ACCIDENT REPORT

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

Report on the investigation of the capsize and sinking of the tug *Biter* with the loss of two lives, while assisting the passenger vessel *Hebridean Princess* off Greenock, Scotland on 24 February 2023

VERY SERIOUS MARINE CASUALTY   REPORT NO 17/2024   NOVEMBER 2024

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

Front cover images courtesy of Hebridean Island Cruises Ltd and Kevin Kelway (Dorcas Media)

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Image courtesy of Hebridean Island Cruises Ltd

Biter

Image courtesy of Kevin Kelway (Dorcas Media)

Hebridean Princess

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

°	-	degrees
AIS	-	automatic identification system
ASD	-	Azimuth Stern Drive
BML	-	Boatmasters’ Licence
BPG	-	Bridge Procedures Guide
BTA	-	British Tugowners’ Association
c.	-	circa
CCTV	-	closed-circuit television
CHA	-	Competent Harbour Authority
Clydeport	-	Clydeport Operations Limited
cm	-	centimetre
CMS	-	Clyde Marine Services Limited
CoC	-	certificate of competence
COSWP	-	Code of Safe Working Practices for Merchant Seafarers – 2015 edition, Amendment 7, October 2022
ECDIS	-	Electronic Chart Display and Information System
ENG1	-	the standard medical fitness certificate for UK seafarers on seagoing vessels
GCNS	-	Glasgow College of Nautical Studies
GP	-	general practitioner
GPS	-	global positioning system
GT	-	gross tonnes
GTGP	-	A Guide to Good Practice on Port Marine Operations
HMPE	-	high modulus polyethylene
ICS	-	International Chamber of Shipping
IMO	-	International Maritime Organization
kts	-	knots
LOA	-	length overall
LPS	-	Local Port Service
m	-	metre
MCA	-	Maritime and Coastguard Agency

MGN	-	Marine Guidance Note
MPX	-	master/pilot exchange
MSN	-	Merchant Shipping Notice
nm	-	nautical mile
NOS	-	National Occupational Standards
NVIC	-	Navigation and Vessel Inspection Circular
PEC	-	Pilotage Exemption Certificate
PMSC	-	Port Marine Safety Code
PTX	-	pilot/tug exchange
RA	-	Risk assessment
RIB	-	rigid inflatable boat
SHA	-	Statutory Harbour Authority
SMS	-	safety management system
SOG	-	speed over the ground
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
t	-	tonne
UTC	-	universal time coordinated
VHF	-	very high frequency
VTE	-	Voluntary Towage Endorsement
WA	-	The Workboat Association (formerly the National Workboat Association)

TIMES: all times used in this report are UTC unless otherwise stated.

SYNOPSIS

At about 1527 on 24 February 2023, the twin screw conventional tug *Biter* girted and capsized off Greenock, Scotland while attached to the stern of the passenger vessel *Hebridean Princess*, which was making its approach to James Watt Dock. *Biter*'s two crew were unable to escape from the capsized vessel and lost their lives.

The investigation found that *Biter* girted and capsized because it was unable to reverse direction to operate directly astern of *Hebridean Princess* before the tug's weight came on to the towing bridle and, when this happened, the tug's gob rope did not prevent it being towed sideways. The investigation also found that *Hebridean Princess*'s speed meant that the load on *Biter*'s towlines was between two and five times more than at the port's recommended speed range. Thereafter, given the tug's rapid capsize, it was unlikely that *Biter*'s crew had sufficient time to operate the tug's emergency tow release mechanism. Once the tug was inverted, the open accommodation hatch might have prevented air being trapped inside the wheelhouse, potentially limiting the crew's chance of survival.

The investigation also found that the master/pilot and pilot/tug information exchanges were incomplete and that the opportunity to correct the pilot's assumption about *Biter*'s intended manoeuvre was lost. Further analysis indicated that the training provided had not adequately prepared the pilot for their role and that it was likely that the tug master did not fully appreciate the risks associated with the manoeuvre.

Two safety issues that did not directly contribute to the accident have been examined in the report: the guidance to seafarers on what medical conditions need to be reported to their approved doctor; and that the tugs were not required to be fitted with automatic identification systems while operating in confined waters covered by a local port service that used this equipment to monitor marine traffic within the port.

Recommendations have been made to *Biter*'s owner, Clyde Marine Services Limited to: review its risk assessment and safety management system to provide clear guidance to its masters on the rigging and securing of the gob rope, and the safe speed for the conduct of key manoeuvres; and, to adopt an appropriate training and qualification scheme for its tug masters. Recommendations have also been made to Clydeport Operations Limited to commission an independent review of the tug training provided to its pilots within the port and to risk assess and review its Pilot Grade Limits and Tug Matrix; and, to UK pilot, harbourmaster, port, tug owners and workboat associations to develop appropriate marine guidance on the safety issues raised in this report.

SECTION 1 – FACTUAL INFORMATION

1.1 PARTICULARS OF *BITER*, *HEBRIDEAN PRINCESS* AND THE ACCIDENT

SHIP PARTICULARS		
Vessel's name	*Biter*	*Hebridean Princess*
Flag	UK	UK
Classification society/certifying authority	The Society of Consulting Marine Engineers and Ship Surveyors	Lloyd's Register
Official/IMO number	904500	6409351
Type	Twin screw workboat/tug	Passenger vessel
Registered owner	Clyde Marine Services Limited	Hebridean Island Cruises Limited
Manager(s)	Clyde Marine Services Limited	Northern Marine Ship Management Limited
Construction	Steel	Steel
Year of build	1982	1964
Length overall	16.25m	71.63m
Registered length	16.25m	67.1m
Gross tonnage	28.7	2,112
Minimum safe manning	2	13
Authorised cargo	None	Passengers

VOYAGE PARTICULARS		
Port of departure	Greenock, Scotland	Greenock, Scotland
Port of arrival	Greenock, Scotland	Greenock, Scotland
Type of voyage	Internal waters	Internal waters
Cargo information	None	None
Manning	2	40

MARINE CASUALTY INFORMATION		
Date and time	24 February 2023, at approximately 1527	
Type of marine casualty or incident	Very Serious Marine Casualty	
Location of incident	Off Greenock, Scotland	
Place on board	Wheelhouse	Not applicable
Injuries/fatalities	2 fatalities	None
Damage/environmental impact	Total constructive loss	No damage
Ship operation	Towing	Manoeuvring
Voyage segment	Arrival	Arrival
External & internal environment	Wind north-west Beaufort force 2; sea state 2; good visibility; high water; slack tidal stream	
Persons on board	2	45

1.2 BACKGROUND

At 0928 on 24 February 2023, the passenger vessel *Hebridean Princess* left James Watt Dock, Greenock, Scotland to conduct engine and equipment trials after a 3-month maintenance period. *Hebridean Princess* left the dock stern first, assisted by two tugs: the twin screw conventional tug *Biter* forward and the Azimuth Stern Drive (ASD) tug *Wrestler* aft **(Figure 1)**. Once *Hebridean Princess* had been turned in the navigational channel, the tugs were released and returned to their berths at Victoria Harbour. Shortly afterwards, a Clydeport Operations Limited (Clydeport) pilot disembarked from *Hebridean Princess* and the passenger vessel proceeded into the Firth of Clyde. The plan was for the vessel to return to James Watt Dock that afternoon.

Image courtesy of George Allison (UK Defence Journal)

Figure 1: *Hebridean Princess* leaving James Watt Dock on the morning of 24 February 2023, assisted by the conventional tug *Biter* forward and the azimuth stern drive tug *Wrestler* aft

1.3 NARRATIVE

1.3.1 The accident

At 1406, as the last of *Hebridean Princess*'s equipment trials were being completed, the master briefed the crew on the passage plan for the vessel's return to James Watt Dock. The master described how the vessel would attach two tugs in the navigational channel before turning to starboard and entering the dock stern first. The master did not discuss the vessel's speed with the crew during the briefing.

Approximately 15 minutes later, a Clydeport pilot was embarked while the crew of *Hebridean Princess* were completing an anchor trial in the Alpha Anchorages **(Figure 2)**. The pilot was escorted to the bridge, where they discussed the plan for *Hebridean Princess*'s entry into Greenock with the vessel's master.

During the master/pilot information exchange (MPX), the master handed the pilot the briefing form for *Hebridean Princess*. The master advised the pilot on the vessel's manoeuvring characteristics and draught and informed them that two conventional tugs, *Bruiser* and *Biter*, had been allocated to assist with the move. The master also stated that the vessel would need to enter James Watt Dock stern first to allow it to be berthed starboard side to. In response, the pilot shared their Clydeport MPX passage record **(Figure 3)** that detailed the tidal and environmental conditions, the predicted under keel clearance, a mooring plan and the names and bollard pull of the allocated tugs. In return, *Hebridean Princess*'s master provided the pilot with a copy of the vessel's pilot card that included a table of engine orders alongside predicted speed.

The master and pilot also discussed how to manoeuvre *Hebridean Princess* through the narrow entrance to James Watt Dock. They agreed a plan where the vessel would be turned to starboard in the channel before entering the dock stern first. As the passenger vessel did not have centre line fairleads the master and pilot agreed that each tug would be attached using twin double-eyed towlines, known locally as a bridle, made fast to the port and starboard side of the passenger vessel's forecastle and poop deck. They also agreed that *Biter* would be attached aft and *Bruiser* forward.

Noting that *Bruiser* had yet to arrive from its previous tasking, *Hebridean Princess*'s master and the pilot agreed to delay the vessel's entry to the navigational channel by approximately 30 minutes. The master then manoeuvred the vessel near to the Alpha Anchorages while they waited for *Bruiser* to arrive.

