Australian Government
Australian Transport Safety Bureau

Loss of containers overboard involving *APL England*

46 NM south-east of Sydney, New South Wales, on 24 May 2020

ATSB Transport Safety Report
Marine Occurrence Investigation
351-MO-2020-002
Preliminary – 28 October 2020

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

Published by: Australian Transport Safety Bureau
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Addendum

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Preliminary report

This preliminary report details factual information established in the investigation's early evidence collection phase, and has been prepared to provide timely information to the industry and public. Preliminary reports contain no analysis or findings, which will be detailed in the investigation's final report. The information contained in this preliminary report is released in accordance with section 25 of the *Transport Safety Investigation Act 2003*.

The occurrence

Passage to Australia

On 11 May 2020, the 5,780 TEU[1] fully-cellular container ship *APL England* (Figure 1) departed Ningbo, China, bound for Sydney, New South Wales. The ship was loaded with 3,161 containers (5,048 TEU), with a forward draught of 11.44 m and an aft draught of 13.32 m. The Singapore-flagged ship was managed by the CMA CGM International Shipping Company.

On 13 May the master was informed of a change in destination from Sydney to Melbourne, Victoria. Australian entry requirements during the COVID-19 pandemic required the ship to have been at sea for at least 14 days since Ningbo. This requirement made little difference at this stage and the voyage progressed as planned.

On 22 May, the master received weather advice from the CMA CGM group Fleet Navigation Centre (FNC) regarding a low pressure system and high swells (5–6 m) developing off the New South Wales coast. The master monitored the weather forecasts via updates from the commercial Ship Performance Optimization System (SPOS) service, with which the ship was a registered user.

Figure 1: *APL England* arriving into Brisbane

Source: ATSB

[1] TEU – twenty-foot equivalent unit – a standard shipping container. The nominal size of a container ship in TEU refers to the number of standard containers it can carry.

On 23 May, the FNC (supported by SPOS reports) forecast reducing swell (4–5 m). At 0800 Eastern Standard Time,[2] the ship was 20 NM north-east of Port Macquarie, making good a speed of 14 knots, in north-westerly winds to force 5[3] (17–21 knots) with 2 m seas on a 2.5 m swell. Over the following hours, the weather deteriorated as the winds moved round to the south and the seas increased. The ship's pitching and rolling motion also increased. The master ordered the ship's speed reduced to about 7 knots and advised the officer of the watch (OOW) to use manual steering as required to reduce the motion.

The master rested from 2030 to 2300 and then returned to the bridge. At midnight, the OOW recorded in the bridge log south-westerly winds to force 9 (41–47 knots), high seas (sea state 7, 6–9 m wave height) on a southerly 4.5 m swell. At about 0100, with intermittent use of manual steering, the master felt the rolling was acceptable and returned to the accommodation and to sleep.

Meanwhile, the duty engineer completed the evening inspection of the engine room and at 2130 responded to an engine room alarm (main engine high oil mist detection), which cleared upon acceptance. The engineer returned to the accommodation at about 2200 and went to bed and to sleep. At 2326, the same alarm sounded, and the engineer went to the engine room and again the alarm cleared upon acceptance. A third alarm followed at 2347 (fuel oil overflow). The engineer found no faults and attributed these alarms to the motion of the ship. The engineer returned to the accommodation and to sleep.

At 0215 on 24 May, when about 40 NM east of Sydney, the ship underwent a series of heavy rolls. Crew members, including the master and the duty engineer, were woken and unsecured items, such as books, stationery, crockery and furniture, moved and fell to the deck. The master went to the bridge where the OOW (second mate) had engaged hand steering.

Just after being woken, the duty engineer received a telephone request from the OOW to stand by in the engine room. At about the same time, an engine room alarm sounded (main engine piston cooling oil low inlet pressure) and the engineer went to the engine room to attend to it. The alarm reset upon accepting.

The heavy rolling dissipated while the ship continued to pitch noticeably. At about 0230, the master changed course more southerly to 195° and maintained a ship speed of about 7 knots in 40–45 knots winds from ahead (south-westerly). This reduced the ship's motion and the master retired again at about 0300. The duty engineer remained on standby in the engine room and kept watch from the engine control room.

At 0400 the third mate took the navigation watch (OOW). At about 0420, the master again awoke and returned to the bridge. Course was altered to 185° and hand steering used as necessary. The master remained on the bridge, and the duty engineer remained in the engine room.

