

Departmental investigation into  
a fall from aloft  
aboard the  
**STS LEEUWIN**  
on 12 June 1996



Report No 93



**Transport and  
Regional Development**

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**Navigation Act 1912**  
**Navigation (Marine Casualty) Regulations**  
**investigation into a fall from aloft**  
**aboard the**  
**STS LEEUWIN**  
**on 12 June 1996**  
**Report No 93**

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# Summary

On 12 June 1996, the barquentine rigged STS Leeuwin was cruising in the Timor Sea. On board, in addition to the permanent and volunteer crew, were 31 trainees, mainly young unemployed persons, drawn from all over the Northern Territory and sponsored by the Commonwealth Employment Service.

Shortly after 0830, a team of three trainees, led by their Watch Leader, climbed aloft on the mainmast, to release the gaskets securing the main gaff topsail, so the sail could be set. The second of the three trainees, a woman in her late twenties, fell as she negotiated the futtock shrouds. Although she had clipped on her safety line, the free end of her safety belt slipped through the buckle and she fell 18 m to the deck.

Fortunately, the fall was partially broken by the nock sail sheet. Even so, the trainee suffered severe multiple fractures to her knees and to her thighs, also a collapsed lung. A helicopter medivac was arranged to transfer her to the Royal Darwin Hospital, where she remained in intensive care for 16 days.

# Sources of Information

STS Leeuwin - Master, Mate, 2nd Mate, Watch Officer, Watch Leader, Watch Trainees

Leeuwin Ocean Adventure Foundation Ltd

Captain Chris Blake, H. M. Bark Endeavour Foundation Pty Ltd

Captain David Clarke, former Regional Director, WA, Department of Transport

Department of Employment, Education, Training and Youth Affairs, Northern Australia.

Information and advice on safety harnesses was provided by:

ACT Fire Service

Department of Engineering, Faculty of Engineering and Information Technology, ANU

Mountain Designs, Australia (Canberra)

Scout Outdoor Centre, Canberra

Summit Gear Pty, Ltd Katoomba

Testing of the safety belt conducted by the RTA Crashlab, Rosbery, NSW.

## Acknowledgement

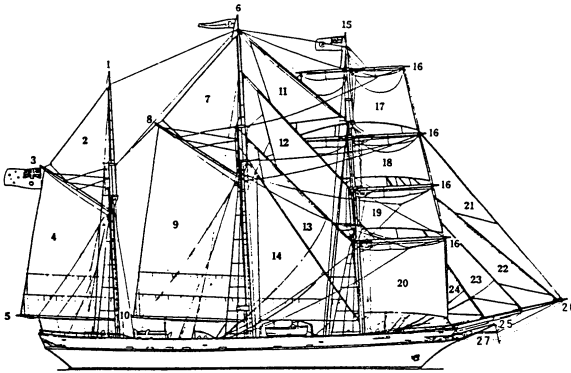
The Inspector acknowledges the assistance provided by the Director of the Bureau of Air Safety Investigation in making available a BASI investigator with sail training experience to assist with the interview of the injured trainee.

# Narrative

## STS Leeuwin

Leeuwin is a steel hulled barquentine, having three masts, square rigged on the foremast and fore and aft rigged on the main and mizzen masts. Under full sail the vessel carries 810 m<sup>2</sup> (8719 ft<sup>2</sup>) of sail. Built in 1986 by Australian Shipbuilding Industries Pty Ltd of Coogee, WA,

the vessel has an overall length of 55 m (42.5 m on deck), a beam of 9 m, a gross tonnage of 236 and a displacement of 300 tonnes. The height of the mainmast, truck to waterline, is 33.5 m.



- |                           |                           |
|---------------------------|---------------------------|
| 1. Mizzen Mast            | 15. Foremast              |
| 2. Mizzen                 | 16. The Yards             |
| 3. Mizzen Gaff            | 17. Topgallant            |
| 4. Mizzen Sail            | 18. Upper Topsail         |
| 5. Mizzen Boom            | 19. Lower Topsail         |
| 6. Main Mast              | 20. Fore Course           |
| 7. Main Gaff Topsail      | 21. Flying Jib            |
| 8. Main Gaff              | 22. Outer Jib             |
| 9. Mainsail               | 23. Inner Jib             |
| 10. Main Boom             | 24. Fore Topmast Staysail |
| 11. Main Topmast Staysail | 25. Bowsprit              |
| 12. Middle Staysail       | 26. Jib Boom              |
| 13. Nock Sail             | 27. Figurehead            |
| 14. Main Staysail         |                           |

Leeuwin is equipped with modern electronic navigation aids, including GPS, and is soon to be equipped with GMDSS equipment. The vessel is also equipped with two auxiliary Detroit 194 kW diesel engines, driving twin propellers and providing a speed of

9½ knots in calm conditions.