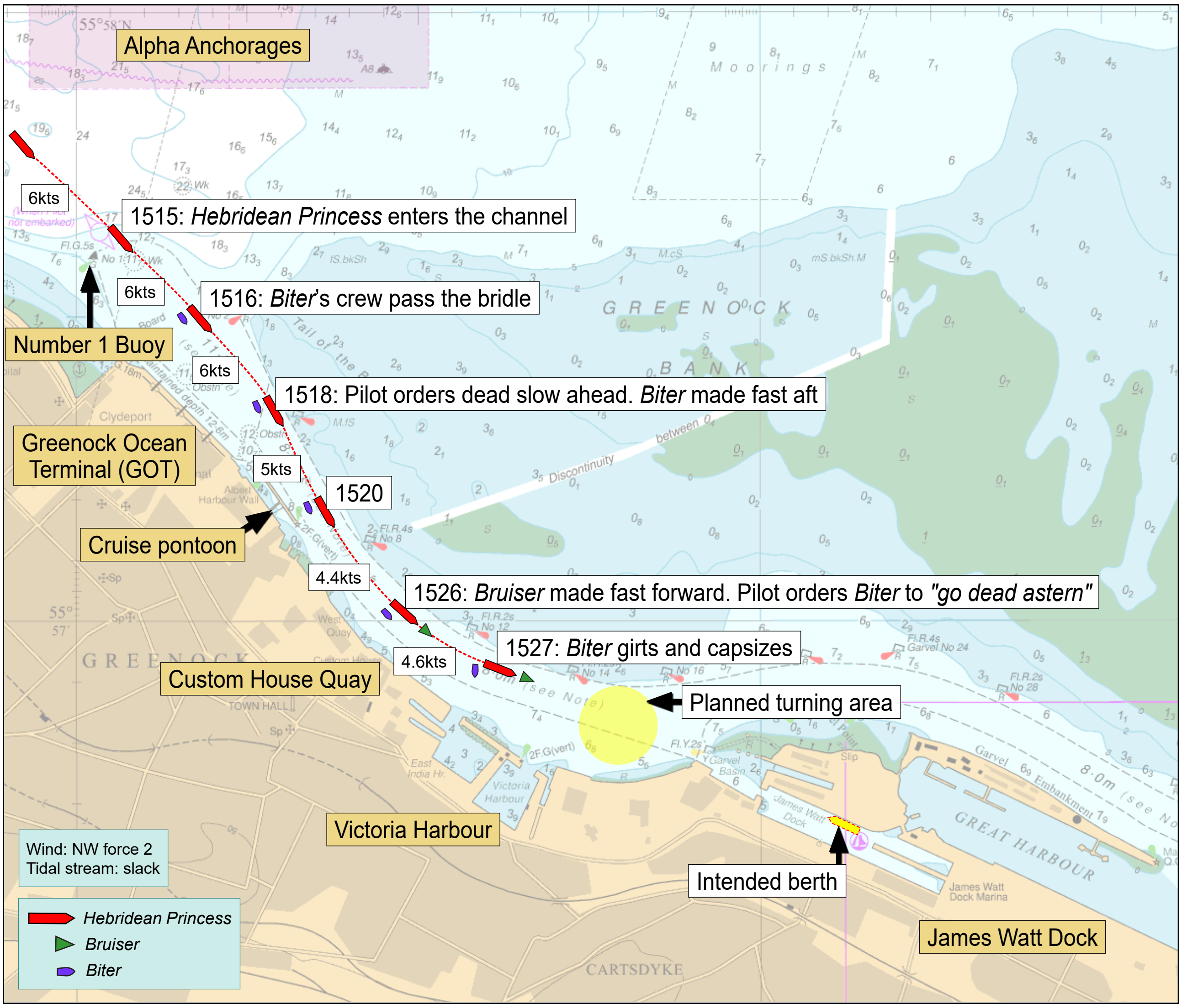
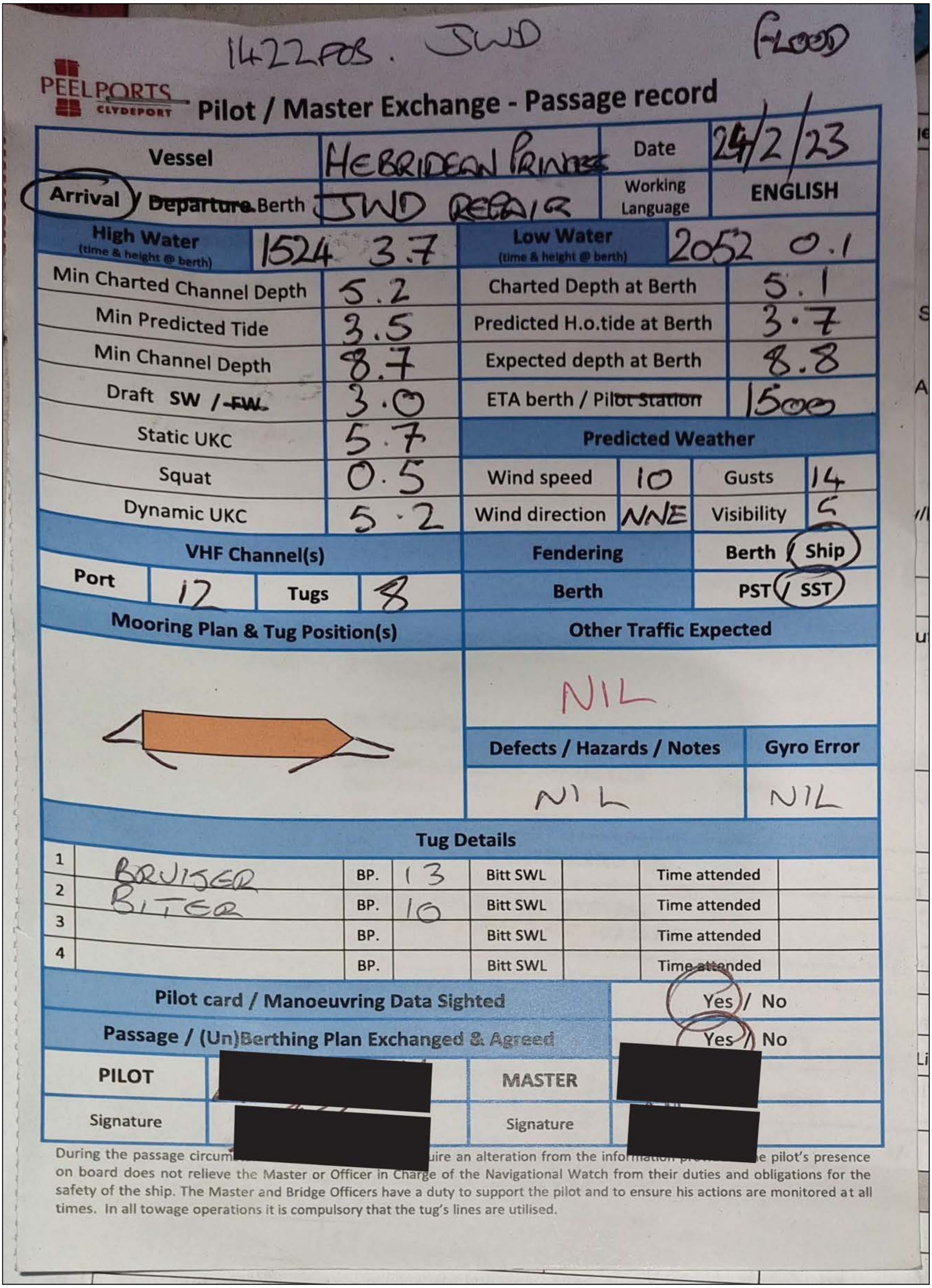


Figure 2: *Hebridean Princess*'s passage towards James Watt Dock



1422 POB. JWD FLOOD

PEEL PORTS CLYDEPORT Pilot / Master Exchange - Passage record

Vessel	HEBRIDEAN PRINCESS	Date	24/2/23
Arrival / ~~Departure~~ Berth	JWD REPAIR	Working Language	ENGLISH
High Water (time & height @ berth)	1524 3.7	Low Water (time & height @ berth)	2052 0.1
Min Charted Channel Depth	5.2	Charted Depth at Berth	5.1
Min Predicted Tide	3.5	Predicted H.o.tide at Berth	3.7
Min Channel Depth	8.7	Expected depth at Berth	8.8
Draft SW / ~~FW~~	3.0	ETA berth / ~~Pilot Station~~	1500
Static UKC	5.7	Predicted Weather	
Squat	0.5	Wind speed 10	Gusts 14
Dynamic UKC	5.2	Wind direction NNE	Visibility 5

VHF Channel(s)				Fendering	Berth / Ship
Port	12	Tugs	8	Berth	PST / SST

Mooring Plan & Tug Position(s)

Other Traffic Expected: NIL

Defects / Hazards / Notes	Gyro Error
NIL	NIL

Tug Details

1	BRUISER	BP.	13	Bitt SWL		Time attended	
2	BITER	BP.	10	Bitt SWL		Time attended	
3		BP.		Bitt SWL		Time attended	
4		BP.		Bitt SWL		Time attended	

Pilot card / Manoeuvring Data Sighted	Yes / No
Passage / (Un)Berthing Plan Exchanged & Agreed	Yes / No

PILOT	[redacted]	MASTER	[redacted]
Signature	[redacted]	Signature	[redacted]

During the passage circum[redacted]uire an alteration from the info[redacted]e pilot's presence on board does not relieve the Master or Officer in Charge of the Navigational Watch from their duties and obligations for the safety of the ship. The Master and Bridge Officers have a duty to support the pilot and to ensure his actions are monitored at all times. In all towage operations it is compulsory that the tug's lines are utilised.

