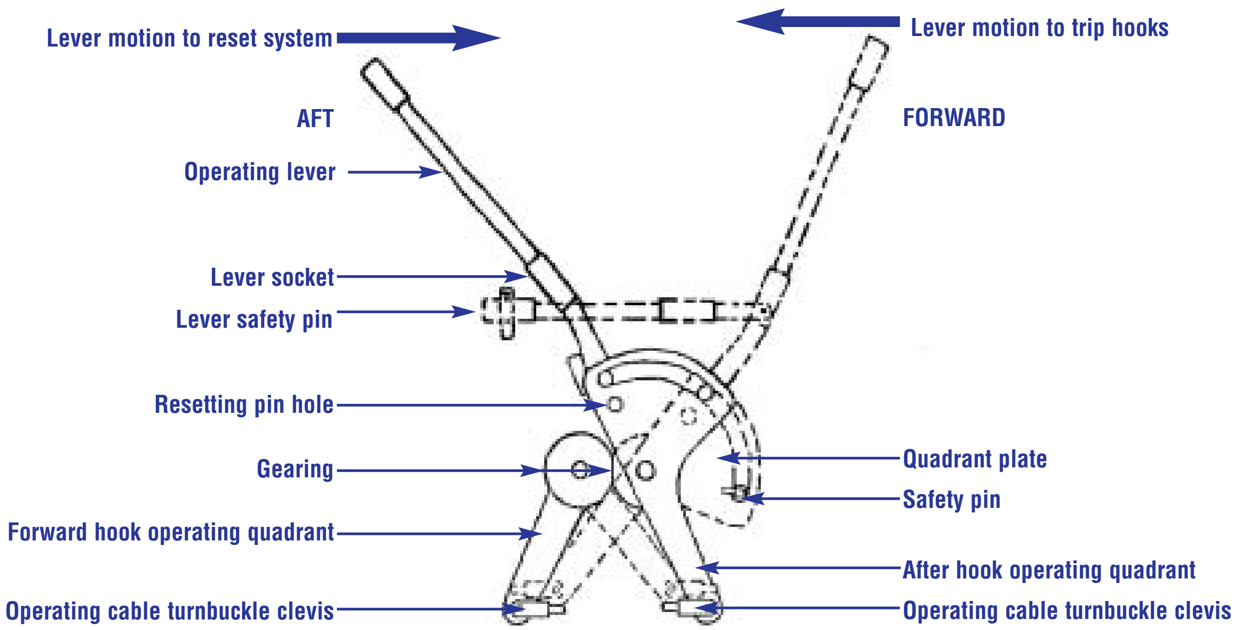
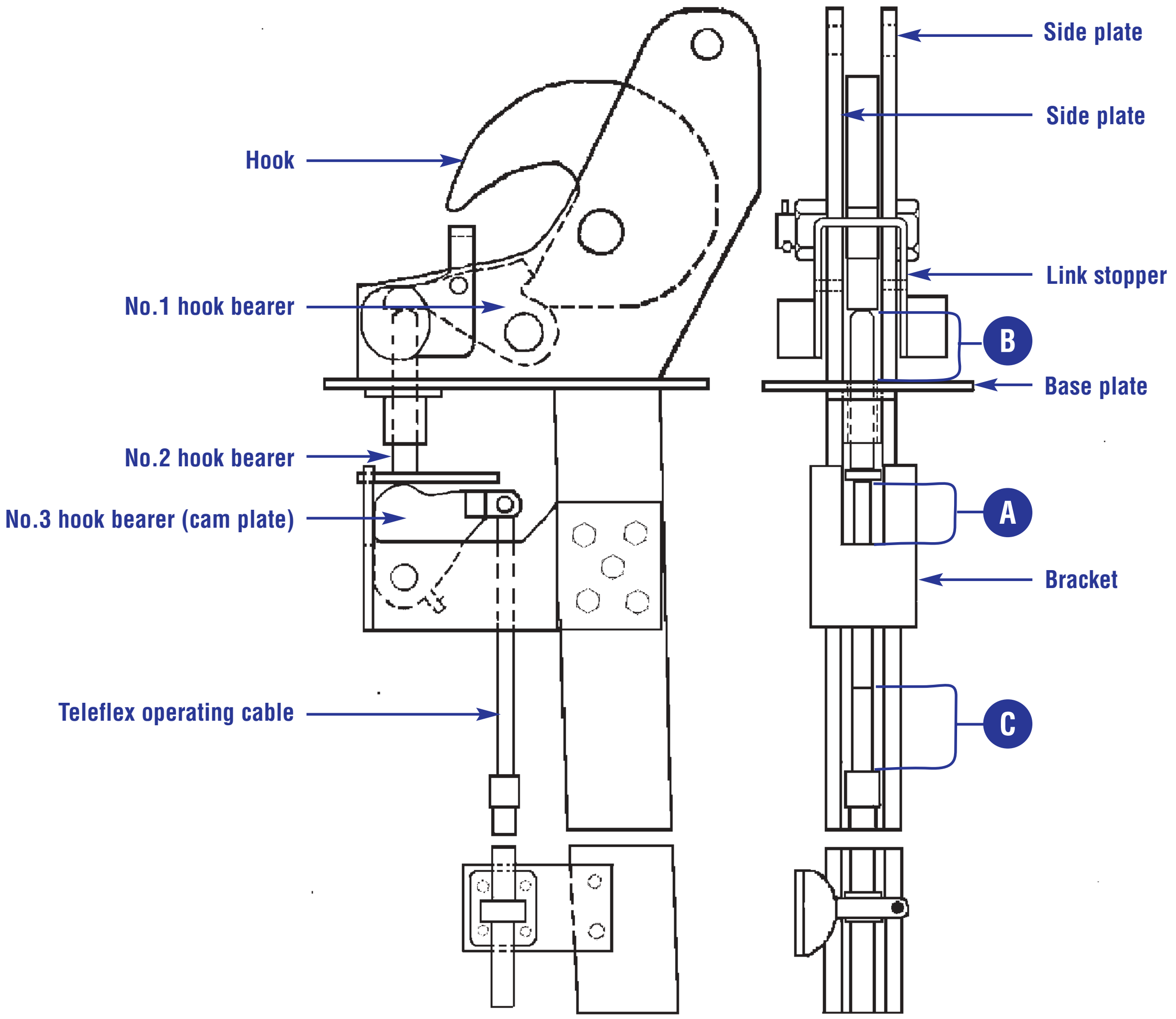