Leeuwin was built and is maintained under Commonwealth survey as a Class 1A Passenger Sailing Ship, allowing the vessel to make interstate and overseas voyages. However, as the vessel, for the greater part, engages in intrastate cruising, manning levels are usually to the requirements of the State Authority.

The vessel is normally manned by a small nucleus of permanent crew - Master, Mate, Second Mate/Bosun, Engineer and Cook - supported by a volunteer crew, comprised of a Watch Officer, four Watch Leaders, Purser, Bosun's Mate and Cook's Mate, drawn from the Sail Training Association of Western Australia. Watch Leaders are chosen very carefully, for their leadership qualities and abilities with young people; many of this relatively small group first sailed as trainees on board, then acted as volunteer crew members on one day sailings and occasionally on longer voyages as Cook's Mate, before being selected and trained for the watch leader's role.

The vessel has accommodation for 40 passengers/trainees.

## **Leeuwin Ocean Adventure Foundation Ltd**

Leeuwin is operated by the Leeuwin Ocean Adventure Foundation Ltd., an independent, non-profit organisation, which relies on a wide range of volunteer and sponsorship support.

The idea for a sail training vessel was that of a local surgeon, motivated in 1974 by a wide, international move towards outward bound schools and sail training vessels for the development of young people. Although there was considerable local interest and support, sufficient funding could not be found until 1984, a boom time for Western Australia, with the added interest of, and the added incentives

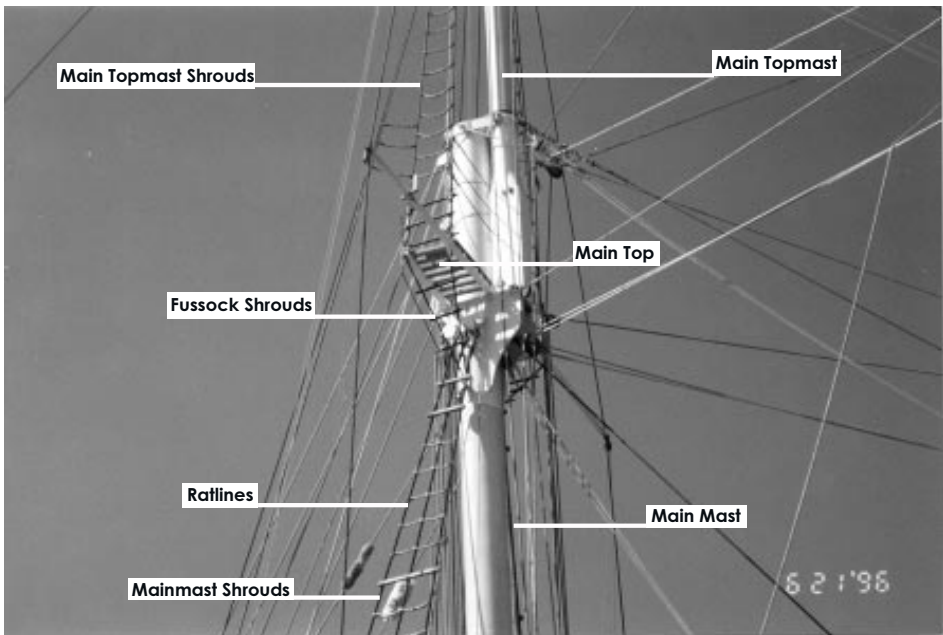
provided by, the forthcoming bicentennial celebrations and the America's Cup.

After much consultation with those already operating in the field, the design was settled on a barquentine rig, with four spars on the foremast. This provided four sails of each type - four jibs, four square, four staysails and four fore and aft sails - one of each type for each of the proposed four watches of trainees.

Although one-day harbour cruises, and two to three day cruises are conducted for the general public, as well as an occasional three-week overseas voyage, the main cruise schedule is of ten-day training cruises for young people under the age of 25, sponsored through schools and Government youth agencies. The program is *“geared towards a personal development exercise that makes the trainees more aware of their capabilities rather than an instruction in sailing”*, the purpose being *“to help young people to mature and develop in areas of self esteem, discipline, team work, leadership and good citizenship.”*

## **Training procedures**

When trainees first join Leeuwin, they are mustered for a welcome and introductory talk by the Master and the Mate, which includes general safety issues. Safety belts are issued to everyone, with the instructions that they are to be worn at all times when on deck, even if on deck for relaxation purposes. The Mate demonstrates their correct fastening, stressing the need for the end to be doubled back through the buckle, to prevent it from coming undone and explaining the possible consequences for failure to do this. The trainees are divided into four watches (red, white, blue and green) and introduced to their watch leaders, who take them individually through safety belt fastening.



