Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Marine Occurrence Investigation No.222
Final

Independent investigation into the loss of the
Department of Immigration and Multicultural and Indigenous Affairs vessel

Malu Sara

in Torres Strait, Queensland, Australia
15 October 2005

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Abstract

In the afternoon of 14 October 2005 the six metre Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) vessel *Malu Sara* was returning from Saibai Island at the northern extreme of the Torres Strait to its home community on Badu Island. During the mid afternoon, the skipper reported that he was lost in reduced visibility. There were five people on board: the two male DIMIA crew, two adult females and a four year old girl.

There was no suggestion of panic or distress. With the onset of darkness, at about 1915 on 14 October, the Thursday Island Police took over coordination of the search for *Malu Sara*. The skipper was instructed to activate the boat's emergency position indicating radio beacon and the boat's position was eventually established. Later the skipper reported that he was close to an island and could see a shore light. It appeared that *Malu Sara* was in a sheltered position. At 0215 the skipper again made contact by satellite telephone and reported that the boat was taking on water and sinking.

Despite an extensive search over six days, involving the Queensland Police Service and the Australian Maritime Safety Authority's Rescue Coordination Centre, no trace of the boat was found. The body of one of the females on board was recovered by Indonesian fishermen near Deelder Reef about 50 nautical miles west of *Malu Sara*'s last known position and landed to Indonesian authorities. The body was subsequently repatriated to Australia for burial.

The investigation report covers key aspects of the tragedy including the seaworthiness of *Malu Sara*, the equipment it carried, fatigue and decision-making and regulatory oversight.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau is pleased to report positive safety action in its final reports rather than make formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

1 EXECUTIVE SUMMARY

1.1 Background

At the time of the incident, the then Department of Immigration and Multicultural and Indigenous Affairs (DIMIA)[1] operated a fleet of eight small aluminium vessels, six of which were used by Torres Strait 'Movement Monitoring Officers' to patrol the reefs and islands of the Torres Strait as an element in their role of monitoring persons visiting the Torres Strait 'Protected Zone'. The six existing patrol vessels used were replaced in August 2005 by six new, slightly larger aluminium vessels.

On the afternoon of 14 October 2005 the six metre DIMIA vessel *Malu Sara* was returning from Saibai Island at the northern extreme of Torres Strait to its home community on Badu Island. During the mid afternoon, the skipper reported that he was lost in reduced visibility. There were five people on board: the two male DIMIA crew, two adult females and a four year old girl.

The boat's skipper was in sporadic contact with the DIMIA office on Thursday Island by satellite telephone. There was no suggestion of panic or distress. With the onset of darkness, at about 1915 on 14 October, the Thursday Island Police took over coordination of the search for *Malu Sara*. The skipper was instructed to activate the boat's emergency position indicating radio beacon and *Malu Sara*'s position was eventually established. Later the skipper reported that he was close to an island and could see a shore light. It appeared that *Malu Sara* was in a sheltered position. However, at 0215 the skipper again made contact by satellite telephone and reported that the boat was taking on water and sinking.

Despite an extensive search over six days, involving the Queensland Police Service and the Australian Maritime Safety Authority's Rescue Coordination Centre, no trace of *Malu Sara* was found. The body of one of the females on board was recovered by Indonesian fishermen near Deelder Reef about 50 nautical miles west of *Malu Sara*'s last known position and landed to Indonesian authorities. The body was subsequently repatriated to Australia for burial.

1.2 Findings

The investigation identified that the overall management by DIMIA of the Immigration Response Vessel (IRV) operation was inadequate. The risks of small boat operations had not been assessed at any level and there was no audit system to ensure compliance with existing procedures or to identify deficiencies in them. The investigation found that the IRVs were lacking in safety equipment and that *Malu Sara* did not carry a navigation chart. There were also deficiencies in training of the IRV crews. Critically important was the lack of training in the satellite telephone system and the lubricating oil system for the two-stroke motors.

1 On 24 January 2006, the role of Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) was changed under the Administrative Arrangement Order to the Department of Immigration and Multicultural Affairs (DIMA).

The investigation found that the tender process for the new vessels was sound and involved a wide consultation process. However, the acceptance process was flawed. No proper testing was undertaken to ensure that the vessels were watertight and complied with required and appropriate design and construction standards.

Examination of the remaining IRVs revealed that none met the necessary freeboard or stability requirements and that the reserve buoyancy had been incorrectly calculated. The self-draining system of the cockpit and the outboard motor well was inadequate. The weather decks of four of the boats built after the prototype, and at the same time as *Malu Sara*, were found to leak.

A significant problem lay in the way that the legislative requirements were understood by those representing DIMIA. The new IRVs were required to comply with the provisions under the Navigation Act 1912. Operated as 'Commonwealth ships' under seven metres, the IRVs were exempted from certain provisions of the Act. The regulatory requirements were not clear and required a degree of specialist knowledge that DIMIA lacked.

The investigation found that the DIMIA duty officer on Thursday Island did provide the skipper with a course to steer that would almost certainly have brought *Malu Sara* to a place of safety if his advice had been followed. The probability is that the skipper's disorientation and fatigue led to poor and illogical decisions, critically when he misidentified Mabuiag Island and turned away from it before darkness fell on 14 October.

Initially the search for *Malu Sara* was hampered by low cloud and strong winds. From the morning of 15 October the surface and aerial search coordinated by the Queensland Water Police, and later the Australian Maritime Safety Authority's Rescue Coordination Centre, offered a high probability of success if *Malu Sara* had been afloat.

1.3 Safety actions taken

The following safety actions have been taken in the course of the investigation and with respect to draft recommendations made by the ATSB:

Department of Immigration and Multicultural Affairs (DIMA)

- The Department suspended the fleet of boats from use immediately following the loss of *Malu Sara* on 15 October.
- The Department commissioned a consultant to undertake a review of its Torres Strait operations early in 2006.
- Procurement and contract management procedures will be tightened to ensure that there is appropriate independent, expert advice and oversight where appropriate.
- The management structure and operation of the Thursday Island office will be changed.

- The Department is seeking a meeting of all Commonwealth agencies with a presence in Torres Strait with a view to adopting a 'whole of government' position to clearly define the objectives for the Commonwealth's maritime operations in the area.
- The Department is taking action to improve its management and reporting structure by the development of a North Queensland jurisdiction under a new position of Deputy Director based in Cairns.
- The Department has established a small team from the National and Brisbane Office to oversight implementation of the recommendations.

Australian Maritime Safety Authority (AMSA)

- AMSA and Maritime Safety Queensland are cooperating in the development and implementation of a joint Torres Strait Maritime Safety Strategy.
- The strategy will target community involvement, education, regulation and strengthening the maritime safety culture in the region. An early focus of the Strategy will be the thorough review of Marine Orders Part 62 and its application to smaller Commonwealth vessels in the Torres Strait region.
- Australian Government departments and agencies operating vessels under Marine Orders Part 62 and a 'Letter of Survey' from AMSA will be required to provide positive confirmation of their compliance with Australian Standard 1799 (Small Pleasure Boats Code). Strengthened requirements for compliance with the Marine Order, including crew qualifications, the wearing of Personal Floatation Devices by crew and passengers when vessels are underway and the carriage of a 406 MHz distress beacon, marine VHF radio and appropriate navigational equipment for the area will be introduced.

Maritime Safety Queensland (MSQ)

- MSQ has conducted a review of the ships in current Queensland survey built by the same builder.

1.4 Further recommendations

In releasing this final report the ATSB has made additional safety recommendations including the following general recommendations to the builder of the IRVs and all Rescue Authorities:

- Subee Explorer Pty Ltd should review their vessel designs, methods of construction, testing, certification, equipping and quality assurance system with a view to ensuring that vessels meet the required statutory and/or contracted standards.
- Search and rescue authorities should consult with satellite and other mobile telephone service providers to determine under what circumstances useful information from satellite telephones and switch records could aid search and rescue operations under certain conditions.

2 SOURCES OF INFORMATION

Officers of the Department of Immigration and Multicultural and Indigenous Affairs

Subsee Explorer Pty Ltd

Queensland Police Service

Queensland Coroner

The Australian Maritime Safety Authority

The Australian Hydrographic Service

Bureau of Meteorology

Geoscience Australia

Australian Customs Service

Australian Quarantine and Inspection Service

Clipper Hull Surveyors (N.Q.) Pty Ltd

Maritime Safety Queensland

Globalstar Australia Pty Ltd

SingTel Optus Pty Ltd

Mercury Marine Australia

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Commonwealth *Navigation Act 1912* as amended.

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Marine Orders Part 62 - Commonwealth Ships, Australian Maritime Safety Authority, 2003.

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Australian Standard AS/NZ 4360:2004, Risk Management

Caldwell, J.A., & Caldwell, J.L. (2003). 'Fatigue in aviation. A guide to staying awake at the stick' Ashgate Publishing Limited: England.

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3 NARRATIVE

3.1 *Malu Sara*

Malu Sara (Figures 1 and 2) was an Immigration Response Vessel (IRV) operated by the then Department of Immigration and Multicultural and Indigenous Affairs (DIMIA)[2]. As a 'Commonwealth ship'[3] defined by the Commonwealth *Navigation Act 1912*, the vessel was under the regulatory jurisdiction of the Australian Maritime Safety Authority (AMSA) and had been issued with a 'Letter of Survey' in accordance with the provisions of Marine Orders Part 62 made pursuant to the Act.

Figure 1: ***Malu Sara***

Malu Sara was built in 2005 by Subsee Explorer Pty Ltd (Subsee), in Cairns, Queensland. The vessel was of a centre console configuration, constructed of welded plate aluminium alloy. It had a designed overall length of 6.65 m, a designed measured length of 5.90 m, a breadth of 2.15 m and a draft of 0.45 m. The vessel was designed to carry up to six people or a maximum of 510 kg.

Malu Sara's hull form was a scaled down version of a seven metre vessel built by Subsee in 1993 and a similar eight metre vessel built in 1995. Both of these vessels were designed by Subsee's director and Jeff Glanville & Co, Naval Architects, and surveyed by the Queensland Department of Transport.

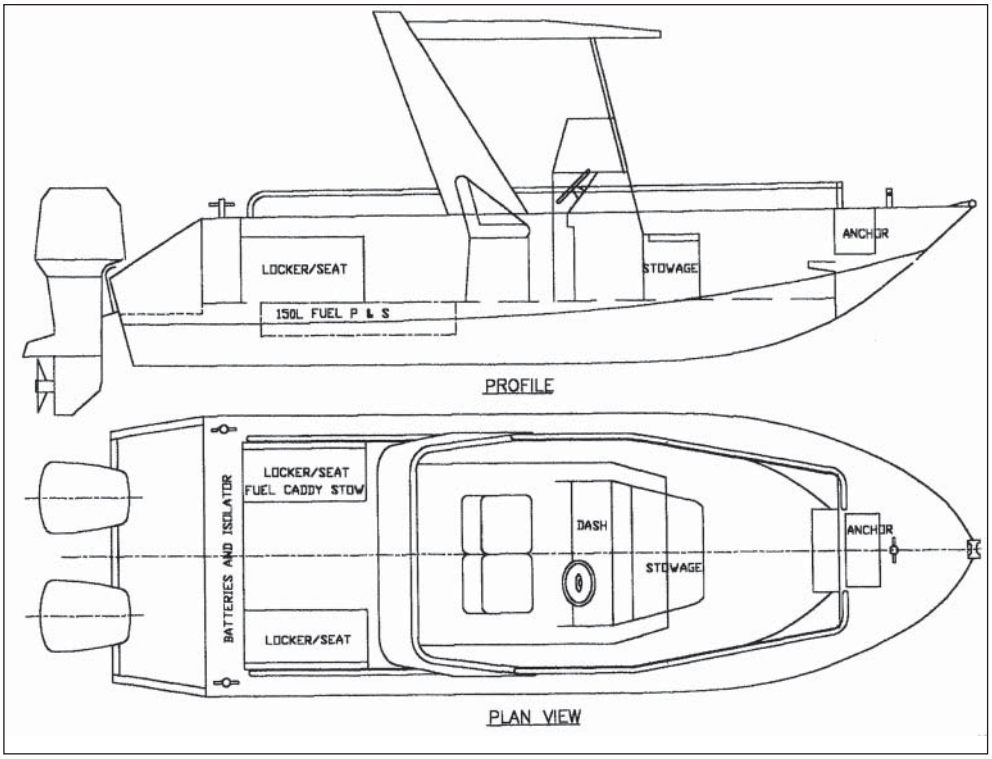
2 On 24 January 2006, the role of Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) was changed under the Administrative Arrangement Order to the Department of Immigration and Multicultural Affairs (DIMA). This report refers to DIMIA with the exception of section 6, Safety Actions.

3 In this case the *Navigation Act 1912* defines a 'Commonwealth ship' as a ship 'that belongs to the Commonwealth or to a Commonwealth authority.'

The layout of the vessel was similar to most centre console vessels, with the helm console located in the midships position, just forward of the mid point of the vessel (Figure 2). The console, fitted with a large Perspex windshield, housed the navigation and communication equipment, engine controls and the steering system. A large fabricated aluminium canopy was fitted over the console and helm position.

Internally, *Malu Sara*'s cockpit was formed by the port and starboard bulwarks and a transverse bulkhead at the after end (cockpit transom). Aft of the cockpit, was a motor-well formed by the port and starboard bulwarks tapering down to a low transverse bulkhead at the stern (motor-well transom). The deck of the motor-well was formed by a flat plate welded over the underdeck framing.

Figure 2: Drawing of the DIMIA vessel



The cockpit deck formed the weather deck and was designed to be watertight and self-draining. It was arranged to drain any water shipped into the cockpit, first to the motor-well through two scuppers[4] port and starboard in the cockpit transom (Figure 3), and then overboard through a single freeing port[5] located centrally in the motor-well transom (Figure 4). Located below the raised foredeck, cockpit floor and outboard motor-well was a void space. The void space contained the vessel's longitudinal and transverse framing and a watertight casing surrounding the fuel tank. The watertight below-deck void space was designed to provide the vessel with a specified volume of reserve buoyancy.

4 A pipe or tube from a deck or cockpit to drain water overboard, as defined in AS 1799.

5 Any direct opening through a boat's bulwarks above the weather deck to rapidly drain water overboard, as defined in AS 1799.

Figures 3: Scupper

Figures 4: Freeing port

Two seats were provided for the helmsman and a passenger immediately aft of the helm console. Further seating for passengers was provided on top of fixed, fabricated aluminium equipment lockers, on the port and starboard sides aft of the console. Forward of the helm position the vessel was open with a further seat

provided on top of a fixed locker on the forward side of the helm console. There was a small foredeck which housed the anchor well.

Malu Sara's navigation equipment consisted of a magnetic compass, navigation lights and two Danforth type anchors which were fitted with short lengths of chain and 50 metres of anchor rope. The IRV's safety equipment included a 121.5/243 MHz emergency position indicating radio beacon (EPIRB), lifejackets, flares, a fire extinguisher, bailing buckets, a 'V' sheet, first aid kit, tool kit, paddles and two hand-held torches.

Communication equipment consisted of a hand-held satellite/CDMA telephone operating on the Globalstar Australia network. The vessel was fitted with a 'hands-free' system for the telephone including a telephone cradle/charger fitted inside a box mounted on the helm console, a remote aerial mounted on the top of the canopy, an external speaker and a remote microphone. A feature of the Globalstar satellite network and the telephone carried by *Malu Sara* was the ability to download the telephone's current position coordinates during a telephone call[6].

A manual bilge pump (Figure 21) was mounted on the cockpit transom. The piping for the bilge pump was arranged to draw water from either the void space under the cockpit floor or from a gutter on the port side of the cockpit floor (Figure 3), selection being by a two-way suction valve. The pump discharge was led through the cockpit transom and into the motor-well.

Propulsive power was provided by two Mercury Marine 3-cylinder, 90 horse power, two-stroke, outboard motors which used standard unleaded petrol. Both motors were mounted on the motor-well transom at the stern of the vessel. Fuel for the motors was stored in the fuel tank, located below the cockpit floor, which was divided into two separate 150 litre tanks by a centreline division plate.

Like most two-stroke motors, *Malu Sara*'s outboard motors used a total loss oil lubrication system with the oil being burned during the combustion process. Unlike more conventional two-stroke outboard motors, where the oil for lubricating the motor is mixed directly with the fuel, *Malu Sara*'s motors used a variable ratio oil injection system. Lubricating oil was led from a 3.78 litre tank (Figure 5), mounted under the engine cowl, to a pump and a variable ratio valve and then into the motor's crank case. The amount of oil injected for this type of system is dependent on the throttle setting but the average fuel/oil ratio is 45–50:1. This meant that a full tank of lubricating oil was sufficient for between 170 and 190 litres of fuel. The lubricating oil tank was fitted with a low level alarm to indicate when the tank had approximately 500 to 750 millilitres of oil remaining.

6 It is important to note that neither the crew of the vessel nor any of the people involved in the initial stages of the incident were aware of this feature of the telephone at the time.

Figure 5: Two stroke oil tank

The DIMIA procedure manual for the IRVs stated that they had a nominal range of about 125 miles[7] at 20 to 25 knots when fully laden. In addition, the vessels were equipped with two 20 litre portable fuel caddies as a back-up supply.

3.2 Torres Strait – DIMIA operations

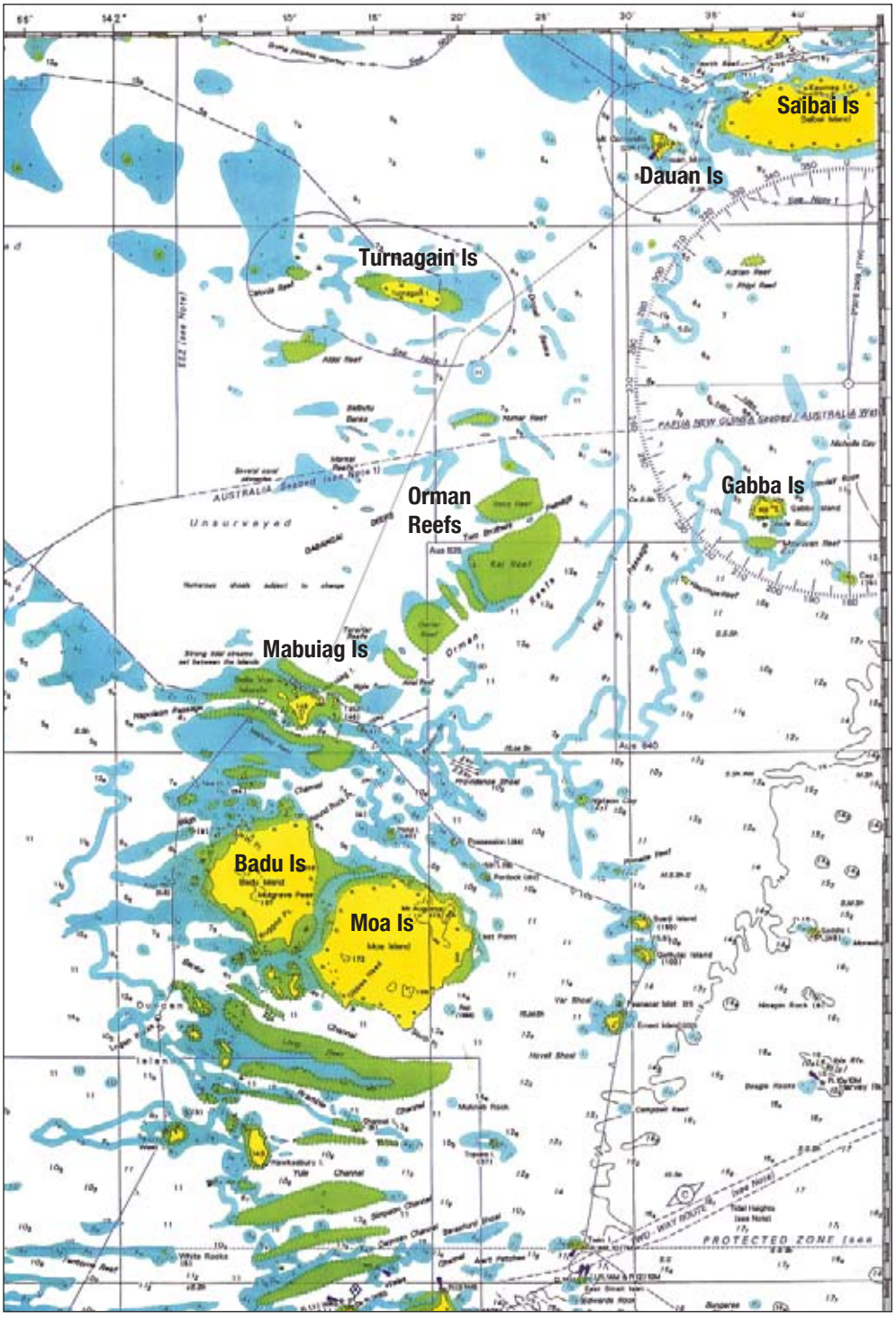
Torres Strait lies between Cape York and the south-west coast of Papua New Guinea with a minimum width of about 80 miles (Figure 6). It is archipelagic and generally shallow with depths of less than ten metres, except in the shipping channels. The Strait is subject to strong tidal streams, particularly towards the south, with flows of up to eight knots at Hammond Rock during spring tides.

The population of Torres Strait is about 8600. There are some 150 islands, reefs and cays of which 18 are inhabited, the main administrative centre being Thursday Island.

The 1985 Torres Strait Treaty between Australia and Papua New Guinea makes provision for a 'protected zone' within which Torres Strait Islanders and certain coastal people of Papua New Guinea carry on their traditional way of life. This traditional life relies heavily on the ability to move within the Strait and travel between islands, normally by boat. Given the depth of water and the demands of the people, these boats tend to be small with shallow draughts.

7 Miles refers to nautical miles, 1852 metres.

Figure 6: Torres Strait north of Prince of Wales Channel



DIMIA is the Australian Government department which has the responsibility for managing immigration and population border control. In Torres Strait this includes the traditional movement of people throughout the 'protected zone'. DIMIA has a regional office on Thursday Island staffed by four full-time employees; a regional manager; an office manager; and two other administration officers. The full-time DIMIA staff are supported by 32 (27 at the time of the incident) part-time movement monitoring officers (MMOs) based in 14 communities on the 13 inhabited islands in the Torres Strait Protected Zone. The MMOs work

under the supervision/direction of one of the two administration officers based on Thursday Island (who act as 'team leaders'). The MMOs work closely with their local community. They report on any non-traditional incursions by individuals or vessels into their area of responsibility.

The DIMIA vessels are stationed on Badu, Dauan, Mabuiag, Mer, Yam and Yorke Islands. The IRVs are primarily used to conduct periodic patrols in the areas around their islands. They are normally crewed by two MMOs; a skipper and another MMO acting as crew.

3.3 *Malu Sara*'s crew

The skipper of *Malu Sara* was a 35 year old Torres Strait Islander from Badu Island. He had been working as a contracted MMO for DIMIA since August 2001 and then became a casual MMO in June 2004 when the structure of the MMOs' employment changed.

Malu Sara's skipper had been a crew member on the original Badu Island IRV. When the original skipper resigned in May 2003 he had been appointed as the new senior MMO on Badu Island and the skipper of the island's IRV.

Like many islanders, he had experience as a cray fisherman. He had also worked on a pearl lugger based in Darwin before returning to Badu Island. He owned his own aluminium boat with an outboard motor. The sea around Badu Island and the waters and reefs to the north were well known to him. He was reported as being fit and well.

In August 2001 the skipper attended a 'Small Vessel Handling Course' formulated and conducted for DIMIA by the Thursday Island Water Police. This course included a day of class room instruction in basic legislation, buoyage[8], navigation, vessel operation and search and rescue. A second day of practical work on vessel preparation, manoeuvring, emergency operation and retrieval and wash-down completed the course. The Tropical North Queensland Institute of TAFE issued a 'Statement of Attendance' to those who participated in the course. In October 2002 the skipper attended a first aid course and obtained a Queensland Ambulance Service 'Statement of Attainment' in first aid.

Malu Sara's regular crew member was a Torres Strait Island man in his fifties. He also had extensive experience navigating in the Torres Strait and had a background in the army reserve, and as a community policeman. He was reported as being fit and well.

8 Codes of practice used internationally under which buoys (and other navigation aids) of various shapes and colours are used for the same navigational purpose.

3.4 Immigration response vessels

3.4.1 History

In 1998 a decision was made by DIMIA to equip some of the MMOs of various communities throughout Torres Strait with small vessels in which to patrol the waters adjacent to their islands. The decision followed Australian Government concerns relating to unauthorised movements in the Torres Strait Protected Zone and the adequacy of coastal surveillance in the area. Before this time the MMOs had undertaken periodic sea patrols, which they had organised with either the Australian Customs Service or another government agency operating vessels in the area. A business case was made for funding the original IRV project which was approved through DIMIA's head office in Canberra.

DIMIA's regional manager on Thursday Island at the time spent the next 12 months or more consulting with the MMOs, other agencies operating small vessels in Torres Strait and regulatory authorities before preparing and letting the tender for the supply of the original six IRVs.

The original IRVs were supplied in 1999. These boats were standard production line 5.6 m pressed aluminium Bermuda 'Wave Breaker' centre console vessels and were registered in Queensland. They were supplied and maintained by a Thursday Island company. Each boat was powered by a pair of 60 hp outboard motors, which had to be manually started, tilted and trimmed.

When the original IRVs arrived on Thursday Island, they were subjected to a number of trials, tests and surveyed by an independent marine surveyor. The tests included a swamp test of one of the vessels. DIMIA staff, including the MMOs who would be operating the vessels and a representative from the company who had supplied them, were present during the testing and survey. During this period the MMO skippers were also provided with training on the vessels and their equipment before the IRVs entered service on the outer islands.