FIGURE 3:
Hook mechanism



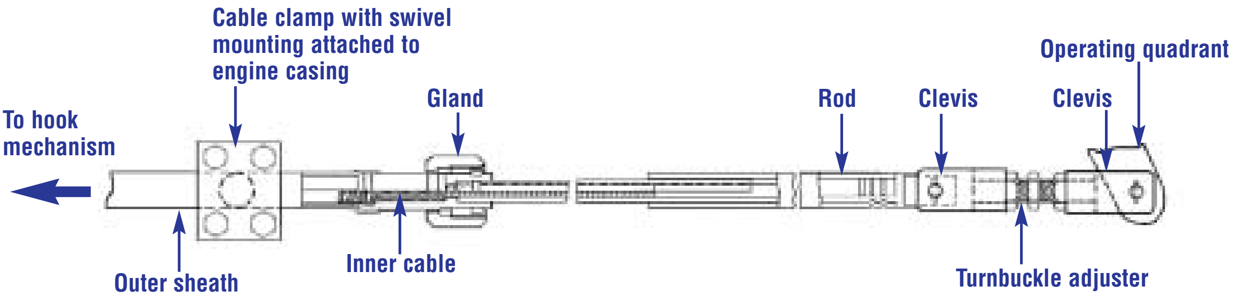
During a resetting operation, movement of the operating lever causes the operating mechanism quadrants to move toward their respective hooks. This motion is transmitted by each teleflex cable so that each end rod moves upward to rotate the no.3 hook bearer. As the cam on the no.3 hook bearer rotates, it moves the no.2 hook bearer upward, which in turn rotates the no.1 hook bearer into a position to lock the toe of each hook. The hooks must be held in the closed position by a crew member during the resetting operation.

To be fully reset (locked) the no.3 hook bearer cam must be rotated past the centre-line of the no.2 hook bearer. If the cam is not rotated into this position, the design of the mechanism will allow limited load to be carried on the hook, however, in this condition the mechanism is subjected to a tripping force and if the load is high enough, the hook will trip open.

The cable system, which operates each of the hook mechanisms, consists of a teleflex cable attached to the quadrants of the operating mechanism via a turnbuckle (figure 4). The cable system is designed to transmit the full motion of the quadrants to each hook mechanism. When the hooks are being tripped the cable is in tension and when the hook mechanisms are being reset the cables are in compression.

The teleflex cables consist of an outer polyethylene sheath over an inner steel flexible cable. The inner cable is designed to slide freely inside the outer sheath. There is a short rod attached to both ends of the inner cable which

FIGURE 4:
Operating cable system



slides through a gland fitted on each end of the outer sheath. The gland provides a seal between the rod and outer sheath to prevent dirt and water ingress into the core of the cable. Lubrication for the sliding inner cable and rods is applied when the cables are manufactured and no further lubrication should be required when the cables are in service.

The turnbuckle, which connects each teleflex cable to its quadrant, consists of a threaded centre section, (one half left-hand and the other right-hand thread) with a clevis and lock nut screwed to each end. One clevis is pinned to the end of the operating cable and the other is pinned to the quadrant. The turnbuckles allow the length of each operating cable to be adjusted.

A single clamp secures the end of each teleflex cable to a fixed point in the boat adjacent to the operating mechanism. The clamps are fitted to the outer sheath of each cable, adjacent to the gland, and secure the end of the cable in alignment with each operating quadrant. The clamps have a swivel mount to allow the end of the teleflex cable to swing through a small arc in order to maintain the correct alignment when the quadrants are actuated.

The davits

Alianthos' lifeboat davits consist of a frame, winch, falls, cradles, boarding platform, forward and aft suspension blocks and cradle stoppers used to secure the boats when stowed (the davits are shown in figure 5). Each boat is suspended in its cradles by the suspension blocks, with the fall wires running from each suspension block to the davit winch. The davit cradles are pinned forward and aft at the base of the davit frame. Each cradle is free to pivot on the pin and rotates, outboard initially when lowering a lifeboat and inboard at the final stage of raising the boat. Each davit cradle is fitted with a stop, which limits the outboard rotation of the cradle

FIGURE 5:
***Alianthos*' starboard lifeboat**

when the lifeboat is being lowered. The davits are also equipped with a wire-operated remote release for the winch. The remote release allows the crew inside the lifeboat to lower it from the stowed position. The davit and lifeboat are designed so that boarding of the crew may take place with the boat either in the stowed position or from the embarkation deck (A deck).

Each crew member on *Alianthos* is allocated a position in either the port or starboard boat. The mate is the designated officer in charge of the port boat and the second mate is the officer in charge of the starboard boat.

The incident

On 20 January 2001, *Alianthos* arrived at the anchorage in Corio Bay, Geelong, after an uneventful voyage from Shanghai, China. The ship was in ballast and intending to load a full cargo of grain at the Geelong grain loader.

On 23 January, the master decided to conduct an 'abandon ship' drill while the vessel was at anchor waiting to go alongside. The drill commenced at 1018 and involved both the port and starboard lifeboats. The boats were prepared, then lowered to the water and taken away from the ship by their respective crews. The drills were completed without incident with both boats rehoused in their davits by 1140. During the post drill debrief, the master expressed his dissatisfaction with some aspects of the lifeboat drill. He ordered that all crew were to receive further instruction and to complete another 'abandon ship' drill the following day.

The following day the 'abandon ship' drill commenced at 1700. Initially the crew were mustered at their boat stations and given instruction by the mate and second mate on the operation of the davit, lifeboat engine and on-load hook release mechanism. The boats were then lowered to the water and taken away from the ship by crews who had not been in one of the boats the previous day. The third mate was assigned as the officer in charge of the port lifeboat with the second engineer, a deck rating and an engine room rating making up the rest of its crew.

When the port lifeboat returned to the ship, there was some delay in reconnecting the falls to the boat's on-load release hooks. After some time, the third mate gave the order to raise the boat from the water. When the boat had been lifted approximately one metre, the third mate asked for the boat to be lowered back into the water where he released the falls from the on-load release hooks. This was the first time that the third mate had actually operated this type of on-load release system. After resetting the hooks a second time, the falls were reconnected and the boat was raised from the water. The crew then disembarked at the embarkation deck and the boat was raised and secured at the head of the davit.