Figure 3: The Clydeport pilot's master/pilot exchange passage record

At about 1430, *Biter*’s crew boarded the tug, departed Victoria Harbour and proceeded towards the Number 1 Buoy. Approximately 35 minutes later, having confirmed that *Bruiser* was approaching Greenock, the master turned *Hebridean Princess* towards the channel. At 1508, the master handed control to the pilot. About 3 minutes later, the pilot ordered slow ahead on both engines[1]. *Hebridean Princess*’s master then asked the pilot what speed was required for *Biter* to connect. The pilot responded that they could go up to 7 knots (kts) and noted that slow ahead had just been ordered. The wind was Beaufort force 2 from the north-west, with 20cm waves and good visibility. High water at Greenock was at 1524 and the predicted tidal stream was slack water.

At 1515, *Hebridean Princess* passed Number 1 Buoy and entered the main Clyde navigational channel at a speed over the ground (SOG) of 6kts. The pilot called *Biter*’s master on very high frequency (VHF) radio and directed the tug to approach and pass its bridle to the passenger vessel’s aft mooring party. The master went to the passenger vessel’s starboard bridge wing to watch *Biter* make its approach and at the same time took a picture of the tug running close to *Hebridean Princess*’s starboard quarter **(Figure 4)**. The pilot remained on the bridge.

Image courtesy of Hebridean Princess's master

Figure 4: *Biter* running alongside *Hebridean Princess*’s starboard quarter, before the lines were passed, showing the tug’s gob rope secured to the port side samson post

[1] Slow ahead on both engines was predicted to deliver 6.5kts.

Once *Biter*'s master had matched *Hebridean Princess*'s speed, the tug's deckhand attached the ends of the two bridle lines to the heaving line and the passenger vessel's mooring party pulled the towlines on board. During this process the mooring party observed the tug master in the wheelhouse and the tug's deckhand, who was on deck, wearing a hard hat, overalls and auto-inflate lifejacket. The mooring party also observed that *Biter*'s wooden wheelhouse door was latched open.

One minute later, the pilot called the second tug *Bruiser* on VHF and asked what speed the tug master required to take the lines forward. *Bruiser*'s master responded that they were content with whatever speed *Biter*'s master was happy with "...*probably 3 to 4kts, something like that*".

At 1518, the pilot informed *Biter* on VHF that, "*We're starting to reduce to 3kts now*" and ordered dead slow ahead on both engines[2] a few seconds later. Shortly afterwards, it was reported that the two lines of *Biter*'s bridle had been made fast on the port and starboard side of *Hebridean Princess*'s poop deck.

At 1520, as *Bruiser* approached *Hebridean Princess*'s bow, the pilot informed the tug master on VHF that the passenger vessel was "*down at 5kts*" and that the tug could take its position under the bow. The master of *Bruiser* then made their approach. *Hebridean Princess*'s SOG was 4.5kts.

Four minutes later, *Hebridean Princess*'s master informed the pilot that the vessel's speed was just over 4kts. This was acknowledged by the pilot.

At 1526, it was reported that *Bruiser* was "all fast forward" and the pilot directed "*After tug minimum dead astern*" on VHF. Biter's master responded, "*Do you want me swinging off pilot and go dead astern?*", to which the pilot replied "*Yeah, dead astern minimum please*". At 1526:40, closed-circuit television (CCTV) images from a building ashore showed *Biter* turning to starboard and peeling away from *Hebridean Princess*'s starboard side then dropping astern of the passenger vessel **(Figure 5)**. On the tug's deck the deckhand appeared to briefly watch the stern before walking back towards the wheelhouse. At 1526:58, as the starboard bridle became taught, the tug's turn stopped with its heading approximately 45° to the right of the passenger vessel's track. *Biter* was then pulled sideways by the bridle and almost immediately heeled to port.

Hebridean Princess's aft mooring party saw that *Biter* was heeling to port and that water was coming over the tug's port bulwark. They also noted that the tug's deckhand was standing just outside the open wheelhouse door. At 1527:08, *Biter* capsized **(Figure 6)**.

Hebridean Princess's aft mooring party immediately informed the bridge, by VHF radio, that the aft tug had capsized. As *Biter* inverted, the passenger vessel's crew noted that the tug's propellers were still turning. Some of the aft mooring party threw lifebuoys overboard and looked for survivors, others rushed to the galley to grab a knife to cut the tug's bridle.

On *Hebridean Princess*'s bridge, the master and pilot immediately directed that the crew should let go the forward and aft tug lines and ordered both engines stopped. Other members of the bridge team then reported the accident to Clydeport's Estuary Radio[3] and His Majesty's Coastguard by VHF and prepared to launch one of *Hebridean Princess*'s lifeboats as a fast rescue craft.

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[2] Dead slow ahead on both engines was predicted to deliver 4.9kts.

[3] Clydeport's local port service.

Images courtesy of [Police Scotland](#)

Biter turns to starboard and peels away from *Hebridean Princess*'s starboard side at 1526:40

Biter's bridle attached to the starboard side of *Hebridean Princess* becomes taut and the tug's turn stops at 1526:58

Biter is pulled sideways by the bridle and heels to port at 1527:01

Biter capsizes at 1527:08

Figure 5: CCTV images of the sequence of events leading to *Biter*'s capsize

Image courtesy of Christopher Brindle

Figure 6: *Biter* capsized with its rudders set at approximately 30° to starboard

1.3.2 The emergency response

On hearing *Hebridean Princess*'s VHF report of the capsize, *Bruiser*'s master released their tug's towlines and manoeuvred close to *Biter* to look for survivors **(Figure 7)**. By 1530, the crew of *Hebridean Princess* had cut the eyes of the port and starboard bridle lines connecting *Biter* to the passenger vessel.

Image courtesy of Christopher Brindle

Figure 7: *Bruiser*'s crew looking for survivors

Several mariners responded to the VHF reports of the accident. By 1539, *Bruiser*, the lifeboat launched from *Hebridean Princess*, a fast rescue craft from Victoria Harbour, and a diving company's rigid inflatable boat (RIB) were all at the scene. The RIB's crew approached the upturned tug and tapped on the hull to establish whether any of *Biter*'s crew were still alive; they heard no response.

By 1550, seven vessels were at the scene and this group was later joined by a coastguard search and rescue helicopter. At 1555, the inverted *Biter* began to list and, at 1602, the tug sank.

Later that afternoon a commercial diver inspected *Biter*, which was resting upright on the seabed. The diver observed a body in the wheelhouse, but the floating lines and debris in the vicinity of the wreck meant that it was judged unsafe to enter the vessel and attempt a recovery.

On 25 February 2023, the bodies of *Biter*'s crew were recovered from the tug's wheelhouse by Police Scotland divers. The tug was subsequently declared a total constructive loss by its insurers. *Biter* was salvaged on 12 March 2023, and placed ashore the following day.

1.4 *BITER* AND CLYDE MARINE SERVICES LIMITED

1.4.1 Overview

Biter was a 16.25m long, Damen Stan conventional twin screw tug, built in 1982. The tug was purchased in 2001 by Clyde Marine Services Limited (CMS).

The company was based at Victoria Harbour, Greenock and operated a fleet of four tugs[4]: ASD tugs *Wrestler* and *Boxer*, which were each 21.19m in length; and conventional tugs *Bruiser* (18m) and *Biter* (16.25m). CMS had provided harbour towage on the River Clyde and Firth of Clyde and the west coast of Scotland since 1913. The company was not a member of either the British Tugowners Association (BTA) or The Workboat Association (WA).

Biter was operated and certified under the Maritime and Coastguard Agency's (MCA) Workboat Code and with two crew could carry up to 12 passengers and was permitted to operate in Area Category 3 waters, up to 20 nautical miles from a safe haven. At the time of the accident the tug was in date for survey and inspection.

1.4.2 Towage operations

The Department for Transport and MCA publication *A Guide to Good Practice on Port Marine Operations* (GTGP) defined types of towage[5] as:

- ***Ship Assist Towage*** *or assisting vessels under way, typically during entering or leaving and/or shifting berth within a harbour;*
- ***Dead Tows*** *or assisting vessels without propulsion including, but not limited to, barges, pontoons, dredgers, rigs which typically involves vessels entering and leaving harbour being towed by a sea-going tug or other vessel;*
- ***General Towage*** *including towage of smaller barges, pontoons, rigs normally within harbour limits and marine construction equipment; and*
- ***Project Towage*** *including unusual events which require special consideration.* [sic]

The GTGP noted that *Ship assist towage can be an extremely hazardous activity and good teamwork is essential*[6].

4 CMS owned a fifth tug, which at the time of the accident was operating elsewhere on a bareboat charter.

5 A Guide to Good Practice on Port Marine Operations, section 10.4.1

6 A Guide to Good Practice on Port Marine Operations, section 10.4.5

The 48 towage/non-towage operations conducted by the conventional tugs *Bruiser* and *Biter* in the 12 months up to and including the manoeuvre on the morning of the accident are summarised in **Table 1**. *Biter*'s master was involved in 23 of these operations, including the ship assist towage operations on 16 November 2022 and the morning of 24 February 2023. The accident occurred during a further ship assist towage operation on the afternoon of 24 February.

Type of operation	Total number	Remarks
Non-towage	6 (13%)	Stores/passenger transfer, etc
Dead/general towage	39 (81%)	Moving barges, ships and other assets
Ship assist towage	3 (6%)	23 April 2022 – assisting a small warship at Greenock 16 November 2022 – assisting *Hebridean Princess* to move from Greenock Ocean Terminal cruise pontoon to James Watt Dock 24 February 2023 – assisting *Hebridean Princess* to sail from James Watt Dock on the morning of the accident

Table 1: CMS conventional tug operations in the 12 months up to the accident

Statistics provided by CMS indicated that, between 2018 and 2022, *Biter*'s master had conducted 47 ship assist operations as follows: 2022 (3); 2021 (1); 2020 (4); 2019 (18); 2018 (21).