3.4.2 Management and the IRV replacement programme

At the end of 2002 the DIMIA regional manager on Thursday Island was transferred. The position was advertised and subject to an open recruitment process. Selection was based on a generic DIMIA Executive Level 1 duty statement and work level standards. The documents against which the applicants were to be assessed contained five general areas – Work Level Description, Operational Demands, Judgement, Task Description and Contribution to Departmental Outputs – and a description of the 'Specific Skill Requirements'. In no part of the document were any duties or issues relating specifically to DIMIA's Torres Strait operations identified. There was no mention of the MMO scheme or managing the six IRVs.

The successful candidate was an external applicant, an Australian Federal Police Officer already based on Thursday Island. A priority for the new regional manager was the replacement of the small fleet of six DIMIA IRVs. The original boats had

been in service for five years and were nearing the end of their effective service life. The vessels also had a reputation for being 'wet' boats and lacked comfort for prolonged operations. In February 2004, a business case to replace the IRVs, signed off by DIMIA's Queensland director and supported by the division head, was approved by DIMIA's finance committee as part of the 2004–2005 Capital Plan.

The regional manager on Thursday Island recognised that he had little experience of boats and little marine knowledge. His intention was to provide boats that were easy to handle, 'dry' and that would give greater comfort for the crews. Before developing the tender document for the new IRVs, the skippers of the existing boats were consulted for their views and recommendations.

After seeking some initial advice from AMSA and other Commonwealth agencies the regional manager realised that the new IRVs would be classified as 'Commonwealth ships' and should come under Commonwealth survey. He consulted with AMSA again who advised him that the requirements of *Marine Orders Part 62- Commonwealth Ships* would apply. This involved approval of the first year's maintenance schedule and the standard operating procedures with particular regard to operational risk assessment. The regional manager was provided with a pro forma letter by which the vessel operator should request a 'Letter of Survey' for a Commonwealth vessel less than 7 metres. This pro forma, headed 'Safety Inspection of Commonwealth Vessel less than 7 metres in length', required the applicant to declare, among other things, that the vessels covered by the application had been built to AS 1799 (Small Pleasure Boats Code)[9].

Consistent with the operation of the existing boats, the regional manager understood that all skippers must hold a current 'Recreational Ship Master's Licence' and an appropriate first aid certificate.

In October 2004 the regional manager also consulted Maritime Safety Queensland as to the State legislation governing the construction and equipment for vessels less than six metres. He was advised that such vessels had to meet the positive flotation requirements of section 66 of Queensland's *Transport Operations (Marine Safety) Regulations 2004* and the safety equipment requirements of the USL Code. He was also told that compliance with, Australian Standard 1799 for construction and Australian Standard 1665: 2004 for aluminium welders qualifications, was very desirable.

In developing the vessel specification for the tender document the regional manager invited a number of government agencies to provide advice. The Queensland Police Service (QPS), the Royal Australian Navy (RAN) and the Army[10] were consulted. A draft specification was sent to the Australian Customs Service, who provided comment and advice on the proposed specification.

The regional manager then sought approval from his superior in DIMIA's state office to proceed to tender and then prepared the final request for tender documentation in consultation with a senior contracts adviser from DIMIA's

9 Australian Standard 1799 sets out the requirements for maximum load, persons, power capacity and for reserve buoyancy, stability and testing of power boats up to 15 metres in overall length. The Standard stipulates specific normative tests to be conducted for weathertightness and watertightness.

10 The Army's 51st Battalion, has a unit based on Thursday Island which specialises in small boat operations.

national office. The tender was then advertised and eight tenders were received by the closing date of 11 February 2005. To evaluate the tenders the regional manager set up an evaluation team with representatives of the RAN, the Army and the QPS, an officer from the DIMIA procurement area and one of the MMO team leaders from the Thursday Island office. In the event, the delegate from the QPS was unable to participate because of operational duties. The tenders were subject to close evaluation and the vessel proposed by Subsee Explorer Pty Ltd, of Cairns with a proposed design length of 5.9 m was selected as being suitable and offering the best value for money.

A contract was subsequently prepared and agreed with Subsee for the supply of six IRVs with the regional manager nominated as DIMIA's 'project officer'. In addition to the usual legal, insurance and completion provisions, the contract contained a detailed description of the proposed vessel, equipment to be fitted, standards of construction and required certification.

The vessels were to be constructed in accordance with the Uniform Shipping Laws (USL) Code and the Australian Standard 1799 and in compliance with the Queensland *Transport Operations (Marine Safety) Regulations 2004*. The contract also made provision for a prototype vessel to be delivered to Thursday Island within seven weeks of the contract signing. The prototype vessel was to be subjected to various acceptance tests, stipulated in the contract (including a sea trial), so minor alterations may be made to the remaining five vessels to be constructed.

The prototype IRV was delivered to Thursday Island on 15 May 2005. The skippers of five of the six existing IRVs, including the skipper of the Badu Island boat, met on Thursday Island and took part in sea trials on the prototype IRV. The boat was reported to have performed well and met with the general approval of the skippers. In conjunction with one of the team leaders from the Thursday Island office, a list of suggested modifications was developed and submitted to Subsee. Most of the modifications were minor in nature but one related to a modification to the deck of the outboard motor-well. This involved changing the deck of the well from a 'V' configuration to one that was flat.

Based on the acceptance at the prototype trial and the modifications Subsee embarked on the building of the remaining five vessels. On 16 June Subsee confirmed that the remaining boats were on schedule for completion by 16 July. The boats were in fact completed by early August and were stored in the builder's yard awaiting finalisation of the DIMIA hull signage.

The regional manager made two visits to the builder's yard and took photographs while the boats were being built. Throughout this period, oversight of the construction and testing of the vessels was left to the builder. DIMIA did not engage an independent marine surveyor to monitor the building or to survey the vessels after they were completed.

On 21 and 22 August the five remaining IRVs were delivered to Thursday Island.

On 24 August the Thursday Island regional manager wrote to AMSA's area manager for maritime operations, declaring in the pro forma letter previously provided by AMSA that:

- the six vessels had been built to Australian Standard 1799
- he was the officer responsible for the safe operation of the six vessels
- the vessels were equipped and manned taking into account the area, time and duration and the navigation and weather hazards that may be encountered
- a planned maintenance programme was in place and available for inspection covering the structure, machinery, equipment, lifesaving appliances and communications equipment
- a risk assessment was conducted before each voyage and
- the vessel's area of operation was the partially smooth waters of Torres Strait.

In addition to the letter he attached a copy of the vessel standard operating procedures and the pre-patrol checklist.

On 2 September, after accepting the regional manager's declarations and assessing the accompanying procedures and checklist, AMSA's manager for maritime operations, (North), issued a 'Letter of Survey' for the six new IRVs which was posted to the DIMIA regional manager on Thursday Island.

On Monday 29 August 2005 the six new IRVs were commissioned and in the following week were delivered to the outer islands.

3.4.3 Operational procedures

At the time of the incident DIMIA had a set of standard operating procedures for their IRVs. These had been in use since the first IRVs were commissioned and had been modified slightly when the new IRVs were commissioned to reflect the differences in the two vessel types. The procedures contained various instructions for the MMOs including a description of the administrative processes associated with operating the vessel and also operational information and a pre-patrol checklist.

Before embarking on a routine patrol or planned operation the procedures required that the MMOs submit a 'Tasking Request Form' to the Thursday Island office. The request form detailed the proposed patrol area, date, the anticipated times of reporting from way-points and the IRV's crew. The request was to be approved in writing by the regional manager before a routine patrol was undertaken. Following the patrol the MMOs had to complete a 'Post Patrol Report' with a completed pre-patrol checklist attached in addition to a fuel request. For search and rescue operations, the procedures allowed for verbal approval by the regional manager as these operations may be conducted at short notice at any time of the day.

The operating procedures also contained information and instructions relating to the operation of the IRVs, including limits of operation in terms of area, time of day, duration, weather and crew qualifications. There were also instructions relating to personnel safety, safety of navigation and periodic position reporting during operations.

The DIMIA records showed that after taking delivery of *Malu Sara* in early September, the vessel's regular skipper had completed one routine patrol on 17 September. This involved about five hours on passage around Portlock Island to the north of Moa Island and Mount Ernest to the east. This patrol covered a distance of about 45 miles and was completed with his regular crew member and one other. Other than a damaged port sidelight no other defects with the vessel were noted in the post patrol report. The accompanying fuel request indicated that the skipper had refuelled *Malu Sara* with 100 litres of petrol. There was no record of any oil purchased to replenish the outboard motor oil tanks.

3.5 The Incident

3.5.1 Workshop on Saibai Island

From 8 to 13 October 2005, DIMIA held an annual training workshop for their Torres Strait MMOs on Saibai Island. The workshop participants included the regional manager, the office manager from Thursday Island and 22 of the 27 MMOs. One of the two MMO team leaders remained on Thursday Island as the duty officer during the workshop (the other team leader was on annual leave at the time).

Most of the workshop participants travelled to Saibai Island on charter aircraft on Friday 7 October. Three of the IRV skippers were tasked to bring their vessels and crews to Saibai Island. Originally the Mabuiag Island boat, *Ngagalayg*, was nominated to travel the 45 miles to Saibai Island together with *Kang* from neighbouring Dauan Island (a passage of about five miles) and *Magani Guthat* from Yam Island (a passage of about 39 miles). However a sick family member meant that the Mabuiag Island skipper could not attend the workshop and so *Malu Sara* from Badu Island was substituted. The intention was to use the vessels during the workshop for various exercises and to provide the MMOs with some training on the vessels.

On the morning of 7 October, *Malu Sara*'s skipper contacted the Thursday Island DIMIA office to arrange a replacement boat key as he had misplaced his. A spare key was subsequently dropped off at Badu Island by the regional manager on his way by helicopter to Saibai Island that afternoon. As it was getting late in the day, the skipper made the decision to wait until the following morning before leaving for Saibai Island.

The following morning, 8 October, *Malu Sara* left Badu Island for the 58 mile passage to Sabai Island with the skipper, his regular crew member and the partner of the crew member on board (who had been approved to travel). After leaving Badu Island, they stopped briefly at the Kubin community, on Moa Island, to pick up another MMO before resuming a northerly passage to Saibai Island. The weather at the time was less than ideal with south-easterly winds of around 20 knots, however for much of the passage the wind and seas were astern of *Malu Sara* and so the IRV rode comfortably at a good speed.

While en route and south-east of Turnagain Island, the Moa Island MMO on board *Malu Sara* made contact with the duty officer on Thursday Island to report that the fuel vapour sensor in the boat had been alarming intermittently. The duty officer suggested that they check the motors and following this advice, the skipper found that the level in the lubricating oil tanks on both motors was low. The skipper had forgotten to bring spare oil and so he contacted the duty officer again to inform him of the situation. The duty officer then made contact with the regional manager on Saibai Island who arranged for the Dauan Island boat, *Kang* (which had already arrived on Saibai Island), to take a supply of oil out to *Malu Sara*. The two boats rendezvoused, and, after topping up the oil tanks on *Malu Sara*'s outboard motors, completed the passage to Saibai Island in company.

During the week of the workshop, *Malu Sara* was used in two training patrols, both on Wednesday 12 October. During the morning patrol around the northern side of Saibai Island, an outboard motor stopped without apparent reason. It was restarted and no further problems with the engine were reported.

Malu Sara's second workshop patrol was that afternoon. During the patrol the vessel was stopped and anchored on the southern side of Saibai Island, with five MMOs on board. While the vessel was anchored, the MMOs noticed that an alarming quantity of water was entering the cockpit through the scuppers in the cockpit transom. The freeing port in the transom of the motor-well was submerged and the motor-well was almost full of water, which was flowing into the cockpit through the scuppers. Three of the MMOs used the manual bilge pump, a bucket and a container to bail water out of the cockpit while one of the others weighed the anchor and the skipper started the motors to get *Malu Sara* under way. Once the vessel was moving forward the remaining water flowed out of the cockpit through the scuppers. Later a plastic bag was found at the after end of the cockpit. It was assumed that this was responsible for the flooding as the MMOs thought that it may have been preventing a scupper flap from closing.

After completing the patrol, the crew in the boat noticed that *Malu Sara* appeared to be sitting low at the stern and reported it to the regional manager. The regional manager went down to the jetty and found the skipper and another MMO using the bilge pump to pump out the cockpit. The regional manager told the skipper to try the pump on the void space under the cockpit. The skipper changed over the suction valve on the pump and found that there was a quantity of water in the void space which he pumped out. He then checked the drain plug for the void space on the motor-well transom and also the inspection port for the space in the motor-well and found them to be secure. The regional manager told the skipper to check the vessel regularly overnight while it was floating tied up to the jetty. The skipper was seen making regular checks on the vessel, and no further problems were reported throughout the following day, the final day of the workshop.

During the afternoon of Thursday 13 October, one of the MMOs recalled overhearing a conversation between *Malu Sara*'s skipper and the regional manager in the DIMIA office on Saibai Island. The gist of the conversation was the skipper telling the regional manager that neither he nor his crew member felt confident to take *Malu Sara* back to Badu Island. He apparently asked the regional manager whether the two men could stay an extra day on Saibai Island and ship the boat

back to Badu Island on a barge. The regional manager is said to have declined permission and apparently indicated that the department could not cover the additional cost. (During the investigation the ATSB sought to substantiate this conversation with the regional manager. He did not recall the conversation or indeed any conversation with *Malu Sara*'s skipper on the afternoon of 13 October.)

After the workshop was completed on Thursday 13 October, a barbecue and dance were held in the communal meals area. The festivities were attended by all of the DIMIA staff and members of the local community who had provided the catering for the workshop. After the barbeque some of the DIMIA staff went to a disco which went on until the early hours of the following morning. One of the DIMIA staff saw *Malu Sara*'s skipper still up and talking with some of the island men in the communal area at about 0330.

On the morning of Friday 14 October, the DIMIA staff prepared to leave Saibai Island. A borrowed vehicle was used to transfer bags and generally move staff about. The skipper of *Malu Sara* took a turn at driving the vehicle and he was reported as being fit and capable. At the airport the regional manager was approached by the skipper of *Malu Sara*, who asked permission to take a passenger for the passage back to Badu Island. The regional manager refused permission and indicated that the vessel was tasked to carry only the skipper and his crew member.

Those returning home by air, including the regional manager, left the island at about 0930.

During the morning the IRV crews prepared the vessels for their respective passages back to their home communities. One of the other MMOs assisted *Malu Sara*'s skipper with refuelling the boat and later confirmed that the fuel tanks were filled to capacity before the vessel departed Saibai Island. At the time, the wind was from the south-east with a speed recorded at Coconut Island at 0900 of 15 knots and at Horn Island an average of 18 knots with gusts to 24 knots. The sea was assessed as moderately rough and the visibility was relatively poor with Dauan Island not visible from the settlement on Saibai Island (a distance of four to five miles). The temperature for the day was recorded as varying between 28 and 30°C with a relative humidity of 71 per cent.

Initially the plan was for *Magani Guthat* (the Yam Island IRV) and *Malu Sara* to leave at about 0900 and travel together as far as Two Brothers (Gabba Island). The boats would then separate to complete the journey to their respective Islands. This would have allowed some four hours (until about 1300) with a west going tidal stream and flatter sea conditions for most of the passage south (as the wind from the south-east would not have been opposing the flow of the tide). However by 1015, *Malu Sara*'s crew member had not arrived at the boat ramp and so *Magani Guthat* departed without *Malu Sara*.

During the morning, the crew member of the Dauan Island IRV, *Kang*, had a conversation with *Malu Sara*'s skipper and expressed concern about the lack of visibility and the sea state, and offered the skipper accommodation on neighbouring Dauan Island until the weather improved. The chief concern of the crew member

of the Dauan Island IRV was the visibility. *Malu Sara*'s skipper declined the offer, stating that he would make for Turnagain Island and then follow a route on the western side of the Orman Reefs[11] south to Mabuiag Island and then on to Badu Island. This plan would mean for much of the passage south that *Malu Sara* would be travelling in better conditions in the lee of the reefs.

At about 1100 the regional manager and office manager arrived back at the DIMIA office on Thursday Island. The regional manager told the office manager to go home and get some rest while he stayed in the office until about midday before going home. Before leaving the office he asked the duty officer, the MMO team leader who had not been to the workshop, to remain as 'duty officer' and to keep the DIMIA mobile telephone until the early evening, when the regional manager would take over.

At about 1115, *Kang*, left the boat ramp on Saibai Island for the passage back to Dauan Island after getting some assistance from *Malu Sara*'s skipper to start one of the outboard motors.

3.5.2 *Malu Sara*'s passage from Saibai Island

Note: There are two sources of information upon which a reconstruction of *Malu Sara*'s voyage from Saibai Island can be based. One is based on the records of conversations with the skipper kept by the DIMIA duty officer and the Queensland Water Police mission coordinator. The other is based on the approximate position of the transmissions from *Malu Sara*'s satellite telephone established by triangulation (refer to Figure 7). (This information was provided by the satellite telephone service provider after the incident). The accuracy of the triangulated positions depends on the number of satellites 'visible' to the telephone at the time of a call. Accuracy varies from 800 m (0.4 mile) to a maximum of 25500 m (13.7 miles). The consistency of the various positions over time allows a judgement to be made on the reliability of the triangulated positions.

At 1222 on 14 October *Malu Sara*'s skipper contacted the DIMIA duty officer on Thursday Island to report that the vessel had left Saibai Island with five persons on board. These were the skipper and his regular crew member, two adult females (including the crew member's partner) and a four year old child (daughter of the other adult female). In addition to the passengers and crew *Malu Sara* had been loaded with 40 kg of mud mussels, a roll of grass matting and the personal effects of the people on board. Some food had also been procured for the passage.

The skipper informed the duty officer that he intended to travel to a point east of Turnagain Island, and then to the west of the Orman Reefs to Mabuiag Island and then on to Badu Island. Turnagain and Mabuaig Islands would be the reporting points. At the time, the wind was still from the south-east and had increased slightly to about 17 knots[12]. The tide was on the ebb and, based on the tidal stream at Hammond Rock, the current would have been west going.

11 Orman Reefs extend north-east of Mabuiag Island and include Numar, Beka, Kai, Gariar, and Anui Reefs.

12 The wind force and direction is approximate only. The closest weather station is Coconut Island about 50 nautical miles south-east of Saibai Island and 50 nautical miles east of Badu Island. The recordings at this station are automatic and provided every 3 hours. Hourly forecasts are given at Horn Island, about 25 nautical miles south of Badu Island and 75 nautical miles south of Saibai Island.

At 1408 the skipper telephoned the DIMIA office and informed the duty officer that *Malu Sara* was on the 'front side' (south-eastern side) of Turnagain Island.

This is consistent with the satellite telephone position (accurate to within 5 miles) which places *Malu Sara* in position 09° 35.82'S 142° 15.2'E, within 2.5 miles of an estimated position off Turnagain Island.

The skipper said that he would call again from Mabuiag Island, a further 21 miles to the south. The duty officer advised the skipper 'to keep in touch' and call again when in the sheltered waters behind the reefs to the south. The wind at the time was from the south-east at about 18 knots.

Between 1554 and just after 1557, *Malu Sara*'s skipper rang the Thursday Island office on four occasions. He told the duty officer that he was 'a bit lost in a fog'. The duty officer asked whether he had seen the reef, to which the skipper replied in the negative. The skipper reported that everybody on board was well and he had plenty of fuel. He had been able to keep the vessel on the plane[13], (a speed of 13 knots or thereabouts), and that the vessel was 'alright'. He told the duty officer that he had steered due south for about one hour and then steered due west for about thirty minutes after leaving Turnagain Island.

The satellite telephone position is at odds with this description. A series of four positions indicated that *Malu Sara* was within 1.8 miles of 09°40'S 142° 06'E, about eleven miles west-south-west of the 1408 position and 12 miles west-south-west of the western point of Turnagain Island.

During this conversation, the duty officer calculated *Malu Sara*'s approximate position based on the courses and speeds estimated by the skipper and the navigation chart in the DIMIA office. He then advised the skipper to steer 160° (C)[14] or 170° (C) to get into the lee of the reefs and towards Mabuiag Island.

The duty officer recalled that the next scheduled call was at 1700. He attempted to call *Malu Sara* at 1625, and 1750. At about 1715 the duty officer left the DIMIA office and went home. He diverted the office telephone to the on-call mobile telephone which he took with him.

At about 1800, the regional manager telephoned the duty officer from his home to check that the three IRVs had arrived safely at their respective islands. The duty officer explained that *Malu Sara*'s skipper had not yet reported his arrival. The manager asked the duty officer to retain the on-call mobile telephone and to continue to monitor events. At 1805 the duty officer attempted to call *Malu Sara* again but was unsuccessful.

At 1813, the duty officer contacted the skipper's cousin on Badu Island to see if *Malu Sara* had arrived, but had not yet reported in. The skipper's cousin reported back to say that the vessel had not yet arrived.

At 1822 the duty officer received a call from the skipper, which was broken after 54 seconds. The duty officer then rang the vessel's satellite telephone and re-established contact. The skipper reported that he had steered the course the duty

13 'To plane', a term used to describe the action of a boat which attains sufficient speed to cause the forward part of the hull to rise and for the boat then to run along the surface of the water.

14 (C) refers to a compass heading.

officer had given him and that they had sighted an island, which the skipper believed to be 'Two Brothers' (Gabba Island). He had therefore turned around and steered a westerly course. The skipper was still lost.

The satellite telephone position from the two calls would suggest that *Malu Sara* was within one mile of position 09° 52'S 142° 00'E, 11.5 miles west-north-west of Mabuiag Island and eight miles from the reef fringing the island.

The duty officer asked whether he could still see the island, to which the skipper replied that he could not. The duty officer told the skipper that the island he had seen was Mabuiag Island, and that the skipper should steer a reciprocal course to re-establish visual contact with it. The duty officer also told the skipper that if he could not relocate the island that he should activate his EPIRB so that his position could be fixed. The skipper then reportedly said 'I will head back in that direction and I'll go now'.

Sunset on 14 October 2005 was at 1827. At the time, the weather recorded at Coconut Island indicated the wind was still from the south-east at 15 knots. The general direction of the current at Hammond Rock was easterly, but slackening and predicted to change direction at about 1930.

At about 1900, the regional manager telephoned the duty officer to obtain an update. The duty officer told the manager that *Malu Sara* had not yet reached Badu Island and that he had told the skipper to activate the EPIRB. At this time the duty officer also told the regional manager that there were three passengers on board the vessel in addition to the two crew. The two men discussed the issue of anchoring and whether it was safe to do so in the current and sea conditions[15]. The regional manager told the duty officer that the Queensland Police Service should be notified that the vessel was overdue.

At about 1915 the regional manager telephoned the Queensland Police Service, Thursday Island, and notified them that *Malu Sara* was overdue, and apparently lost.

At 1934 the skipper again telephoned the duty officer and the two men discussed activating the EPIRB.

The position from the satellite telephone was approximately 09° 53'S 142° 02'E, 9 miles from Mabuiag Island.

At about 1940 an officer from the Queensland Water Police on Thursday Island took over coordination of the search. He assumed the role of 'mission coordinator'. Having been told that the vessel's EPIRB had been activated, the officer contacted the Rescue Coordination Centre (RCC) at the Australian Maritime Safety Authority in Canberra at 2011. He briefed them on *Malu Sara*'s predicament and enquired about the next pass of a satellite, which would pick up the vessel's EPIRB transmission. He was told that the next satellite pass was due at about 2140. The mission coordinator also telephoned the Queensland search and rescue officer and informed him of the situation.

15 In 2004 a dinghy with four people on board had anchored in a strong current in Torres Strait. Apparently the tension on the anchor rope had pulled the bow down so that the boat was swamped. Two adults on board were lost.

Between about 1945 and 2130 the duty officer and the police mission coordinator maintained telephone contact with *Malu Sara*'s skipper. In all some 20 calls were attempted, of which ten were successful. The skipper confirmed that the EPIRB was transmitting. According to both the mission coordinator and the duty officer, *Malu Sara*'s skipper seemed calm, and apart from being uncertain of his position, seemed to be in control of the situation.

The position from the satellite telephone was virtually static in a position centred on 09° 53'S 142° 01'E. This position was apparently maintained until about 2300.

At about 2130 the duty officer contacted *Malu Sara* to tell the skipper that a satellite pass at 2140 should be able to fix his position. The skipper confirmed that the EPIRB was still transmitting and that they were anchored. The skipper said that water was entering the boat but he did not indicate whether this was into the cockpit or the void space below. The duty officer advised the skipper that those on board should don lifejackets, and that they should do something about the water. The skipper did not seem unduly concerned, and the tone of his voice appeared normal. He said that he would pump the water out using the bilge pump. The duty officer's last instruction was 'to keep in touch'.

By 2134, two possible EPIRB positions were established for *Malu Sara*. The first was about 19 miles south east of Saibai Island (09° 40'S 142° 56'E) and the second about 11 miles north-west of NW Point, Badu Island (09° 54'S 141°59'E)[16]. This information was passed to the mission coordinator at 2157, along with the information that the next satellite pass was at 2315.

Based on the information to hand, the mission coordinator on Thursday Island realised that *Malu Sara*'s probable position was the one north-west of Badu Island. At about 2200, the mission coordinator, duty officer and the regional manager made a number of attempts to contact *Malu Sara*. The regional manager made contact for 19 seconds at 2204, but could not recall doing so. The mission coordinator contacted the vessel at about 2216 for 50 seconds. The duty officer made contact at 2228 for 23 seconds and at 2234 for 11 seconds. All involved experienced considerable trouble making and then maintaining contact, and a number of attempts were diverted through to the message bank.

Initially, when the mission coordinator was satisfied that the vessel was west of Mabuiag and Badu Islands, when he had confirmed that *Malu Sara* was equipped with a compass, he advised the skipper to steer between 150° and 157° to bring the vessel into the lee of one of the Islands. At this time the westerly tidal set was running at its maximum. The wind at Horn Island was recorded as south-east, averaging 14 knots but with gusts to 20 knots. The records from Coconut Island showed that the wind was south-east at 19 knots.

At 2323, the RCC notified the mission coordinator that the resolved EPIRB position was 11 miles north-west of Mabuiag Island in position 09° 57'S 141° 59'E. The mission coordinator then tried to contact *Malu Sara*, but he was not immediately successful. When contact was made, after about 20 minutes, he told the skipper to steer due east to gain a lee on the western side of Mabuiag Island.