**Parts of Rigging**

The four watches then rotate through instructional sessions on ropework with the Mate, helm orders with the Watch Officer, safety aloft and yard bracing with the Second Mate/Bosun and going aloft with the Watch Leader. The trainees are instructed that when moving aloft they should always have three points of contact with the rigging, two feet and one hand, or two hands and one foot, and that when working aloft, on the bowsprit, or outboard, they should always clip on their safety line.

For their first venture aloft, the trainees are taken up the foremast, first to the main course (lower) yard, then to the foretop, or platform, which requires the trainees to negotiate the futtock shrouds, steel stays under the platform, which lean outwards and which counterbalance the tension of the topmast stays. Negotiating the futtock shrouds is perhaps the most difficult and potentially dangerous aspect of climbing aloft. To avoid a person having to unclip and reattach their safety line

while negotiating the futtock shrouds, a special safety rail had been fitted.

However, trainees do not have to go aloft, such an activity is purely voluntary and at all stages of the voyage it is left to the individual to decide whether or not they do so.

Whenever possible, the afternoon of the first day is spent in practicing sailing vessel manoeuvres, such as tacking and wearing, in the harbour, after which the vessel is anchored for the night, within harbour waters. The cruise proper starts on the second day.

Strict safety checks are maintained during the first two days, but after that the trainees are expected to start taking responsibility for themselves and checks on safety harnesses are relaxed to a “spot check” basis. As the cruise progresses, the trainees are expected to take on more and more responsibilities, and for the second half of the cruise, each watch elects one of its own members to be team leader and the actual Watch Leaders take on a monitoring role.

## **The incident**

The trainees, 29 in number, for voyage number 12/96, scheduled to commence on 10 June 1996, joined Leeuwin in Darwin on the afternoon of Sunday 9 June. All were sponsored by the Commonwealth Employment Services and came from the main commercial centres of the Northern Territory. Two were employees of the Department of Employment Education Training and Youth Affairs, the remainder unemployed persons, the majority of whom were under the age of 25. Apart from taking on provisions for the voyage, there were no formal activities arranged for that Sunday, but a few of the trainees expressed an interest in climbing aloft and were taken up the foremast by the Watch Leaders.

The cruise schedule started after the trainees had had their breakfasts on the Monday morning, the trainees being mustered at 0800 for the induction talk by the Master and the Mate. In accordance with the normal procedures, the trainees were instructed in the correct wearing and fastening of their safety belts, which included a demonstration followed by a practice session, each and every trainee being checked for correct fastening by their Watch Leader.

The trainees, divided into their four watches, then rotated through the operational training sessions. When it came to the Red Watch's turn to go aloft, three of the eight Watch members chose not to make the climb.

At 1110, Leeuwin cast off from the berth and moved out into the Roads, where it was brought to anchor at 1140. The trainees were then settled into the shipboard watch routine and put to various tasks to bring them together to work as a team and various games and exercises to develop trust. They were introduced to anchor watch routines and instructed how to maintain the deck log book, part of the training being to maintain the trainees' own deck log.

Anchor watch routines continued throughout the night and the following (Tuesday 11 June) morning, with further team building tasks and trust building exercises after breakfast. The trainees were again reminded about the correct fastening of their safety belts and each trainee's belt was checked by their Watch Leader. At 1130, all hands were mustered and exercised in emergency procedures.

After lunch each watch was allocated two sails and the ship was prepared for sea, each watch going aloft as necessary to release the gaskets that secured the sails in their stowed positions. In Red Watch, three trainees again chose not to climb aloft, preferring to restrict their activities to hauling on the sheets and halliards.

The anchor was weighed at 1430 and Leeuwin manoeuvred out of the harbour under sail, assisted by the ebbing tide. Three jib sails, the three mainmast staysails and the nock sail, the mainsail and mizzen sail were all set. Leeuwin cleared the Heads (East and West Points) at 1720 and at 1800, with the wind light from the north-west, course was set on 300°, close hauled on the starboard tack. This took the vessel down Middle Pass and out into the Beagle Gulf. At 1845 the engines were started and Leeuwin proceeded under both engines and sail, the wind remaining light and becoming variable.