After the boat was housed, at the master's request, the mate continued to instruct members of the ship's catering and engineering staff who were not fully conversant with some aspects of the operation of the lifeboats. His instruction included the preparation of the boat for lowering and the operation of the on-load release system for the falls. During this time he took some of the crew into the port lifeboat to show them the procedure for operating the on-load release system. While he was in the boat he noted that both hooks appeared to be in a reset position.

At 1742, the mate finished instructing the crew and the crew left the boat and mustered on deck. They prepared the port lifeboat for lowering to the embarkation deck, this time empty. The mate instructed one of the motormen to operate the davit winch to lower the boat. The motorman, who had not operated the davit before, lifted the winch brake handle and started to lower the boat. The boat moved quickly out and down from the housed position as the davit cradles pivoted outboard from their vertical, housed, positions. The master, who was on the port bridge wing, saw that the boat was being lowered too quickly and shouted to the motorman to slow down. At the same time the mate also shouted to the motorman to stop lowering. However, at this point, the davit cradles came to an abrupt halt as they made contact with their stops at deck level.

When the davit cradles hit their stops, the boat was seen to jerk sharply. At this instant, the after fall was released from its hook. The stern of the lifeboat fell, suspended only by the remaining forward fall. As the weight of the whole boat came onto the forward davit cradle it buckled and the boat fell further, making hard contact with the side of the ship. The starboard side of the lifeboat was cracked and holed by the contact. The forward fall and hook continued to hold the weight of the lifeboat, which had come to rest with its stern just above the port gangway.

After assessing the damage to the lifeboat and davit, the master realised his priority was to ensure that the lifeboat was adequately secured in case the forward hook should fail and allow it to fall to the water. He instructed the mate to secure the forward end of the boat using a wire sling rigged between a shackle on the boat's forward hook unit and an eye welded on the lifeboat deck. Once the forward end of the lifeboat was secure, the ship's port stores crane was used to lift the stern of the boat using a shackle attached to the after hook unit. When the lifeboat was horizontal, another wire sling was used to secure the stern of the boat to the after davit cradle. The lifeboat was left secured alongside the ship in this fashion until *Alianthos* berthed on the morning of 26 January.

Comment and analysis

A marine investigator from the Australian Transport Safety Bureau attended *Alianthos* on the morning of 26 January to conduct an investigation of the incident. The master, mate and third mate were interviewed and provided detailed accounts of the incident. Copies of relevant ship's documents were obtained, including the lifeboat davit and on-load release instruction manuals, lifeboat certificates of survey and lifeboat maintenance instructions. There were no records on board relating to past maintenance on the lifeboats. The master, however, indicated that the on-load release systems in both lifeboats had been overhauled by the crew in November 1999, when the ship's management had changed.

The primary aim of the investigation was to establish the sequence of events with a view to determining how the after fall became detached from the lifeboat and the factors that may have contributed to the incident. Although there was no loss of life or serious injury, the incident was significant as there have been a number of failures involving lifeboat on-load release systems in recent years.

Damage

The port lifeboat and davit were both damaged as a result of the after fall being released. The damage to the port lifeboat consisted of a small hole and several cracks on the rubbing strake on the starboard side where the canopy joins the hull (figure 6). The rubber fender was also damaged in way of the hole. The damage was consistent with the boat making hard contact with the side of the ship as a result of the after fall releasing and the subsequent failure of the forward davit cradle.

Damage to the port lifeboat davit was extensive (figure 7). The forward cradle was severely damaged and bent down and aft at approximately 90°, halfway along its length. The davit frame supporting the forward cradle was twisted approximately 5° in the same direction (aft). From the damage it was apparent that the davit had experienced a large load mostly in a vertical plane but with a lateral component directed aft. The damage was consistent with the effect of the large dynamic loading of the swinging lifeboat when the after fall released.

FIGURE 6:
Damage to port lifeboat

FIGURE 7:
Damage to port lifeboat davit

The on-load release system

Initial inspection

An examination of the on-load release system was conducted to establish how the after fall became detached from its hook when the boat was being lowered. The system was initially inspected while the boat was still suspended outboard of the main deck. The master and mate both stated that the on-load release system in the boat had not been operated, adjusted or reset in the time between the incident and the inspection.

The after hook was found to be in a tripped, or open, condition (figure 8). The hook locking mechanism was in a partially reset position indicated by the position of the cam plate on the no.3 hook bearer (refer to figure 3). The link stopper on the hook was undamaged with no witness marks to suggest that the suspension ring may have been forced past the stopper and off the hook. The disposition and condition of the various components of the after hook mechanism indicated that the hook had been forced open under load.

The forward hook was found to be in an untripped, or closed, condition. Its locking mechanism was also found to be in a partially reset position, indicated by the position of the cam plate on its no.3 hook bearer but closer to the fully reset position than was the after hook mechanism (figure 9).

The operating mechanism was found to be in the secured position with the safety pins fitted to both the release lever and the quadrant plate.

Various measurements were taken of the forward and aft hook mechanisms. Initially the distance between the bottom of the no.2 hook bearer and the bottom of the slot in the adjacent bracket ('A' on figure 3) was measured to reveal: 30 mm for the forward hook, 18 mm for the after hook. As a reference for this measurement, the distance between the point of contact between the no.1 and no.2 hook bearers and the hook base plate ('B') was also measured