16 EPIRB detection works on the Doppler principle. An initial signal will provide two possible positions. The two positions are assigned a percentage probability. In this case the probabilities were 51 per cent and 49 per cent. A second satellite pass is required to resolve the actual position.

The position of the vessel's satellite telephone at this time was about 10° 00'S 142° 01'E, seven miles west-north-west of North West Point on Badu Island and nine miles south-by-west of Mabuiag Island .

At 0000 on 15 September, the air temperature at Coconut Island was 25.9°C and the wind was south-east at about 18 knots. At Horn Island the temperature was 26.6°C and the wind from the south-east at 15 knots with gusts to 21 knots. The tidal stream at Hammond Rock was still running to the west.

Malu Sara's skipper tried to telephone the duty officer at 0014 but the connection could not be maintained. About 20 minutes later at 0034, the skipper telephoned the duty officer who advised him to head due east.

Over the next hour or so the duty officer and the mission coordinator attempted to call *Malu Sara* on twelve occasions but contact could not be maintained.

At 0133, the mission coordinator made contact with *Malu Sara*. The skipper advised that they were at anchor and that they believed that they could see Mabuiag Island. There was some mention of oil, possibly that they were out of oil but the mission coordinator could not hear clearly due to wind noise in the background. The skipper said that they were taking some water. The bilge pump was being operated and water was being discharged, though again it was not clear whether this was from the cockpit or the under deck void space. By this time the tidal stream at Hammond rock had started flowing to the east.

The approximate position given by the satellite telephone was 10° 00'S 141° 56'E, about five miles west of their previous position.

At about 0215, *Malu Sara*'s skipper contacted the duty officer. His tone of voice had changed and now showed marked urgency. The skipper reported that they were taking on water rapidly and the vessel was sinking 'fast'. They could see a light from Mabuiag Island and they did not seem far from the beach. The duty officer told him to make sure everyone had their life jackets on and to be sure to grab the EPIRB. All contact was then lost with *Malu Sara*'s skipper and the others aboard.

The satellite telephone position was within 1490 m of 10° 00'S 142° 01'E.

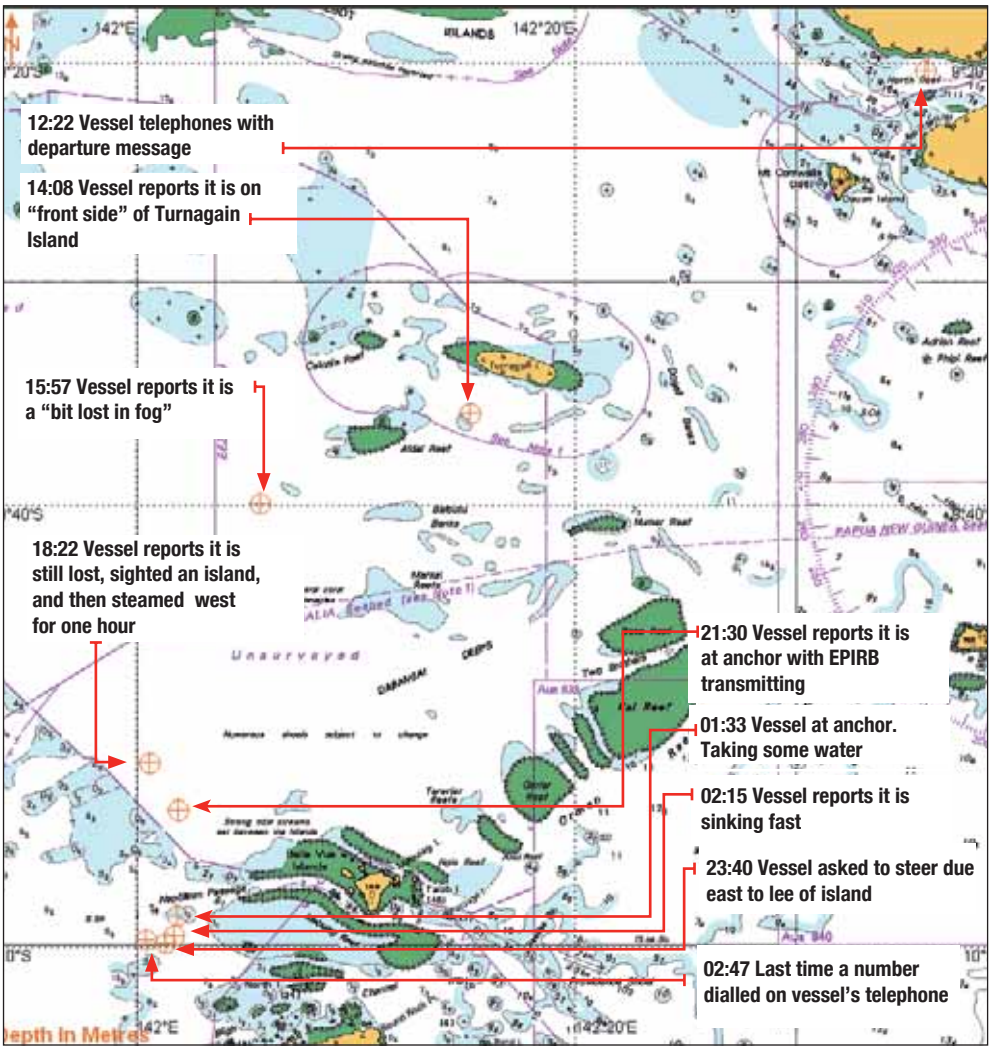
The duty officer then telephoned the regional manager and the mission coordinator and advised them of the conversation he had just had with *Malu Sara*'s skipper and that they needed urgent assistance. The mission coordinator immediately contacted the RCC and confirmed the updated EPIRB position as 10° 00' S 142° 03'E and that the next satellite pass was at 0300.

The wind at this time was from the east south-east averaging about 15 to 16 knots with gusts of 21 to 23 knots. The tidal stream was east going.

The telephone records show a number of calls connecting momentarily to *Malu Sara*'s satellite telephone before dropping out. All of the calls after 0057 were directly to the hand set and not to the telephone's remote aerial (part of the hands-free kit). This means that the handset was not in its cradle on the helm console. The satellite telephone records also show that one call was attempted from *Malu Sara*'s satellite telephone at 0247 on 15 October, but the radio link failed.

The last call to the telephone while it was potentially operational was at 0403 on 15 October within 3.6 miles of 09°59'S 142° 01' E. Thereafter, from 0432, all attempted calls were diverted to the voicemail service.

Figure 7: **Portion of chart AUS 376 showing positions of Malu Sara triangulated from satellite telephone data at the times of significant calls. (Accuracy in the range of 810 to 9400 metres)**



3.6 Attempted rescue

After speaking with the duty officer, the mission coordinator considered a number of options to assist *Malu Sara*. The conditions precluded the use of a helicopter. A helicopter rescue operation would operate under night visual flight rules and at low level. Night visual flight rules require amongst other minimum requirements that when operating below 3000 feet above mean sea level, visibility must be at least 5 km (2.7 miles), the helicopter must be clear of cloud and be able to see the sea surface. On the night these conditions could not be met.

The mission coordinator decided to activate the Thursday Island Volunteer Marine Rescue (VMRTI) vessel *Pedro Stephen*. The VMRTI vessel is faster than the Thursday Island police launch and is equipped with radio direction finding equipment which could be used to home in on *Malu Sara*'s EPIRB signal.

At about 0230, the mission coordinator rang the after hours contact number for VMRTI. The VMRTI coordinator advised the mission coordinator that they could

assist, and also asked whether or not he had contacted VMR at St Paul's community on Moa Island which was closer. The mission coordinator then contacted the VMR duty officer at St Pauls but was told that their vessel was currently out of service. He then rang VMRTI back to request that they attend *Malu Sara*. The VMRTI coordinator then went about telephoning the contacts on the duty roster to organise the crew for the vessel.

During this time the DIMIA duty officer contacted a community police officer on Mabuiag Island with a message for the MMO based on the island to call him urgently. His intention was to get the MMO to take the Mabuiag Island IRV out to *Malu Sara* to render assistance.

At 0350 the mission coordinator telephoned the VMRTI coordinator who advised him that the crew were in the process of launching *Pedro Stephen*. By 0415 the VMRTI vessel had left the boat ramp on Thursday Island with three crew on board and was en route to the last position resolved for *Malu Sara*'s EPIRB. The overcast and moonless conditions meant that the crew of the vessel had to navigate using only the vessel's chart plotter system, radar and echo sounder.

By 0440 the community policeman on Mabuiag Island had managed to contact an Australian Customs Service officer on the Island who rang the DIMIA duty officer. He arranged to ring back when he had woken the Mabuiag Island MMO. This message was relayed to the mission coordinator who contacted *Pedro Stephen* to indicate that a crew from Mabuiag Island were being sought to assist in the search and rescue operation.

At 0555, the Mabuiag Island MMO rang the duty officer to indicate that the Mabuiag Island IRV, *Ngagalayg*, had been launched. The vessel was being skippered by the MMO who had the Mabuiag Island Customs officer acting as his crew. The duty officer gave him an approximate position to start the search, north-west of North Island. The duty officer then informed the mission coordinator. At about this time the mission coordinator contacted the RCC in Canberra and asked whether or not the EPIRB was still transmitting, their response was affirmative and they updated its last resolved position.

During this time *Pedro Stephen* was heading north to the search area and was west of Badu Island at 0608 when the sun rose.

At 0645 *Ngagalayg* arrived in the vicinity of *Malu Sara*'s last known position, more than four hours after the skipper's last telephone call to the duty officer.

3.7 The search

At 0700 on 15 October, the duty officer had a discussion with the regional manager who asked him to get someone on Badu Island to check if *Malu Sara* had arrived. At this time *Malu Sara*'s EPIRB was still transmitting from a position west of Badu Island.

By 0749, the VMRTI vessel, *Pedro Stephen*, had also arrived at *Malu Sara*'s last known position and made contact with the crew of *Ngagalayg*. The weather was poor with confused seas, 20–25 knot south-easterly winds and 2–3 metre seas reported by the crew of *Pedro Stephen*.

The two vessels started to search the area to the west of North Island with the crew of *Pedro Stephen* also using their radar to scan the area up to six miles around the vessel.

At 0810, one of the skipper's relatives on Badu Island rang the DIMIA duty officer to indicate that *Malu Sara* had not arrived on the Island.

By 0815, *Pedro Stephen*'s crew had detected *Malu Sara*'s EPIRB signal on their radio direction finding (RDF) equipment and started to track it. During this time they were maintaining contact with the VMRTI coordinator who was relaying information to the mission coordinator via telephone.

By 0835, *Pedro Stephen* was within two miles of the EPIRB but had not sighted anything in the water. In the prevailing conditions the crew felt that it was unsafe to have someone on the vessel's bow operating the RDF gear and so they requested aerial assistance to help guide them to the EPIRB's position. This request was relayed to the mission coordinator at 0847.

At 0925, the DIMIA duty officer handed over the on-call mobile telephone to the regional manager. During this time the crew aboard *Ngagalayg* continued to search an area to the west and north-west of *Malu Sara*'s last position. They found that when they slowed the boat to use the satellite telephone, water was flowing into the motor-well which caused them some concern. The skipper decided to head towards North Island and more sheltered water so they could ring the regional manager.

By 0930, the mission coordinator had gained approval to use a helicopter. He contacted a local service provider and briefed them on the task. *Pedro Stephen*'s crew were also contacted and indicated that they were in rough water and would head in a little way towards shelter to await the arrival of the helicopter.

Around this time the skipper of *Ngagalayg* telephoned the regional manager and told him he was concerned about the vessel in the conditions they were experiencing. He explained that when he slowed the boat, water was coming in through the freeing port on the motor-well transom and then flowing into the cockpit through the scuppers in the cockpit transom. The regional manager told him to return to Mabuiag Island.

At 1015 the helicopter sighted *Ngagalayg* en route to Mabuiag Island and were told that this was DIMIA's Mabuiag Island IRV. The helicopter continued to search the area for *Malu Sara*'s EPIRB.

At 1036 the EPIRB was located by the helicopter in position 10° 00.2' S, 141° 55.9'E approximately 5 miles north west of Badu Island. The EPIRB was floating free with a short 1.5 m length of its lanyard still attached and no sign of *Malu Sara* in the area.

Pedro Stephen was advised that the helicopter had located the EPIRB. The decision was made to leave the EPIRB in the water to act as a search datum. The mission coordinator then instructed the crew of the helicopter to start an expanding square search out to six miles from the EPIRB. The situation had become one of distress. The mission coordinator asked *Pedro Stephen* to stand-by in the area to assist as surface support. The seas were very rough and the crew of *Pedro Stephen* asked if they could head into more sheltered waters to stand-by. The mission coordinator responded by asking them to search some of the rocky outcrops nearby.

Throughout the morning the mission coordinator was in periodic contact with the RCC who were providing advice and updated resolved positions of *Malu Sara*'s EPIRB. The mission coordinator also contacted the satellite telephone service provider and asked about getting position information from the provider based on the triangulation of the telephone's position when the last calls were made.

With the aerial search proceeding fruitlessly, it was becoming increasingly likely that *Malu Sara* had sunk and the people aboard were in the water. The mission coordinator arranged to get survivability information based on the weather and sea temperature. The information he received was that the conditions were survivable for people in the water with life jackets for 2–5 days based on the water temperature of 26.8 degrees and winds of 20–25 knots.

At 1218, the mission coordinator telephoned the RCC and the coordination of the aerial search was handed over to the RCC. *Pedro Stephen* was released to head back to Thursday Island at 1355 and was tasked to check the small islands south of the search area on the way home.

During the afternoon seven aircraft were tasked by the RCC to search an area of approximately 2300 square nautical miles north and west of Badu Island. No people or debris from *Malu Sara* was located. The weather continued to be poor with strong south-easterly winds and rough seas.

At 1930, the RCC assumed overall coordination for the search. They arranged a large scale search the following day, Sunday 16 October, using thirteen fixed wing aircraft, three helicopters and three large surface vessels. The aircraft searched both visually and using radar. There were no confirmed sightings of people or debris from *Malu Sara*.

Further advice was obtained from medical experts in the likely survival time of people in the water in the prevailing conditions. It was considered possible that one or more of the adults could still be alive by first light on 17 October, if they were wearing a lifejacket. For anyone not wearing a lifejacket the probability of surviving more than 40 hours in the water was considered to be very low to remote.

On Monday 17 October, the RCC coordinated two search sorties, one in the morning and one in the afternoon using fifteen fixed wing aircraft and a helicopter. The visual search covered an area of 1617 square miles and the radar search 4161 square miles.

The medical advice was updated during the day and it was considered possible that an adult wearing a lifejacket may have been able to survive another day so the searched continued.

On Tuesday 18 October, morning and afternoon search sorties were conducted using sixteen fixed wing aircraft, three helicopters and three surface vessels. Visual and radar searches were conducted in approximately 4500 square miles comprising areas of Torres Strait and areas along the coastlines of Papua New Guinea and Irian Jaya. In addition, the RCC arranged for side scan sonar equipment and a team of divers to search for *Malu Sara* in the area of its last known position. Medical advice received in the afternoon was that persons who had been in the water since the previous Saturday morning would not survive another night. At the end of the day the overall coordination of the search was returned to the Queensland Police Service.

On Wednesday 19 October, the search was scaled down with five fixed wing aircraft, two helicopters and three surface vessels. The search area included areas in west Torres Strait, islands and reefs in the Strait and the coastlines of Papua New Guinea and Irian Jaya.

The search continued over the next two days using fixed wing aircraft and surface vessels. Police divers also continued to search for *Malu Sara* using side scanning sonar and a magnetometer. At 1800 on Friday 21 October 2005, the search for *Malu Sara* and the five people on board was suspended by the Queensland Police Service. During the six days of the search there were no confirmed sightings of the vessel or its five occupants. The only piece of debris picked up during the search which was positively identified as *Malu Sara*'s was the vessel's EPIRB.

On 26 October the Queensland Police Service were advised that a deceased adult female had been found by Indonesian fishermen near Deelder Reef about 50 miles west of *Malu Sara*'s last known position. The body was transported to Merauke Hospital in Indonesia where it was examined and identified as one of the passengers on board *Malu Sara* before eventually being repatriated to Australia for burial on Badu Island.

4 COMMENT AND ANALYSIS

4.1 The investigation

There has been no way to establish a complete picture of what happened on board *Malu Sara* on the passage from Saibai Island, to the time of the last satellite telephone conversation at 0215 on 15 October. *Malu Sara* was not located and none of those on board have been found alive. There is no direct evidence as to what happened to the boat and no eye-witnesses to the passage from Saibai Island.

The evidence reviewed by the investigators, out of necessity, is based on the observations of those involved in the operation of the DIMIA boats, those involved in the workshop on Sabai Island from 8 to 13 October, circumstantial evidence based on eyewitness reports, boat testing, and the contemporaneous and subsequent records of those involved in the search for the missing vessel. The documentary evidence used to reconstruct the sequence of events was primarily the log entries made by the DIMIA duty officer on Thursday Island, the police search and rescue records, the telephone records of calls made to and from *Malu Sara*'s Satellite/CDMA telephone and the telephone's approximate position, and the EPIRB detection records.

On 25 October 2005, two investigators from the Australian Transport Safety Bureau (ATSB) travelled to Thursday Island to investigate the loss of *Malu Sara*. Interviews were conducted with DIMIA staff, staff from the Queensland Police Service, volunteers from the Thursday Island Volunteer Marine Rescue Service and with other parties who had knowledge of the vessel or could assist the investigation. DIMIA management staff with line responsibility for the Thursday Island operations were also interviewed and provided evidence as to the organisational oversight of the MMO scheme.

Documentary evidence was obtained from DIMIA relating to the specification and tender process, contract, commissioning and operation of the IRVs and the DIMIA movement monitoring operations in Torres Strait.

The director of Subsee Explorer Pty Ltd who was the workshop manager, and responsible for overseeing the building and certifying of the vessel, was interviewed in Cairns. Other documentary evidence was also obtained from the vessel's builder.

The post mortem examination results for the passenger on board *Malu Sara*, who was found by Indonesian fisherman near Deelder Reef, were provided by the Queensland Coroner's office. The examination, which was conducted by Australian authorities in Indonesia on 4 November 2005, lists the direct cause of death as 'Immersion'.

4.1.1 Interim recommendations

Following the incident, the Australian Maritime Safety Authority (AMSA) sent two surveyors to Torres Strait to inspect the remaining five IRVs. Based on this inspection AMSA withdrew its 'Letter of Survey' of 2 September 2005 covering the

remaining five IRVs. The ATSB provided advice to DIMIA in early November, that following AMSA's withdrawal of its letter of survey, that the IRVs should be subject to the following tests conducted by a person expert in stability and seaworthiness of small vessels:

- a full flotation and stability test on at least one of the vessels
- weather tightness and watertightness tests in accordance with Appendix C of Australian Standard 1799.1 – 1992 on all of the vessels
- check the adequacy of the deck drainage arrangements and the size of the freeing ports on all of the vessels in accordance with Australian Standard 1799.1 – 1992 and
- test the integrity of the fuel tanks and fuel system on all of the vessels.

4.1.2 *Malu Sara*'s sister vessels – tests

The first of the IRVs supplied to DIMIA was Yorke Island's, *Kuzi*, which was delivered in May 2005. It was a prototype and was trialled by DIMIA staff who subsequently provided feedback to the builder. The remaining five vessels were delivered in August 2005, with some minor modifications to the original design. As a consequence the final five boats were not constructed exactly the same as *Kuzi*.

The last five vessels, *Zueber Erkep*, *Kang*, *Malu Sara*, *Magani Guthat* and *Ngagalayg* were in all respects, almost identical. Inspection and testing of the remaining four sister IRVs provides circumstantial evidence as to the condition of *Malu Sara*. It is reasonable to use the outcomes of the tests and observations to base a general hypothesis of what may have happened to *Malu Sara*, based on the description of *Malu Sara*'s performance on Saibai Island and that it was built as a sister vessel at the same time, in the same yard as the other IRVs.

Between 28 November and 1 December 2005, a thorough examination and testing of *Malu Sara*'s sister vessels was carried out in accordance with the ATSB's interim recommendations. The examination and testing was undertaken on Thursday Island by an independent Queensland registered surveyor in consultation with two ATSB investigators, in the presence of an AMSA surveyor.

A thorough examination of *Malu Sara*'s four sister vessels concluded that they all had:

- areas of poor quality welding,
- significant leaks between the cockpit deck and the void space below,
- inadequate and insufficient deck drainage arrangements to free the cockpit of water,
- insufficient operational freeboard,
- unreliable and inaccurate fuel gauges,
- the fume detectors in the fuel tank casing disconnected,
- fuel tank casings which were not watertight, and,
- the capacity plates fitted to the vessels by the builder did not comply with AS 1799.1.

The testing included a sea trial using *Kang* as the test vessel. Practical stability and swamp tests were carried out on the design using *Zueber Erkep* as the test vessel. The swamp test proved that the vessel would not float in an upright attitude when there was an accumulation of water in the cockpit and that the vessel would capsize if the cockpit was swamped.

Zueber Erkep's fuel tank was also removed for inspection and testing. The test indicated that the tank was not fuel/watertight. It was also noted that the tank was poorly designed, supported and constructed.

4.2 The passage from Saibai Island

4.2.1 Passage planning

The passages to be undertaken by *Malu Sara*, and the Yam Island boat *Magani Guthat* back to their home Islands on 14 October 2005, were not typical DIMIA operations. In terms of risk, the potential hazards relating to position fixing and navigation were different from those of a normal patrol which were usually an out and back passage adjacent to familiar landmarks. *Malu Sara* was required to make a one-way passage in open seas of about 58 miles (107 km) in significantly reduced visibility and a fresh south-easterly wind.

Torres Strait islanders are experienced small boatmen and navigate between islands using their local knowledge. Most voyages are conducted in daylight hours using landmarks like reefs and islands as waypoints. The scattered distribution of the islands within Torres Strait means that in conditions of reasonable visibility, there are relatively few times when an island or other landmark is not visible from a small boat underway in the Strait.

From the cockpit of *Malu Sara* the distance to the sea horizon, given a height of eye of two metres, would be 3.0 miles.[17] If the visibility had been clear, those on board *Malu Sara* would have been able to see Gabba Island from the time they left Saibai Island and Mount Augusta on Moa Island and Mabuiag Island well before reaching Turnagain Island[18]. Visibility however, was restricted, with anecdotal evidence suggesting that Dauan Island was not visible from the settlement on Saibai Island, a distance of four to five miles. The reduced visibility would have been evident to *Malu Sara*'s skipper while he was preparing for the passage.

In these conditions, *Malu Sara*'s skipper (and *Magani Guthat*'s) would have to rely on dead reckoning (calculating a position by applying course and distance made through the water) to estimate the vessel's position during the passage. In 2001, *Malu Sara*'s skipper had received instruction from the Thursday Island water police in dead reckoning navigation, using a navigation chart and compass. Other skippers of the IRVs stated that dead reckoning was a normal practice used by the MMOs in times of rain or other conditions limiting visibility.

17 Distance to sea horizon = $2.095\sqrt{h}$, where h = height of eye in metres.

18 At extreme range Mt Augusta on Moa Island is visible at about 40 miles, Gabba Island at about 30 miles and Mabuiag Island at about 29 miles.

The evidence is that *Malu Sara* did not have a chart of Torres Strait on board at the time of the incident. A navigation chart of Torres Strait (Aus 376) had been supplied to each of the original IRV skippers. The charts were laminated in a plastic cover and the skippers had been told to transfer the charts from the old IRVs to the new IRVs. Following the incident, the chart issued to the Badu Island MMOs was found in the Badu Island office. Without a chart of the area, *Malu Sara*'s skipper would have had extreme difficulty estimating the vessel's position using dead reckoning navigation. He would have been totally reliant on his local knowledge and memory of the relative positions of the islands (and that of the other people in the boat).

Of the three vessels that left Saibai Island on 14 October 2005, it is evident that only the Yam Island vessel had a chart on board. The skipper of the Yam Island vessel, a qualified coxswain, had removed the chart from his old vessel and transferred it to the new IRV. On the day, he successfully navigated by dead reckoning from Saibai Island to Gabba Island and then from Gabba Island to Yam Island. It is also noteworthy that the 'check list' prescribed by the IRV 'Standard Operating Procedures' did not list a navigation chart as an item to be carried on board. Had *Malu Sara*'s skipper followed the original plan to leave Saibai Island with *Magani Guthat* and sail in company to Gabba Island, the skipper would at least have had access to a navigation chart for part of the passage.

The declaration by DIMIA's Thursday Island regional manager to the AMSA area manager when applying for the 'Letter of Survey' stated that before each IRV patrol a risk assessment is undertaken. The IRV standard operating procedures stated that before any patrol, an assessment should be made of the actual and forecast weather conditions, a tasking request should be completed, together with a pre-departure check list.

The patrol tasking request requires that the anticipated departure time is nominated, identification of way-points during the passage and the expected schedule of satellite telephone calls from each and the time of return. If the tasking request was used in conjunction with a navigation chart to plan and visualise the route to be followed, it formed the rudiments of a practical passage planning process.

It is not possible to say to what extent any of these procedures were followed prior to *Malu Sara* leaving Saibai Island. The skipper did not have ready access to weather reports on Saibai Island and no tasking request was sent to the Thursday Island office. The skipper did however nominate his planned route and reporting points when he telephoned the duty officer on leaving Saibai Island at 1222.

The IRV operating procedures set maximum voyage durations depending on weather and sea conditions. In the conditions prevailing on the morning of 14 October, the procedures allowed a maximum duration of only four hours. These limits are set to ensure that the crew is not unduly fatigued. To meet the four hour limit on passage time *Malu Sara* would have needed to average 15 knots throughout the passage. Given that it was evident *Malu Sara* would be making relatively slow headway into the weather for much of the voyage, its duration would have exceeded four hours even if it had gone to plan. It seems that no one involved with planning

the vessel's passage that morning had considered this factor or any additional risks posed by this particular passage.