Due to the limited space within James Watt Dock it was CMS's practice to allocate two conventional tugs to assist *Hebridean Princess* to enter and leave the dock. On the morning of 24 February, *Bruiser* was unavailable and CMS assigned the ASD tug *Wrestler* to assist the vessel's departure. When returning to James Watt Dock that afternoon, *Hebridean Princess*'s aft tug, leading the vessel in stern first, was required to operate in close proximity to craft moored within the marina.

1.4.3 Equipment

Biter was propelled by two diesel engines, each driving a fixed pitch propeller controlled by morse levers in the wheelhouse. The engine exhausts were in the vessel's transom. *Biter*'s rudders could be operated with a joystick or by using the wheel; during towing operations tug masters used the wheel to steer and judged vessel speed from its chart plotter/global positioning system (GPS) or radar's SOG, engine revolutions, or by eye. The tug master stood on the starboard side of the wheelhouse when manoeuvring the vessel, looking in the direction of travel while simultaneously operating the wheel, engine controls and VHF radio and giving verbal orders to the crew **(Figure 8)**. *Biter* was not equipped with an automatic identification system (AIS).

Image courtesy of Police Scotland

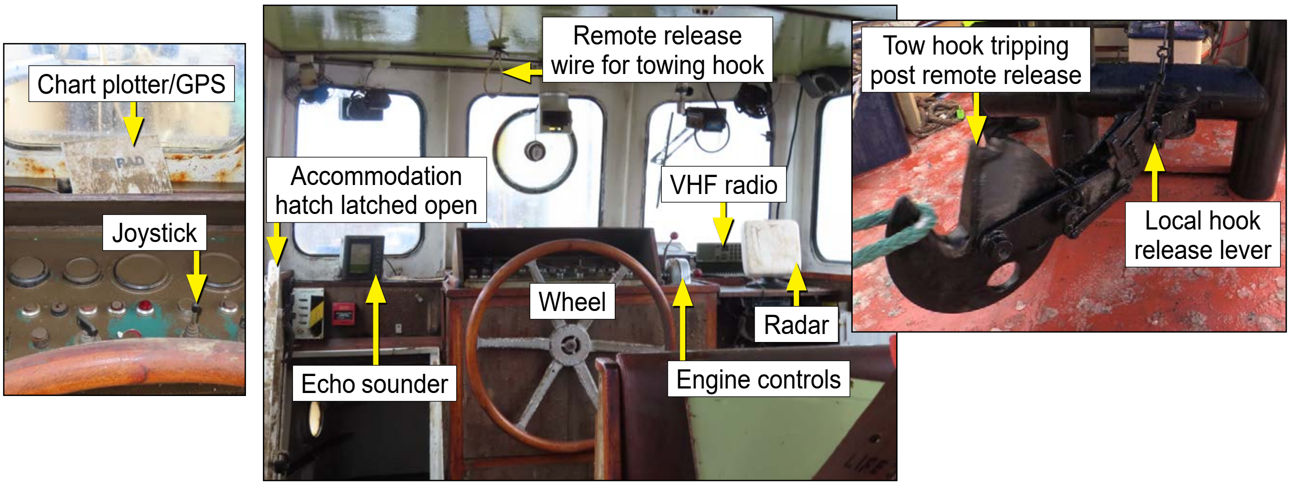

Figure 8: *Biter*'s wheelhouse and tow hook post-salvage

1.4.4 Watertight/weathertight integrity

Biter's stability information, required by The Workboat Code, stated that the vessel's required levels of stability were:

> *entirely dependent upon water being excluded from within the main hull and deckhouse…Open doorways, hatchways, etc. breach this watertight integrity and leaving the vessel vulnerable to capsize when suddenly heeled, or when taking sea on board*[7]*.* [sic]

In line with this requirement, *Biter*'s crew were required to keep certain hatches and doors closed when at sea. These included the forepeak hatch; accommodation hatch; engine room forward and aft hatches; steering gear compartment hatch; and the door between the accommodation space and the engine compartment. These openings were all marked *KEEP CLOSED AT SEA*.

It was reported that *Biter*'s wheelhouse was noisy when underway and tug masters almost always kept the wooden wheelhouse door latched open to allow them to communicate with their crew.

1.4.5 Towing arrangement

Biter could be configured to tow over its bow but was almost always operated towing over its stern. In this configuration the tug was able to deliver up to 10 tonnes (t) bollard pull and could safely operate at speeds of up to 5kts ahead when attached to the bow of the assisted vessel. The maximum operational speed astern was about 3.5kts to 4.0kts; any faster and the tug was difficult to control and there was a risk of flooding the vessel's transom exhausts and losing propulsion.

Biter was fitted with a single disc towing hook located behind the wheelhouse for use when towing over its stern. This could be tripped by operating either a local release lever on the side of the hook or by pulling on a wire hoop in the wheelhouse deckhead adjacent to the conning position **(Figure 8)**.

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[7] *Biter* stability information, part 1, paragraph 6, dated 10 October 2022.

For ship assist towage, where the vessel being assisted was not fitted with centreline fairleads, *Biter* used two 26m double-eyed tow ropes[8] known locally as a bridle. When made fast, one eye from each rope would be placed on the tug's tow hook, with the other eyes secured via fairleads to the assisted vessel's bollards on either side of its bow or stern. To ensure that the towing point remained at the aft end of the tug, these tow ropes were always led through the eye of the tug's gob rope **(Figure 9)**.

Image courtesy of Hebridean Island Cruises Ltd

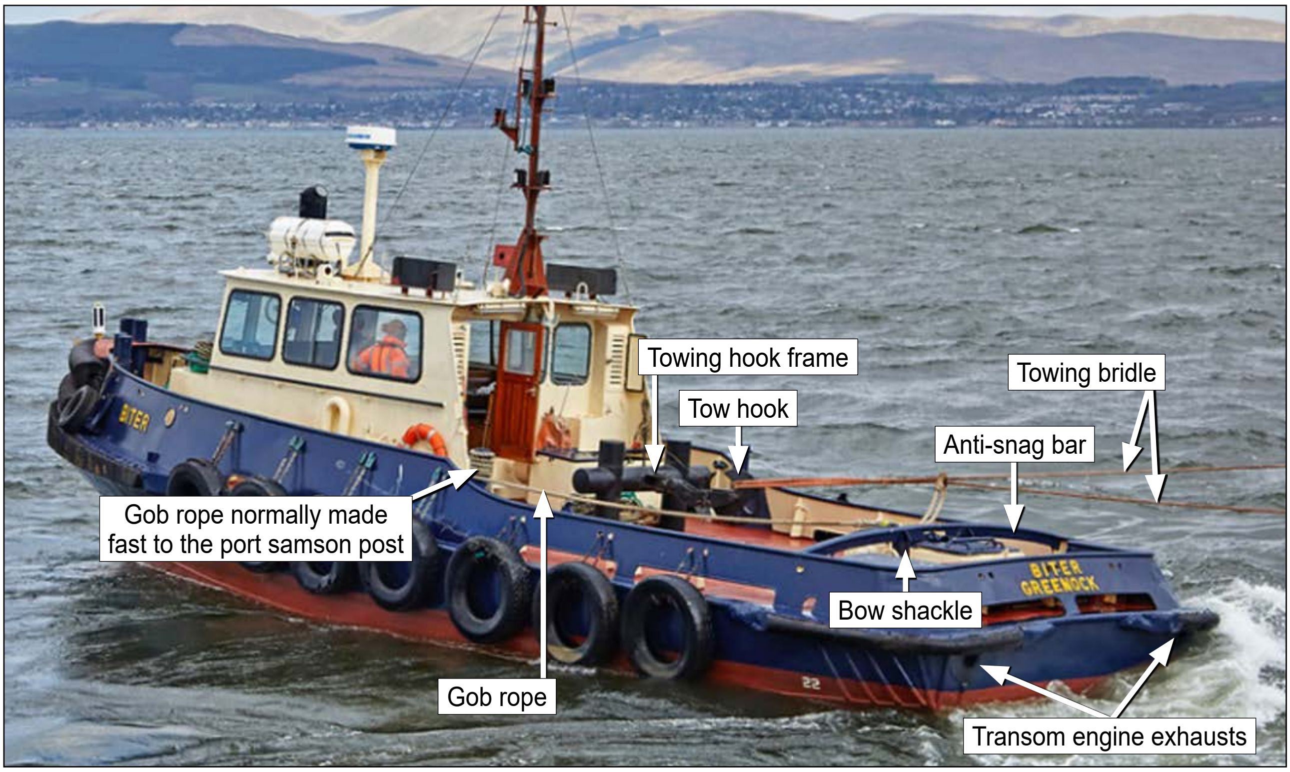

Image courtesy of Hebridean Island Cruises Ltd

Figure 9: *Biter*'s towing arrangements

[8] Both ropes had a 72.5t safe working load.

1.4.6 Gob rope

One of the biggest hazards to safe towage operations was a tug being girted. The practical guide Tug Use in Port[9] defined girting as *the situation when a vessel, usually a tug, is towed broadside (sideways) by a towline and is unable to manoeuvre out of this position*. The forces acting on a tug being girted are shown at **Figure 10**. The tug capsizes if the heeling moment (pull on the towline/water resistance) exceeds the righting moment (GZ) and the towline is not released.