FIGURE 8:
After hook as found

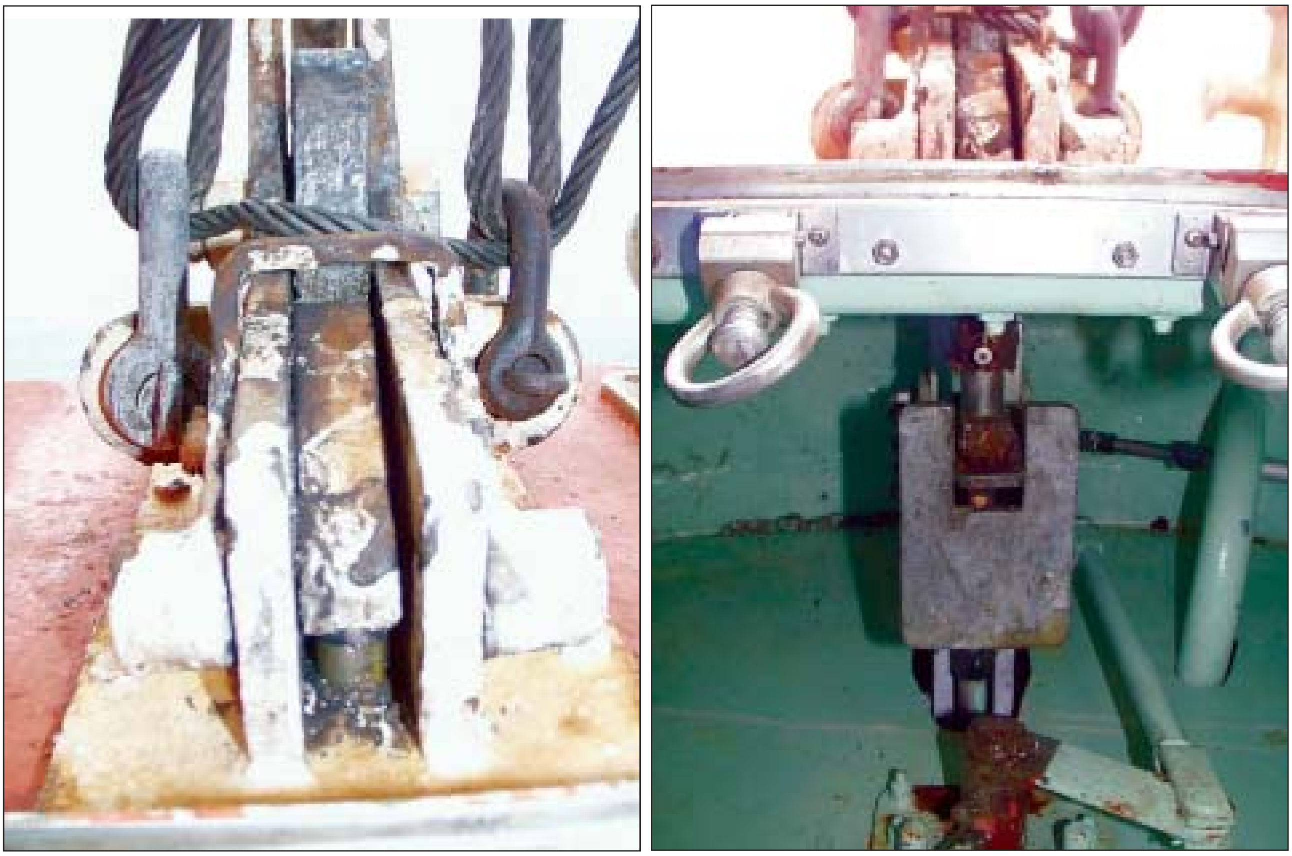


FIGURE 9:
Forward hook as found

to reveal: 45 mm for the forward hook and 35 mm for the after hook. According to these measurements the forward hook's no.2 hook bearer was 10 mm higher (more reset) than the after hook.

The travel of each teleflex cable (indicated by the grease marks on the rods attached to the no.3 hook bearer, ('C') was measured: forward hook 72 mm, after hook 35 mm. These measurements indicate that the teleflex cable operating the forward hook mechanism was extended 37 mm more in the resetting direction than the after hook.

Further examination

Several tests were performed on the on-load release system after the lifeboat had been lifted onto the ship's poop deck using the stores crane. Initially, both hooks were tripped and then reset using the procedure described in the manufacturer's instructions. After resetting the system the forward and after hook locking mechanisms were closely inspected and more comparative measurements were taken. The measurements and inspection revealed that neither hook mechanism had moved to the fully reset position, with the after hook mechanism still substantially less reset than the forward one. The procedure was repeated several times until it became apparent that neither hook could be fully reset using the procedure prescribed in the instruction manual.

FIGURE 10:
After hook operating cable system

Closer examination of the operating unit mechanism and the after hook mechanism revealed that there appeared to be some lost motion in the operating cable connecting the two. To allow an inspection of the cable system operating the after hook, the screws securing the footplate under the operating mechanism were removed and the footplate lifted.

With the after operating cable system exposed, the operating lever was actuated several more times. When the operating lever was moved to reset the hooks the end of the teleflex cable was deflecting downward, so that the turnbuckle clevis attaching it to the operating lever was making contact with the bottom of the boat. Thus, each time the operating lever was moved to reset the after hook, instead of sliding the rod longitudinally inside the outer sheath of the teleflex cable, the end of the cable was being forced down in a 'bend' to touch the bottom of the boat. The motion lost as a result of this deflection was at least 60 mm in the resetting direction. Where the clevis attached to the end of the teleflex cable had been making contact with the bottom of the boat the paint had been worn away (figure 10). This indicated that the after hook operating cable had been deflecting in this fashion for a lengthy period of time.

The rod on the teleflex cable at the operating mechanism end was dry indicating a lack of lubrication. The swivel bracket securing the end of the teleflex cable to the side of the engine casing, although securely fastened to both the cable and the casing, was worn enough to allow the end of the cable to swing relatively freely. The after hook could only be fully reset by manually supporting the operating cable, at the union between the end of the rod and the turnbuckle, to prevent it deflecting when the operating lever was actuated. When resetting the after hook in this fashion, a higher than normal force was required to move the resetting lever the last portion of its throw. This stiffness in the system was apparently due to some binding within the teleflex cables.

The cable system operating the forward hook was also inspected. There was no significant lost motion found in the system. It appeared that the forward hook was not moving to a fully reset position as a result of incorrect adjustment of the turnbuckle.

A limited load test was next applied to the after hook. First the hook was reset using only the full travel of the operating lever ie. to the partially reset position allowed by the deflection in the operating cable. Inspection revealed that the hook locking mechanism had moved to the same position as found after the incident, that is a distance of 18 mm measured at position ‘A’. A limited load was then applied to the hook (using a length of steel pipe as a lever on the hook) with the intention of ‘breaking’ the hook open. The hook remained closed under this test which verified that the hook was able take a limited load in the partially reset position.

The whole system showed surface corrosion and flaking paint on all external components. The grease on both the hook and operating mechanisms was old, hard and contaminated. A build up of paint and rust flakes 3–4 mm thick was found on the mating surface between the no.1 hook bearer and the toe of the after hook. As a final test, this debris was removed and the operating cable was supported with a piece of timber to prevent it deflecting during the resetting operation. The after hook was again reset with measurements at position ‘A’ revealing that the no.2 hook bearer’s travel had increased from 18 mm to 42 mm.