4.2.2 The decision to sail

The decision whether to sail or not was that of the skipper. The operating procedures are clear that the IRV skippers had the discretion to abort any patrol if they were unsure of weather or the serviceability of the vessel. Also the skipper had been offered accommodation on Duaun Island until the adverse weather improved.

The idea that the skipper may have felt 'pressured' into leaving as a result of his reported conversation with the regional manager on the Thursday afternoon of the workshop cannot be substantiated one way or the other. The reported conversation, in which *Malu Sara*'s skipper apparently asked to ship the IRV to Badu by barge, was overheard by a third party and recalled at the height of the emotion in the aftermath of the loss of the vessel and the people on board.

The regional manager did not recall any such request, though he does remember being in the office at the time alleged. The substance of any conversation that may have taken place and the context cannot be established. The regional manager's position was that each skipper had the discretion as to whether or not to sail.

The fact that the skipper was willing to take three passengers, one of whom was a small child, would suggest that the skipper's confidence to operate the vessel had not been undermined to any significant degree.

The fact remains that the Yam Island IRV navigated safely to its home base, though the passage was 'wet'.

4.2.3 Saibai Island – southbound

Malu Sara's departure from Saibai Island was delayed until about 1220 on 14 October by the late arrival of the crew member and the passengers. The delay in departure had two primary effects. Firstly, the original plan to sail in company with the Yam Island IRV had to be abandoned and secondly the hours of daylight for the passage were reduced, although the six hours until sunset at 1827 should have provided sufficient time for the passage. In addition, the sea conditions for the passage would have been somewhat worse as there would have been more time with an east going tide and consequently rougher seas.

The IRV sailed with five persons, a quantity of personal effects and about 40 kg of bagged mud mussels. While the boat was not significantly overloaded, the people and goods probably represented close to the vessel's specified maximum weight limit.

The skipper reported his departure and declared the number of persons on board. The DIMIA duty officer on Thursday Island did not query the carrying of passengers, assuming that permission had been given.

When the skipper reported at the Turnagain Island way-point he did not report any problems. The satellite telephone triangulation placed *Malu Sara* at the western

side of Turnagain Island. Given the distance and an understanding of the term 'front side of Turnagain' as meaning the south-east side, *Malu Sara* had completed between 23 and 26 miles, depending on the exact position, in 1.75 hours giving a speed of between 13 and 15 knots.

When the vessel left Turnagain Island the skipper could not see Mabuiag Island ahead (or any other land mass) for a visual frame of reference. To maintain the vessel's heading, initially to the south, he would have been reliant on the compass and to some extent the direction of the wind and sea.

By 1445, at an average speed of 13 knots, *Malu Sara* should have been within the lee of Beka and Kai Reefs. If the skipper had maintained his southerly heading, by 1545 the vessel should have been within 1½ miles of Mabuiag Island.

At 1557, *Malu Sara*'s skipper contacted the Thursday Island duty officer and conducted a five minute 53 second conversation. He was lost but did not seem concerned. He had plenty of fuel, and the others on board were 'alright'. He stated that he had run due south for an hour and then due west.

The triangulated position from which the call was made at 1557 was just ten miles west-south-west of the 1408 position. This is inconsistent with what the skipper told the duty officer. If the skipper steered a southerly course for one hour and then due west as stated, at 1600 *Malu Sara* should have been about nine to ten miles north or north-north-west of Mabuiag Island. The satellite telephone triangulation, however located *Malu Sara* 17½ miles north-west of Mabuiag Island. Unless the four triangulated positions detected between 1554 and 1557 were all totally erroneous, which seems unlikely, the two legs steered by the skipper were not south and then west. There are two possible explanations: one that the skipper was steering by the direction of the sea, rather than the compass, or that the compass was in error.

The duty officer assessed *Malu Sara*'s position by dead reckoning and told the skipper to steer between 170° (C) and 160° (C) to gain the shelter of a reef near Mabuiag Island. In theory this should have brought *Malu Sara* within three miles of Mabuiag Island at about 1700. The telephone conversation ended at 1603. No further contact was made with *Malu Sara* for a further two hours and 19 minutes, although the duty officer made three attempts to make contact.

When *Malu Sara*'s skipper telephoned at 1822 he told the Thursday Island duty officer that he had steered between 170° (C) and 160° (C) as advised, and that he had seen an island. He took the island to be Two Brothers (Gabba Island) which is to the north-east of Mabuiag Island. He then turned and steered due west in an apparent attempt to establish contact with the Orman Reefs which are to the west of Gabba Island. It is not possible to understand why, when the island was sighted, the skipper did not contact the Thursday Island duty officer, but rather elected to steer west for a period that was probably in excess of 60 minutes before contacting Thursday Island. On the face of it, the action was illogical, critical to the outcome of the voyage, and may have been symptomatic of acute disorientation.

Malu Sara's skipper was familiar with the area north of Mabuiag Island. The evidence is that he had fished and hunted dugong and turtle along the Orman Reefs to the north many times. It is hard to understand how a person, so familiar with the area, mistook Mabuiag Island for Gabba Island.

If the island had been Gabba, *Malu Sara* would have been to the east of Orman Reefs and the passage would have been made in much more open water. *Malu Sara* would have been punching into a steep head sea from about 1330, as the wind would have been against tide. Beka and Kai reefs are 11 miles west of Gabba Island and would have been encountered within an hour of steering any westerly course. West of the Orman Reefs, with low tide at Talab Island at 1719, there would have been some protection from both wind and sea. In addition, waters to the west of the reefs are relatively shallow and consequently are light green or even milky during spring tides. Waters to the east of the reef are relatively deep and consequently are generally darker in colour.

The main unanswered and unanswerable question is why he did not report in straight away and why he then turned away from the Island and set a westerly course for such a long period of time.

Any disorientation was compounded by the lack of a navigation chart or a charting aid such as a global positioning system (GPS). Carrying a mental picture of the relative position of features in any landscape is prone to significant error. In a more featureless seascape relying on memory for the relative orientation of islands and other marks is fraught with risk. Looking at a chart, even with the most rudimentary knowledge of navigation, would show that Mabuiag Island is south of Saibai Island. Gabba Island is east-south-east of Turnagain and just 10 minutes of latitude south of Turnagain Island's latitude.

At 1824, the satellite telephone triangulation placed *Malu Sara* about 11.5 miles west-north-west of Mabuiag Island. The predictions from Hammond Rock indicate that the tidal stream would still have been flowing to the east and thus assisting *Malu Sara*'s return east-bound passage (after the telephone conversation at 1822). However it is evident that between 1824 and 1942 *Malu Sara* made very little progress, closing from 11.5 miles to eight miles to the west-north-west of Mabuiag Island.

Sunset on 14 October 2005 was at 1827 and by 1930 it would have been quite dark. Even in clear weather none of the navigation aids in the shipping lanes to the south would have been visible. While the moon was three days from full, the cloud cover was reported as heavy and any moon light through breaks in the cloud would have been offset by the reduced visibility.

4.2.4 EPIRB activation

According to the record of events kept by the DIMIA duty officer on Thursday Island, the first mention of activating *Malu Sara*'s EPIRB was made at about 1820. The telephone records show two contacts made at 1822 and 1823 respectively between *Malu Sara* and the DIMIA duty officer on Thursday Island. The first from *Malu Sara* lasted 54 seconds and was followed by a sustained telephone conversation from the duty officer to *Malu Sara* at 1823, which lasted just over five minutes. The duty officer's log indicates that the advice was that if the vessel was lost, then the EPIRB should be activated.

A further note in the duty officer's log indicated that the use of the EPIRB had been discussed with the regional manager at 1900. The next telephone contact between the DIMIA duty officer and *Malu Sara* was at 1946.

The Thursday Island Water Police sergeant assumed the role of 'mission coordinator' at about 1940. The first direct contact between the mission coordinator and *Malu Sara* was at 2020, followed by further contacts at 2035, 2055 and 2057. These calls were preceded by two earlier calls at 2041 and 2045 that were unsuccessful.

Between 1943 and about 2300, the telephone records show *Malu Sara* maintaining a position in latitude 09° 53'S and longitude 142°02'E. It is probable that the IRV was at anchor during this time. Depending on the accuracy of the triangulation, the IRV was probably in about 4.0 m of water, a westerly tidal stream was predicted to start at Hammond Rock at 1924, which would have flattened out any sea.

Records of satellite passes over Torres Strait which detected a 121.5 MHz EPIRB, indicated that it is highly probable that the passes at 1800 and 1939 would have detected any EPIRB transmission[19]. The first detection of *Malu Sara*'s EPIRB was at 2134, from satellite S06. It is therefore probable that *Malu Sara*'s EPIRB was not activated until after 1940.

By 2200, *Malu Sara*'s approximate position was fixed with a reasonable degree of certainty. At 2323, a resolved EPIRB position of 09°57'S and 141° 59'E was obtained.

4.2.5 The sinking

It would appear that at about 2300 *Malu Sara* got underway and moved in an southerly direction for about 5 miles, before maintaining a position about eight miles west of Mabuiag Island at 2338. This would strongly suggest that the skipper had again anchored the IRV. By 2230 the skipper had been in contact by satellite telephone with the mission coordinator, the DIMIA duty officer and the regional manager. While the telephone reception was poor there was no indication that Mala Sara's skipper was not in control. Although the satellite telephone was proving an unreliable means of two-way contact, another series of seven connections between 2338 on 14 October and 0014 on 15 October, also suggested that the skipper was in control. It is possible that the presence of the other people on board, the women and child in particular, may have made the skipper reluctant to indicate any concerns that he may have had about the vessel's predicament.

The satellite telephone position suggests that at 0100 *Malu Sara* moved due west by about by five miles in under two minutes. At this time the satellite position error almost doubled from about 4000 m (2.1 miles) to 7560 m (about 4 miles). Similarly in a two minute period 0131 and 0134 the IRV apparently returned to a position very close to that at 2338. It is probable, therefore, that the vessel had been

19 The ATSB asked AMSA if there were any satellites that would have detected the EPIRB between 0800 UTC and 1125 UTC on 14 October 2005. The AUMCC was not designed to undertake such queries, however with the assistance of EMS Pacific, a prediction was performed using saved historical orbit data and pass schedules, and resetting the computer clock to 14 October 2005. This prediction was undertaken on the training MCC, TRNMCC on 1 December 2005. This procedure is not included in the EMS document but AMSA believes that the results are accurate.

at anchor in the one position for two hours. It is also probable that this position was maintained until the final successful telephone call at 0215.

At 0137, when the skipper reported that they were at anchor and thought they could see shore lights, on what he took to be Mabuiag Island, *Malu Sara* was actually in a position about nine miles west of Mabuiag Island and seven miles west-north-west of North West Point on Badu Island. It was during this telephone call that there was some reference to oil, possibly being 'out of oil'. It is uncertain whether this meant two-stroke oil or fuel.

What is apparent is that the wind strength was significant. With the IRV stopped and at anchor the noise of the wind made it difficult to hear what the skipper was saying. Given the experience during the workshop exercise off Saibai Island and subsequent tests and trials, it is probable that while at anchor water was being taken through the freeing port on the motor-well transom, and from there through the scuppers in the cockpit transom, and into the cockpit. What is also probable, based on tests and trials of the sister IRVs, is that despite any attempts to bail or pump the cockpit dry some water had already leaked into the void space under the cockpit floor. If the vessel was without fuel, the skipper could not get underway to drain the cockpit. Without adequate reliable two-way communications the mission coordinator was not aware of the developing situation or whether the vessel could get under way.

Based on an approximation of the route *Malu Sara* had covered in excess of 70 miles. It is also probable that the IRV had been at anchor for over six hours. The boat was being driven at economical revolutions, sufficient to keep the IRV on the plane. There should have been both fuel and oil reserves[20], if both had been fully replenished before leaving Saibai Island. *Malu Sara* would have consumed oil during the northbound passage and on patrols during the workshop. While there is evidence that the petrol was replenished there is no evidence that the outboard motor oil tanks were refilled or that spare oil was carried. It is more likely that any reference to oil at 0137 referred to the level in the lubricating oil tanks. On the passage from Badu Island to Saibai Island the skipper had not replenished the two-stroke oil before setting out. It is apparent that he did not understand the alarm system or the reserve of oil available when the alarm sounded.

There is no way of knowing exactly what occurred on board *Malu Sara* during the passage, but the evidence is that they could see shore lights but were apparently unable or, for some reason unwilling, to use the motors to reach safety.

By 0215, unless the IRV had got underway and was on the plane, the cockpit would have been awash, creating a free surface[21] of water. A quantity of water had probably also leaked into the void space inside the hull creating a further free surface if the crew had not periodically pumped the water out of this space during the passage.

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20 The outboard motor manufacturer's maximum fuel consumption figures are 34 litres per hour at 3000 rpm. *Malu Sara*'s fuel consumption would have been significantly less as the motors would not have been fully loaded at the speeds the vessel was achieving in the conditions, particularly when steaming downwind in following seas.

21 Free surface effect is the reduction in a vessel's ability to return to the upright, caused by the sloshing motion water that is free to move, see Appendix 2.

Off Mabuiag and Badu Islands at 0215 on 15 October *Malu Sara* was experiencing winds of about 15 knots, with gusts to 21 knots (based on observations at Horn Island). The direction of the tidal stream would have changed to east going at about 0119 and by 0230 the boat would have been experiencing a short steep wave pattern that would have caused a sea state in excess of that for which the boat was designed. If, as reported at about 0215, the boat was taking water rapidly, significant and unstoppable capsizing forces would have been present. The speed of the rolling and pitching of the vessel would have meant that these forces could not have been counteracted by the movement of those on board. The swamp test conducted by the ATSB showed that the free surface effect would have caused the boat to capsize. Based on the strong probability that *Malu Sara* was in a similar condition of watertightness to the sister IRVs the capsized hull would have eventually sunk.

Malu Sara left Saibai Island after midday on 14 October on a passage that should have taken no more than 4½ hours. In none of the contacts between the duty officer and *Malu Sara*'s skipper between 1222 and about 2130 was there any suggestion that the IRV was not coping with the conditions. Indeed the earlier telephone contacts suggested all was well.

By the early hours of 15 October *Malu Sara* had been at sea for over 13 hours, seven and a half hours longer than the passage should have taken. From the weather records at Horn and Coconut Islands, the evidence is that the wind speed and direction over the period 1200 on 14 October to 0300 on 15 October was consistent with average wind speeds of 15 or 16 knots and maximum gusts varying between 19 and 23 knots. The sea conditions and wave height would have varied with the direction and strength of the tidal flow. The wind speed did increase marginally in the forenoon of 15 October while the VMR vessel *Pedro Stephen* and the Mabuiag Island IRV, *Ngagalayg*, were searching. The steep and confused sea state experienced was mostly a function of a strong tidal flow in shallow water or in the gutters between the reefs in the area.

The circumstantial evidence is that *Malu Sara* had nearly exhausted its two-stroke oil. Once stopped in the water the evidence from testing the sister IRVs is that water would have been taken through the engine pod and the scuppers into the cockpit. If the vessel was anchored over the bow using a conventional anchor there was also a very real danger that the bow would 'dig in' and large quantities of water would be taken rapidly into the cockpit. This would be critical in conditions of wind against tide when the sea would be short and steep and the wind would be blowing the top off the wave crests in the form of spume.

4.2.6 Fatigue and the skipper's decisions and perceptions

The skipper of *Malu Sara* had been involved in an extensive MMO training program on the five days preceding the return passage to Badu Island. On the night of 13 October he would have had broken sleep as he was periodically checking the condition of *Malu Sara* after the vessel had taken water into its void space during the workshop patrol in the afternoon. In the early hours of the morning prior to the passage home he was still awake at 0330 and was seen again at 0800. At best the skipper would have had less than four hours sleep. People who spoke to the skipper

prior to *Malu Sara*'s departure did not notice anything unusual in his demeanour and there was no evidence that he was still under the influence of any alcohol he had consumed the previous evening.

Throughout the course of the passage south, the skipper's level of fatigue would have increased significantly. For much of the time the vessel was making headway into a short steep sea with the skipper performing a physically demanding task on a warm humid day. The evidence indicates that the skipper's judgement, perceptions and decisions before setting out and during the passage were probably symptomatic of acute fatigue which became worse during the passage south. These actions and perceptions included:

- his willingness to accept the risk of taking the three passengers without approval,
- the decision to proceed in a vessel with which he apparently had concerns,
- his unwillingness to abandon the voyage when it must have been apparent that the conditions, (visibility in particular), were going to make the passage difficult especially without a navigation chart,
- his apparent perception that he was east of the Orman Reefs despite his extensive local knowledge,
- the misidentification of Mabuiag Island as Gabba Island,
- and his apparent unwillingness to signal his distress.

Fatigue can impair decision making processes (Caldwell & Caldwell, 2003) and increase an individual's willingness to accept risk. The skipper's initial decision to proceed with the passage south on 14 October in less than ideal weather conditions, despite his apparent concerns about *Malu Sara*'s seaworthiness, may have been to some degree influenced by his level of fatigue. Prior to leaving, the skipper made the further decision to take the three passengers despite the regional manager's express instructions to the contrary. On the face of it, this was a very risky decision given the potential for work related sanctions for disobeying the regional manager's directive. While there may have been other influences including some pressure from his crew member to take the passengers, the decision was the skipper's to make. The fact that he agreed to take the passengers in these circumstances suggests that he had not carefully considered the consequences of the decision.

Fatigue can also reduce an individual's ability to identify important information, process that information and make an effective decision. What information was available to the skipper, (speed, time, compass headings, sea characteristics, local knowledge, etc), while *Malu Sara* was en route to Badu Island during the daylight hours on 14 October, may not have been effectively used to maintain his understanding of where he was and regain his bearings once lost.

Situational awareness refers to the perception of the elements in the environment, comprehension of the current situation, and the projection of their status in the near future (Endsley, 1995). Research suggests that an individual's ability to maintain situational awareness diminishes with the effects of fatigue (Caldwell & Caldwell, 2003). There was strong evidence to suggest that the skipper's situational

awareness was progressively compromised throughout the day of 14 October. His apparent perception that the vessel was on the eastern side of the Orman Reef system, despite his local knowledge and other visible cues, the misidentification of Mabuiag Island and his various assessments of the courses that he had steered which were proven to be incorrect and his apparent unwillingness to signal distress earlier in the evening, are all examples of the skipper's diminished situational awareness.

At the time that the final distress call was made at 0215 on 15 October, the skipper had had four hours sleep in the previous 39 hours (at best) and had been awake for the previous 18.5 hours.

4.3 The DIMIA Immigration Response Vessels

4.3.1 Vessel tender and contract specifications

The DIMIA request for tender document included the following specification[22]:

> The vessels are to be constructed so as to comply with the Uniform Shipping Laws Code (USL Code) and the Australian Standard 1799 (AS 1799). They must also be constructed to comply with the Queensland Transport Operations (Marine Safety) Regulations 2004 and be capable of being registered in Queensland as a commercial ship under six metres.

After the tender process was completed and the builder's tender was accepted, a contract between the builder, Subsee Explorer, and DIMIA was signed. This contract also contained provisions relating to the standard of construction[23]. These provisions included:

> The contractor shall provide Certificates of:
>
> - Construction to USL Code Class 2C
> - Certificate of positive floatation
> - Certificates for 15 NM operations [USL Partially Smooth]
> - Fitted out and outfitted to Class 2C survey standard
> - Comply with AS 1799 & if alloy construction AS 1665.

It was also a contractual requirement that the IRVs be constructed to comply with the *Queensland Transport Operations (Marine Safety) Regulations 2004* and be capable of being registered in Queensland as a commercial ship under six metres.

Although the contract required that the vessel was issued with a certificate of construction, this could not be issued on behalf of Queensland, as the IRVs were to comply with the Commonwealth *Navigation Act 1912* through Marine Orders Part 62. Marine Orders 62.6.2 did not require the vessel to carry, or be issued with, any certificates other than the AMSA 'Letter of Survey'. Any certificate of construction issued would have been a declaration by the builder that the boats conformed to the requirements of the contract.

22 DIMIA tender document RFT 04/65 section 5.5.

23 Contract schedule, sections c and d.

Regardless of certification, the terms of the contract required that six seaworthy and properly constructed IRVs meeting the requirements of both USL Code 2C and AS 1799 should be delivered to DIMIA.

4.3.2 Construction

Subsee Explorer as a company, and the director who managed the workshop as an individual, were both accredited as ship builders under the Queensland *Transport Operations (Marine Safety) Act 1994* as provided for under the provisions of regulation 46 of the *Transport Operations (Marine Safety) Regulations 2004*. Both the company and the director were also accredited as designers for commercial vessels built primarily of aluminium or steel up to 10 metres. Subsee's director had no formal qualifications in any of the fields in which he was accredited. The accreditations that he held were based on his previous experience in the ship building industry and the company's construction of a number of vessels under his supervision.

The process of accreditation by the Maritime Division of Queensland Transport, now Maritime Safety Queensland (MSQ), was conducted in 1996 after an initial application by Subsee's director. The accreditation process consisted of an assessment of the director's statement of claims (relating to his past experience building vessels at Subsee) and an interview where the director's shipbuilding and ship design knowledge were assessed. For the company, there was also a requirement to detail such things as the company's staff and equipment, adherence to various workplace health and safety requirements, work method standards/ documentation and to have the appropriate insurances in place. To maintain their accreditation, the company and the director were also subject to periodic audits by MSQ. The audits are intended to examine the process and outputs of ship designers and builders for compliance with minimum standards under the *Transport Operations (Marine Safety) Act 1994.* Subsee's last audit by MSQ was in September 2000.

The builder's accreditation under Queensland legislation had no validity under the Commonwealth's Navigation Act 1912. The standards required under Queensland legislation were, however, the contractual standards to which the IRVs were designed and constructed.

Maritime Safety Queensland publish a guide to assist with the construction of a commercial vessel for operations in Queensland waters, and the process by which vessels under six metres in length can be commercially registered. The guide suggests that vessels should be constructed to a recognised standard such as the USL Code, AS 1799, or a performance based approach. Queensland has no specific set of construction rules for a vessel of this size and type.

Figure 8: The IRVs under construction at Subsee

Figure 9: The IRVs under construction at Subsee

By specifying Queensland requirements in the building contract, a vessel under six metres in length can only be registered for Class 2C service if documentation is provided to attest that the vessel has positive flotation, and is suitable for its intended service. The requirements also state that the documentation should confirm compliance with the buoyancy and stability requirements of AS 1799, or the American Boat and Yacht Council, or Section 10 Appendix N of the USL Code. It is also stated that the documentation should confirm compliance with the swamp and stability test as detailed in the brochure 'Guide for Conducting a Swamp and Stability Test for Vessels Under Six Metres'.

In other words a swamp test should be conducted. However, the relevant provision also states that where a vessel cannot be swamp tested, calculations and a statement attesting to the sufficiency of the reserve buoyancy should be submitted by an accredited designer or surveyor.

The builder provided a positive flotation statement with respect to *Malu Sara* and the other vessels on 16 May 2005. In this statement the builder declared that:

> 'the subject vessel is able, when filled with water, to remain afloat in an upright position while carrying its normal operational equipment and the total number of persons recorded in this statement' (six).

The positive flotation statement requires the builder (in the absence of a swamp test result) to nominate a recognised standard and provide complete calculations to confirm the basis on which the positive flotation statement is made. Although the builder attached some basic calculations to the statement, there was no recognised standard nominated, and the diagram attached to the statement showing the volume of buoyant material is in fact referring to the void space below the cockpit which should have been watertight. These spaces were not fitted with any solid form buoyant material whatsoever.

The builder supplied a positive flotation certificate stating that the vessels were stable, 5.9 metres in length and suitable for 2C operation with six persons on board and 100 kilograms of equipment.

4.3.3 Reserve buoyancy

AS 1799 requires that a vessel is provided with sufficient reserve buoyancy to prevent it from sinking when swamped. The standard also requires that the buoyancy material is fitted in a way that ensures the vessel remains upright and level when it is swamped in smooth water. The standard gives guidance on how to calculate the required amount of reserve buoyancy for any given vessel, and where the buoyant material should be located in the vessel to ensure that it floats upright when swamped.

While AS 1799 permits the use of air as a buoyancy material, it states that where air is used, the two largest integral air compartments should be disregarded when calculating the vessel's reserve buoyancy. The IRV's underdeck void space, disregarding the fuel tank casing, formed a single compartment.

The USL code requires that a defined quantity of solid, slab form, internal buoyancy be fitted into the vessel. In practice solid form buoyancy material is fitted to exclude water from enclosed spaces (space under thwarts, under gunwales or below areas of deck) and provides positive buoyancy under all circumstances, even when the space becomes flooded.

It is also a requirement of the USL code that the centre of mass of the buoyancy material must be above the flooded centre of gravity of the vessel. The object of this provision is to ensure that the vessel will float upright when swamped

The design of the DIMIA IRVs relies on a single under floor integral air compartment to supply all of the vessels reserve buoyancy. The boat builder calculated that this area has a volume of 1.91 cubic metres. (The builder submitted that more accurate calculations revealed that the volume was in fact 2.3 cubic metres).

The builder's calculations regarding reserve buoyancy ignore both the USL Code and the AS 1799 requirements. His calculations relied entirely on the single void space filled with air to supply all of the vessel's reserve buoyancy.

Air is not an acceptable flotation material as defined by the USL code, and a single integral air compartment fails to meet the requirements of AS 1799. In addition the mass of the buoyancy is below the flooded centre of gravity. The vessels are deficient with regard to the amount of reserve buoyancy provided, and failed to meet either the AS 1799 or USL Code requirements.

4.3.4 Freeboard, stability and swamp test

The IRVs were constructed with an 'uppermost continuous deck exposed to the weather' and were therefore 'well deck' vessels. The freeboard is the distance measured from a predetermined point at the waterline vertically to the weather deck.