The incident

Just after 0600, the ship was on hand steering and maintaining its southerly course at about 7 knots (Figure 2). Conditions remained unchanged with the ship pitching and periodically rolling more noticeably in high seas and gale force winds.

At 0610 the ship underwent a series of very heavy rolls, to about 25° either side of upright (position 34º 21.98' S, 151º 54.78' E). Again, many items moved and fell to the deck, including those which were previously secure such as the bridge document laminator, and personnel held on to maintain their footing.

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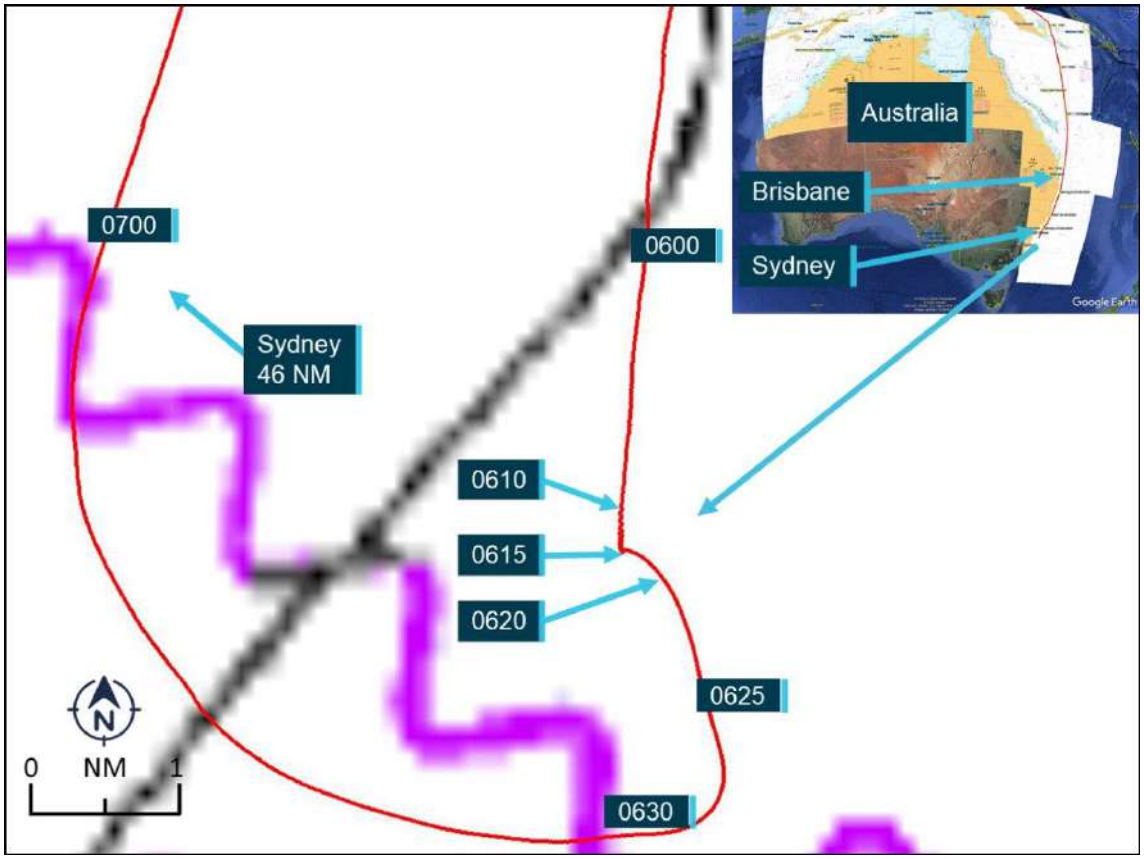
[2] All times in this report are east coast Australia local time, Eastern Standard Time (UTC + 10 hours) unless otherwise stated.

[3] The Beaufort scale of wind force, developed in 1805 by Admiral Sir Francis Beaufort, enables sailors to estimate wind speeds through visual observations of sea states.

A steering system alarm sounded, followed by an engine room alarm at 0610:28 (main engine piston cooling oil low inlet pressure). The duty engineer was seated at the engine control console (near the alarm acknowledge push button) when the heavy roll and alarm occurred. The engineer had to hold on for security and answered the alarm 6 seconds after it sounded.