Examination conclusions

The following conclusions were drawn from the inspection and testing of the on-load release system fitted to *Alianthos*’ port lifeboat:

- neither the forward or after hook could be fully reset using the prescribed method. The forward hook operating cable system was incorrectly adjusted and there was a large amount of lost motion in the cable system which operates the after hook mechanism;
- marks where the turnbuckle clevis had been in contact with the bottom of the boat indicate that there had been lost motion (in the resetting direction) in the cable system which operated the after on-load release hook mechanism for a lengthy period of time;
- the crew of the vessel were not aware that there was lost motion in the cable system operating the after hook as it was covered by a section of plate, screwed to the deck, and thus not visible to the operators of the system;
- the crew had not been checking the position of the cam plates on the no.3 hook bearers as such an inspection, carried out correctly, would have revealed that neither hook mechanism was resetting fully;
- its general condition and the long standing problem with the after hook operating cable, indicates that maintenance of the system had been inadequate.

Sequence of events

Considering the statements of the witnesses and the physical evidence in the form of the damage to the port lifeboat and davit, together with the condition of the on-load release system as found after the incident and analysis of the design of the system, the sequence of events appears to have been:

- the port lifeboat’s hooks were not fully reset when the lifeboat returned to the ship and was recovered on the afternoon of 24 January;
- the speed of lowering the lifeboat to the embarkation deck resulted in the davit cradles making hard contact with their stops at deck level;
- the partially reset locking mechanisms on both hooks were subjected to a relatively high dynamic load as a result of the boat being brought to an abrupt halt by the davit cradle stops,

- the dynamic load when the davit cradles made contact with their stops, was sufficient to cause the after hook to release,
- once the stern of the lifeboat was disconnected from its fall, it started to swing forward applying a greatly increased dynamic load to the forward davit cradle with a component of the load directed laterally and aft,
- the forward davit structure was insufficiently stiff in a lateral plane to carry the load of the swinging boat and so failed. The failure occurred at the weakest point in the davit cradle ie. at the bend midway along its length, with sufficient force being transmitted through the cradle pinion to twist the frame,
- the lifeboat continued to fall until it was vertical, impacting on the side of the ship shortly after the forward cradle failed,
- damage to the boat was sustained on impact.

Operation of the davit winch

It was the usual practice on the vessel for the crew member operating the lifeboat davit winch brake to control the initial speed of lowering to ensure that the davit cradles made relatively gentle contact with their stops at deck level. On this occasion the motorman controlling the winch brake was not experienced with the operation of the davit and did not control the speed of lowering. The relatively hard contact when the davit cradles hit their stops caused a higher than usual load on the on-load release hooks and caused the partially reset after hook to trip open. However, the actions of the motorman are not considered to have contributed to the failure as the after hook would not have tripped open if the on-load release system had been fully reset. If anything, his actions may have been fortuitous as there was the potential for a serious accident if the hook had failed during the next abandon ship drill when the lifeboat would have been occupied.

The lifeboat launching system is designed to allow the coxswain to lower the boat using the remote winch brake release cable inside the boat. It is not reasonable, particularly in an emergency, to require the coxswain to control the rate of descent using this system and so the davit and lifeboat design must allow for the davit cradles making contact with their stops at the maximum rate of lowering allowed by the centrifugal brake in the davit winch. Indeed, the relevant statutory and classification society requirements dictate that the on-load release hooks are to be tested to six times their design load.

Past incidents

In the last nine years there have been several investigations into incidents around the world involving the on-load release systems in Shigi lifeboats. These include; the investigation of an incident on board the bulk carrier *Kayax* in 1994 (ATSB report number 71), the United Kingdom's Marine Accident Investigation Branch's investigation of an incident on *Ivory Ace* in 1993 and the Canadian Transportation Safety Board's (TSB's) investigation of an incident on *Iolcos Grace* in 1998. These investigations revealed factors common to the incident which occurred on *Alianthos*. The *Iolcos Grace* incident, in particular, being very similar.

On 9 November 1998, in Vancouver harbour, the forward on-load release hook on the port lifeboat of the bulk carrier *Iolcos Grace* opened under load during a drill. As a result, the lifeboat fell seven metres to the water with six crew on board. One crew member was killed and the five others were all injured to varying degrees. The subsequent investigation found that the forward hook had not been fully reset after the previous drill and had opened when the boat was being lowered. The investigation found, among other things, that the operating cables connecting the forward and aft hook mechanisms to the release mechanism were incorrectly adjusted.

The TSB's investigation also found that the crew had repaired a hole in the bottom of the lifeboat some time before the incident. An operating cable turnbuckle on the boat's on-load release system had made the hole when it had deflected in exactly the same manner as found on *Alianthos*' lifeboat.

These three investigations revealed that the crew of each ship were insufficiently conversant with the operation of the on-load release system and that they had difficulty understanding the lifeboat manufacturer's operating instructions.

In August 1997, Shigi Shipbuilding Company responded to several incidents involving on-load release systems on their lifeboats by distributing a circular to each ship fitted with a Shigi lifeboat. The circular contained warnings relating to the resetting of the hooks, upgraded instructions for testing and maintaining the on-load release equipment and some new instruction and warning plaques. Of particular relevance was a new warning plaque to be fitted inside each lifeboat which advised the operators to check the position of the cam plate on the no.3 hook bearer to ensure that the hooks are fully reset.

On 1 February 2001, the ATSB provided Shigi Shipbuilding Company with details of the *Alianthos* incident and requested the design specification, load testing and certification of the on-load release system. These documents were subsequently provided to the investigation in addition to a copy of the 1997 circular, which the company indicated had been sent to the ship, (*C.S. Elegant* at the time). Inspection of *Alianthos*' documentation relating to the lifeboats revealed that the ship had received the circular, however the warning plaque relating to the position of the cam plate on the no.3 hook bearer was notably absent in the documentation and had not been fitted inside the lifeboat.

On-load release design

The Shigi SZK-5 on-load release system was designed to meet the requirements of the 1974 International Convention for the Safety of Life at Sea (SOLAS) and 1983 amendments. The design has been in use since 1988 and is approved by various classification societies including Lloyd's Register and Nippon Kaiji Kyokai.