In this respect Australian Standard AS 1799 is not clear. It refers to 'flush deck' boats and 'well deck' boats and 'cockpit boats' but the terms are not defined. The term 'freeboard' is not defined, but requires that the freeboard be measured from the weather deck in both flush deck boats and well deck boats. The Standard also refers to the 'static float plane' as being 'a plane parallel to the reference plain passing through the lowest point of the weather deck'. The diagrams are, however, misleading in that the static float plane could be interpreted as coinciding with lowest point of the gunwale.

The IRVs were effectively constructed with a negative freeboard. When carrying its designated personnel and with the engines shipped and a full fuel load water was able to flood through the freeing port and scuppers into the cockpit.

On 1 December 2005, static stability and swamp tests were carried out on *Zueber Erkep*, one of *Malu Sara*'s sister vessels in a sheltered position adjacent to a breakwater and boat ramp on Thursday Island. The vessel was secured bow into the ramp with its stern to seaward and an anchor on each quarter. The conditions at the time were reasonable with a 15 to 18 knot wind from the port beam (from which the hull was sheltered by the breakwater) and a very slight sea from astern (Figures 11, 12 and 13).

The static stability and swamp tests were conducted in accordance with guidance notes issued by MSQ for vessels under six metres. The required weights were provided by two adult males and a number of sand bags.

A static stability test was conducted first. Freeboard is not defined in Australian Standard 1799. Generally it is the vertical distance between the upper edge of the deck-line and the waterline. The lowest freeboard was measured from the waterline to the top of the gunwale and was approximately 430 mm. This was well in excess of the minimum requirement of 75 mm (Figure 11).

It should be noted, however, that in some jurisdictions, Western Australia for example, that freeboard must be measured on a vessel fitted with a self draining cockpit from the waterline to the weather deck (the cockpit floor) and not the top of the gunwale. If this criterion is used the IRVs were not sufficiently stable as the cockpit floor and the scuppers which drain it were lower than the waterline during the test.

The sea trials conducted by the ATSB, the episode involving *Malu Sara* during the workshop patrol on Saibai Island and the experience of the Mabuiag Island vessel during the search for *Malu Sara* on 15 October, all demonstrate that the IRVs did not have sufficient freeboard. When stopped in the water or at low speed with the vessel fully loaded, the motor-well freeing port was below the waterline regardless of whether or not there was any water inside the void space. This means that water will actually back flood through the freeing port to the extent that the motor-well fills with a substantial quantity of water (Figure 10). Water then flows into the cockpit via the two scuppers.

The likelihood is that *Malu Sara* did not meet the freeboard, stability, or swamping requirements of Australian Standard AS 1799. In all probability these deficiencies were directly causal in the loss of *Malu Sara*.

To conduct the swamp test a portable fire pump was used to fill the test vessel, *Zueber Erkep,* with water. For the vessel to pass the test it should first be filled with water until the water inside the vessel is level with the surrounding water. In this case the water was progressively added by the fire hose at a reasonably slow rate.

Zueber Erkep soon exhibited unstable characteristics due to the free surface effect. The two persons on board had difficulty keeping the vessels stable by use of their body weight. After about eight minutes the vessel took a significant list to starboard and submerged the gunwale. The two people moved to the port gunwale to try and keep the vessel from capsizing.

After a total elapsed time of about 11 minutes the vessel capsized to starboard and inverted (Figures 12 and 13). The vessel remained afloat, inverted, but was obviously supported for a time by entrapped air. It was also noted that the hull was very slippery and offered few effective hand holds for anyone in the water attempting to cling to the upturned boat.

The *Zueber Erkep* clearly failed the swamp test, as it did not float upright as required. It was also apparent that the vessel was being supported by entrapped air, and that in a seaway this air would quickly escape and the vessel would float very low in the water based on the buoyancy represented by the volume of air in the void space.

The USL Code and the Australian Standard 1799 contain design and testing requirements for vessel buoyancy and stability to ensure that in the event that a vessel becomes swamped it will remain afloat in an upright attitude. The intention is to safeguard the vessel's occupants by ensuring that as a last resort the vessel will act as a 'lifeboat'. For *Malu Sara*'s occupants the evident failure of the vessel's design to meet these basic seaworthiness requirements meant that they effectively did not have this 'last line of defence' in the events which unfolded in the early hours of 15 October 2005.

Figure 10: Water flooding the motor-well at slow speed

Figure 11: Measurement of lowest freeboard during static stability test

Figure 12: *Zueber Erkep* capsizing

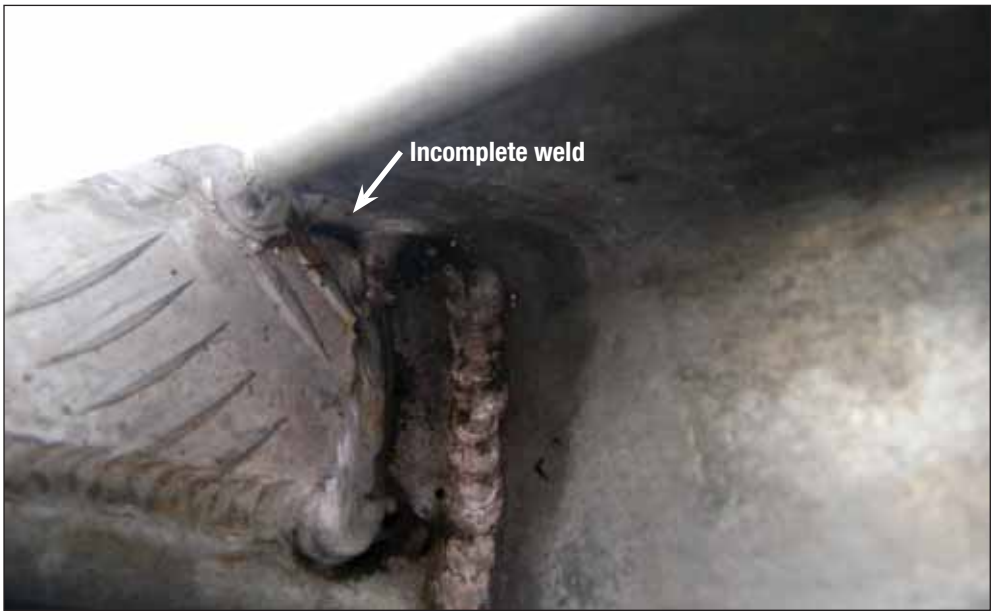
Figure 13: *Zueber Erkep* floating inverted

4.3.5 Watertightness

Although not floating upright, if watertight, the under deck void space would have provided some buoyancy to prevent the vessel from sinking. Before the swamp test on *Zueber Erkep* on 1 December 2005, the under deck void space was checked and proved dry. After the tests the under deck void space was drained of about 200 litres of water.

Examination of *Zueber Erkep* revealed a section of weld missing where a transverse frame penetrated the cockpit deck (Figure 14). The cockpit deck was therefore not watertight.

Figure 14: Leak in *Zueber Erkep*'s cockpit deck



A sea trial on board *Kang* was carried out on 29 November 2005. Before the sea trial the under deck void space was checked and proved dry. After the 74 minute sea trial the under deck void space was inspected and drained of about 20 to 40 litres of water (Figure 15).

The cockpit decks of *Kuzi*, *Kang*, *Magani Guthat* and *Ngagalayg* were tested by hosing the weather deck and maintaining a depth of approximately 50 mm of water across the cockpit deck for a period of 30 minutes. *Kuzi* was found to be watertight. However, in the case of each of the other three vessels about 10 to 20 litres of water was drained from the under deck space at the completion of the test.

These tests and observations prove that the under deck void spaces of *Malu Sara*'s four sister vessels[24] were not watertight. It would also be fair to assume, given the account of witnesses on Saibai Island, that *Malu Sara*'s under deck void space also leaked. The vessel would have been taking water throughout the voyage on 14 and 15 October 2005. Any water accumulation in the void space would not have been visible to the people aboard the vessel and so it would have been necessary for them to check the space periodically by using the bilge pump. Once capsized, any water leaking into the under deck void space would have compromised the capsized vessel's reserve of buoyancy and eventually the vessel would have sunk.

24 The vessels referred to as 'sister vessels' refer to the five vessels delivered in August 2005 including *Malu Sara*.

Figure 15: Water being drained from the under deck void space

4.3.6 Deck drainage arrangements

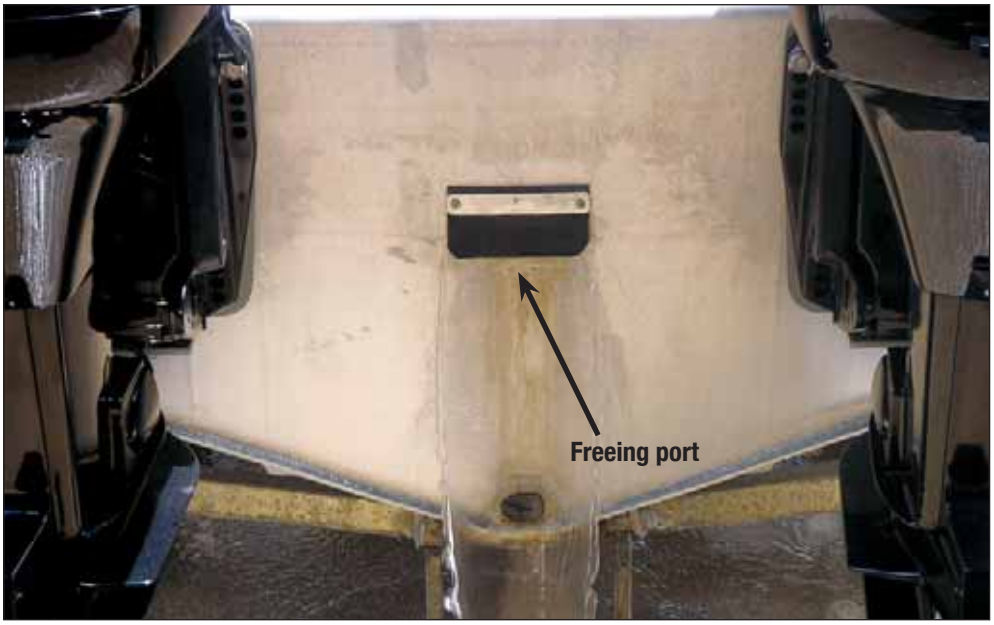
The IRVs are fitted with scuppers leading through the cockpit transom, port and starboard, to the motor-well deck (Figure 16). The motor-well deck has a single freeing port on the centreline of the motor-well transom (Figure 17). All of the freeing ports and scuppers are fitted with external flexible flaps. Any water shipped into the cockpit drains first to the motor-well through the scuppers and then overboard through the freeing port in the motor-well transom.

Figure 16: Port side cockpit transom scupper and flap

The scupper area from the main deck to the motor-well on *Malu Sara*'s sister vessels is 1 590 mm^2 on each side – a total of 3180 mm^2. The area of the single freeing port in the motor-well transom of the five remaining IRVs varies between about 6 160 mm^2 and 8 215 mm^2.

AS 1799 specifies a formula to calculate the minimum scupper size required according to the size of the deck area to be drained. In the case of the DIMIA IRVs the cockpit area is estimated at no less than eight square metres, after deductions for excluded areas such as lockers and compartments. The minimum required total effective area of all scuppers is 5 600 mm^2. This means that the scupper areas in *Malu Sara*'s four sister vessels is 57 per cent of the minimum required by AS 1799.

Figure 17: Motor-well transom freeing port and flap



The freeing port arrangement does not conform to the AS 1799 standard, which requires freeing ports, port and starboard.

If the freeing port just drained the motor-well, those fitted to the vessels exceed the minimum required size of 3500 mm^2. However the freeing port was also an integral part of the cockpit drainage arrangement. As such the total area of the freeing port should have been a minimum of 72 000 mm^2 , or at least nine times larger than those fitted.

The arrangement of two small scuppers from the main deck to the motor-well and then a single freeing port in the transom leading overboard is demonstrably inadequate in its ability to drain the motor-well plus the volume of water which would flow into the well from the main deck via the scuppers. Furthermore these calculations make no allowance for the restriction of flow caused by the external flaps fitted to the scuppers.

The standards governing the minimum sizes of scuppers and freeing ports are intended to ensure that a vessel's stability is not unduly compromised by water

taken onto the weather deck in a seaway. In the event that a large quantity of water is taken onto a weather deck or into a cockpit (for example a wave breaking over the vessel) the drainage arrangements for the deck or cockpit must ensure that the water is rapidly drained overboard to lessen the risk of the vessel capsizing.

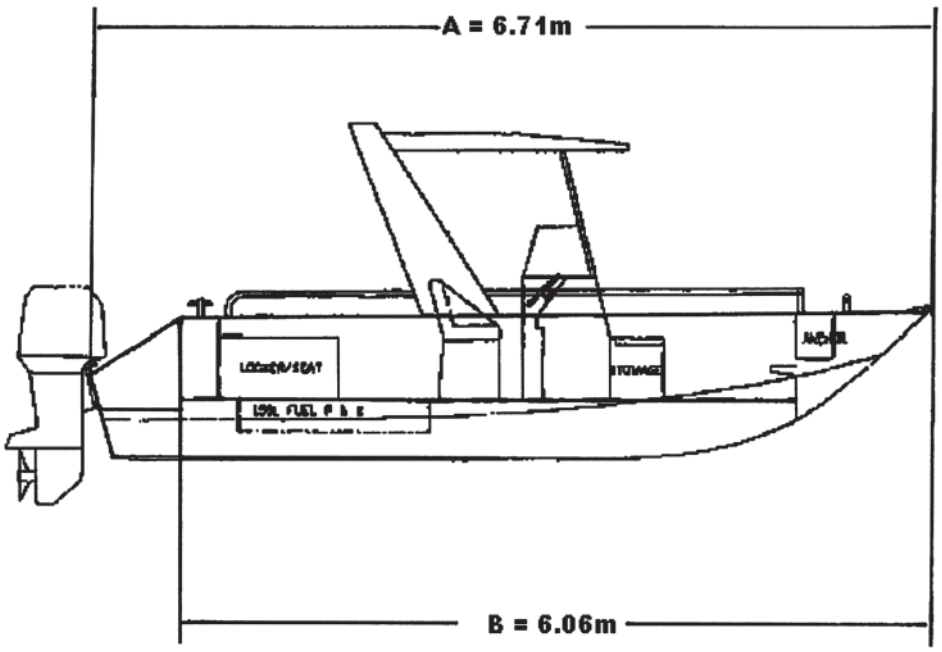
The combination of *Malu Sara*'s inadequate freeboard and undersized/inadequate scupper/freeing port arrangement meant that any accumulation of water inside the cockpit would not have drained overboard quickly enough when the vessel was at standstill. This was graphically demonstrated when *Zueber Erkep* was swamp tested as neither of the scuppers in the cockpit transom or the freeing port in the motor-well transom were sealed for the test and the vessel's cockpit filled quite quickly with a relatively slow rate of pumping.

4.3.7 Registered length

The registered length of a vessel is determined by the greater of the following (as per the MSQ Guidance notes for measurement of commercial vessels):

> 'The distance from the fore part of the hull to the after part of the hull, measured at the upper side of the uppermost weather tight deck or, in the case of an open vessel, at the height of the gunwale.
>
> or
>
> 96 per cent of the distance between a vertical line passing through a point being the foremost part of the hull and a vertical line passing through a point being the aftermost part of the hull, excluding appendages.
>
> Whichever is the greater'

Figure 18: Vessel length measurement



Zueber Erkep was extensively examined and measured. The measurements of the remaining four vessels were also checked. The measurements of all the vessels were consistent, and are as follows, as shown in Figure 18. The relevant measurement is from the foremost part of the hull to the aftermost part of the hull which is 6.71 m. 96 per cent of that length is 6.44 m.

The measured length of the vessel is therefore 6.44 m, not 5.9 m as declared by the builder. As such, the IRVs could not be registered in Queensland as commercial vessels under six metres, a requirement of the building contract.

4.3.8 Vessel marking

Section 4 of AS 1799 requires that all vessels have a permanently fitted capacity plate in a conspicuous place. This plate should contain the following information:

- Builders name and address or trademark.
- Serial number, model number and year of production.
- Maximum power for which the craft has been designed and tested.
- Nominated maximum persons capacity, in open and protected waters.

The capacity plates fitted in these vessels (Figure 19) do not nominate the maximum number of persons allowed on board or the maximum power for which the craft were designed and tested.

Figure 19: Vessel capacity plate

4.3.9 Vessel fit-out

The schedule in the contract for the supply of the DIMIA IRVs stated that the builder should supply a certificate stating that the vessels are 'fitted out and outfitted to Class 2C survey standard'.

The schedule in the contract also lists the ancillary equipment that should be supplied with each vessel. All of the ancillary equipment listed in the schedule was supplied with the vessels. The only failing of the equipment supplied is that the vessels were fitted with a 70 mm compass and Class 2C requires that the vessels are fitted with a 75 mm compass.

There are however, a number of items that whilst not listed in the ancillary list in the contract are required for the vessels to be of Class 2C survey standard, unless the operator seeks an exemption. The equipment list includes a clock, a barometer, distress flags 'N' and 'C', navigation charts, a means of sounding water depth (a hand lead line or mechanical depth sounder), a sea anchor and at least a VHF radio (depending on the vessel's area of operation).

In an open boat both the clock (providing a good watch is carried) and the barometer may be considered unnecessary. However equipment, such as a depth sounder, charts and VHF radio would have significantly reduced the risk of *Malu Sara*'s skipper getting lost, and improved the vessel's communications. A sea anchor would have enhanced *Malu Sara*'s ability to ride out the conditions the IRV experienced in the early hours of 15 October.

An echo sounder would have allowed the skipper to navigate more safely after the onset of darkness if running at slow speed. In the shallow waters of Torres Strait there is an ever present risk of running aground on a reef at night. While a depth sounder is not completely effective in preventing a grounding, it indicates when the seafloor is shelving. After twilight on 14 October *Malu Sara*'s skipper would have been navigating blind without an accurate idea of his position. A depth sounder would have given him some reassurance that he was not going to run the vessel onto a reef in the darkness.

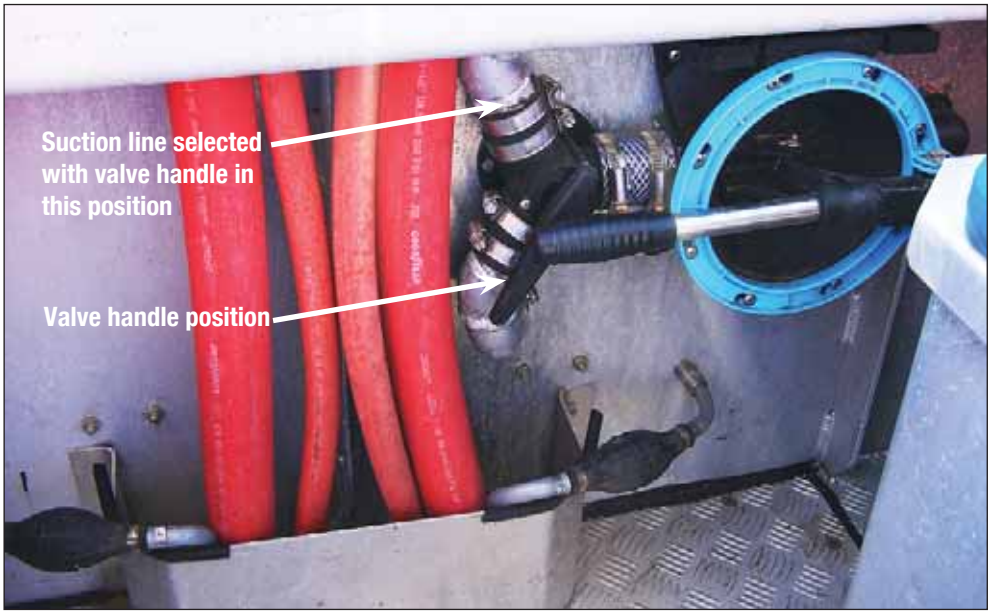
A sea anchor (or drogue) would have been a much safer way of keeping *Malu Sara*'s bow into the wind and waves than the Danforth anchors carried on board. In the situation that *Malu Sara* must have been experiencing in the early hours of 15 October, where the wind was opposing tide and the swells were short and steep, an anchor fixed to the sea bottom would have tended to pull the bow down, resulting in water being taken over the bow. A sea anchor rigged over the bow would have slowed the vessel's rate of drift and held the bow into the wind while allowing it some freedom to pitch in the swell.

The vessels were fitted with a hand operated bilge pump, which whilst meeting the requirements of both the USL Code and AS 1799, was inadequate for the purpose of pumping the vessel dry. The bilge pump discharge line (Figure 20) led into the motor-well and relied on the water then draining from the well through the freeing port. As discussed earlier, the freeing port arrangement is not adequate for clearing the build up of water in the motor-well when the vessel is stationary and the bilge pump would simply be circulating water from the cockpit to the motor-well.

In addition, the bilge pump two-way suction valve is counter intuitive and potentially confusing. The position of the valve handle does not clearly indicate from which line the pump is drawing (Figure 21). The evidence is that the skipper was apparently familiar with operation of the valve as he had used it on at least one occasion during the Saibai Island workshop. However, when the vessel was taking on water in darkness in the early hours of 15 October, it may have created needless confusion as it would not have been immediately clear whether water was being pumped from the void space or cockpit.

Figure 20: Bilge pump discharge

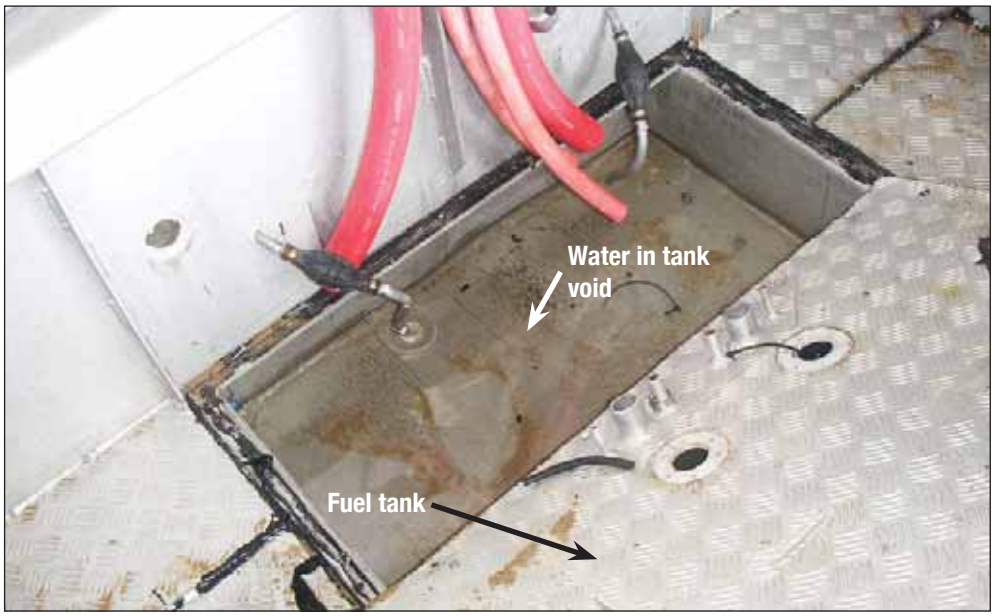
Figure 21: Bilge pump suction valve



4.3.10 Fuel storage arrangement

The IRV's fuel storage arrangement consists of a single fuel tank divided into two sections (each 150 litres). The fuel tank space is recessed into the cockpit deck on the centreline aft, and is contained in a 'casing' arrangement forming a void space that is designed to be watertight. The tank is constructed as a separate welded aluminium module with the top of the tank forming the cockpit deck with the tank installed (Figure 22).

Figure 22: Fuel storage tank and void arrangement



The tank has a flange around its upper edge which rests on the top of the surrounding cofferdam. The flange, which was sealed with mastic and screwed down, supports the weight of the tank and its contents as the bottom of the tank casing does not make contact with the bottom tank plating.

The casing is fitted with a gooseneck type breather mounted outside the cockpit transom on the port side. A fume detector sensor is also fitted to the casing on the starboard side aft with a wire connection via a cable conduit to the console where an audible alarm unit is fitted. Each section of the tank is provided with a combined filler/breather, a suction line that leads to the motors via a filter, and a fuel level gauge. The filler, breather and suction lines are attached to welded alloy up-stands at the aft end of each tank. The fuel gauge is flush mounted directly onto the chequer plate tank top.

The fuel gauges on all five boats were found to be inaccurate and the fume detectors were found to be disconnected and hence inoperable.

The fuel tank from *Zueber Erkep* was removed and inspected to give some insight into the construction of the fuel tank arrangement. After removal the tank was not pressure tested but was simply filled with water, the tank immediately started to leak. The weld quality of the tanks seams was poor (Figure 23) and it was not able to withstand the ordinary pressure of the liquid within it, even under static conditions.

Figure 23: Fuel tank weld quality

The casing surrounding the fuel tank was found to be full of water, and there was no means by which it could be emptied. There were a number of ways that water could have entered the casing. These included the unsealed penetration for the fuel fume detector cable, the unsealed screw holes in the fuel tank flange and several areas where the mastic had not formed a watertight seal.

It is probable that the fuel system on board *Malu Sara* exhibited similar failings to those noted on the other boats. The level measurement was probably inaccurate, the fuel tank may have leaked and the void space surrounding the fuel tank was probably full of water.

Given the combination of these failings the possibility of water contamination of the fuel cannot be ruled out.

4.3.11 Vessel quality assurance

The IRVs delivered to Thursday Island in August 2005 had flaws in design and construction which indicate that builder's quality control and assurance system was deficient. These flaws included the failure to meet the contract specifications in respect of the reserve buoyancy/stability requirements, inadequately/inconsistently sized deck drainage arrangements, leaks in the cockpit decks, and the poorly constructed fuel tank on at least one of the vessels. While DIMIA's tender and contract specifications did not stipulate that the vessel builder must meet any quality assurance system criteria, their reasonable expectation was that as they had prescribed the standards to which the vessels were to be built, they would be fit for purpose. It is of note that at least one of the other tenderers had an accredited quality assurance system in place and provided DIMIA with a detailed work methods statement based on their system.