Figure 2: *APL England* track and incident location



Source: Australian Hydrographic Office, Google Earth, annotated by the ATSB

The ship continued to roll heavily. At 0610:53, 25 seconds after the initial alarm, the main engine shut down due to loss of engine lubricating oil pressure.

The OOW noted the loss of power and slowing of the ship, alerted the master to the loss of the main engine and, following procedure, moved the engine telegraph to 'stop'.

At 0611:50, the duty engineer informed the OOW that, with the engine telegraph set to 'stop', the engine could be started again once the alarms had cleared (and the main engine shutdown lockouts had reset).

The main engine was restarted, dead slow ahead. By this time the ship had turned to port, beam on to the seas, and continued to roll heavily.

The events had woken the chief engineer and the chief officer who both went to the bridge. Upon seeing that the main engine had shut down the chief engineer went to the engine room.

Incident recovery

The chief officer took control of navigation to recover the ship. The ship was turned easterly and then southerly, into the weather. The response was slow and the main engine speed was increased to half ahead. The ship gathered speed and, by 0617, passed 1 knot and continued turning to starboard and south. At 0622 the ship's speed was 6 knots on steady 165° heading. The master and chief officer discussed options. It was decided to head north, with the weather, until a final decision was made.

The turn to starboard was commenced at 0627 and the ship was steady on a northerly course (about 015°) and with a speed of about 12 knots at 0700. At this time the ship was 44 NM south-east of Sydney. The chief officer contacted Sydney vessel traffic services (VTS) and was informed that the weather was not expected to improve.

As the skies lightened (sunrise was at 0647), the chief officer noticed fallen stacks of containers aft (bay 62) (Figure 3). The master notified the company of the incident. Upon returning to the bridge about 10 minutes later, the master was notified by the chief officer of the damage and loss of containers forward (bay 30).

Figure 3: Looking forward and aft from navigation bridge at about 0700

Source: CMA-CGM ANL

On the northerly heading, though the weather remained unabated from the south-south-west, the ship's movement was improved and no further loss of containers occurred. The winds eased to force 7 (28–33 knots) into the afternoon and at 1600 the ship was passing Newcastle.

The decision was made to continue passage to Brisbane, Queensland, about 400 NM further north. The weather eased as the ship travelled north. By noon on 25 May, off Byron Bay with 120 NM to travel, winds were force 5 (17–21 knots) from the south-west with sea state 5 (2.5–4 m waves) on a 3 m south-south-easterly swell.

Brisbane

At about 2136 on 25 May, *APL England* anchored 7 NM off Point Cartwright, Queensland, and the entrance to the Port of Brisbane. Prior to being allowed entry into port, several inspections and assessments by surveyors and maritime authorities were carried out. Maritime Safety Queensland (MSQ) formulated a recovery plan and risk assessment for the operation. Additional piloting, towage, pollution prevention and on-water guidance measures were put in place.

Two days after arriving off the port, at 0600 on 27 May, *APL England* weighed anchor and proceeded into Brisbane. At 1342 the ship was all fast alongside.

Over the following days personnel representing several different stakeholders attended the ship, including investigators from the ATSB, the Australian Maritime Safety Authority (AMSA) and MSQ.

On 29 May, the first damaged container was removed from the ship. In all, 50 containers (including 26 empty) were lost, and 63 were damaged but remained on board. One container lost overboard contained hazardous goods in the form of dry powder fire extinguishers. AMSA identified a search area of about 1,000 km^2 stretching between the Illawarra and Sydney's southern suburbs in water depths of up to 200 m.

By 19 June all remaining containers had been discharged and AMSA released *APL England* to sail from Australia to Zhoushan (China) to undertake repairs. On 4 July, *APL England* arrived at the shipyard.

Context

APL England

At the time of the incident, *APL England* was owned by CMB Ocean 13 Leasing Company and managed by CMA CGM International Shipping Company, both of Singapore. It was time-chartered by ANL Singapore from APL.[4]

APL England had a multi-national crew of 25 from Malaysia, Singapore, China, Myanmar and Ukraine. There were four deck officers with the chief officer on daywork devoted to deck maintenance and cargo operations—the chief officer did not maintain a navigation watch.