At 2000, with Charles Point bearing 128° at six miles and with the vessel well clear of Charles Point Patches, course was altered to 270°. This course was maintained until 2345 when, with Charles Point bearing 109° at 17.6 miles, course was altered to 250°. Throughout the night, the trainees stood turns at the wheel and also stood lookout duties at the bow.

Wednesday 12 June dawned fine and clear, the wind force two from the south-east, the sea slight with no swell, causing little movement to the vessel. At 0715 the engines were stopped and Leeuwin continued under sail alone.

At 0800, course was altered to 270° and the trainees mustered for allocation of the day's tasks. Red Watch was given the task of setting the main gaff topsail and the Watch Leader, a young woman sailing for the first time as Watch Leader, mustered the Watch by the port side (windward side) mainmast shrouds and explained what had to be done. Three trainees were needed to climb to the main top to untie the knots of the gaskets securing the sail, so that the sail could be hoisted from the deck.

The Watch Leader invited one of the men and one of the women to undertake the job and then another woman, one in her late twenties and who had not ventured aloft as far the tops before, volunteered to

make up the trio. As this was the Watch's first time aloft on the mainmast the Watch Leader's duty was to go first, to lead the way and, as it was also the second woman's very first climb, the first, younger woman was appointed to be her "buddy", to help her as necessary.

The Watch Leader climbed first, followed by the man. Initially, the two women climbed side by side, the elder of the two using and repositioning her safety line as she went. As the shrouds narrowed, making the side by side ascent impossible, the younger woman stopped and allowed the other to go ahead.

When the man had negotiated the futtock shrouds and was safely on the maintop, the Watch Leader instructed him to help the woman, then moved over to the sail, to locate the gasket knots. The man knelt down so as to be in a better position to provide help and advice to the woman below him. The Watch Leader, having quickly located the gasket knots, then moved to stand behind the kneeling man, so as to observe the woman's progress.

The woman arrived at the bottom of the futtock shrouds and clipped



**Negotiating the mainmast futtock shrouds**

her safety line onto the safety rail, placing her left arm around the shrouds for security as she did so. Looking down, she became frightened and wanted to climb down and, instead of

climbing up the futtock shrouds, she tried to climb in behind them, first from the forward side, then from the after side. Encouraged and guided by the others, she was eventually in the correct position for climbing them, but then took a short rest, hooking both her arms over one of the ratlines.

Apparently determined to go on, the woman resumed the climb and reached the position where she had both hands on the bottom ratline of the main topmast shrouds. She then became very frightened, stopped and called to the others that she was frightened. The Watch Leader told her to hang on, that she was on her way down to help her, but before she could move the woman let go with both hands, then screamed as she fell.

The Watch leader expected the woman's safety line to stop the fall, but after being arrested very briefly, the woman continued to fall, striking the other woman on the shrouds beneath her as she fell. Initially the woman fell down the outside of the shrouds, but then fell clear a few metres from the deck, falling slightly head first. Instinctively, she grabbed for, and her left arm caught over, the nock sail sheet, belayed on the pin bar immediately inboard of the shrouds. This partially arrested her fall and caused her to pivot, so that she landed legs first on the main staysail sheet, coiled on the deck just forward of the shrouds.

The woman's safety line was still fastened to the futtock shroud safety rail, the safety belt, unfastened, suspended from it.

The Second Mate/Bosun, a trained nurse, was the first to reach the woman and immediately realised that both the woman's legs had been broken, the left thigh bone protruding through the flesh. The Second Mate/Bosun was joined by the Purser, also a trained nurse, and the two comforted the woman, still fully conscious, as best they could,

calling for a mattress, blankets and a splint. The woman was very apologetic for not having fastened her safety belt properly.

The Master had been on his way to the poop from the charthouse when he heard the scream and the thump of the woman hitting the deck. The time was recorded as 0845. He received reports from the Second Mate/Bosun, realised the woman would have to be got to hospital and gave orders for the sails to be furled preparatory to turning about and making best speed back to Darwin. With the sails furled and the engines at full speed, Leeuwin was brought onto course at 0925.

The Master made radio contact with the RAN Staff Hospital in Sydney, for medical advice, also with the Leeuwin Foundation, the Darwin Harbour Master and the MRCC, Canberra.

The woman, who remained fully conscious, was administered morphine, but attempts to introduce an intravenous feed were unsuccessful. At 1050, it was agreed that MRCC should arrange for a doctor to be taken to the ship by helicopter, arrangements being confirmed by MRCC at 1118.