The design of the on-load release system has some aspects that may have contributed to incident on board *Alianthos*. The cable system operating the hooks exhibits design inadequacies which make it prone to acquiring the 'lost motion' found in the port lifeboat's after hook cable. The design of the hook mechanism is also of concern as it allows load to be taken by a partially reset hook, which may trip open under conditions of higher than normal sustained or transient load. As such, it is debatable whether the on-load release system complies with the intent of the applicable SOLAS requirements.

Another significant factor in the incident was the lack of a 'telltale' or mark to readily indicate to the crew whether or not the hooks are in the fully reset position.

Lost motion in the operating cable system

After a period of time in service, teleflex cables inevitably become stiffer to operate. Friction between the inner cable and outer sheath, and between the rods and glands increases with the aging of the internal lubricant, hardening of gland seals, ingress of dirt and/or water, corrosion, and infrequent operation. These cables are not designed to be maintained on board ships and so must be renewed periodically when their condition deteriorates. In practice they are infrequently replaced as sourcing the correct replacement cables is difficult and expensive with few crews sufficiently trained or confident to perform the maintenance work.

Alianthos had been in service for about 12 years with no evidence that the lifeboat teleflex cables had ever been replaced. Over this period of time, the cables had become progressively stiffer. In the case of the after hook in the port lifeboat, as the cable stiffness increased, the swivel mounting on the cable clamp adjacent to the operating mechanism would have been required to react with progressively more force in both the tripping and resetting operations. Eventually the swivel mount on the clamp had worn to the point where it was not maintaining the alignment of the cable end with the operating quadrant. Once there was sufficient misalignment the end of the cable was relatively free to deflect during each resetting operation, pivoting about the clevis pins in the turnbuckle. With both turnbuckle clevises aligned, there was an easy degree of freedom for the cable end to deflect in the vertical plane, in this case downwards, until it was in contact with the bottom of the boat.

The design of the on-load release system was not tolerant of the increasing compressive forces required to reset the hooks as the movement of the teleflex cables became stiffer with age. The swivel mount clamps did not adequately maintain the alignment of the cable ends with the operating quadrants and there was too much freedom in the vertical plane as a result of the turnbuckle clevises being aligned in the same direction.

SOLAS requirements

Chapter III regulation 41.7.6 of SOLAS 74 (as amended in 1983) contains the requirements for lifeboat on-load release systems applicable at the time Shigi Shipbuilding developed the SZK-5 system.

Regulation 41.7.6.2.2 states with respect to the on-load release capability:

> …This release capability shall be adequately protected against accidental release or premature use.

The design of the on-load system does incorporate measures for preventing accidental release, including the two safety pins in the operating mechanism. However the number of incidents involving this particular type of release equipment, where partially reset hooks have opened under load, demonstrates that these measures are inadequate. In the Inspector's opinion the design of the system fails to comply with the SOLAS provisions against accidental release. Subsequent International Maritime Organization (IMO) resolutions have clarified and amended the relevant SOLAS requirements.

IMO Resolution MSC.48 (66) adopted the International Life-Saving Appliance Code (LSA) on 4 June 1996, effectively amending Chapter III of SOLAS on life-saving appliances and arrangements. To reduce the chances of an accidental release of hooks while on load, the Code requires 'special mechanical protection', an improvement over the previous requirement for 'adequate protection'. To satisfy this requirement, a number of designs, including later Shigi models, have incorporated an hydrostatic interlock.

SOLAS 1997, Chapter III, 41, 7.6.2.2 now contains a clarification with regard to the operation of lifeboat on-load release system interlocks:

> To prevent an accidental release during recovery of the boat, the mechanical protection (interlock) should only engage once the release mechanism is properly and completely reset.

Such an arrangement, designed to engage only when both hooks were fully reset, if fitted to

Alianthos' lifeboats, would have greatly reduced the chances of the incident occurring

Hook indicator

The absence of a clear indication that the hook mechanisms were not fully resetting was a factor in the incident. Such an indication would have provided positive information as to whether the hooks were fully engaged or not and would have prompted the crew to investigate the on-load release system. This would have given them the opportunity to find and rectify the problems with the operating cables.

The bottom of the no.2 hook bearer is a rectangular plate which has the dual function of; providing a bearing surface for the no.3 hook bearer (cam plate) which drives it, and locating the no.2 hook bearer in the adjacent slotted bracket (preventing it from rotating or falling out). The vertical position of the plate with respect to the slot in the bracket provides an easily visible indication of the status of the hook.

Once the on-load release system has been installed, and the length of the release cables has been properly adjusted, the final or fully locked position of the no.2 hook bearer with respect to the bracket should not change. A simple painted or engraved mark on the bracket would provide an easily-seen gauge for the status of each hook. Such an indication would not negate the need to inspect the position of the cam plate on the no.3 hook bearer, which must be rotated past the centre line of the no.2 hook bearer to ensure positive locking of the hook mechanism. However it would prevent the situation which occurred on *Alianthos* where neither hook was being fully reset, with the after hook's no.2 hook bearer moving only 18 mm from the fully tripped position due to the lost motion in the operating cable.

Operation and maintenance of the on-load release system

Alianthos had a number of documents on board relating to the operation and maintenance of the lifeboat on-load release system. These included; Shigi Shipbuilding Company's original operation and maintenance manual for the lifeboat and the 1997 circular relating specifically to the on-load release system. These documents contained instructions for tripping and resetting the on-load release system and various warnings relating to its operation and maintenance. While some of the documents on board the vessel, including the instructions for operating the lifeboat davits, had been translated into Cyrillic text used by the Ukrainian crew, these had not. There was no ship-specific procedure relating to the operation of the system contained within the International Safety Management Code procedure manuals on board.

Two etched steel instruction plaques with English text, one for releasing the hooks and the other for resetting the hooks, were mounted inside the port lifeboat. The instructions on both of these plaques were unintelligible, as the reference numbers for the parts of the system were missing, both in the diagrams and in the text. Even if the numbers had been present on the instruction plaques, as they were in the other documentation on board, the resetting instructions would still have been somewhat confusing to the operator as a single diagram shows the system in both states, ie. tripped and reset (as in figure 2). The diagrams on both plaques include parts of the mechanism that are hidden below deck level and so are not readily visible to the operator and this may also lead to some confusion.

The lack of reference numbers, the English text and confusing diagrams rendered the instructions for operating the on-load release system inside *Alianthos*' port lifeboat effectively useless to its crew.