During March 2020, CMA CGM changed *APL England*'s voyage plan from the China–India service to the China–Australia service. *APL England* completed the China–India service in Manila and in early April proceeded to Shanghai to load for the Australia service. The change of service prompted increased attention to the ship's condition (deck and engine room), including deck condition, cargo lashing equipment, access hatches and deck structures as well as other machinery and equipment such as lifeboats, winches and windlasses. Two additional fitters joined the ship to assist with deck repairs and maintenance. Direction was received from, and regular reports were made to, fleet management.

The ship was classed with DNV GL and had completed the most recent annual survey during April 2020. This survey identified, amongst other items, heavy corrosion, wastage and cracking around a small number of cargo hatch coamings. No mention was made regarding findings related to the condition of cargo securing or deck fittings.

Carriage of containers

APL England was designed exclusively for the carriage of containers as cargo. Containers were carried in athwartship spaces called 'bays', both on deck and in cargo holds. The ship's bays were numbered from bay 01 forward to bay 62 aft, with bay numbers 46 to 62 located aft of the accommodation.

In accordance with SOLAS regulations, containers carried on board needed to be loaded, stowed and secured in accordance with a cargo securing manual (CSM) approved by the ship's administration. *APL England*'s CSM was compiled by Kunshan Lucky Sea Industrial and first approved in 2001.

Containers are stowed and secured with suitable securing arrangements to withstand the forces imposed on them while being transported by sea. The motions of a ship in a seaway give rise to accelerations and forces, the magnitude of which depend upon the dimensions of the ship, its stability conditions and the wind and sea conditions being experienced. A ship's cargo stowage arrangement and securing system is designed to ensure that the forces generated at sea remain within defined, allowable limits and that the container stow remains intact. The CSM provided details of these limits, stowage arrangements and container securing systems, including lashing patterns and details of lashing gear.

APL England had a capacity of 5,780 TEU. With limited durations in port for cargo operations, a means to easily and quickly ascertain that the forces acting on the ship would not exceed specified limits was required. To that end, in addition to the CSM, the ship was fitted with a Seacos MACS3 (v NET1.1) loading computer system developed by Interschalt maritime systems. Amongst other applications, this system also incorporated a container or cargo loading module and a lashing calculation program. The system met the requirements of Germanischer Lloyd (GL) Guidelines for Loading Computer Systems 2013 (GL2013).

[4] APL and ANL Singapore are headquartered in Singapore and are part of the CMA CGM Group.

On board *APL England*, the equipment used to secure containers on deck included twistlocks, lashing bars and turnbuckles. Twistlocks were used to secure containers stowed on deck to the hatch cover or deck, and to secure containers to one another vertically in a stack. Turnbuckles were anchored to lashing eyes on the ship's deck, hatch coaming or lashing bridge, depending on the location on board. The lashing bars secured containers to the ship and were tensioned via the turnbuckles.

The load computer results based upon ship conditions on departure from Ningbo showed nine lashing lifting force exceedances, from 102 to 107 per cent of the maximum force. The master and chief officer accepted these values in the knowledge, confirmed by forces checks, that changing ship conditions (ballast and fuel) would bring these forces within the acceptable range as the voyage progressed.

Recorded data

APL England was fitted with a simplified voyage data recorder (S-VDR)[5] designed to collect and store data from various shipboard systems in compliance with SOLAS requirements. This included parametric data, bridge and communication audio, and radar images. Roll and pitch data were not recorded on board nor was there any requirement to record such data.

APL England's system was designed to contain 12 hours of data, written concurrently to a Compact Flash (CF) card and the protective capsule. This system required crew interaction to ensure the data was saved following an incident where power was not lost. The oldest data is continually overwritten and to preserve data, it is saved to the CF card and the card removed. As per procedures, the data post-incident was saved by the crew to the CF card which was then provided to the ATSB. The downloaded data was successfully converted in accordance with the manufacturer's procedures.

APL England was also fitted with a Panasonic video recording system, which captured 8 video feeds, and contained about 1 month of data.

Initial analysis of audio recordings revealed the falling objects banging and crashing noise which occurred on the bridge around 0610 was significantly more than during the earlier 0215 roll event. The review of the available recorded data is ongoing and will be included in the ATSB's final investigation report.

Condition of securing arrangements

The ATSB onsite investigation examined securing arrangements and lashing equipment in use on the ship. The lashing equipment appeared in generally good condition. However, many of the ship fittings (lashing eyes, lashing bridges and deck structures) were not found in good condition, as evidenced by the examples shown in Figure 4.