The helicopter was sighted at 1325 and the engines were stopped. Being a sailing vessel, Leeuwin has no clear deck space for helicopter operations and so the rescue boat was launched. Even so, the doctor and one helicopter crewman had to be dropped into the sea, to be picked up by the rescue boat crew. The doctor was on board Leeuwin at 1400 and, after having examined the woman and also having experienced difficulty introducing an intravenous feed, he advised the Master that the patient should be evacuated.

The woman was strapped in the stretcher and placed in the rescue boat at 1425. Her transfer to the helicopter, and that of the doctor and helicopter crewman, was achieved by 1450, the helicopter then

delivering her to the Royal Darwin Hospital, where she was admitted straight into the Intensive Care Unit.

With the woman evacuated from the vessel, the Master could have resumed the cruise. However, he decided to return to Darwin, to enable the AMSA surveyor to investigate the incident while it was still fresh in everyone's minds. Leeuwin anchored in Darwin harbour at 2055, resuming the cruise the following morning.

The woman remained under intensive care until Friday 28 June, her injuries having included the multiple fracture of both thigh bones, the shattering of both knee caps, broken fingers and a collapsed lung. The young woman had also received a chafe burn on her left arm, caused by the nock sail sheet, and a chafe burn beneath her breasts, caused by the slipping safety belt.



**Correctly fastened**



**Incorrectly fastened**

# Comment and Analysis

Fortunately there have been only a very small number of incidents where trainees have fallen from aloft aboard Australian sail training vessels. In two previous instances the trainee lost either his or her hand hold or his or her footing while moving from one point to another and were not clipped on to a safety point at the time. According to the Leeuwin Foundation, there have been numerous, unreported instances of persons aloft slipping from their position, but on every occasion they were held by their safety harness.

There are a number of aspects to this incident. The fall itself can be attributed, in part, to fear. For the safety belt not to arrest the fall required the belt either to fail, or for it not to have been fastened correctly and therefore it is necessary to look not only at why it occurred, but also at the defences that should be in place to prevent such an occurrence. It is also relevant to look at the type of equipment used and the type of equipment available.

## Cause of the fall

The young woman, who was rather heavy in build, had played a passive role during the first two days of the voyage, not venturing aloft other than an exploratory partial climb of the mainmast shrouds. This was because climbing the rigging held a considerable amount of fear for her, which is one of the obstacles the training cruise is meant to show individuals they can overcome, that they are not insurmountable.

Although she volunteered to go aloft that third morning, the fear was still present and was heightened when she looked down when at the top the shrouds. The situation would have been exacerbated during her efforts trying to climb in behind the futtock shrouds. This

manoeuvring about the futtock shrouds would also have sapped both her energy and her strength, in fact after being guided into the correct position by the others, she had to rest, hooking both her arms over one of the futtock shroud ratlines.

Although very frightened, but apparently determined to go on, with the encouragement of the others she attained the position where she was at full stretch, leaning backwards, with much of her weight supported by her hands and arms. It was in this position that she called out that she was frightened and from which she “peeled” off the rigging.

When interviewed eight weeks after the incident, she explained that at that point, although very frightened, she was overcome with an inner sense of calm. Although knowing she would fall, she believed she would be all right and she let go with both her hands. According to her original account, she did not release her hold due to an inability to retain her grasp through fatigue, in fatalistic acceptance, although in falling head first, she did believe she would be killed.

Although almost 30 years of age, the woman appeared very immature, at times exhibiting an almost childlike innocence and belief. It is considered that it was this innocence that led to her releasing her hold on the ratlines. Although the immaturity and a slowness at learning was noted by at least two of the crew members, there is no onboard philosophy or procedure whereby such a person is afforded supplementary attention.

The mainmast is the tallest mast, the maintop the highest of the three tops and the shrouds the steepest, therefore the mainmast is not the appropriate one for a novice to be making his or her first venture aloft. Policy on board Leeuwin is for trainees to be introduced to climbing aloft on the foremast, where the top is at not such a great height and the shrouds not so steep. However, the operational procedures do not

make allowance for the trainee who does not venture aloft during the first two days of the voyage.

Before any trainee is allowed to climb either the main or mizzen masts, the Inspector considers that an individual should first be required to ‘prove’ him or herself by climbing the foremast rigging which is less demanding.

## **Safety belt checks**

The young woman’s fall should have been arrested by her safety line and belt, after a fall of no more than one metre. Although she had clipped the snap-link of her safety line on to the futtock shroud safety rail and although her fall was checked momentarily, the belt rapidly became undone. This should not occur unless the belt has not been fastened correctly by passing the free end back through the buckle.