The warning plaque pertaining to the position of the no.3 hook bearer cam plates and safety pins, which Shigi Shipbuilding stated had been supplied to the vessel, was not fitted in the lifeboat. The written warning and diagrams on this plaque would have provided the crew with enough information to ascertain that the after hook, in particular, was not resetting fully and may have prevented the incident.

Instructions on maintaining the on-load release system were included in the documentation on board. The maintenance described consists of the periodic inspection, actuation, resetting and greasing of both forward and aft no.2 hook bearers. The updated maintenance instructions supplied by Shigi Shipbuilding in 1997 includes the following warnings relating to the teleflex cables and instruction plaques within the boats:

> If there is any problem with the cables, contact Shigi Shipbuilding immediately.

and:

> Make sure the Instruction poster and Caution Notice for the hook release mechanism are clear and legible. If they are hard to read, contact Shigi Shipbuilding immediately.

It appears that these warnings were either not known to, or had been ignored by the crew as both of these problems pre-existed the incident for a lengthy period of time.

Maintenance of the on-load release system in the port lifeboat was manifestly poor. The general condition of the system was poor, with flaking paint and corrosion on the hooks and grease on both hooks and the operating mechanism which was old, hard and contaminated. Both teleflex cables were stiff and poorly adjusted. There were no maintenance records for the system on board, the reasonable assumption being that the system had not received any significant maintenance for a protracted period. The adequacy of the maintenance carried out on the system in November 1999, only 14 months prior to the incident, must also be questioned based on the general condition of the system.

The lack of maintenance over time was directly implicated in the incident as a thorough inspection of the on-load release system would have revealed the problem with the after hook's operating cable.

Crew Training

The safety management system aboard *Alianthos* included a standard form for scheduling safety drills. According to the form, an 'abandon ship' drill is scheduled every three months to comply with the requirements of SOLAS, in the months of March, June, September and December. In practice however, the master indicated that he conducted drills when the ship's operations, schedule and weather permitted, generally when the ship was at anchor or in port.

As the management of *Alianthos* had changed in November 1999, the maximum time any of the crew had served on the vessel was a single contract of six months, in addition to around two months of the current contract. Thus no member of the crew had participated in more than three lifeboat drills on the vessel prior to the incident. The crew had conducted a lifeboat drill on the day before the incident. The master stated that he had ordered another drill the following day as he felt that the crew were not sufficiently conversant with the operation of the lifeboats.

The third mate, who had reset the on-load release system immediately prior to the incident, had been on the vessel only three months. He had not operated the on-load release system prior to this occasion and his only training on the system was some verbal instruction given by the mate immediately before the drill. He had no previous experience of the type of on-load release system fitted in *Alianthos*' lifeboats. Given his lack of experience, minimal training, the lack of a 'reset indicator' and the unintelligible instruction plaques in the boat, it is hardly surprising that he did not recognise that the hooks were failing to fully reset.

Conclusions

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular individual or organisation.

Based on the evidence available, the following factors are considered to have contributed to the incident involving *Alianthos*' port lifeboat on 24 January 2001:

1. The hooks were not fully reset when the lifeboat returned to the ship immediately prior to the incident and the after hook tripped under load when the davit cradles made harder than normal contact with their stops at deck level.

2. The forward davit cradle failed as a result of the sudden increase of load, applied dynamically, when the whole weight of the lifeboat was suspended suddenly from the forward fall.

3. The on-load release hooks in *Alianthos*' port lifeboat could not be fully reset using the operating mechanism in the prescribed fashion.

4. There had been up to 60 mm of lost motion in the cable system operating the after hook mechanism for a lengthy period of time.

5. The design of the on-load release operating cable system is inadequate with respect to maintaining cable alignment over time, specifically when in compression.

6. The design of the on-load release system does not incorporate any mechanical safeguards against incomplete resetting of the hooks.

7. There was no readily visible mark to indicate the status of each hook release mechanism.

8. The maintenance of the on-load release system was poor.

9. The operating instructions for the on-load release system inside the boat were effectively useless to the crew.

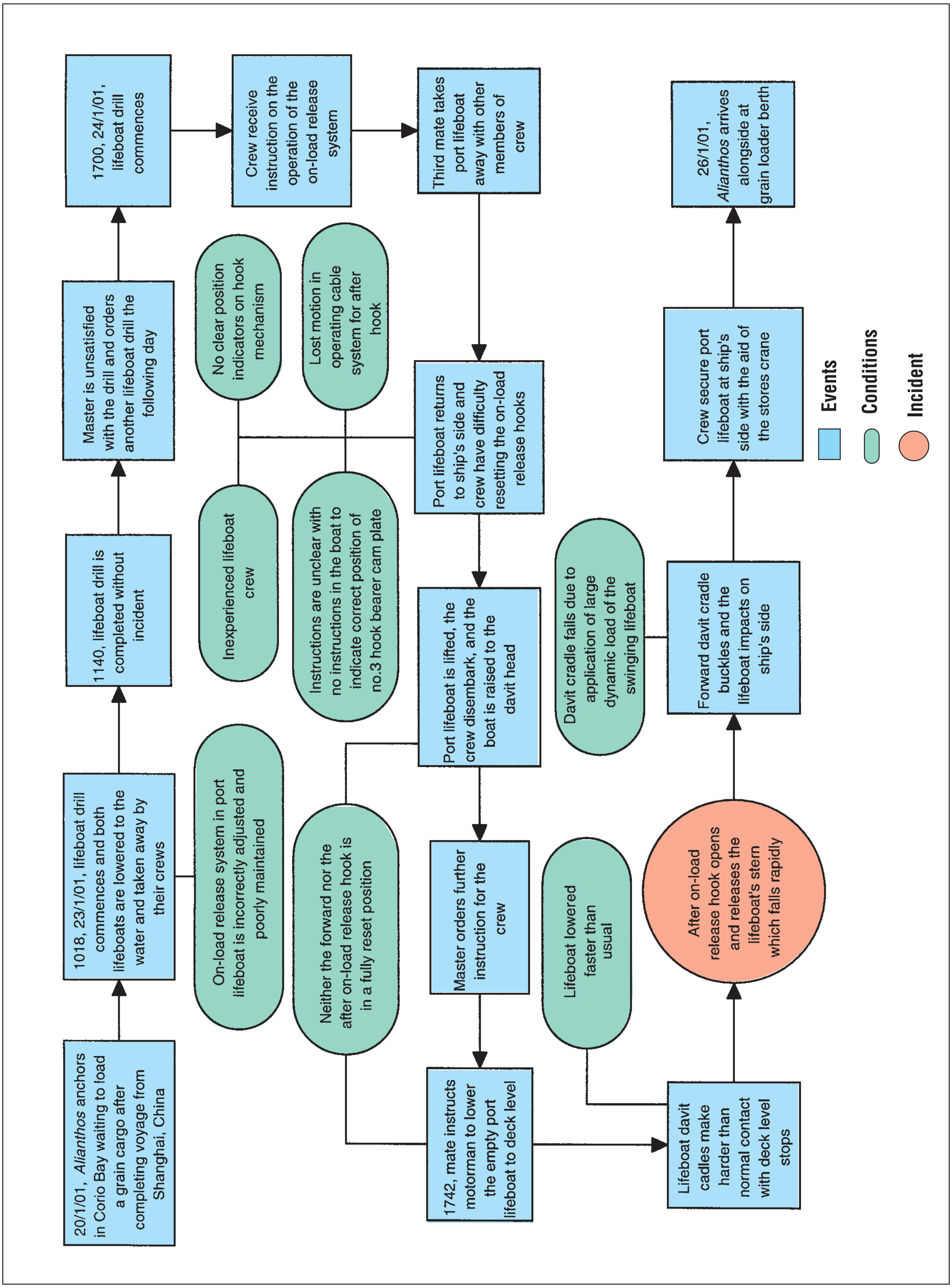
10. The warning plaque relating to the position of the no.3 hook bearer cam plates had not been fitted inside the lifeboat.