For illustrative purposes only: not to scale

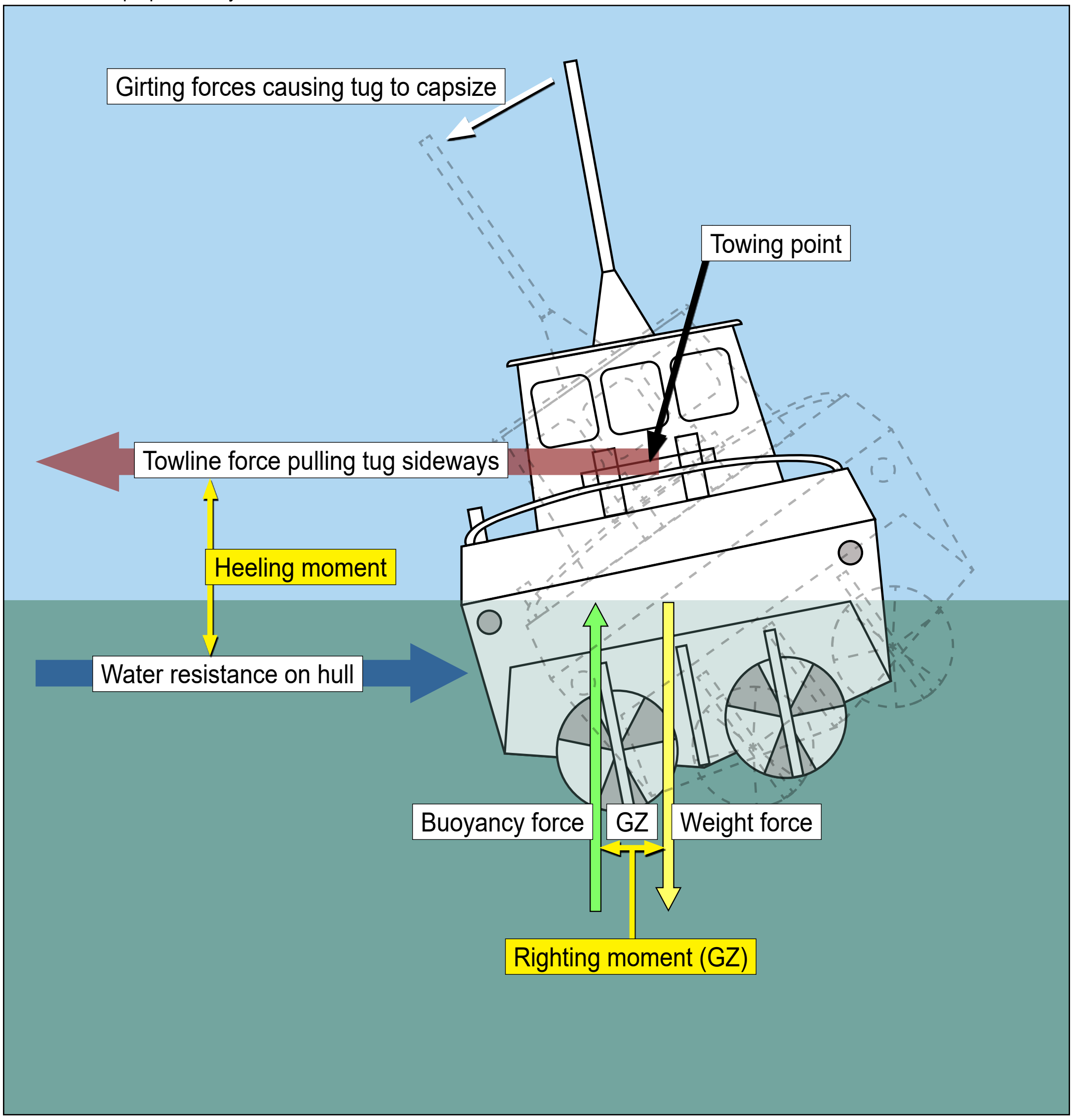

Figure 10: Forces acting on a tug being girted

To prevent girting, tugs were often fitted with a gob rope[10] designed to move the towing point aft. In the event of the tug losing propulsion, or if the assisted vessel was going too fast, the gob rope would cause the tug to align with the direction of tow, preventing the tug being towed sideways and reducing its risk of being girted **(Figure 11)**.

[9] Hansen, Captain H. 2021. Tug Use in Port: A Practical Guide, Including Ports, Port Approaches and Offshore Terminals, Fourth Edition revised, page xi.

[10] Also known as a gog rope.

For illustrative purposes only: not to scale

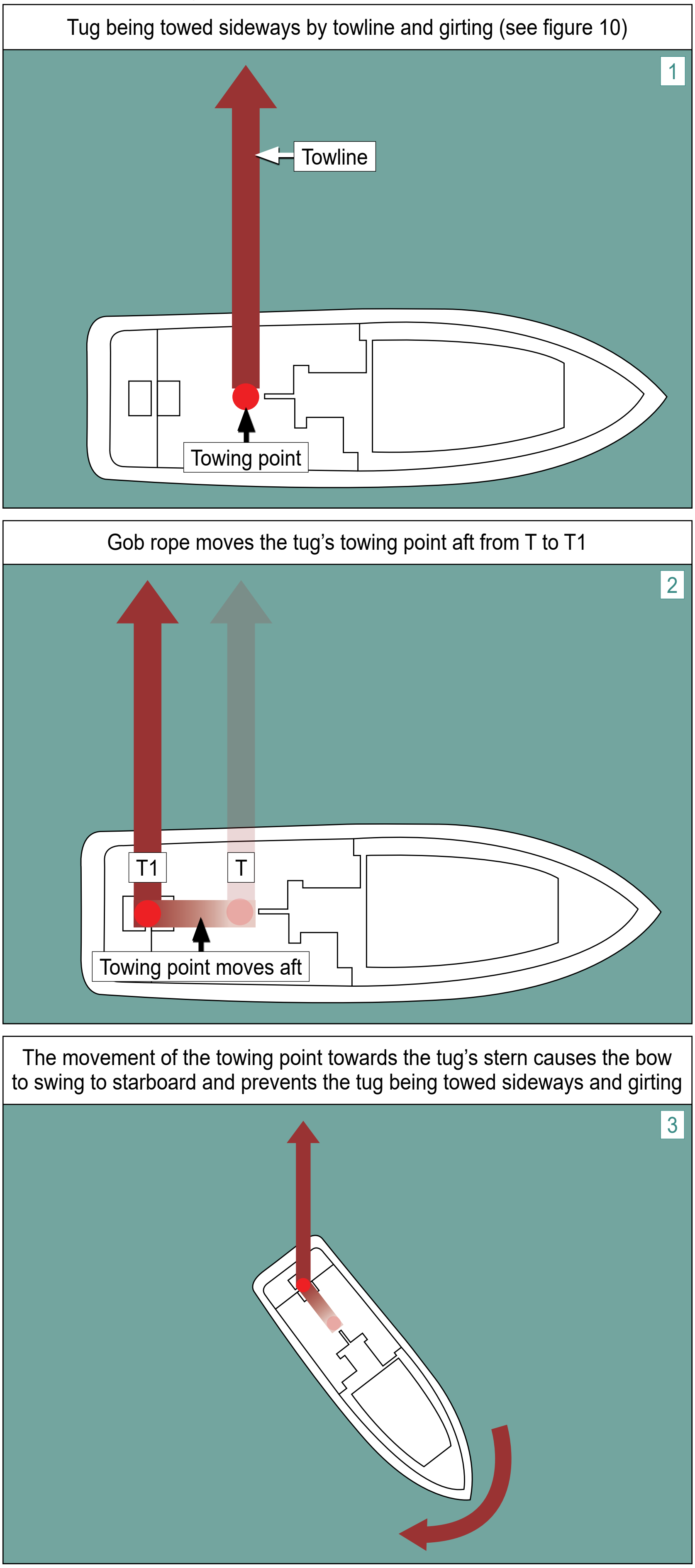

Figure 11: The effect of a gob rope preventing a tug being towed sideways and girted

Biter's gob rope was a 25m long, 22mm diameter, high modulus polyethylene (HMPE) fibre rope with a spliced eye at each end[11]. Compared to other types of rope, HMPE ropes had a relatively low coefficient of friction[12] and were therefore more prone to slippage. The gob rope was led through a bow shackle before being taken forward and secured to either the port side samson post or towing hook frame **(**see **Figure 9)**.

Photographs of *Biter* in operation indicate that the preferred option for securing the gob rope was for it to be turned up four or five times around the port side samson post before locking turns were placed on the post's two stag horns. The gob rope could be manually loosened or tightened when secured around the samson post; when secured using figure of eights around the towing hook frame the increased friction made the arrangement more secure and harder to adjust. There had been no reported issues with the securing arrangements for the gob rope in CMS's conventional tugs and these methods of securing the gob rope had been in use for many years and were decided on by the tug master. In common with other tug operators, neither method of securing the gob rope had been formally tested or evaluated. Further, neither method allowed the gob rope to be adjusted when the towline or bridle was under tension.

Some UK operators of similar small conventional tugs had adapted their vessels to move the gob rope securing point aft and fitted gob winches to allow the rope to be adjusted from the wheelhouse **(Figure 12)**.