The procedures in place aboard Leeuwin involve methodical explanation and demonstration of the safety belts and checking of each trainee’s safety belt during the first two days of the voyage. In the first instance, the Mate explains and demonstrates the safety belt and safety line, also explaining what can happen if the belt is not correctly fastened. During the instructional sessions on the first morning, the Second Mate/Bosun and the Watch Leaders also instruct the trainees on the correct wearing of the safety belts and the Watch Leaders physically check each trainee’s belt before taking their Watch aloft on the foremast. On the second day, every trainee’s safety belt is checked for correct fastening each and every time they go up on deck.

The Foundation and on board policy is that from the third day onwards, the checking of safety belts is relaxed, the philosophy being that the individual has to take responsibility for his or her self. The policy does not take into account possible inattention or different

levels of comprehension and has the effect of removing the defences for preventing a trainee from climbing aloft with their safety belt incorrectly fastened.

The Inspector considers that a “buddy” system, whereby each trainee is checked by a peer, would not be contrary to the philosophy of increasing the individual’s responsibility. The Fire Service has a “touch-check” system, whereby a wearer’s harness is checked by someone else, every time a harness is put on. Touching each fastening and item of equipment concentrates the checker’s attention on the task in hand and guards against a cursory glance, which may overlook something that is wrong.

## **Foundation safety culture**

The safety record aboard Leeuwin is good, due to a very positive attitude and commitment to safety by the permanent and volunteer staff. To obviate the need for persons working aloft on the yards to change their safety line from one anchor point to another as they traverse a yard, a continuous taut wire has been rigged along the top of each yard.

During the first few months of the vessel’s operation, someone fell from the futtock shrouds while moving their safety line from one anchor point to another. On that occasion the person rolled down the shrouds and fetched up against the bulwark and fortunately suffered only bruising. As a result of that incident, the Foundation designed and fitted a safety rail on the after side of each set of futtock shrouds. This very good safety system has reportedly been adopted on board a number of other sail training vessels.

The Foundation’s instruction manuals stipulate that safety belts have to be worn by everyone at all times when on deck. However, the

procedures and actual demonstrations of and instructions on the safety belts and the philosophy regarding reduced checking have all been developed on board and there are no written instructions covering these points.

After this particular incident, the Master and the Mate introduced a “buddy” system on the next voyage, to ensure non-occurrence of this type of incident. It is considered that it would be appropriate for the Foundation’s instruction manuals to include this procedure, to ensure that it is maintained after changes of personnel.

The Leeuwin Foundation has also been investigating the feasibility of having the reverse side of the belt a contrasting colour to that of the front, giving an immediate visual indication that the belt has been properly fastened.

## **Safety belt**

The safety belt worn by the woman trainee had seen considerable use and had become quite shiny, both from wear and from a small amount of grease. The end, cut at an angle, was beginning to spilt, greatly reducing its rigidity. Although the belt was simple to fasten in the normal manner, when lifting the buckle to thread the end back through for the locking tuck, because of its shininess, the belt tended to slacken off. Also, because the end was beginning to split, it was more difficult to thread back through, which would cause the wearer to lift the buckle higher, which in turn would cause a greater slackening of the belt around the wearer’s waist. This fact could lead a person not intending to go aloft to not bother threading the free end of the belt back through the buckle.

The Second Mate/Bosun, the first person to reach the young woman after she had fallen, stated that the young woman was apologetic for not having fastened her safety belt properly. When interviewed, eight

weeks after the incident, the young woman was sure she had fastened the belt properly, but she could not recall being given any instruction on its correct fastening.

The safety belt worn by the trainee was tested at the Road Transport Authority Crash Laboratory at Rosebery, NSW. The testing, witnessed by the investigating officer, involved drops, similar to that experienced by the trainee, using a dummy used in testing safety harnesses for the Standards Association of Australia. Correctly fastened, the belt held, the webbing slipping 5 mm through the buckle, which was well within the 25 mm allowed under AS 2227<sup>1</sup>. Incorrectly fastened, the belt rapidly came undone, with no restraining effect on the fall.

## **Selection of trainees**

Sail training is widely acknowledged as a highly effective training regime that boosts self reliance, self esteem and team work. World wide training programs for a wide cross section of society, particularly young people, are in place, from which they obtain great benefit.

Selection of trainees for the DEETYA voyages is carried out by the local CES office managers, the selection regime being such that on occasion it is not possible to fill the full quota of trainees. The majority of those selected are young, long-term unemployed persons, many of whom suffer from one or more of the inherent problems in being unemployed for a long time.