The September 2000 MSQ accreditation audit of Subsee Explorer identified that the company did not have procedures in place to ensure that the workforce had their responsibilities and duties clearly defined. The audit also highlighted that the company had no survey plan available for the testing and inspection of vessels during construction and the practice was simply to refer to the terms of the contract or leave it to an external surveyor if one was used. The evidence is that no systems or procedures had been implemented by the company with respect to construction surveys, between the time of the MSQ audit and the construction of the DIMIA vessels. The contract with DIMIA did not stipulate a survey plan and no external surveyor was engaged, consequently any inspections or testing of the vessels while they were under construction were conducted totally at the builder's discretion.

It was Subsee's normal practice to engage the required skilled staff when the company secured building contracts, and so there were very few permanent staff on the shop floor. Even the workshop foreman was employed on a casual basis. This system of employment gave the company a great deal of flexibility and provided considerable cost savings. However, there was little continuity in the work force and consequently no program of ongoing employee development. In this situation it is critical to have a rigorous system of quality control and inspection.

In submission the builder stated:

> As is the norm of most small and large boat building companies, there are very few permanent staff. None are employed as "permanent" but half of Subsee's staff were employed for many years. Even the foreman was employed on a "casual" basis – all are.
>
> Our foreman and core staff had been present/employed for every vessel built by Subsee Australia for many years.

At the time that Subsee won the contract to supply the DIMIA IRVs, the director estimated that he required a work force of 15 people to complete the vessels, and other vessels that he had on order. However there was a shortage of qualified aluminium welders in Cairns and so he only managed to engage eight suitably qualified workers. This led to longer than normal working hours for the welders and a slight delay in the completion of the vessels. During the construction of the IRVs, the evidence provided by the director was that there were no formalised quality control procedures in place. Any inspections of completed work were conducted informally by the director or the workshop foreman.

The director's evidence was that his calculations regarding reserve buoyancy for the IRVs were conservative with respect to the under deck void space (later more accurately calculated as being 2.3 cubic metres). While this may have been the case his calculations did not meet the relevant requirements of either the USL Code or AS 1799. He did not make any calculation with regard to the sizing and placement of scuppers. In addition, while he stated that the cockpit floors were tested for watertightness and the fuel tanks pressure tested, there are no detailed records of these tests. The tests conducted by the ATSB during the investigation provide clear evidence to indicate that the builder's tests were at best poorly carried out, or alternatively not carried out at all. At no time, either before or during the construction process, did the builder make an attempt to instigate a plan for the surveying or formal inspection of the vessels.

The time proven method of ensuring the supply of a quality vessel has been to implement a system of checks or surveys. The design needs to be checked for compliance with relevant standards, the labour force needs to be appropriately skilled and adequately monitored, the quality of the building materials and construction processes need to meet the relevant standards and most importantly the product, the vessel itself, needs to be inspected and adequately tested at critical stages of construction. The results of the ATSB's testing and inspection of the remaining DIMIA IRVs indicates that these basic principles were not adhered to during the construction of the vessels.

4.3.12 Equipment

Outboard motors

While the performance of *Malu Sara*'s outboard motors was not a factor in the incident, the skipper's unfamiliarity with them may have been. In particular, the lubricating oil injection system and the increased fuel consumption compared with the original IRVs.

Most of the small vessels operating in Torres Strait are fitted with conventional two-stroke outboard motors which require the lubricating oil to be mixed directly with the fuel. This was the case for the motors fitted to the original DIMIA IRVs.

The new IRVs had motors fitted with a variable ratio oil injection system. Each motor was fed from a 3.78 litre oil tank mounted under the cowling. There was a commonly held belief amongst the MMOs that the oil tanks on the motors should contain sufficient oil for two full tanks of fuel. This was in fact incorrect, the lubricating oil in the tank was sufficient for around 170 litres of fuel, only a little more than one full tank of fuel (150 litres fuel = approx 3 litres of oil). In addition if the low level alarm in the lubricating oil tank was set at its higher level of 0.75 litres, the oil level would have been right on the alarm point when the vessel's main fuel tank was exhausted. This meant that it was necessary to fill the lubricating oil tanks to capacity every time the boat was fully fuelled on completion of a patrol.

Given their limited time operating the new vessels, the MMOs had probably not had sufficient experience to gauge what was 'normal' in terms of oil consumption. *Malu Sara*'s skipper had experienced a low level in the oil tanks while en route to Saibai Island on 8 October. The likelihood is that he had not replenished the oil in the outboard motor tanks after completing the routine patrol on 17 September and consequently they had reached the low level alarm point towards the end of the voyage to Saibai Island. His oversight in not carrying spare oil was probably a result of his underestimation of the amount of oil consumed by the outboard motors.

The evidence is that the skipper fuelled *Malu Sara* to capacity for the return voyage to Badu Island on 14 October. Even if he had refilled the oil tanks at the time, when the main fuel tanks were nearing exhaustion the levels in the outboard motor oil tanks would have been very close to the low level alarm. There were no records that he did fill the oil tanks before to leaving Saibai Island or take spare oil on the voyage. A low level alarm may have been what prompted the skipper to go to

anchor in the early hours of 15 October and may have been what he was trying to communicate to the water police mission coordinator during the conversation at 0133.

If *Malu Sara*'s main fuel tanks were exhausted, the emergency fuel supply in the two 20 litre fuel caddies on board the vessel would have allowed another 40 minutes or so of running. If the level in the oil tanks had reached the low level alarm, there still would have been enough oil for at least 25 litres of fuel. The skipper may have been reluctant to operate the motors with the oil low level alarm sounding and it is unclear whether or not the skipper knew that he could operate the motors in this situation. He was not familiar with the motors and had not received any training on their operation.

Satellite/CDMA telephone

Malu Sara's only method of two-way communication was the satellite/CDMA telephone. Satellite and mobile phones are not the preferred mode of safety communication for small craft. In December 2001, AMSA issued a marine notice dealing with the limitations of cellular telephones for distress and safety communications. The notice strongly urges that vessels should be equipped with properly installed and maintained marine communications equipment as the primary means of distress and safety communications[25].

Between the time the skipper reported that *Malu Sara* was leaving Saibai Island and the last contact with the IRV at 0215 on 15 October, a total of 123 attempted calls were made, either to or from the boat's satellite telephone. Thirty seven calls were connected successfully, 86 were unsuccessful and a further 16 calls were diverted to the telephone's voicemail service. The satellite telephone was apparently achieving a connection reliably. However, the skipper did not seem to fully understand the telephone system on board.

The previous DIMIA vessels were equipped with a soft canvas canopy over the coxswain's position. While the canopy would have had some effect on the satellite telephone reception, the MMOs were in the habit of walking to the bow of the boat (away from the canopy) when making a call.

The new IRVs were fitted with a large canopy constructed of aluminium. This structure effectively obscured the telephone's handset aerial from a large portion of the sky and the satellite constellation. To overcome the problem of the canopy the new boats had been fitted with a hands-free kit including an aerial mounted on top on the canopy. If the user of the phone reverted to past practice and removed the phone each time it was used there would have been a significant impact on the telephone's reception.

Satellite telephone connections may be terminated or fail through a number of causes, those relevant to this incident are:

- the satellite telephone operator may terminate the call – 'mobile release';
- the person on the land line may terminate the call – 'land release';

25 Marine Notice 18/2001 – 'Use of Cellular Telephones for Distress and Safety Communications'.

- the radio link between the satellite and the telephone may be interrupted – 'radio link failure'.

The satellite telephone switch records show the 14 of the 37 of the telephone conversations were terminated because of radio link failure. A further 13 connections were terminated before contact was made due to radio link failure. This strongly suggests that the satellite telephone was being obscured from the available satellite constellation, probably by the aluminium canopy when the telephone was removed from its hands-free cradle.

At the time of the incident, the evidence is that *Malu Sara*'s skipper had limited knowledge of the operation of the satellite telephone (a new type) and had not been shown how to use the hands-free system. It is likely that he had been using the previous procedure of removing the telephone from its cradle in the console and had made his calls standing in the bow of the boat. The movement of the vessel in the prevailing weather conditions, probably meant that many of the telephone calls were terminated when the telephone's aerial was obscured from the satellite by the moving canopy.

A rate of successful connection of 30 per cent of satellite telephone calls suggests that the way the system was fitted and the training of the skipper in the use of the telephone resulted in a manifestly inadequate form of two-way communication.

The regional manager had intended to provide some training to the MMOs on the use of the new telephone and hands free system during the workshop on Saibai Island. However each afternoon during the workshop they ran out of time and this training was never provided.

An important feature of the satellite telephone fitted to *Malu Sara* was the ability for the user to download the telephone's current position coordinates in latitude and longitude while making a call. The process is relatively simple, clearly explained in the telephone's user manual and involves a sequence of pressing four buttons on the handset. This information would have been invaluable after *Malu Sara* became lost in the afternoon of 14 October. Unfortunately none of the people aboard *Malu Sara*, the duty officer, regional manager or the Queensland Water Police realised at the time that the telephone had this feature.

The position coordinates downloaded to the satellite telephone are derived by using the known positions of the satellites in the 'visible' constellation to triangulate the telephone's position. The accuracy of the position depends on the number of satellites visible to the telephone at the time and accuracy information in metres is also downloaded to the telephone when the user requests the position information.

During *Malu Sara*'s passage on 14 and 15 October the accuracy of the satellite derived positions varied from 800 m (0.4 mile) to a maximum of 25500 m (13.7 miles). At the critical time when the skipper telephoned the duty officer at 1557 on the 14th to indicate that he was lost, the position information available for down load was accurate to within about 3500 m. Had the skipper or the duty officer been aware that this information was available from the telephone it would have been a simple matter for the duty officer to plot *Malu Sara*'s approximate position on the chart in the office on Thursday Island and then relay a course for the skipper to steer. Both men would have had the knowledge that the position was

accurate within defined limits and thus have eliminated the uncertainty associated with dead reckoning the vessel's position based on the skipper's faulty recollection of the vessel's previous speeds, headings and times. Similarly at various times in the latter stages of the passage the vessel's position could have been established almost immediately with some degree of certainty.

EPIRB

Malu Sara was equipped with an analogue 121.5/243 MHz emergency position indicating radio beacon (EPIRB). This type of EPIRB will be superseded in 2009 when the satellite system servicing this frequency is decommissioned. The intention is to replace these EPIRBs with a better digital type operating on 406 MHz which have been operational for many years and are being sold in increasing numbers.

While 406 MHz EPIRBs are currently more expensive to purchase than 121.5/243 MHz beacons (approx $500 as opposed to $200), they are detected more quickly and provide more accurate position information.

Depending on the location of the 406 MHz beacon, it may be detected instantly by geostationary satellites or within several minutes if detected by the low earth orbiting satellite system. This is compared with the average one to two hours it takes to get a confirmed satellite detection from a 121.5/243 MHz EPIRB using low earth orbiting satellites.

Position information derived from standard 406 MHz EPIRBs is generally more accurate giving positions to within 2.7 miles as opposed to more than 10 miles for 121.5/243 MHz EPIRBs. Position accuracy may also be improved to 120 m using a GPS equipped 406 MHz beacon (GPIRB).

If *Malu Sara* had been equipped with even a standard 406 MHz EPIRB, the knowledge that it would be detected almost immediately and provide an accurate position, may have prompted the skipper to use it when he became lost. In the evening of 14 October, when the skipper did activate *Malu Sara*'s EPIRB, the vessel's position would have been far more accurately resolved and relayed to the skipper much sooner if it had been a 406 MHz EPIRB. This would have removed any uncertainty as to the vessel's position in the minds of the skipper and mission coordinator and possibly led to an earlier rescue response.

In any event, if the new IRVs were to be used for a similar time to the original vessels ie. until the year 2010, DIMIA would have had to replace the existing 121.5/243 MHz EPIRBs with 406 MHz EPIRBs.

The compass

The compass fitted to each of the IRVs had a 70 mm card, rather than the 75 mm card specified in the USL Code for a class 2C vessel. Given the visibility and the requirement to navigate by dead reckoning, the accuracy of the compass was critical.

Between 1408 and 1557 on 14 October, *Malu Sara*'s skipper reported that he steered south for about one hour and then west. In fact the 1557 position, if accurate,

suggests that either the compass was significantly inaccurate, or that the skipper did not use the compass on at least one of the courses he steered.

Subsee's director indicated that the compasses fitted to the IRVs had been checked when they were installed. He indicated that it was his experience that this type of compass always had an error of less than two degrees.

The possibility that any inaccuracy of the compass may have been caused by external influences, such as the satellite telephone mounted adjacent to the compass, was tested aboard one of the sister IRVs. No discernable error was caused by the satellite telephone and the compass gave a heading that was accurate in practical terms.

Whether or not metallic objects placed close to the compass may have caused an error cannot be determined. It seems more likely that, given the compass was not easy to read over a prolonged period, he assessed his heading from the direction of the wind and waves and this led to inaccurate navigation.

The fact remains that by 0130 *Malu Sara*, by all accounts was within seven miles of Badu Island, apparently close to safety.

4.4 Regulatory oversight

4.1.1 Marine Orders Part 62 – Commonwealth Ships

History of Marine Orders Part 62

Marine Orders Part 62 – Commonwealth ships (Appendix 1) came into force on 1 March 2003. Prior to 2003, nearly all Commonwealth ships (including all vessels less than seven metres) were exempted[26] from compliance with the *Navigation Act 1912* (the Act) provided that they complied with 'relevant provisions' of the Uniform Shipping Laws Code (USL Code).

The original IRVs, commissioned in 1999, were subject to the exemption from the Act and so had to comply with the relevant provisions of the USL Code. To meet this requirement, DIMIA made the decision to register the vessels in Queensland and thus they were subject to Queensland survey. Compliance with Queensland marine safety legislation meant that the original IRVs had to be designed, constructed and surveyed in compliance with the relevant provisions of the USL Code.

In submission AMSA stated:

> In 1999, AMSA commenced a review of the regulation of Commonwealth ships with a view to replacing the general exemption instrument, which meant that these vessels were effectively regulated by State/Territory safety agencies that administer the USL Code. As the *Navigation Act 1912* expressly applied to Commonwealth ships, it was felt more appropriate for AMSA to assume direct responsibility for the

26 The exemption was in the form of an instrument made on 8 May 1985 by a delegate of the Minister for Transport under the then section 423A of the Navigation Act 1912.

safety regulation of all Commonwealth ships, in line with AMSA's administration of most sections of the Navigation Act.

AMSA's initial task was to establish the types and number of Commonwealth ships over which it would be extending safety regulation. Hence AMSA sought information from all relevant Australian Government Departments and agencies about the number, size, description, and area of operation of their "Commonwealth ships".

When this information was collated, AMSA reviewed the application of 1985 general exemption of most Commonwealth ships from compliance with the Navigation Act and decided that the making of a new part to Marine Orders covering "Commonwealth Ships" would facilitate uniform application of the relevant sections of the Navigation Act to particular classes of vessels. The new part to the Marine Orders also would improve transparency of the exemption process by making the exemption, now granted under section 421 of the *Navigation Act 1912*, part of the new Marine Order.

On 6 September 2002, AMSA prepared a letter to the departments and agencies operating Commonwealth ships proposing the introduction of a new regime to be governed by new marine orders. A draft of *Marine Orders Part 62 – Commonwealth ships*, was attached to the covering letter for comment. The DIMIA addressee was the State Director, Queensland. At the time of publication, DIMIA had not been able to establish whether it received the letter and attached draft Marine Orders. AMSA has no record of receiving any comment from DIMIA on the draft Marine Orders. After considering the responses from nine agencies who responded to the letter of September 2002, AMSA amended the draft Marine Orders and brought them into force.

Application of Marine Orders Part 62 – Commonwealth ships

Marine Orders Part 62 was developed by AMSA using a 'performance based' regulatory approach. The Orders are intended to set out the requirements to be met by the Commonwealth department or agency operating the vessel and provide flexibility in the manner in which the operator meets and demonstrates compliance with the requirements.

The Orders differentiate between three vessel sizes based on length – 24 metres or more, seven metres or more but less than 24 metres, and less than seven metres- in relation to their compliance with specific provisions of the Act. In respect of vessels less than 24 metres, provision 6.1 of the Orders requires that such vessels be built, equipped and surveyed in accordance with the USL Code. The Orders provide in provision 6.2 that for vessels less than seven metres, the USL Code provisions do not apply 'if the Chief Marine Surveyor is satisfied that the operator of the vessel has established and maintained a planned maintenance and inspection system for the vessel.'

In respect of vessels of less than seven metres, Marine Orders Part 62 makes no mention of any legislation other than the *Navigation Act 1912*. Neither the construction standard required nor the general content of the maintenance and inspection document, of which the Chief Marine Surveyor must be satisfied, are specifically mentioned.

With regard to the application of the Orders to vessels less than seven metres AMSA stated:

> The exercise of this discretionary power in the Chief Marine Surveyor is guided by AMSA's Instructions to Surveyors, ITS 62-01, which details the requirements to be met by the Commonwealth department or agency in lieu of meeting the Uniform Shipping Laws Code survey requirements. These requirements include that the vessel is built to the specified Australian Standard, is suitable for the intended area of operation, is in a seaworthy condition before each operation, has a planned maintenance program, undertakes a risk assessment prior to each operation of the vessel, is appropriately crewed and equipped for the nature of each voyage and the vessel's area of operation is smooth/partially smooth waters.
>
> The Commonwealth department or agency is required to make a declaration to AMSA in the form set out in ITS 62-01 that these requirements have been met. As most of the requirements under ITS 62-01 also meet standard procurement practices for the Commonwealth and are required to satisfy their occupational health and safety obligations, AMSA considered that it was reasonable to expect that a Commonwealth department or agency that provided such a declaration to AMSA had, in fact, undertaken appropriate inspections and assessments of its vessels to underpin the veracity of its declaration to AMSA.
>
> The Marine Order does not require, and was never intended to require, AMSA to conduct any survey or testing of vessels less than seven metres in length in lieu of requiring the vessels to meet the Uniform Shipping Laws Code survey requirements. In fact, the whole intention behind provision 6.2 of the Marine Order is to avoid the unnecessary duplication of survey and examination of these smaller craft on the basis that the Commonwealth department or agency already would have met the necessary requirements in ITS 62-01 by undertaking its own examination of its vessels to satisfy the Commonwealth Procurement Guidelines and occupation health and safety laws.

Application of Marine Orders Part 62 to the DIMIA IRVs

DIMIA's regional manager on Thursday Island was provided with the information contained in ITS 62-01 and other advice, including the need for the new IRVs to comply with the requirements of AS 1799, in telephone conversations with AMSA surveyors in October 2004. Additionally, the pro forma letter specified by ITS 62-01 to request AMSA's Chief Marine Surveyor to issue the letter of survey was sent to him as the basis for the declaration that the IRVs met the provisions of Marine Orders 62 and ITS 62-01. At no time was he advised by AMSA that there was an expectation that DIMIA would or should undertake appropriate inspections and assessments of the IRVs to underpin the veracity of its declaration, including that the vessels complied with the design and construction standards of AS 1799.

Before the IRVs were commissioned, the regional manager, on behalf of DIMIA, signed a letter to AMSA making the required declaration in the approved form under ITS 62-01. He attached a copy of the IRV operating procedures to support his declaration, although there was no specific requirement to do so. The lodgement of the operating procedures could be seen as similar to submitting a safety case, albeit a low level safety case, to an accreditation body. The subsequent issue of the letter

of survey could suggest that the procedures were endorsed by the Chief Marine Surveyor.

In building and certifying the new IRVs, DIMIA changed from a prescriptive regulatory environment, under the Queensland regulations, to the performance based approach of Marine Orders Part 62. There is a strong possibility that the way the legislative requirements are structured in the Marine Orders and the terminology used, induced some confusion or false impression in the minds of the DIMIA staff responsible for the IRV procurement and operation. The pro forma letter of application specified in ITS 62-01 for AMSA to issue a letter of survey is entitled 'Safety Inspection of Commonwealth Vessel less than 7 metres in length'. The word 'inspection' suggests an active process of examination. But no inspection of the vessels by AMSA was envisaged and the maintenance and inspection programme did not have to be submitted, only available for inspection.

Similarly, AMSA issues a 'Letter of Survey'. The letter, in effect, is a permit to operate a vessel without a survey to ensure that the vessel meets the required standards or any examination by AMSA of supporting documentation to back the declarations made by the operator. The letter of survey provided to the regional manager was predicated on the assumption that DIMIA had had the IRVs inspected to ensure that they met the required standards, and that the vessels would be operated safely consistent with DIMIA's responsibilities as a Commonwealth department to ensure a safe workplace.

This process meant that unlike similar sized commercial vessels built and operated within State jurisdictions, there was no plan approval process, no construction surveys and no final survey by, or on behalf of, the regulator to ensure that the new IRVs were constructed and equipped to the specified standard. However, AMSA submitted that plan approval and/or survey of the IRVs would have been provided by AMSA on a fee for service basis, if such a request had been received.

Commonwealth legislation provides differing operating provisions under the *Navigation Act 1912* for Commonwealth departments and agencies than commercial ships. AMSA assumes that commercial operators may seek to minimise costs in terms of safety standards and hence inspections and surveys on a fee for service basis are necessary to ensure safe standards are applied. Conversely, the assumption is that Commonwealth entities do not have commercial reasons to seek to lower standards. They are also bound by an established regulatory framework including the requirements under the *Occupational Health and Safety (Commonwealth Employment) Act 1991* which AMSA believes should provide a practical level of operational safety.

In at least one respect, however, the Commonwealth departments and agencies operating within Torres Strait had sought to reduce the standards contained in ITS 62-01. The instructions, consistent with the standards in the USL Code[27], require that the minimum qualification for a skipper operating a Commonwealth ship of less than seven metres should be a Coxswain's certificate. By agreement with

27 Uniform Shipping Laws Code, Section 2 – Qualifications and Manning, Trading Vessels, - Part 4 – Minimum Safe Manning of Trading Vessels.

the departments and agencies operating in Torres Strait, AMSA issued a letter of dispensation lowering the standard to that of a Recreational Ship Master's Licence.

There is little doubt that the DIMIA staff responsible for the introduction and operation of the new IRVs did not properly understand the scope and nature of the advice given on the survey and certification of the IRVs as Commonwealth ships. This misunderstanding contributed to *Malu Sara*, and the other IRVs, being insufficiently tested and carrying insufficient equipment (such as VHF radio and a chart).

There is a high probability that *Malu Sara*'s deficient design, poor construction and inadequate equipment were directly causal in the loss of the vessel on 15 October 2005. Had the vessel been subjected to the same regulatory oversight as a commercial vessel, or had the regulatory requirements and standards been clearer and less confused, it is much less likely that *Malu Sara* would have been lost.

In submission DIMIA stated:

> '… it would appear that a misunderstanding arose as to the scope and nature of AMSA's advice on survey, certification and registration under the *Navigation Act 1912*. It would, in our view be beneficial if there could be greater clarity as to the roles and responsibilities of agencies, the nature and scope of the survey, certification and registration processes and the interaction of Commonwealth and State standards.'

There appears to have been a gap between the perceptions and expectations of AMSA and the regional manager on Thursday Island and other DIMIA staff. The interpretation and application of provision 6.1 of Marine Orders Part 62 requires an understanding of the structure of the legislation and a sound knowledge of small boat safety standards.

Neither the regional manager, nor those within DIMIA to whom he reported, had either the necessary marine experience or knowledge to assess the IRVs' seaworthiness or equipment requirements or the necessary understanding of the process of performance based regulation. Nor did DIMIA appreciate the need for the expert advice required to meet the requirements of provision 6.2 of Marine Orders 62.

Smooth and Partially smooth waters

AMSA's ITS 62-01 limits the operation of vessels of less than seven metres in length to 'smooth' or 'partially smooth' waters. The use of the term 'partially smooth' raises a number of issues. The ITS 62-01 definition for 'smooth' and 'partially smooth' water operations is taken from the USL Code. 'Partially smooth' waters are defined as:

> …where the wave height, under normal conditions, does not exceed 1.5 m from trough to crest.

AMSA does not provide any guidance on the geographical limits where such sea conditions may normally be found. The Queensland *Transport Operations (Marine Safety) Regulations 1995* (schedule 8) describes an area which takes in the waters

from the Cape York Coast to the Islands south of Hammond Rock, but does not describe any area north of Hammond Rock other than in terms of 'normal conditions'.

The predominating wind direction in Torres Strait is recorded as south-easterly or easterly on about 70 per cent of all observations[28]. At Thursday Island, the average annual monthly wind speed is 14 knots. Under such conditions much of Torres Strait may fall within the 'partially smooth' wave height category. But from May to November, average wind speed varies between 16 and 19 knots. Under such conditions it is questionable whether the more exposed waters of the Strait could be described as 'partially smooth' waters.

4.5 Organisational oversight

The original acquisition and implementation of the DIMIA IRV program arose out of whole of government considerations relating to unauthorised movements in Torres Strait and the perceived need to improve surveillance in the area. The funding was significant and was approved by the DIMIA Finance Committee at the time.

DIMIA management, while endorsing the IRV program, did not appear to understand the risks involved in such an operation. There is no evidence of any general assessment of the risks that the IRV program may pose to DIMIA or its staff. When agreeing to the new acquisition programme DIMIA did not assess the risks in building new boats using an amended design rather than procuring 'off-the-shelf' boats. There is no evidence that anybody asked the simple question 'has the regional manager or any other staff the knowledge, experience and skills to commission and maintain safe IRV operations?'

The implementation of the original scheme and the replacement program was effectively left to the regional managers on Thursday Island. For the IRV replacement program, while the regional manger reported to his superior in Brisbane, oversight of the operation of the scheme effectively ended there. Neither the regional manager or his immediate superior had a practical knowledge of boat operations.

During the preparation of the IRV tender the regional manager obtained advice from other government agencies on the equipment carried on board similar government vessels. DIMIA is one of three Commonwealth agencies operating small vessels in Torres Strait. Both the Australian Customs Service (ACS) and the Australian Quarantine and Inspection Service (AQIS) operate a fleet of small vessels as Commonwealth ships under the provisions of Marine Orders Part 62.