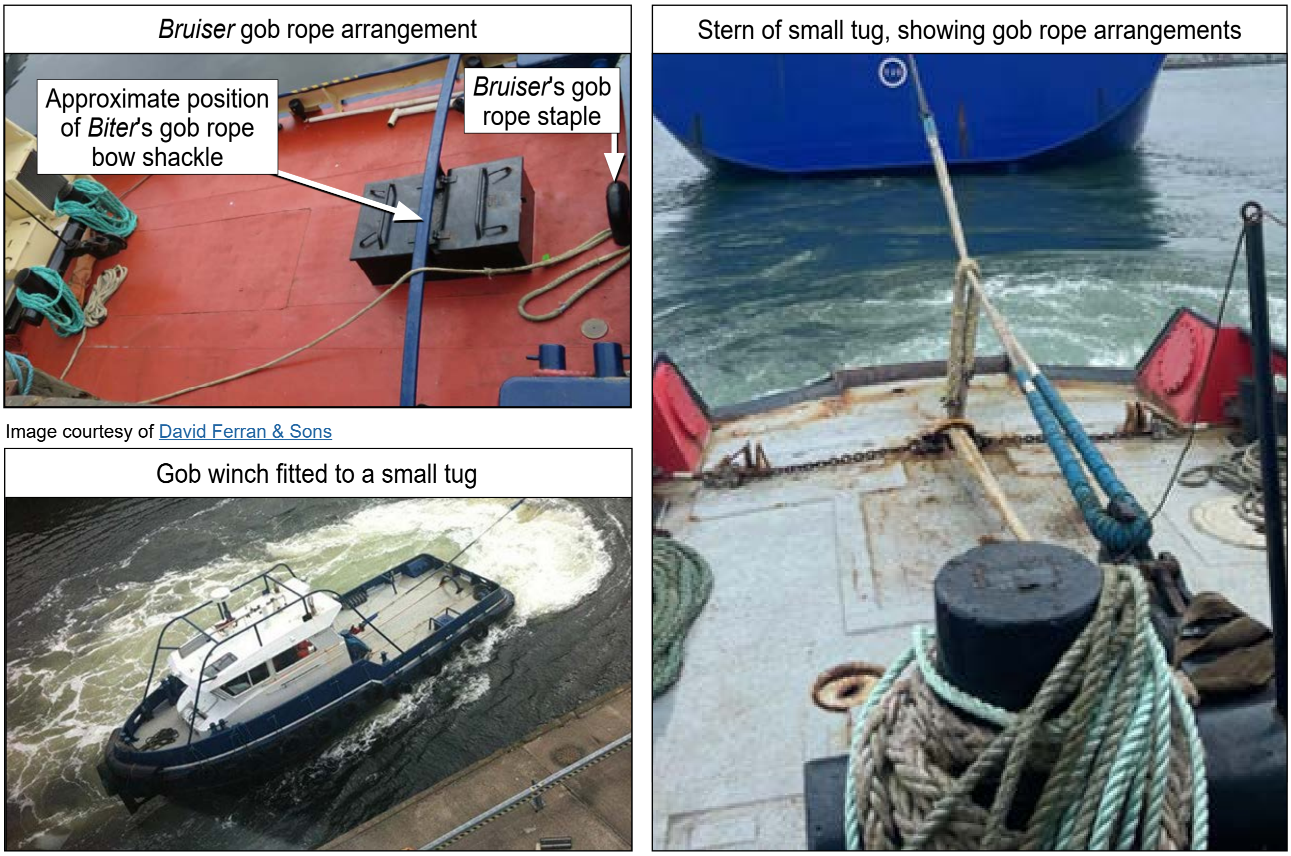

Figure 12: Alternative gob rope arrangements on similar conventional tugs

11 The gob rope had a 41.2t safe working load.

12 The force required to move two sliding surfaces over each other divided by the force holding them together. On a smooth, dry steel surface the coefficient of friction was 0.07 to 0.08 for HMPE; 0.14 to 0.17 for nylon rope; and 0.11 to 0.17 for polyester rope.

Biter and *Bruiser*'s gob ropes were configured differently. *Bruiser*'s gob rope was led through a steel staple on its main deck immediately adjacent to the tug's stern, *Biter*'s gob line did not reach as far aft and was led through a bow shackle approximately 1.2m from the tug's stern and about 45cm[13] above its main deck.

When *Biter* operated astern of an assisted vessel the master used the gob rope to push indirectly on the towing bridle, controlling the assisted vessel's speed and direction. Photographs, including one taken on the morning of 24 February 2023 as *Biter* assisted *Hebridean Princess* to sail from James Watt Dock, indicated that *Biter*'s gob rope was usually rigged with the 1.5m spliced eye extending beyond its shackle **(Figure 13)**.

Biter's towing bridles and gob rope had been independently examined in November 2022, with no defects or abnormalities noted.

Image courtesy of Ian Catterson

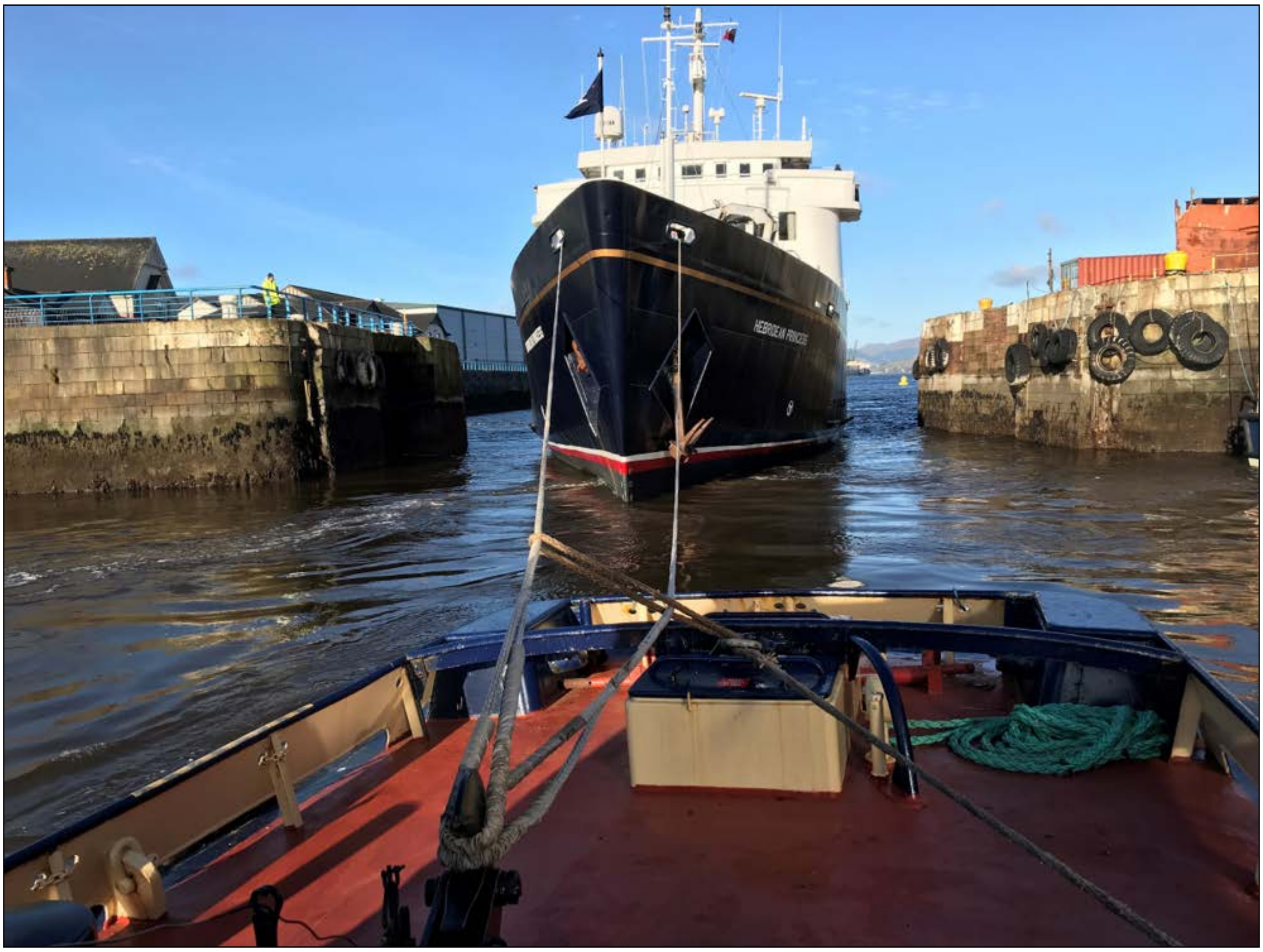

Figure 13: *Biter*'s gob rope while assisting *Hebridean Princess* to leave James Watt Dock on the morning of 24 February 2023

1.4.7 Safety management system

The four CMS tugs were operated with a safety management system (SMS) in line with the guidance in Appendix 7 of The Workboat Code Edition 2 – Amendment 1. The suite of risk assessments in the company's SMS included *risk assessment RA19 – Vessel dragged back at speed*. RA19 identified the hazard as the *speed of*

[13] The height of the engine room hatch was 45cm.

the ship being above the agreed drag speed, which could lead to capsize or damage to the tug or other infrastructure as well as fatal, serious or minor injury. The risk assessment recorded the following risk control measures:

- *Only trained & competent personnel to undertake towing operations*
- *The master to ensure that all weather tight doors are closed and secure prior to using the boats towhook.*
- *The master to agree towing plan with the pilot and to ensure good communications are established prior to the start of the operation and maintained throughout the operation.*
- *The master and pilot agree ship to release point drag speed 3-4knots & the ship release point drag speed has not to be activated the master is to release the tow line to avoid potential capsize.*
- *The master to ensure that a lookout is posted at the stern of the vessel to avoid a collision.*
- *The master and crew to work within the safety parameters of the vessel.*[14] [sic]

These control measures were incorporated into a series of operational procedures that included:

Preparation before starting a tow – This procedure contained a pre-sailing checklist requiring the crew to check/turn on and record findings for the tug's water/ weathertight integrity, lifesaving appliances, machinery, navigational aids (chart plotter/GPS and radar) and towing equipment, including towing hook and ropes before towing operations started.

Towing operations – This procedure directed that the pre-sailing checklist and a toolbox talk with the crew should be completed before the vessel got underway. *Biter*'s paperwork was lost when the tug capsized and there was no record ashore of either the pre-sailing checklists or toolbox talk from the day of the accident.