The Leeuwin Foundation and the permanent staff of Leeuwin are well aware of many of the problems and traumas experienced by these young people, but individual needs have to be assessed as each voyage progresses. The burden on the master and officers would be greatly eased if they were advised of any special needs of particular trainees before the voyage commenced. However, in this particular

instance, any immaturity or slowness in learning was not apparent to the young woman's CES Case Manager.

## **Safety harnesses**

There are numerous types and brands of safety harness available on the market, most designed for specific purposes, such as mountaineering, abseiling, potholing and rescue, and not always suitable for other uses. Many harnesses utilise a buckle that requires the free end of the webbing to be passed back through the buckle in order to prevent slipping, however, other types of buckle are available.

Working aloft on a sailing vessel has its unique problems. A safety harness must not include loops that can snag while the wearer is moving about the rigging, and buckles must not be of a type that can snag or trip-release. A harness must also be relatively easy to put on and remove, bearing in mind the need to change working apparel according to the varying climatic changes often experienced at sea. However, almost all of the people consulted considered that a "sit in" type harness (one with leg straps) should be used.

Another factor to be considered is the webbing. The webbing used for the safety belts used aboard Leeuwin is of a fine weave, whereas most safety harnesses now available are constructed of much heavier weave webbing than that used for the Leeuwin safety belt.

Although when tested and fastened correctly the belt held the test dummy, conforming to AS2227, it is considered that it would be appropriate for the Leeuwin Foundation to reassess the safety belt used aboard Leeuwin, against the harnesses used by other sail training establishments.

## Standing rigging

The design of the rigging of Leeuwin is along traditional lines, with access to the tops being by way of ratlines (ladder treads) on the lower mast shrouds and the futtock shrouds, the latter forming an overhang. To make the negotiation of the futtock shrouds to the top a safer task, a continuous safety rail has been fitted, allowing the crew and trainees to do this without having to reposition their safety line during the process.

Although overcoming fear is all part of the training process, it is considered worthy of note that aboard Alan Villiers' square rigged sail training ship Joseph Conrad (1934/6) (ex Danish school ship Georg Stage, built 1882) manropes were rigged from the shrouds to the tops, while aboard the Russian four masted training barque Kruzenstern (ex German Padua, built 1926) there are actual rigging ladders. The rigging ladders aboard Kruzenstern were not part of the original rigging and were presumably added when the vessel was adapted for sail training.

# Conclusions

These conclusions identify the factors contributing to the incident and should not be taken as apportioning either blame or liability.

The trainee fell from the futtock shrouds because, although very frightened, she intentionally let go her hand hold in the belief she would be all right.

The main contributing factors to the trainee's fall to the deck are considered to be:

- The trainee had not fastened her safety belt properly, so that it came undone instead of preventing her from falling further.
- The absence of a safety check system, which meant that the trainee was able to climb aloft with an improperly fastened safety belt.
- The onboard philosophy and procedures that removed the safety barrier of safety belt checks before trainees ventured aloft.

Other factors that are considered to have contributed to the accident are:

- The onboard procedures that allowed a trainee to climb aloft for the first time on the mainmast.
- The absence of an onboard philosophy or procedure whereby a trainee with a slow learning capability is afforded supplementary attention.

It is also considered that the shiny surface of the well-worn, fine-weave webbing created difficulty in the tight fastening of the safety belt, which may have contributed to the trainee not fastening the belt correctly.

It is further considered that the trainee's death was averted only by her left arm hooking over the nock sail sheet.

# 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 final draft of the report, or parts of the report, was sent to the following:

The injured woman trainee.

Master, Mate and Watch Leader of STS Leeuwin.

Chief Executive Officer, Leeuwin Ocean Adventure Foundation Limited.

Area Manager Northern Australia, Department of Employment, Education, Training and Youth Affairs.

A submission was received from the Watch Leader and one on behalf of the woman trainee. The text of the report has been amended where considered appropriate.