11. The crew training was deficient with regard to the operation of the on-load release system.

It is also considered that:

12. The operation of the davit winch at the time of the incident was not a factor as the after on-load release hook would not have opened when the davit cradles made contact with their stops if it had been fully reset.

FIGURE 11:
Alianthos: **Events and causal factors chart**



Recommendations

It is recommended that:

1. Owners and operators of ships carrying Shigi lifeboats fitted with SZK-5 on load release systems should seriously consider retrospectively fitting hydrostatic interlocks.

2. Indicators be fitted on Shigi lifeboats to clearly show crew when the on-load release hook mechanisms are fully reset.

3. Regular programmed planned maintenance and inspection of lifeboat on-load release systems by specifically trained and qualified personnel should be instigated.

Submissions

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

The draft investigation report was sent to the following: *Alianthos*' master, third mate and managers, Shigi Shipbuilding Company and the Australian Maritime Safety Authority.

A submission was received from Shigi Shipbuilding Company, the following is an extract from that submission:

> First of all, we would like to express our respect and admiration for the thorough and scrupulous investigation carried out by your inspectors. We are deeply impressed by the meticulousness and fairness of the report, and are in agreement with all its findings and recommendations.
>
> We are of course greatly disturbed that a number of incidents have occurred with type of lifeboat. Although we did everything in our power to ensure complete safety for crew members when designing the boat and its release system, in retrospect we can see that there were some design flaws, which taken together with lack of regular maintenance and proper training, have had tragic consequences.
>
> However, we would like to stress that we did what we could to prevent the present incident on the ALIANTHOS taking place. The circular we sent on August 28, 1997 was found among the vessel's documents, and it is indeed unfortunate that the Warning Sign we attached therewith was not put up inside the lifeboats. As stated on page 19 of the report, "the written warning and diagrams on this plaque would have provided the crew with enough information to ascertain that the after hook, in particular, was not resetting fully and may have prevented the accident." We also supplied replacement instruction stickers detailing the Release and Resetting procedures at the same time, "in case the original stickers became faded and difficult to read," and had these been put up also, the parts numbers described on page 19 as missing would have been clearly visible.
>
> Also, we do believe that, had proper maintenance been carried out regularly in accordance with our manual's instructions, this incident may well have been prevented. We are in full agreement with the report's comment on page 20 that "This lack of maintenance over time was directly implicated in the incident as a thorough inspection of the system would have revealed the problem with the after hook's release cable."
>
> With regard to the aspects of the SZK-5 hook release system's design which were found to be factors in causing this incident, we would like it to be known that all of these have been eliminated in the SZK-30 and SZK-36 release systems we have been producing since 1992. (The SZK-5 ceased production the same year.)
>
> Namely our present release system has:
>
> 1) an indicator (color marking) clearly showing whether the hooks have been fully reset,
>
> 2) a hydrostatic interlock, and
>
> 3) the teleflex cable is screwed in directly at both ends. With the turnbuckle and clevises eliminated from the release handle end, deflection of the cable (lost motion) as occurred in this incident is no longer a possibility.

And further:

> Regarding the Recommendations given at the end of the report:
>
> 1) We are ready and willing to retrofit a hydrostatic interlock on the SZK-5 hook release system, and indeed already have done so on a number of lifeboats at the request of their owners.
>
> 2) We are also prepared to provide indicators on lifeboats with the SZK-5 release system. Sending out a circular to all ship owners with lifeboats having this release system is something we will seriously consider.
>
> 3) As for the final recommendation regarding a regular maintenance and inspection program by trained and qualified personnel, we have service suppliers in the Netherlands and Singapore who have completed a training program with us here in Osaka, and who are authorized by us to carry out maintenance and inspections of our hook release systems. We hope to expand our network of trained and qualified service suppliers around the world, and are of course ready to provide such service ourselves.

Alianthos

Name	*Alianthos*
Former names	*Young Senator*-1992, *Rubin Elegant*-1994, *C.S. Elegant*-1999
IMO No.	8805169
Flag	Malta
Classification Society	Nippon Kaiji Kyokai
Vessel type	Bulk carrier
Owner	*Alianthos* Shipping Company
Year of build	1988
Builder	Namura Shipbuilding Company, Japan.
Gross tonnage	36 074
Summer deadweight	65 850 tonnes
Length overall	225.78 m
Breadth, moulded	32.20 m
Draught (summer)	12.822 m
Engine	Mitsubishi Sulzer 6RTA62
Engine power	7 838 kW
Service speed	14.05 knots
Crew	19 (Ukrainian)

Independent investigation into the lifeboat incident on board the Maltese flag bulk carrier Alianthos at Geelong, Victoria on 24 January 2001

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