Both ACS and AQIS operate small vessels of about the same size as the DIMIA IRVs. The ACS vessels in particular are equipped with an extensive range of safety, communications and navigation equipment, including echo sounders, VHF and UHF radios and GPS. The equipment on the AQIS vessels is not as extensive but the

28 Admiralty Sailing Directions, Australian Pilot Volume III.

vessels carry two means of communications and echo sounders. The ACS and the AQIS vessels have been built to either the USL Code standard or AS 1799.

The DIMIA IRV replacement tender document and subsequent contract stipulated a list of equipment to be carried that the regional manager, the team leaders and the IRV skippers considered suitable for a six metre boat undertaking daytime operation in partially smooth waters. The list did not include VHF radios, echo sounders or GPS, all of which were in use on the ACS and some AQIS vessels.

There is no doubt that the regional manager acted in good faith. His oversight of the tender process, the building specifications and letting the contract was conscientious and marked by sensible and effective consultation, making up for the shortfall in his own knowledge. Neither DIMIA senior management nor the regional manager, however, recognised the risks in commissioning new vessels without independent expert marine assistance, and accepted the builder's assurances that the vessels met the contract specifications on good faith.

The regional manager's concept was to maintain a basic operation with equipment that he and his officers saw as meeting a satisfactory level of safety, without introducing unnecessary maintenance and reliability issues. He identified some risks in terms of the malfunction or loss of assets in remote communities through inexpert operation, poor maintenance or other human intervention. He did not consider that, by not supplying certain equipment, the IRVs were vulnerable in adverse weather, particularly poor visibility, or if a vessel became disabled for any reason.

No risk assessment has been seen by the investigation. There seems to have been an assumption that the persons using the boats were experienced in small boat operations and the sea, or at least waters of Torres Strait were 'in their blood'. However, there was no assessment of the gap between any innate skills, their knowledge of safety, communications and navigation, and the requirements for operating the IRVs. This is particularly significant as the new IRVs were structurally different with a self draining cockpit, had different fuel/oil delivery systems, different sensors and alarms and a new satellite telephone with a modified arrangement.

There was also an underlying assumption that the IRVs would patrol in a limited area in the vicinity of their community. Under such conditions the skippers would normally have land marks to navigate by. DIMIA assumed that a Recreational Ship Master's Licence and a First Aid Certificate would meet any qualification standards required. While these assumptions may well be true, there are specific risks posed by small boat operations in Torres Strait.

Chief amongst these is the risk of running out of fuel or being disabled or becoming lost. Although thick fog or even mist[29] is uncommon, restricted visibility from heavy rain, smoke haze or haze caused by water droplets in the atmosphere is not unusual.

29 Mist – where visibility is impaired but not less than ½ mile.

Some of these issues were dealt with in the IRV 'Standard Operating Procedures'. The requirement to have maximum capacity fuel before setting out on patrol was covered, as was a reporting system. However, it does seem that the reporting scheme was not rigorously observed.

Missing, however, was the realisation that skippers may get lost, particularly in reduced visibility. The IRV operating procedures only refer to the visibility when addressing the issue of speed in reduced visibility. There is no advice or prohibition on operating in conditions of reduced visibility. In addition, even though charts were supplied, the check list did not require a chart to be carried. There was no evaluation of new systems such as GPS, which may provide chart, speed and course information. There was also no evaluation of the communications requirements.

Although the IRV skippers were familiar and knowledgeable about Torres Strait there was no recognition of developments in navigation aids and communication equipment that would have reduced identifiable risks. Navigation aids such as GPS are relatively new, but are widely used by the boating community in Torres Strait. Similarly the IRVs each carried a 121.5/243 MHz EPIRB. The regional manager was not aware that these EPIRBs are being phased out and replaced with 406 MHz EPIRBs. The difference is important.

Satellite telephones had been adopted as the most convenient, suitable and flexible communications system between the IRVs and the office. This may have been a valid decision, but no evaluation of alternative or additional communications had been made. VHF is an invaluable tool when undertaking search and rescue operations, which was a recognised secondary function for the IRVs under certain circumstances. There is a Telstra network of remote VHF stations in Torres Strait with remote stations on Moa Island, Darnley Island and Thursday Island, which provide a 'Seaphone' service, supports the Reef Centre VHF channels monitoring Torres Strait and other communication channels. Importantly marine VHF sets are designed and manufactured for the marine environment. In addition, the Australian Customs Service has a UHF network for their patrol vessels.

There was no audit system that assessed the skipper's on-going competence and level of knowledge. In addition, there was no audit of the overall performance of the MMO IRV patrol process.

In any operation there are six basic questions that need to be answered in assessing whether the risk was properly addressed:

- Were the risk factors identified or identifiable?
- Is the equipment in use fit for purpose?
- Were the systems and procedures on board effective to maintain safe operation?
- Were the individuals involved fit, competent and effective?
- Were emergency procedures and defenses effective?
- Was there a management system to monitor performance?

In each case the answer was 'no'.

4.6 Crew training and certification

4.6.1 General

The skippers of the DIMIA boats were all Torres Strait Islanders with a life-long association with the sea and boats.

The original six IRVs were registered in Queensland. As commercial vessels under six metres it was determined that the minimum qualification that each skipper should hold was a Recreational Ship Master's Licence, in accordance with sub-section 58(1) of Queensland's *Transport Operations (Marine Safety) Regulations 1995* (in force at the time).

In August 2001 DIMIA arranged a two-day 'Small Vessel Handling Course', which was conducted by officers of the Queensland Water Police based on Thursday Island. The course involved one day of classroom instruction covering legislation, buoyage and lights, search and rescue, basic navigation, and vessel operations. The second day was devoted to practical field work.

The basic navigation component of the course included basic chart work and dead reckoning navigation.

DIMIA offered two opportunities for the skippers to familiarise themselves with the new IRVs, at the testing of the prototype in May and at the time the vessels were commissioned in August. At least one MMO skipper was absent on each occasion. The evidence is that any training or induction for the skippers on the operation of the new boats at this time was limited and not effective.

4.6.2 *Malu Sara*'s skipper

Malu Sara's skipper attended the course conducted by the Queensland Police in August 2001. In recognition of this activity the skipper was issued with a certificate of attendance from the Tropical North Queensland Institute of Technical and Further Education. He had not however, applied for a Recreational Ship Master's Licence following the course, and at the time of the incident did not have this qualification. It is not considered that his lack of the required licence was a factor in the incident.

Malu Sara's skipper had attended the sea trails of the prototype IRV on Thursday Island in May 2005. During this time the MMO skippers in attendance were given very limited instruction on the new vessel by the builder. However the primary purpose of the sea trials was to assess the prototype with a view to making modifications for implementation on the remaining boats.

Before the vessels were commissioned on 29 August 2005, five MMO skippers travelled to Thursday Island. During this time one of the MMO team leaders (not the duty officer at the time of the incident) provided more detailed instructions on operating the vessels, their equipment and safety gear.

The training/familiarisation with the new boats does appear to be somewhat rushed. At the commissioning the satellite telephones had not arrived and installation of

the 'hands-free' kit was undertaken in the week after the commissioning, before the boats were transported to their respective communities. None of the MMO skippers had been shown the new telephone arrangement or had any hands-on practice.

Critically the skipper of the Badu Island IRV did not attend the commissioning or the subsequent familiarisation. He was booked to attend but missed the plane. There was a clear opportunity in the following week to send him to Thursday Island to ensure he understood the new propulsion system, fit out and communications system.

Without any real training on the new IRVs, *Malu Sara*'s skipper was reliant on his previous experience and knowledge of small boats to operate the new IRV and its equipment. It is apparent from his subsequent actions that he did not have an adequate knowledge of the vessel, in particular the lubricating oil system for the motors, and the operation of the satellite telephone system. This lack of knowledge was a significant factor in the events which unfolded on 14 and 15 October 2005.

4.7 Lost

4.7.1 Initial actions

With hindsight it is easy to be critical of the actions of both the duty officer on the afternoon of 14 October and later the mission coordinator after he assumed responsibility for the search. Knowing the outcome, the reaction is why a more urgent response was not made? With perfect knowledge it is possible to arrange the few known and probable facts logically and chronologically. Incidents, as they unfold do not happen that way. Information comes in piecemeal fashion and at irregular intervals.

Neither the DIMIA duty officer nor the Queensland Police Service mission coordinator associated the transmission from a satellite telephone with establishing the telephone's geographical position. There were no procedures that covered the location of telephones by satellite triangulation in the search and rescue (SAR) context and no knowledge that the information may have been obtained from the telephone itself. SAR procedures rely on EPIRB transmissions to locate persons in distress. *Malu Sara*'s skipper had not declared the vessel was in distress, but he was lost. Had the potential for the *Malu Sara*'s position to be established within reasonable limits soon after 1557, directions to the skipper could have been made with more certainty. The duty officer, however, made a reasonable assessment of the vessel's probable position and if his directions had been followed would have resulted in a safe outcome.

The fact that faced both the duty officer and the mission coordinator was that the boat was initially lost but it was not in distress. Their prime aim was to bring the boat to a place of safety. They very nearly succeeded.

The duty officer gave initial guidance that, had it been followed, should have brought the IRV to safety. The decisions made by *Malu Sara*'s skipper brought those logical endeavours undone.

Later, when the IRV's probable position was established the mission coordinator provided directions that seemed to succeed. At 0133 on 15 October *Malu Sara* was apparently close to land and safety. It is at this time that the IRV apparently exhausted its two-stroke oil or fuel supply. While there were paddles carried on board *Malu Sara* given the weight and beam of the boat and the open sea conditions it is doubtful whether they could have been used effectively. It is also possible that the engine could be run but the skipper was not sufficiently familiar with the system for him to be aware of this.

It is important to remember that the mission coordinator assumed SAR responsibilities after dark. Nightfall, the percentage of cloud cover and its height severely limited his SAR options in terms of aviation and particularly helicopter operations.

4.7.2 Search and Rescue activity in Torres Strait

Instances of small boats getting into trouble in Torres Strait are far from unusual. Figures from the Rescue Coordination Centre show that between 1 January 2000 and 31 December 2004 there were 243 small craft incidents reported. After discounting hoax calls, inadvertent alerts and other alerts that were not related to distress, 206 incidents were recorded over the five years, or about one per week. In that same five year period there were 146 EPIRB activations by small craft.

A significant percentage of the alerts were initiated because a boat had run out of fuel.

These figures relate only to the SAR incidents which involved the RCC. They do not include search and rescue alerts which the Thursday Island Police have completed without reference to the RCC.

The number of SAR incidents is illustrative of the level of risk posed by small boat operations in Torres Strait, involving people who routinely use such boats[30]. The rate of nearly one SAR incident each week indicates a high level of risk.

4.7.3 Search – DIMIA

The procedures governing the operation of the IRVs require that a vessel when on patrol is required to report its position, the well-being of the crew and its progress by satellite telephone at hourly intervals. If a boat fails to make contact within fifteen minutes of its scheduled call the duty officer is required to try and establish contact. If after one hour the officer is unsuccessful, the Thursday Island Police Station is to be contacted to initiate SAR action.

This means that the time lapse between the last positive message and the police being notified is two hours 15 minutes.

The boat patrol tasking request, however, requires that the MMOs make a 'scheduled call' at each way-point. From previous patrol tasking forms it is clear that 'scheduled calls' were nominated at irregular times, some three hours apart.

30 The Australian Standard (AS/NZ 4360:2004) refers to measuring risk in terms of likelihood and consequence.

While hourly calls were stipulated in the operating procedures, it is not clear whether or not the practice was just to report 'scheduled calls' when the way-point was reached.

The time lapse between *Malu Sara* reporting its departure and the first call from the IRV was one hour and 46 minutes. In that time there is no evidence that the duty officer tried to call *Malu Sara*, in accordance with the procedures. There was a further one hour and 46 minutes time lapse between the way-point off Turnagain Island and *Malu Sara*'s skipper reporting he was lost. Again no attempt was made by the duty officer to contact the IRV between 1408 and 1554.

More significantly, following a brief contact at 1557, two hours and 24 minutes lapsed before contact was re-established at 1822. The duty officer, however, had tried on three occasions to contact the IRV in this time.

When *Malu Sara*'s skipper reported being lost the duty officer was faced with a novel problem. It is apparent that he was either not familiar with the procedures, such as they were, or made the decision based on the fact that the skipper was in no apparent distress to attempt to guide the lost vessel to Mabuiag Island. Also the procedures to aid the duty officer were very limited, apart from notifying the police there was no guidance. He had had no training in the procedures nor had any emergency exercise been conducted to cover such a contingency.

The duty officer maintained a rough log of events but in the absence of wider procedures he had no training to fall back on. This became an increasing problem as the situation continued in an unresolved state.

To compound the duty officer's uncertainty, *Malu Sara* had not declared an emergency and he had confirmation that all on board were well and the vessel had plenty of fuel. Given the number of reefs and islands in the area it was reasonable for the duty officer to expect, having given clear directions as to a course to steer, that *Malu Sara*'s skipper would find some point of reference, if only a reef fringe to follow south. At this time the duty officer probably felt that he was in control of the situation. He had told the skipper to 'keep in touch'. The skipper ignored this stricture, even when he sighted land at sometime between 1630 and 1700.

4.7.4 Search and Rescue

The Queensland Police Service on Thursday Island was notified of the overdue IRV at 1915 on 14 October. The constable on duty in turn contacted the sergeant of Water Police. The sergeant arrived at the police station and assumed the role of 'mission coordinator' at 1940.

He telephoned the duty officer and confirmed the details of the incident, boat details, satellite telephone number and that the EPIRB had been activated. At 2000 he telephoned the RCC, told them of the incident and asked at what time the next satellite pass would be expected to detect an EPIRB in Torres Strait. In accordance with normal SAR procedures he informed the state search and rescue coordinator and briefed him on the incident. He then contacted Cairns Police Communications Centre to inform a senior officer of the missing IRV.

There is little doubt that the mission coordinator had difficulty in establishing effective communications with *Malu Sara*. *Malu Sara*'s skipper did not attempt (or did not know the number) to contact the police at any time. In all the Water Police made 58 attempts to contact *Malu Sara*, of which 13 attempts were successful. Notwithstanding this, by 0130 on 15 October *Malu Sara* was in sight of land. It was at 0133 that the first hint that the IRV was experiencing difficulty was given. The message was lost in the wind but the issue of oil was mentioned.

From 0133 to 0200 the mission coordinator made 17 attempts to contact *Malu Sara*, but apparently without success, although a conversation of nearly 26 seconds was recorded at 0145:30. At this stage it would have been reasonable to initiate an active SAR operation with the limited resources available.

4.7.5 Rescue Coordination Centre

The Australian Maritime Safety Authority's Rescue Coordination Centre is based in Canberra. It is staffed by officers with marine or aviation backgrounds.

In marine emergencies necessitating a SAR response in coastal waters, the local police undertake the initial response coordination. The RCC provide search advice based on analysis of wind drift, currents and tidal flows, EPIRB positions and when requested coordinate search craft, usually aircraft.

The RCC first became aware that a vessel was missing in Torres Strait at 2000 on 14 October. They advised the mission coordinator of the times of satellite passes that could establish the position of an activated EPIRB in Torres Strait. The position of *Malu Sara*'s EPIRB was passed to the mission coordinator at 2157 and 2320 on 14 October, and at 0221, 0600 and 0700. The EPIRB was seen in the water at 1055, and later recovered in position 09°59.5'S 141° 54.9'E. The RCC sent one of their officers to Torres Strait to liaise with the local police.

The RCC took over coordination of the aerial search at 1218 on 15 October. A major air search was coordinated for the afternoon of 15 October, but without any positive sightings. Overall responsibility was passed to the RCC at 1930 on 15 October.

In addition to the aircraft involved the VMRTI vessel *Pedro Stephen*, the Customs vessel *Botany Bay*, the RAN vessel *Malu Baizam* and the Queensland Police vessel *W Conroy* were involved in the search in addition to aircraft. Searches were conducted of the islands, islets and rocks in the vicinity of Mabuiag and Badu Islands. Aerial searches were conducted of the Papua New Guinea and Irian Jaya coasts and the reefs and islands both inside and to the west of Torres Strait. No positive sighting was made.

The SAR team consulted widely with persons with local knowledge and elements of the search were based on this advice. A side scan sonar search was also conducted using co-opted police resources from the New South Wales Police diving unit.

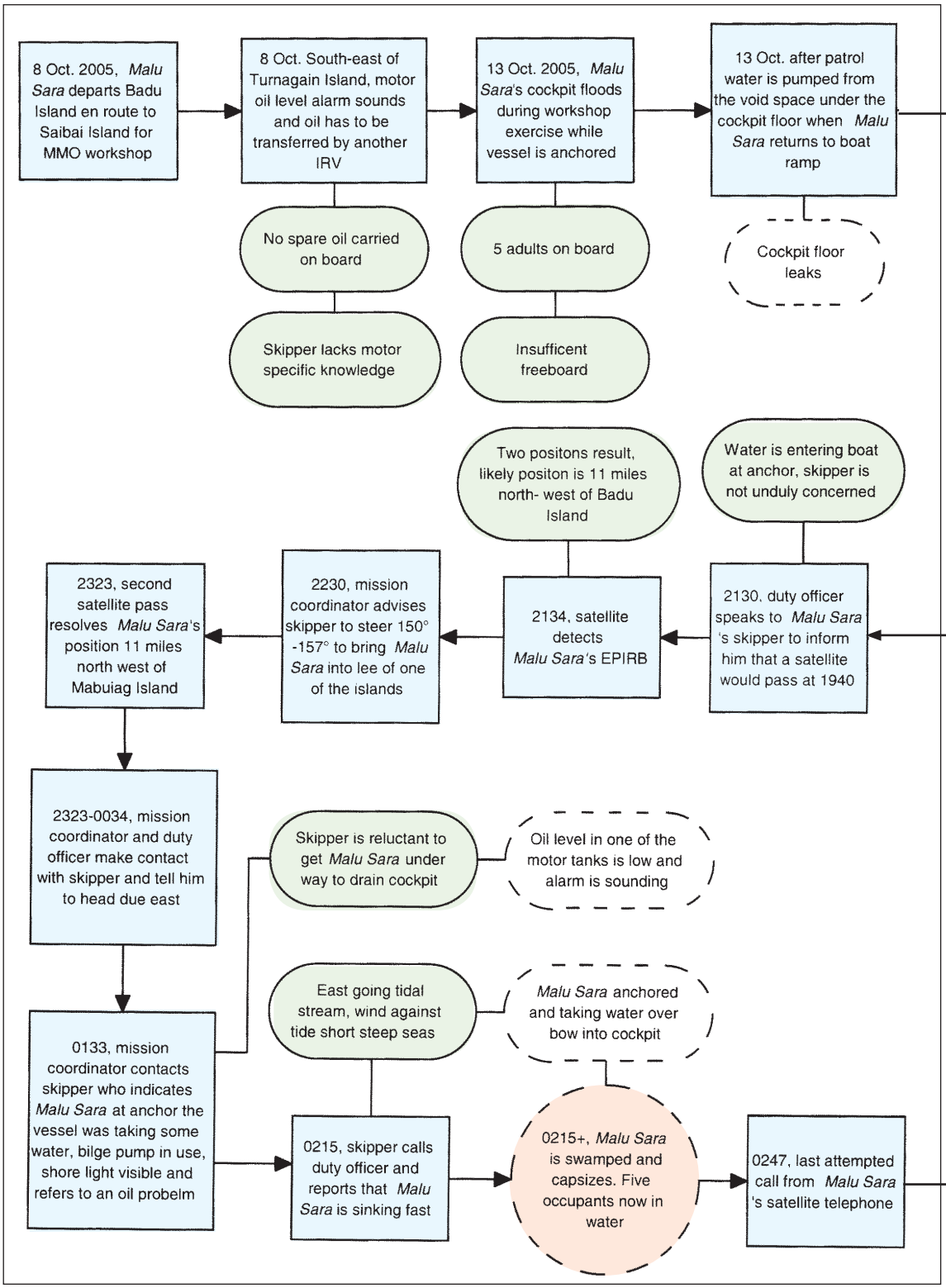
By the evening of 18 October the RCC assessed that the search would have located any survivors or debris on the surface. A number of sightings had been made but none were confirmed as being associated with *Malu Sara*. At 1925 on 18 October coordination of the search was passed back to the Queensland Water Police, while

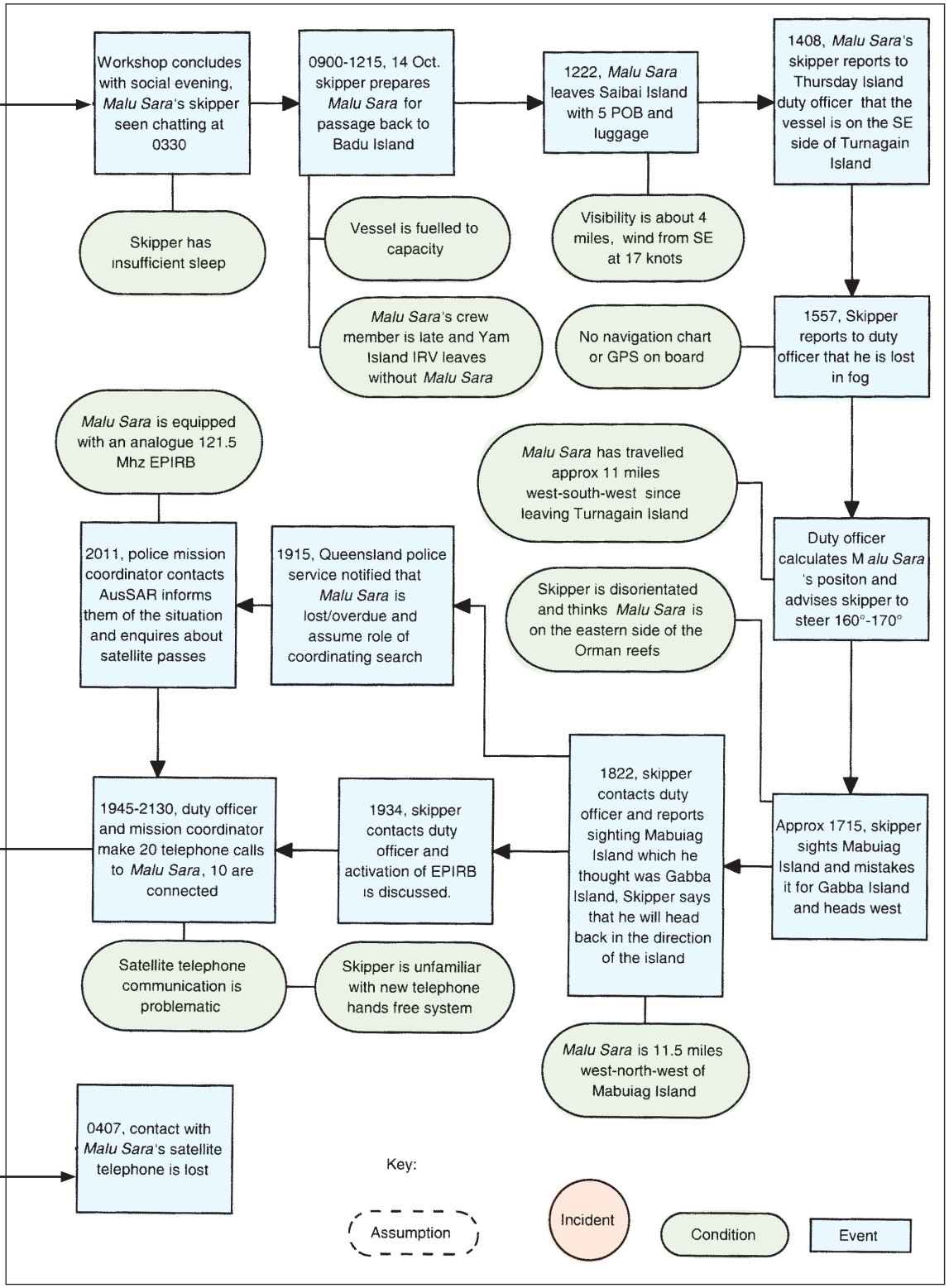
the RCC continued to coordinate the aerial search.

The SAR operations were suspended at 1800 on Friday 21 October.

DIMIA continued to make inquiries. MMOs visited villages on the south-west Papua New Guinea coast to seek any evidence relating to the missing people and boat.

Figure 24: *Malu Sara* events and causal factors chart




Workshop concludes with social evening, Malu Sara's skipper seen chatting at 0330
0900-1215, 14 Oct. skipper prepares Malu Sara for passage back to Badu Island
1222, Malu Sara leaves Saibai Island with 5 POB and luggage
1408, Malu Sara's skipper reports to Thursday Island duty officer that the vessel is on the SE side of Turnagain Island
Skipper has insufficient sleep
Vessel is fuelled to capacity
Visibility is about 4 miles, wind from SE at 17 knots
Malu Sara's crew member is late and Yam Island IRV leaves without Malu Sara
No navigation chart or GPS on board
1557, Skipper reports to duty officer that he is lost in fog
Malu Sara is equipped with an analogue 121.5 Mhz EPIRB
Malu Sara has travelled approx 11 miles west-south-west since leaving Turnagain Island
Duty officer calculates Malu Sara's positon and advises skipper to steer 160°-170°
2011, police mission coordinator contacts AusSAR informs them of the situation and enquires about satellite passes
1915, Queensland police service notified that Malu Sara is lost/overdue and assume role of coordinating search
Skipper is disorientated and thinks Malu Sara is on the eastern side of the Orman reefs
1822, skipper contacts duty officer and reports sighting Mabuiag Island which he thought was Gabba Island, Skipper says that he will head back in the direction of the island
Approx 1715, skipper sights Mabuiag Island and mistakes it for Gabba Island and heads west
1945-2130, duty officer and mission coordinator make 20 telephone calls to Malu Sara, 10 are connected
1934, skipper contacts duty officer and activation of EPIRB is discussed.
Satellite telephone communication is problematic
Skipper is unfamiliar with new telephone hands free system
Malu Sara is 11.5 miles west-north-west of Mabuiag Island
0407, contact with Malu Sara's satellite telephone is lost
Key:
Assumption
Incident
Condition
Event

5 CONCLUSIONS

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

From the evidence available it is concluded that *Malu Sara* capsized and sank in the early hours of 15 October 2005 in a position approximately seven miles west of Mabuiag Island.