[5] The voyage data recorder for a cargo ship larger than 3,000 gross tons, constructed before July 2002 may be an S-VDR.

Figure 4: Examples of condition of cargo securings and ship structure

Source: ATSB

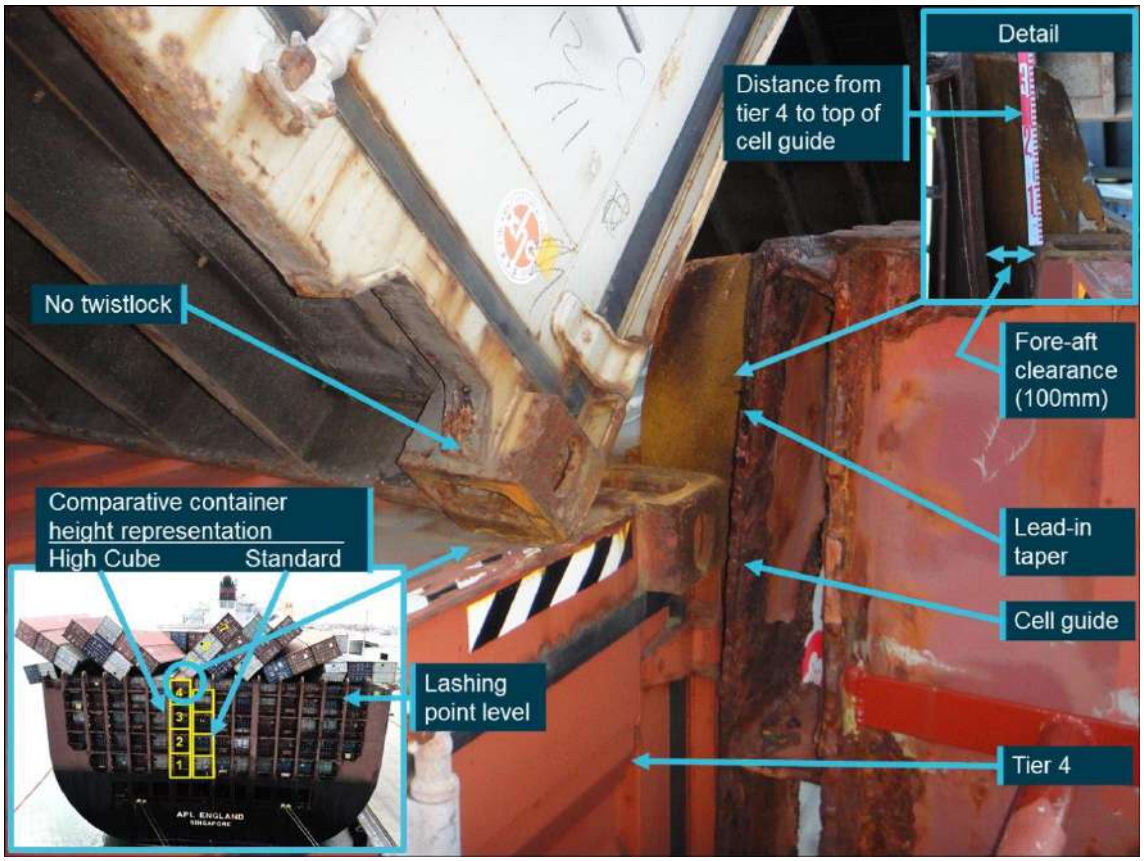
The ATSB inspection of the bay 62 (aft) arrangement and damage revealed similar structural and securing conditions as shown in Figure 4. However, in addition to this, examination of the stowage arrangement showed that the security of the stow above the container cell guides used in bay 62 was affected by the use of high cube (2.9m (9'6") high) as opposed to standard height (2.6 m (8'6")) containers.

Containers loaded on deck into bay 62 were secured as per the CSM. The CSM allowed for 8 tiers of 40' containers to be loaded with the lower 4 tiers held within the cell guide structure. Containers in these tiers were not secured to each other or the deck via twistlocks or other securing arrangement. Atop tier 4, the lower part of tier 5 containers were within the cell guides and, due to access reasons, not secured to tier 4 containers by twistlocks. Tier 5, 6, 7 and 8 containers were secured together by twistlocks and lashing rods secured these stacks to the ship as per the CSM—lashing rods connected from lashing eyes (mounted to the cell guide structure) to the lower foot of tier 5 containers.