Underway and manoeuvring of the tow – This procedure provided general guidance to the crew on the conduct of towing operations within the River Clyde and Firth of Clyde. The procedure did not advise on how the gob line should be secured.

Capsizing while towing – This emergency procedure instructed tug crews to take the following steps in the event of a capsize while towing:

- *Release/cut the towline,*
- *Contact the towing vessel,*
- *If required, ask the towed vessel to release the towing line at their end,*
- *Disengage the propulsion units, if possible, especially if you suspect there is a crew member overboard.* [sic]

[14] CMS RA19 – control measures.

CMS commissioned an external audit of its SMS in December 2021. The audit report noted that the relatively low volume of towage activity meant that it was difficult for CMS tug masters to maintain their skills.

1.4.8 *Biter*'s manoeuvre

Biter's manoeuvre required the tug to connect its towing bridles while running alongside the starboard quarter of *Hebridean Princess*, before dropping back and reversing direction to operate directly astern of the passenger vessel. This *peel off/ drop back* manoeuvre was described in Tug Use in Port:

> *During a certain phase of manoeuvring it may be necessary for a ship with headway to have the port or starboard position tug* **(Figure 14**, position 1**)** *move astern of the ship* **(Figure 14**, positions 3 or 4**)** *to assist in steering or speed control…This manoeuvre is dangerous to conventional tugs when carried out at too high a ship's speed. This is at speeds of more than about three knots, and depends on tug manoeuvrability, stability and freeboard…*
>
> *The manoeuvre just described is no problem for a tractor or reverse tractor tugs, even with a fairly high ship's speed. Conventional tugs with a gob rope system, whereby the towing point can be transferred towards a far aft position, can also swing around at a higher speed. The gob rope system should be strong enough and fully reliable otherwise such a manoeuvre becomes really dangerous for the tug.*[15] [sic]

Image courtesy of Captain Henk Hensen, Tug Use in Port, fourth edition

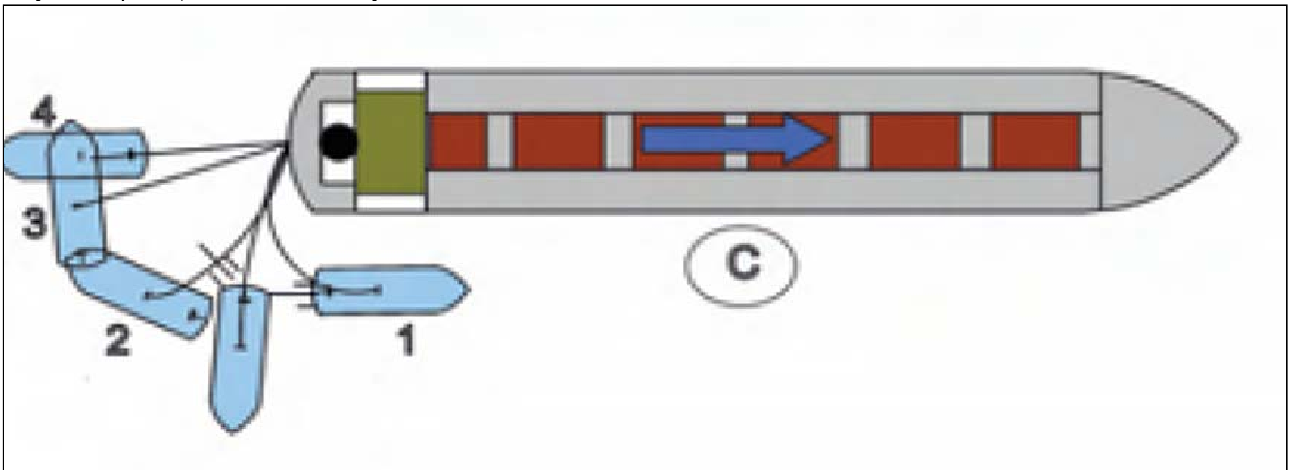

Figure 14: Stern tug manoeuvring from a standby position on starboard or port quarter towards a position astern of the ship

There was no guidance in the CMS SMS on how tug masters should conduct this manoeuvre. Some CMS tug masters required the assisted vessel's speed to be less than 2kts, others were content to conduct the manoeuvre at speeds of up to 4kts. The tug masters who required the assisted vessel's speed to be 2kts or less, aimed to complete the manoeuvre while putting minimal weight on the towlines. Those who conducted the manoeuvre when the assisted vessel's speed was at about 4kts relied on the tug's gob rope to complete the turn **(Figures 11** and **15)**. In both cases, once the tug was operating stern to stern with the assisted vessel the tug master would use the tug's engines to orientate their vessel as required by the pilot. When in position the weight of the tug astern acted to reduce the assisted vessel's speed.

[15] Hansen, Captain H. 2021. Tug Use in Port: A Practical Guide, Including Ports, Port Approaches and Offshore Terminals, Fourth Edition revised, section 6.3.9, page 162.

For illustrative purposes only: not to scale

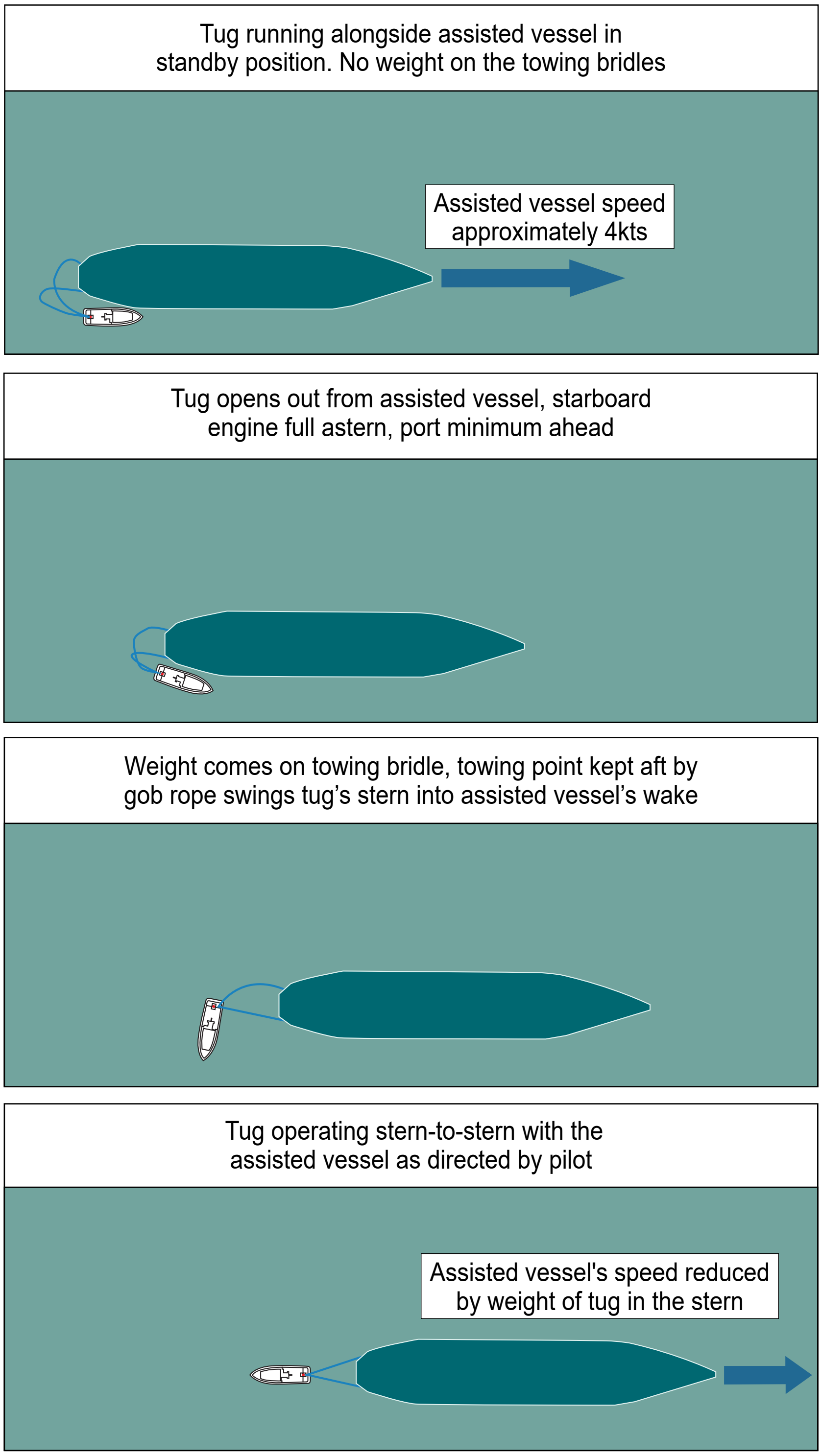

Figure 15: Tug master's planned manoeuvre

1.4.9 *Biter*'s crew

Biter had two crew. The 65-year-old tug master, George Taft, had worked on conventional tugs and workboats for over 45 years. He held a Tier 2 Level 2 MCA Boatmasters' Licence (BML), which permitted him to operate CMS passenger vessels on the Clyde. He also held an International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW) II/2 Master (Code Vessel) less than 200 gross tonnes (GT) certificate of competence (CoC) that qualified him to operate *Biter*[16].

[16] Not more than 150 miles from a safe haven.

Mr Taft was an experienced and respected master on conventional tugs and more junior CMS staff regularly sought his advice on how best to handle these vessels. He always inspected and set his own lines before the start of each job. Mr Taft had completed several workboat and tug training courses, the most recent of which was an ASD tug training course in 2018.