Based on the available evidence, the following factors are considered to have contributed to the loss of *Malu Sara* and the presumed death of the five people on board the vessel during its passage from Saibai Island to Badu Island on 14 and 15 October 2005:

- *Malu Sara* was not seaworthy in its design or construction for the intended voyage in the following respects:
  - The design of the vessel was deficient with respect to its reserve buoyancy as there was no solid form buoyant material fitted to the vessel.
  - The cockpit floor was not watertight and thus compromised the vessel's reserve buoyancy provided by the single underfloor compartment (void space).
  - The vessel when fully loaded did not have sufficient freeboard to prevent the flow of seawater into both the motor-well and the cockpit.
  - The vessel's cockpit scuppers and motor-well freeing port were inadequately sized, poorly located and not fitted with closing devices effective in preventing the backflow of seawater into the motor-well and cockpit.
  - The vessel would have exhibited unstable characteristics and ultimately capsized when the cockpit was swamped.
  - The fuel tank arrangement was poorly designed and constructed and would probably have led to some water contamination of the fuel.
- *Malu Sara* was not seaworthy with respect to its equipment for the intended voyage in the following respects:
  - The vessel did not have a navigation chart on board.
  - There was no sea anchor on board.
  - The vessel's satellite/CDMA telephone system was not effective in maintaining two-way communication in that siting and stowage of the telephone inhibited two-way communication.
  - The vessel was not equipped with and alternative communication system (for example a very high frequency radio transceiver – VHF).
  - The vessel was not fitted with a designated navigation system capable of accurately and readily fixing its position (for example a global positioning system – GPS).

  - The vessel was not fitted with a device capable of readily sounding the water depth under the keel (an echo sounder).
  - The bilge pump arrangement was ineffective in removing water from inside the vessel and would have been difficult and confusing to use in the circumstances.
  - The vessel was not equipped with the most effective emergency position indicating radio beacon (it had a 121.5/243 MHz EPIRB rather than a 406 MHz EPIRB).

- *Malu Sara* was not seaworthy with respect to the actions and likely fatigue of the skipper. The skipper was significantly fatigued before the intended voyage to Badu Island on 14 and 15 October as a result of his activities during the week of the DIMIA workshop on Saibai Island, in particular the social activities the previous evening. His level of fatigue would have progressively increased during the voyage due to the sustained activity navigating the vessel in arduous sea conditions. It is likely that the skipper's level of fatigue would have had a significant impact on his perceptions, decisions and actions throughout the voyage.
- The perceptions, decisions, actions and knowledge of *Malu Sara*'s skipper contributed in the following respects:
  - The decision to leave Saibai Island in the prevailing conditions despite his apparent concerns about the vessel's seaworthiness.
  - The action in not carrying a navigation chart for the voyage.
  - The decision to accept the three additional passengers, without approval, and thus load the vessel to its maximum capacity for the voyage.
  - Inadequate communication with the Thursday Island duty officer in accordance with the IRV operating procedures.
  - The apparent misidentification of Mabuiag Island as Gabba Island which led to the skipper taking *Malu Sara* away from an area of relative safety.
  - The apparent perception that *Malu Sara* was on the eastern side of the Orman Reef system rather than the western side despite extensive local knowledge and other identifiable clues.
  - The decision to steer west for at least one hour without telephoning the duty officer on Thursday Island after the misidentification of Mabuiag Island.
  - The decision not to indicate distress until the time the vessel was taking on water while it was at anchor in the early hours of 15 October.
  - The skipper had insufficient knowledge of the vessel's outboard motor lubricating oil system.
  - The skipper had insufficient knowledge of the operation of the satellite telephone and its hands free system.

- The management of the operation and procurement of DIMIA's new Immigration Response Vessels and the Movement Monitoring Officer system in Torres Strait contributed in the following respects:
  - There had been no reasonable organisational assessment of the risks associated with the operation of a fleet of small vessels in Torres Strait.
  - While the steps taken in drawing up the tender document and developing the building contract were sensible and reasonable, the new IRVs were accepted without ensuring that they met the standards stipulated in the contract. In particular, the provisions of the USL Code and AS 1799 detailing design, construction and equipment requirements were not complied with.
  - The regional manager on Thursday Island did not have sufficient marine experience to oversee the building of the vessels without expert advice, direct assistance and supervision.
  - The regional manager did not have the knowledge or experience to make decisions regarding what was fitted to the vessel in terms of equipment.
  - There was no independent expert oversight of the building process or survey of the new IRVs on behalf of DIMIA.
  - There was a lack of understanding by DIMIA of the scope and nature of AMSA's advice in the acceptance and operation of the new IRVs.
  - The decisions made by the regional manager with respect to the new IRVs were not subject to scrutiny by anyone either within the organisation, or externally, with the requisite marine expertise.
  - The IRV skippers were not provided with sufficient training on the new vessels, in particular, with respect to the operation of the satellite telephone, its hands free system and the lubricating oil system on the motors.
  - The IRV operating procedures were deficient in a number of respects including the lack of advice regarding limiting conditions for navigating in restricted visibility, the carriage of a navigation chart and the checking and carriage of spare outboard motor lubricating oil.
  - There was no allowance made for the different nature of the risks associated with the voyages to and from Saibai Island for the DIMIA MMO workshop.
  - The training provided to the MMOs on the new IRVs was inadequate and in the case of Malu Sara's skipper, was non-existent.
- The regulatory oversight of the construction and survey of the new IRVs contributed in the following respects:
  - The provisions of the *Navigation Act 1912* and the provisions of *Marine Orders Part 62 – Commonwealth ships*, do not provide sufficient clear and unambiguous guidance to a potential operator on the recommended standards relevant to the testing, survey, equipment or qualifications required to operate small vessels.

- The new IRVs were not subject to the appropriate tests to ensure the hull was seaworthy, neither the builder, the operator, nor any third party carried out a 'swamp' test or effective watertightness tests.
- The Positive Flotation Statements issued by the builder did not reflect the true state of the IRV's flotation capabilities and were not approved or scrutinised by any authority.

- The following conclusions are made with respect to the search and rescue operation:
  - The use of the position information available from the vessel's satellite telephone would have led to considerably more certainty about the vessel's position. Had this information been used it is likely that *Malu Sara* would have been navigated safely to its destination.
  - The DIMIA duty officer's advice to the skipper of *Malu Sara* during the afternoon of 14 October when the vessel became lost, was sound and would have brought the vessel into safe waters if it had been followed.
  - There was insufficient contact between the DIMIA duty officer and *Malu Sara*'s skipper during the afternoon of 14 October. The delay in reporting his sighting and misidentification of Mabuiag Island, in particular, was critical in the events which followed.
  - The skipper's apparently calm demeanour and failure to indicate any distress during the afternoon and evening of 14 October probably led to less concern and consequently a less urgent response on the part of both the DIMIA duty officer and the Queensland Police Service mission coordinator.
  - The weather conditions which existed in the early hours of the morning on 15 October precluded the use of a helicopter in response to the skipper's distress message.
  - The decisions and actions of the Queensland Police Service in coordinating the search for *Malu Sara* and its occupants in the time following the loss of the vessel in the early hours of 15 October were sound.
  - The decisions and actions of the Rescue Coordination Centre in coordinating the search for *Malu Sara* and its occupants in the time following the loss of the vessel in the early hours of 15 October were sound.
- The following additional conclusions are made with respect to the DIMIA IRVs:
  - The findings of Maritime Safety Queensland's accreditation audit in September 2000 with respect to survey plans for the testing and inspection of vessels during construction were not actioned by Subsee Explorer.
  - The vessel's registered length was 6.44 metres not 5.9 m as declared by the builder. The vessel did not meet the specified contract standard.

6 SAFETY ACTIONS TAKEN

The Australian Transport Safety Bureau has been advised that the following safety actions have been taken as a result of the loss of *Malu Sara*, the investigation of the accident and the release of recommendations in the ATSB's draft investigation report.

6.1 Department of Immigration and Multicultural Affairs (DIMA)

DIMA has taken the following safety actions with respect to the ATSB's draft recommendations:

- The department suspended the fleet of boats from use immediately following the loss of *Malu Sara* on 15 October. Given the tragic outcome of this incident, a decision has been made not to use any vessels until and unless it can be clearly demonstrated that they meet all of the suggested tests specified by the ATSB.
- The department commissioned a consultant to undertake a review of its Torres Strait operations early in 2006. An aspect of the review was specifically to evaluate whether a departmental marine capability is required to meet its responsibilities or whether there is an alternative to a departmental owned and managed unit. If a maritime unit is to be re-established, the consultant was asked to advise on how this should be managed, how the department should go about developing operational standards and operating procedures, training programs and safety standards.
- Procurement and contractual management procedures will be tightened to ensure that there is appropriate independent, expert advice and oversight where appropriate. Revised procurement arrangements within the department include the completion of a risk assessment in all procurements.
- The review of the department's Torres Strait operations has identified the need to change the management structure and operation of the Thursday Island office. The implications of the consultant's recommendations are being examined.

DIMA has also advised the ATSB of the following:

- DIMA is seeking a meeting of all Commonwealth agencies with a presence in the Torres Strait with a view to the adoption of a 'whole of government' position to clearly define the objectives for the Commonwealth's maritime presence and how best to position resources to meet these objectives.
- DIMA is taking action to improve its management structure by the development of a North Queensland jurisdiction under a new position of Deputy Director based in Cairns to provide a better focus on the Torres Strait operations and the department is addressing the associated resource, management and reporting issues as a matter of priority.

- The department has established a small team from the National Office and the Brisbane Office to oversight implementation of the recommendations.

6.2 Australian Maritime Safety Authority (AMSA)

AMSA submitted the following:

> AMSA are joining with Maritime Safety Queensland (MSQ) in the development and implementation of a joint Torres Strait Maritime Safety Strategy. At a meeting on 30 January 2006, AMSA and MSQ agreed to establish a steering committee to provide oversight of the Strategy and to appoint a senior project manager to be responsible for the Strategy's implementation with assistance from senior AMSA and MSQ officers.
>
> The Torres Strait Maritime Safety Strategy aims to take a broader approach to maritime safety issues. It is a long-term, holistic program that will target community involvement, education, regulation and strengthening the maritime safety culture in the region. An early focus of the Strategy will be the thorough review of Marine Orders Part 62 and its application to smaller Commonwealth vessels in the Torres Strait region. The incident involving the *Malu Sara* has highlighted areas of concern that AMSA is keen to address in a cooperative way with MSQ, the relevant Australian Government Departments and agencies and the Torres Strait community.
>
> AMSA wrote in December 2005 to each Australian Government Department and agency that operates vessels under Marine Orders Part 62 advising that those seeking a Letter of Survey from AMSA under provision 6.2 of the Marine Order will be required to provide positive confirmation of their compliance with Australian Standard 1799 (Small Boats Code), such as by a test report from the builder or an independent marine surveyor. The letter also specified strengthened requirements for compliance with the Marine Order, which include crew qualifications being in compliance with the Uniform Shipping Laws Code, the wearing of Personal Floatation Devices by crew and passengers when vessels are underway and the carriage of a 406 MHz distress beacon, marine VHF radio and appropriate navigational equipment for the area of operation of the vessel.

6.3 Maritime Safety Queensland (MSQ)

MSQ submitted the following:

> MSQ has conducted a review of the ships in current Queensland survey built by the same builder. MSQ has identified 12 Queensland ships that were registered on the basis of Certificates of Compliance for Building or Certificates of Compliance for Design issued by Subsee Explorer Pty Ltd under its company accreditation, or by (Subsee's Director) under his individual accreditation.
>
> The file for each of these ships is being reviewed to confirm whether these ships were monitored by Shipping Inspectors since entering service. If so, the follow-up action will be a desktop audit to confirm compliance with internal buoyancy requirements. If not, the ships will be monitored as a matter of priority.

7 RECOMMENDATIONS

MR20060025

Subee Explorer Pty Ltd should review their vessel designs, methods of construction, testing, certification, equipping and quality assurance system with a view to ensuring that vessels meet the required statutory and/or contracted standards.

MR20060026

Search and rescue authorities should consult with satellite and other mobile telephone service providers to determine under what circumstances useful information from satellite telephones and switch records could aid search and rescue operations under certain conditions.

8 SUBMISSIONS

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

The final draft of this report was sent to: the Secretary of the Department of Immigration and Multicultural Affairs, DIMA's Deputy State Director for Queensland, the Thursday Island Regional Manager and both MMO team leaders at the time of the incident; the Chief Executive Officer of the Australian Maritime Safety Authority, AMSA's Manager Maritime Operations, North; the General Manager of Maritime Safety Queensland; the Director of Subsee Explorer; the Queensland Police Service mission coordinator at the time of the incident; and the Queensland State Coroner.

Submissions were received from: the Secretary of the Department of Immigration and Multicultural Affairs, DIMA's Deputy State Director for Queensland, the Thursday Island Regional Manager and the DIMA duty officer (MMO team leader) at the time of the incident; the Chief Executive Officer of the Australian Maritime Safety Authority; the General Manager of Maritime Safety Queensland; and the Director of Subsee Explorer.

Submissions were included and/or the text of the report was amended where appropriate.

9 *MALU SARA*

Boat usage	Immigration Response Vessel
Registration	AMSA letter of survey
Ship Type	Centre console, welded plate aluminium construction
Builder	Subsee Explorer, Cairns, Qld
Year built	2005
Owners and managers	Department of Immigration and Multicultural and Indigenous Affairs
Length overall (designed)	6.65 m
Length overall (measured)	6.71 m
Designed measured length	5.90 m
Beam	2.15 m
Design draft	0.45 m
Capacity	6 passengers or maximum weight 510 kilograms
Engines	2 x 'Mercury 90' 3 cylinder, 2-sroke, oil injected outboard motors
Total power	180 HP (134 kW)
Crew	2 (Australian)
Passengers	3 passengers (1 child)

10 APPENDIX 1 – MARINE ORDERS PART 62 - COMMONWEALTH SHIPS

AMSA
Australian Maritime Safety Authority

MARINE ORDERS

Part 62

Commonwealth ships

Issue 1

Order No 1 of 2003

Pursuant to Section 425(1AA) of the *Navigation Act 1912*, I hereby make this Order issuing the attached Marine Orders, Part 62, Issue 1, to come into operation on 1 March 2003.

Clive Davidson
Chief Executive Officer
4 February 2003

Table of Contents

1 Purpose of this Part

1.1 The *Navigation Act 1912* defines a Commonwealth ship as a ship:

"(a) that belongs to the Commonwealth or to a Commonwealth authority;

(b) the beneficial interest in which is vested in the Commonwealth or in a Commonwealth authority; or

(c) that is for the time being demised or sub-demised to, or in the exclusive possession of, the Commonwealth or a Commonwealth authority;

but does not include a ship:

(d) that belongs to ANL Limited;

(e) the beneficial interest in which is vested in ANL Limited; or

(f) that is for the time being demised or sub-demised to, or in the exclusive possession of, ANL Limited."[1]

1.2 All Commonwealth ships are covered by the *Navigation Act 1912*. However, many provisions of the Act, particularly in Part II, are inappropriate for Commonwealth ships and for the public employees crewing them. AMSA has therefore exempted Commonwealth ships from some or all of the provisions of the Act, on condition that the ships comply with the requirements set out in this Marine Order. The exemption is reproduced in Appendix 1 to this Order.

2 Definitions of words and phrases used in this Part

AMSA means the Australian Maritime Safety Authority established by the *Australian Maritime Safety Authority Act 1990*;

Chief Marine Surveyor means the person occupying the position of Manager, Ship Inspections, in AMSA or, in respect of any particular purpose under this Part, a suitably qualified person authorised by the Manager, Ship Inspections, for that purpose;

length, in relation to a ship, has the same meaning as in the International Convention on Load Lines, 1966, as amended by the Protocol of 1988;

penal provision means a penal provision for the purposes of Regulation 4 of the Navigation (Orders) Regulations;[2]

USL Code means the Code referred to in section 427 of the *Navigation Act 1912*.

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[1] ANL Limited has not been in operation since 1998.

[2] Regulation 4 of the Navigation (Orders) Regulations provides that a person who fails to comply with a provision of an order made under subsection 425(1AA) of the *Navigation Act 1912* that is expressed to be a penal provision is guilty of an offence and is punishable by:–

(a) if the offender is a natural person - a fine not exceeding 20 penalty points; or

(b) if the offender is a body corporate - a fine not exceeding 50 penalty points.

By virtue of section 4AA of the *Crimes Act 1914*, a penalty point is equivalent to $110.

3 Interpretation

3.1 In this Part:

- headings and sub-headings are part of the Part;
- the Appendix is part of the Part;
- a footnote is not part of the Part, but may provide additional information or guidance in applying the Part.

4 Application

4.1 This Part applies to all Commonwealth ships.

4.2 Where a provision of this Part is inconsistent with a provision of another Part of Marine Orders, the provision of this Part will prevail to the extent of the inconsistency.

5 Official log-book

For the purposes of subsection 171(1) of the Navigation Act, the prescribed form of log-book for a Commonwealth ship of 7 metres or more in length but less than 24 metres in length[3] is Form 1 in Appendix 2 and the entries to be made are those referred to in that Form.

6 Surveys and certificates

6.1 Subject to 6.2, the structure, machinery, equipment, life-saving appliances and radio installations of a Commonwealth ship of less than 24 metres in length[4] are subject to survey in the manner and at the times set out in the USL Code.

6.2 Provision 6.1 does not apply to a vessel of less than 7 metres in length if the Chief Marine Surveyor is satisfied that the operator of the vessel has established and maintained a planned maintenance and inspection system for the vessel.

6.3 Subject to 6.4, the master of a Commonwealth ship of less than 24 metres in length[5] must not take the ship to sea unless:

(a) there is in force such certificates as would enable the ship to comply with sections 206T and 227A of the *Navigation Act 1912*; or

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[3] The prescribed form of log-book for a Commonwealth ship of 24 metres or more in length is to be found in Marine Orders, Part 53.

[4] A Commonwealth ship of 24 metres and over in length must meet the survey requirements set out in Marine Orders Part 31.

[5] A Commonwealth ship of 24 metres and over in length must meet the certificate requirements set out in Divisions 2C and 5 of Part IV of the *Navigation Act 1912*.

(b) there is in force in respect of the ship certificates in accordance with the USL Code issued by or acceptable to the administration of the State or Territory in which the ship operates and appropriate to the voyages to be undertaken.

This is a penal provision.

6.4 Provision 6.3 does not apply to a vessel to which 6.1 does not apply by virtue of 6.2.

7 Dangerous goods

To the extent practicable, dangerous goods carried on board a Commonwealth ship should be packed, loaded and stowed in accordance with the International Maritime Dangerous Goods Code and Marine Orders, Part 41.[6]

8 Stowing and carriage of cargo

The loading, stowing and securing of cargo on board a Commonwealth ship must:

(a) comply with 8 to 14 (inclusive) of Marine Orders, Part 42; or

(b) if the ship is less than 24 metres in length, be to the satisfaction of the administration of the State or Territory in which the ship operates.

* * * * * *

[6] Marine Orders, Part 41, enables the Chief Marine Surveyor to modify a requirement, or exempt a ship from a requirement, in appropriate circumstances.

Appendix 1

EXEMPTION UNDER SECTION 421 OF THE *NAVIGATION ACT 1912*

I hereby:

(a) pursuant to paragraph 4(b) of the *Transport and Communications Legislation Amendment Act 1994*, revoke the exemption under section 423A of the *Navigation Act 1912* made on 8 May 1985; and

(b) pursuant to section 421 of the *Navigation Act 1912*, exempt each ship included in a class of ships specified in Column 1 of the schedule from such provisions of that Act as are specified in Column 2 in respect of that class, subject to such conditions as are specified in Column 3 in respect of that class and, in respect of an individual ship within that class, any additional conditions imposed by the Authority in respect of that ship.

SCHEDULE

Column 1	*Column 2*	*Column 3*
A Commonwealth ship under 7 metres in length	Sections 45 to 48 (inclusive), 50 to 94 (inclusive), 110, 113, 127 to 132B (inclusive), 138, 148 to 167 (inclusive), 171, 173, 174, 206T, 227A, 255, 268 to 269N (inclusive)	The ship complies with relevant provisions of Marine Orders, Part 62.
A Commonwealth ship of 7 metres or more in length but under 24 metres in length	Sections 45 to 48 (inclusive), 50 to 94 (inclusive), 110, 113, 127 to 132B (inclusive), 138, 148 to 167 (inclusive), 173, 174, 206T, 227A, 255, 269A to 269N (inclusive)	The ship complies with relevant provisions of Marine Orders, Part 62.
A Commonwealth ship of 24 metres or more in length	Sections 45 to 48 (inclusive), 50 to 94 (inclusive), 110, 113, 127 to 132B (inclusive), 138, 148 to 167 (inclusive), 173, 174, 255	The ship complies with relevant provisions of Marine Orders, Part 62.

Clive Davidson
Chief Executive Officer
Australian Maritime Safety Authority
4 February 2003

Appendix 2

Forms

Form 1

Official log-book

Description Of Vessel

Name of Vessel ……..…….

Official No. (if any) …… Home port (if any) ……....

Purpose of vessel ..……..

Registered Tonnage (if any): Gross…… Net …….……

Name of Master ……..

Record of tests, drills etc required by the *Navigation Act 1912*
(such as fire drills, steering gear tests and drills, abandon ship drills, survival craft drills, examination of life-saving and fire fighting appliances, opening/closing of watertight doors)

…….

…….

…….

Occurrences
(such as a grounding, a collision, fire, flooding, damage to hull/machinery or any other dangerous occurrence)

…….

…….

…….

Events specified in s.268 of the *Navigation Act 1912*

…….

…….

…….

11 APPENDIX 2 – FREE SURFACE EFFECT

Free surface effect

Free surface effect can occur in any space in which a liquid is able to move. *Malu Sara* had three potential spaces in which a free surface of water could form: In the under deck void space, the motor-well, and within the open cockpit. The longitudinal framing in the under deck void space meant that any movement of water with a free surface would have been limited to the fore and aft direction. However, any accumulation of water in the cockpit or the motor-well, was free to move both fore and aft, and from side to side.

A liquid that can move within a space will flow from side to side with any movement (roll or pitch) of the vessel. Such a flow of water, or more specifically the centre of gravity of the wedge of water, has a significant effect on the vessel's stability and can seriously reduce the vessel's ability to return to the upright. In such a case the centre of gravity of all the weights on the boat causes the boat to heel until the upward force of the centre of buoyancy moves to act upwards through the centre of gravity and the vessel finds equilibrium and floats at an angle (list).

The danger is that with the vessel moving in a seaway, the fluid will move rapidly to the low side as the vessel rolls or pitches, causing a sudden transfer of weight and causing the vessel to roll violently, even to the extent of causing a capsize.

In conducting tests on *Malu Sara*'s sister vessel, in which the cockpit was flooded with water, the boat almost immediately adopted a list as a result of the water entrapped on the weather deck in the cockpit. Increasing the weight of water caused the boat to capsize.

12 MEDIA RELEASE

ATSB Final Report on the 15 October 2005 Loss of *Malu Sara*

The ATSB has found that deficient boat design and construction, inadequate equipment and training, fatigue and poor decision-making, weather conditions and regulatory confusion, all combined in the tragic loss of five Torres Strait Islanders travelling on board the 6 metre boat *Malu Sara* in Torres Strait on 15 October 2005.

According to the final investigation report by the Australian Transport Safety Bureau (ATSB), the boat did not meet basic freeboard or stability requirements. When operating at slow speed or stopped, water flooded the boat's cockpit from the stern freeing port. The four remaining sister vessels had weather decks that were not watertight which allowed water to leak into the hull.

The skipper carried no chart and the only navigation aid with which he was familiar was a magnetic compass. There is strong circumstantial evidence that the skipper did not fully understand the use of either the outboard motors with their separate lubricating oil systems or the satellite telephone system, not having had proper training in either before embarking on the voyage. This was a tragedy waiting to happen.

Malu Sara was one of six boats built in Cairns and commissioned in late August 2005 for the then Department of Immigration and Multicultural and Indigenous Affairs (DIMIA). The ATSB found that the Commonwealth regulatory regime governing the construction and survey of the vessels did not provide sufficient clarity or unambiguous guidance. This led to some confusion by DIMIA, who did not have, or employ, the expertise necessary to prove the seaworthiness of the vessels or understand the various risks inherent in small boat operations.

On 14 October the *Malu Sara*, was returning from Saibai Island to its Badu Island base, a passage of about 58 miles, with four adults and one four year old child on board. In the afternoon the skipper became lost in reduced visibility. Over a period of almost eleven hours both the DIMIA duty officer and later the Queensland Police Service mission coordinator using emergency position indicating radio beacon (EPIRB) positions, attempted to guide the boat to safety. At 0215 on 15 October 2005, when *Malu Sara* was just seven miles from its home island, the skipper reported that the boat was taking water and was sinking.

Despite an extensive search over six days no trace of the boat or four of its five occupants was found. One body was recovered by Indonesian fishermen about 50 miles west of *Malu Sara*'s last known position. While there is no certainty as to what happened on the passage from Saibai Island, according to the ATSB, the probability is that fatigue and disorientation in the reduced visibility led to poor decision-making. Satellite telephone position records show that from about 1930 on 14 October *Malu Sara* remained within 18 km of either Mabuiag or Badu Islands and spent prolonged periods in static positions, probably at anchor.

The parties concerned have implemented wide ranging safety actions to prevent any similar tragedy in the future which are documented in the ATSB report. The ATSB has also made a number of additional safety recommendations.

Independent investigation into the loss of the Department of Immigration and Multicultural and Indigenous Affairs vessel *Malu Sara* in Torres Strait, Queensland, Australia
15 October 2005