In this arrangement, when loading standard height containers, the top of tier 4 was about 1,550 mm (5'1") below the top of the cell guides. However, high cube containers are 300 mm (1') higher than the standard height container. Therefore, when loading high cube containers into bay 62, the top of tier 4 was 1.2 m (4') higher than when loading standard height containers. In these circumstances, the bottom of tier 5 containers would be about 300 mm below the top of the cell guides, and within the tapered (fore-aft) lead-in section of the guide (Figure 5).

For the voyage to Australia, bay 62 was loaded with predominantly high cube containers to 7 tiers. The loading computer lashing and forces checks did not show any conflicts for this arrangement.

Figure 5: Bay 62 container stowage versus cell guide arrangement



Source: ATSB

Weather—Australian east coast low pressure systems

As *APL England* travelled down the east coast of Australia, the master received weather information regarding a complex low pressure system developing off the south-east of the country. This included regular forecasts and warnings (including gale warnings) issued by the Bureau of Meteorology (BoM) along with reports and guidance provided by the FNC and through SPOS.

With regard to low pressure systems off the east coast of Australia, BoM noted that 'some of Australia's worst maritime disasters are caused by the destructive winds, torrential rainfall and rough seas that accompany stronger East Coast Lows'.[6] ATSB incident investigations related to east coast lows include the loss of containers overboard from *YM Efficiency* in 2018, and the grounding of the bulk carrier *Pasha Bulker* in 2007.

BoM also stated:

> …east coast lows are intense low pressure systems which occur, on average, several times each year off the eastern coast of Australia, in particular southern Queensland, NSW and eastern Victoria. Although they can occur at any time of the year, they are more common during autumn and winter with a maximum frequency in June. East Coast Lows will often intensify rapidly over a period of 12-24 hours making them one of the more dangerous weather systems to affect the eastern coast…
>
> East coast lows can generate one or more of:
>
> - Gale or storm force winds along the coast and adjacent waters
> - Very rough seas and prolonged heavy swells over coastal and ocean waters which can cause damage to the coastline.

[6] East coast lows—www.bom.gov.au/weather-services/severe-weather-knowledge-centre/eastcoastlows.shtml

Related occurrences

YM Efficiency, 1 June 2018[7]

At about 0035 on 1 June 2018, *YM Efficiency* was steaming slowly into strong gale force winds and very rough seas off Newcastle, en route to Sydney, when it suddenly rolled heavily, causing container stacks to collapse and topple. As a result, 81 containers were lost overboard and a further 62 were damaged. The ship sustained structural damage to its lashing bridges, superstructure, and accommodation ladder. Substantial debris from the lost containers subsequently washed ashore on the New South Wales coast.

The ATSB investigation determined that the forces generated during the sudden, heavy rolling placed excessive stresses on containers stowed aft of the ship's accommodation. This resulted in the structural failure of containers and components of the lashing system, leading to the loss of containers overboard. Potential causes for the sudden rolling were investigated, but there was insufficient evidence to establish a definitive reason.

Further, the condition of the ship's lashing equipment was considered not to have contributed to the loss of containers. However, the investigation found that the weights and distribution of containers in the affected bays were such that calculated forces exceeded allowable force limits as defined in the ship's cargo securing manual (CSM).

APL England, 18 August 2016

At about 1500 (local time UTC + 8 hours) on 18 August 2016, while transiting the Great Australian Bight, *APL England* lost 37 containers overboard in rough seas. At the time of the occurrence, the ship was on an easterly heading (095°) at a speed of 17.9 knots in south-westerly winds of force 7/8 (34–47 knots) with a 4–5 m south-westerly swell on 6 m seas.

The master reported that the ship was rolling easily/moderately to a beam and quarterly swell but at around 1445–1500 the vessel encountered a sudden heavy roll to port (about 25°) coinciding with the loss of containers.