The submission on behalf of the woman trainee expressed extreme pleasure at the introduction of the buddy system, agreement that an individuals learning capabilities should be taken into account and stated that the woman :

*“Cannot recall much about day two of the voyage and the instructions about fastening the harness.*

*Doesn't recall previously climbing the mainmast shrouds, but can recall climbing on the rope ladder that extends from the bow of the ship, outwards towards the water (under the bowsprit) on the Tuesday.*

*Recalls that she did do the harness up properly. She recalls that after she fell she realised that she no longer had the harness on, someone pointed out that the harness was still attached to the mast and she recalls saying words like "It must have been my fault, I mustn't have done the harness up properly."*

*Recalls very clearly that she hung on to the extent that her "hands were burning", let go out of pure fatigue and the fact that she could not hang on any longer."*

*The possibility that she was going to die didn't enter her mind as she thought she would be safe, because of the harness.*

*She only thought she might die when the harness came loose."*

# Details of 'LEEUWIN'

|                               |   |
|-------------------------------|---|
| <b>IMO No.</b>                | 8510855   |
| <b>Flag</b>                   | Australian                                      |
| <b>Classification Society</b> | -   |
| <b>Ship type</b>              | Barquentine - sail training vessel              |
| <b>Owner</b>                  | Leeuwin Ocean Adventure Foundation Ltd          |
| <b>Year of build</b>          | 1986  |
| <b>Builder</b>                | Australian Shipbuilding Industries (WA) Pty Ltd |
| <b>Gross tonnage</b>          | 236   |
| <b>Net tonnage</b>            | 99  |
| <b>Displacement</b>           | 300 tonnes                                      |
| <b>Length overall</b>         | 55 m  |
| <b>Length on deck</b>         | 42.04 m   |
| <b>Beam</b>                   | 9 m   |
| <b>Draught</b>                | 3.4 m   |
| <b>Height of main mast</b>    | 33 m  |
| <b>Sail area</b>              | 810 m <sup>2</sup>                              |
| <b>Auxiliary engines</b>      | Two Detroit straight six diesels                |
| <b>Engine power</b>           | Total 388 kW                                    |
| <b>Crew</b>                   | 13 Australian                                   |
| <b>Trainees</b>               | 40  |

# Attachments

Arrangements for access to tops aboard STS Joseph Conrad and STS Kruzenstern

Type of safety harness in use aboard STS Malcolm Miller

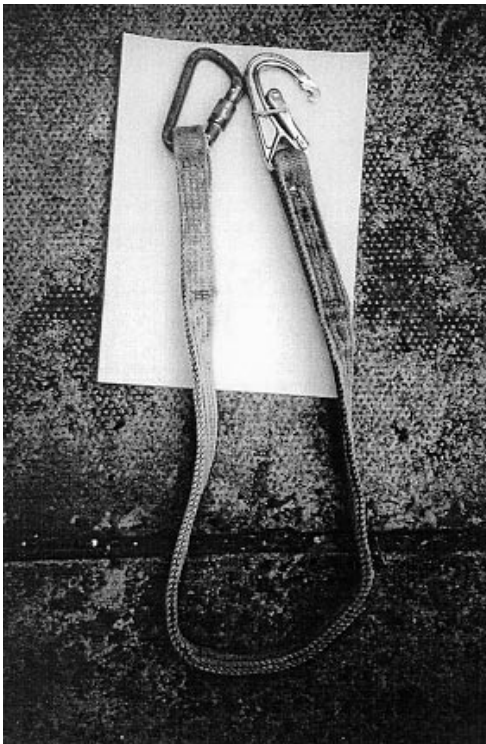
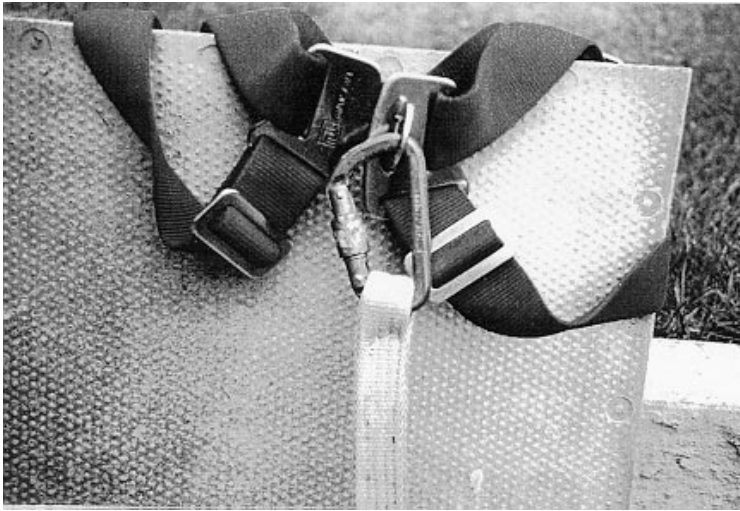


Photo: Ernie McLintok

**Arrangement aboard K Ruzenstern**



**Arrangement aboard "Joseph Conrad"**



Photographs MAIB UK

**Safety harness as used aboard STS Malcom Miller**