The ATSB did not investigate the occurrence. AMSA conducted an investigation and concluded that:

- the vessel had a high metacentric height (GM)[8] which may have contributed to generation of excessive dynamic forces leading to failure of container base sockets and collapse of the stow
- the topmost container tier in all rows of the collapsed bay was over the recommended weight although the stack weight in each row was not exceeded
- the master was well prepared for heavy weather and had complied with safety management system requirements on departure from Fremantle
- the weather experienced was as expected in the Great Australian Bight during the winter season
- the ship conditions (draft, loading, stability) were within criteria which may have led to parametric rolling.

Following this incident, *APL England* was removed from this service and did not return to Australia until the 24 May 2020 incident.

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[7] ATSB investigation 344-MO-2018-002: Loss of containers overboard from *YM Efficiency*, 16 NM east-south-east of Newcastle, New South Wales, 1 June 2018.

[8] Metacentric height is one of the critical measurements of a ship's stability. It is usually referred to as 'GM', the term used for it in the equation used to calculate metacentric height.

Machinery

APL England's main engine was a Samsung B&W 12K90MC, delivering 55,659 kW at 94 revolutions per minute (RPM) through a direct drive six-bladed propeller. At 94 RPM the main engine consumed 210 tonnes of fuel per day at a ship speed of 25.0 knots. Economical speed was 60 RPM, consuming 67.7 tonnes of fuel per day at 16.3 knots.

The main engine lubricating oil system included two vertical centrifugal pumps with 400 mm delivery bore and 1,200 m³/hour capacity at 0.45 MPa pressure. The pumps were mounted into the lubricating oil sump tank at the forward end of the main engine. Minimum oil level in the sump tank was 480 mm maintaining the pump suction submersed by 350 mm. The system was designed to operate in conditions to 22.5° roll and 7.5° pitch angles.

The main engine lubricating oil system pressure monitoring consisted of two pressure sensing circuits. The first was a pressure transducer which provided real-time pressure values to the engine room alarm and monitoring computer system. The monitoring system provided a display of oil pressure in the machinery control room. Normal inlet pressure to the engine was 2.7 MPa. Software alarm and shutdown triggers were based upon readings from this transducer. A separate pressure switch was also fitted as an independent low-low pressure main engine shutdown. The software low pressure alarm was set at 1.7 MPa with zero time delay, and both low-low pressure shutdowns were set to 1.5 MPa with zero time delay.

Further investigation

To date, the ATSB has completed site inspections and gathering of evidence including interviews, documentation, data records and the ship's voyage data recorder. Evidence collection continues through requests directed to parties related to the incident including the shipping company, class, regulators, port authorities and weather organisations. Safety analysis of gathered evidence is on-going.

The investigation is continuing and will include review and analysis of the following:

- the ship's container stow and lashing arrangement
- ship's maintenance regimes (deck and engine room)
- ship's service history and associated inspections
- relevant requirements for inspection of deck equipment for securing containers
- ship's stability condition
- weather conditions and weather information provided to the crew at the time of the incident
- available recorded data during the incident
- actions of the ship's officers and crew during the incident.

Should a critical safety issue be identified during the course of the investigation, the ATSB will immediately notify relevant parties so appropriate and timely safety action can be taken.

A final report will be released at the conclusion of the investigation.

General details

Occurrence details

Date and time:	24 May 2020 – 0610 EST (UTC + 10 hours)	
Occurrence category:	Accident	
Primary occurrence type:	Cargo loss and damage	
Location:	46 NM south-east of Sydney N.S.W.	
	Latitude: 34º 21.97' S	Longitude: 151º 54.78' E

Ship details

Name:	*APL England*
IMO number:	9218650
Call sign:	9VDD2
Flag:	Singapore
Classification society:	DNV-GL
Departure:	Ningbo, China, 11 March 2020
Destination:	Melbourne, Victoria, Australia
Ship type:	Fully cellular container ship
Builder:	Samsung Heavy Industries (South Korea)
Year built:	2001
Owner(s):	CMB Ocean 13 Leasing Company (Singapore)
Manager:	CMA CGM International Shipping Company (Singapore)
Gross tonnage:	65,792
Deadweight (summer):	67,986.6 t
Summer draught:	14.026 m
Length overall:	277.255 m
Moulded breadth:	40.00 m
Moulded depth:	24.30 m
Main engine(s):	Samsung B&W 12K90MC
Total power:	55,659 kW at 94 rpm (MCR)
Speed:	25.0 knots
Injuries:	Crew – 1 minor
Damage:	50 containers lost overboard, 63 containers damaged and remaining on board; vessel structure damage