Biter's deckhand was 73-year-old able seaman Ian Catterson, who had worked at sea as a deck officer in the 1970s before changing career. He held a STCW II/5 Able Seafarer Deck CoC. He had started to work for CMS, on a casual basis in 2021. Since then, he had completed 12 days on the ASD tugs *Wrestler*, *Warrior* and *Boxer* and one day on *Biter* conducting passenger transfer operations. On the day of the accident, Mr Catterson was originally programmed to work on the ASD tug *Wrestler* but was allocated to *Biter* when he arrived at the CMS offices that morning.

Both crew held valid medical fitness certificates for seafarers (ENG1). The postmortem reports for both Mr Taft and Mr Catterson recorded the cause of death as drowning.

1.4.10 Tug master's medical fitness

The postmortem examination of *Biter*'s master detected concentrations of blood pressure medication, paracetamol and codeine within his blood. Of these medicines, only codeine had the potential to inhibit the function of an individual to operate a tug. The forensic toxicologist recorded that:

> *The concentration of codeine…* [was] *within the concentration range expected for therapeutic use. Known side effects of codeine are sleepiness and dizziness. If present these side effects would be expected to inhibit the function of an individual to drive a motor vehicle or be at the controls of a tug. However, the presence and severity of any side effects seen with codeine use would depend on the tolerance of the deceased to codeine.*

Biter's master had been prescribed codeine by his general practitioner (GP) to manage periodic knee pain since 2013. The MCA approved doctor[17] had noted on the medical examination of seafarers report form that the tug master had arthritis in his right knee and took paracetamol to manage this condition; it did not record that he had been prescribed codeine.

Biter's master had undergone hospital surgery in early January 2023 and his GP had declared him fit to return to work 27 days later, on 2 February 2023.

Merchant Shipping Notice (MSN) 1887 (M), *Maritime Labour Convention, 2006: Medical Certification*, published in 2018, detailed the statutory regulations under which ENG1 certificates were issued. The note on the back of the ENG1 advised seafarers that:

> *If you are off sick for more than 30 days or your medical fitness changes significantly, you should contact an Approved Doctor (preferably the one who issued the certificate) for medical review.*

MSN 1887 (M) did not define or offer any guidance to seafarers on what conditions might constitute a significant change to an individual's medical fitness. As a result, *Biter*'s master had not informed the MCA approved doctor of his surgery.

[17] The MCA used a network of approved doctors to issue seafarers with their medical fitness certificates.

1.4.11 Company training

As well as holding the mandatory CoCs and supporting certification, CMS required its tug crews to complete internal training and assessment before they got underway.

The company's *Tug Induction* covered the nature of the job; commonly used terms; an explanation of the importance of the gob rope, including a review of the MAIB's investigation report into the capsize and foundering of the conventional tug *Trijnie* (see section 1.11.2); the use of personal protective equipment; the inherent dangers of tug operations, including the risk of capsize The induction culminated with the crew member being required to demonstrate their ability to operate the tug safely.

Tug masters were also required to complete a familiarisation, training and assessment package before they could command any CMS vessels. The masters were expected to successfully complete an externally provided training course for the ASD tugs and internal training and local assessment for the conventional tugs.

The scope of both the crew induction and tug masters' familiarisation packages comprised of a list of subject areas to be covered rather than a detailed syllabus. Deckhands were required by CMS to have their skills reassessed every 3 months; there was no requirement for tug masters to undergo any periodic reassessment or revalidation.

Company records showed that *Biter*'s master had completed his training for both ASD and conventional tugs in July 2018. Since then, he had worked almost exclusively on the conventional tugs. There were no records to indicate that *Biter*'s deckhand had completed any internal training.

1.4.12 Previous Clyde Marine Services Limited incidents and accidents

The company had recorded 27 tug incidents since 2018, of which the majority were minor accidents that included parted/trapped lines and minor damage during towing and berthing operations. The last girting incident had occurred in October 2022, when a warship came ahead without warning and caused the ASD tug operating at the bow to be girted. The ASD's towing arrangements, with the towline led through a staple close to its bow, meant that the tug was not towed sideways and it subsequently collided with the warship's side.

1.4.13 Post-accident inspection of Biter

Biter was inspected ashore after its salvage. The post-salvage inspection and photographs taken after the accident and during a Police Scotland dive inspection on 2 March 2023 resulted in the following observations **(Figure 16)**:

- *Biter's* wooden external wheelhouse door was missing and the internal hatch between the wheelhouse and accommodation space was open. All other compartment doors and hatches were shut.

- Only one side of some of the doors and hatches was marked with *KEEP CLOSED AT SEA*. This warning sign was therefore obscured when the hatch between the wheelhouse and accommodation space was open.

- The chart plotter/GPS and radar displays in the wheelhouse were covered.

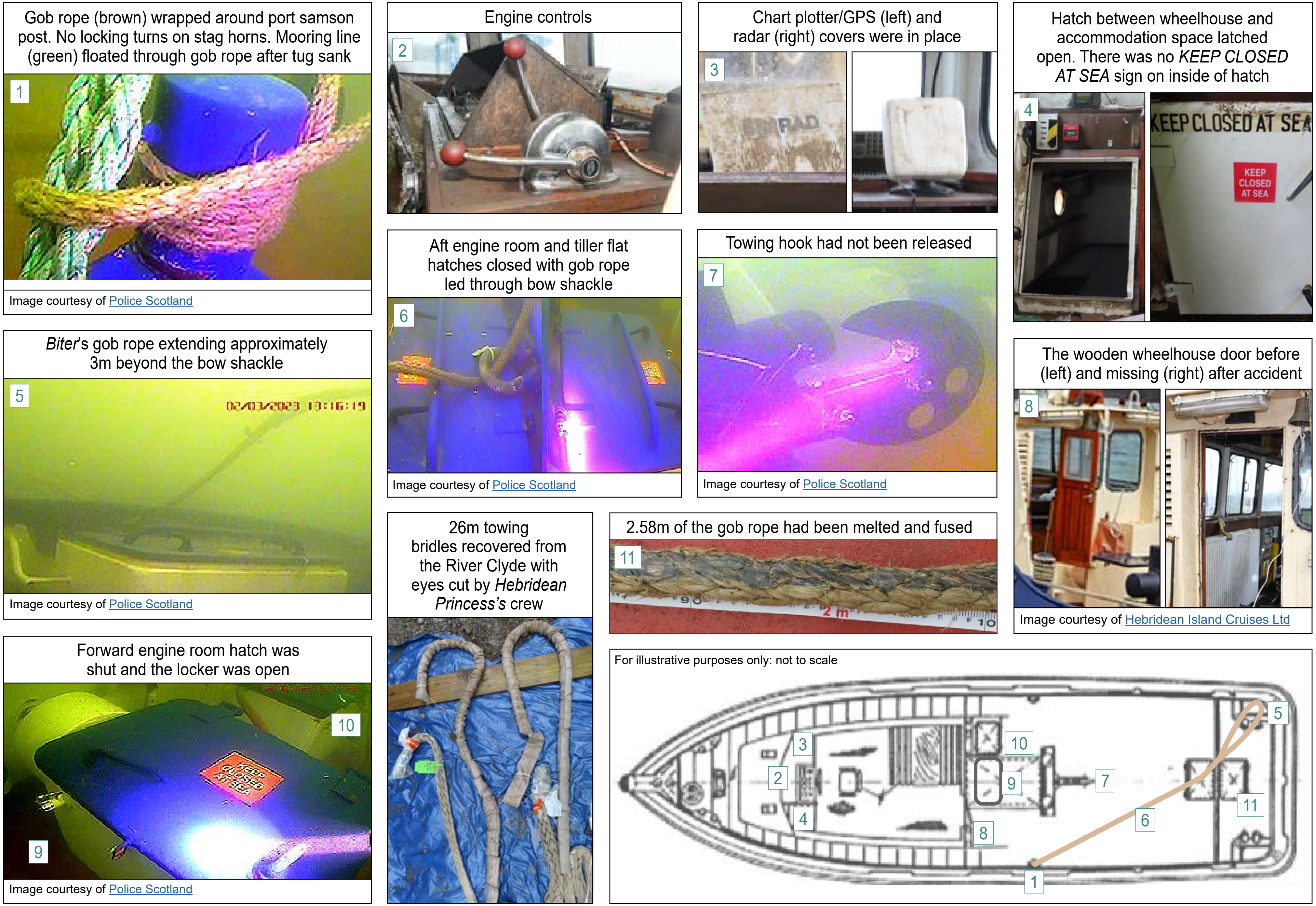

Figure 16: *Biter* post-accident inspection

- The tow hook had not been released. When the tow hook was tested post-salvage, the local release mechanism at the hook and the emergency release wire located in the wheelhouse operated correctly.

- Both towing bridles were recovered from the River Clyde immediately after the accident and, with the exception of the eyes cut by *Hebridean Princess*'s crew, were undamaged.

- During the dive survey the gob line was seen to be wrapped around the port samson post and had been led aft through a bow shackle mounted between the engine room and aft peak hatches. The were no locking turns on the samson post. Close inspection of the gob line after salvage found that 2.58m of the 25m rope had been melted and fused. The location of the fused area was coincident with the section of the rope that would have been wrapped around the samson post.

- The starboard engine control was set to full astern and the port engine control was set to minimum power ahead. When tested, the controls operated the gearbox selector and speed control correctly.

- The rudders were both set at approximately 30° to starboard when the tug capsized and the tug's wheel operated correctly when tested.

- A fuel sample retrieved from the engine was clear and bright and showed no visual signs of contamination.

1.5 *HEBRIDEAN PRINCESS*

1.5.1 Vessel

Built in 1964 as a domestic car and passenger ferry, *Hebridean Princess* was purchased by Hebridean Island Cruises Limited in 1989 and converted into a luxury passenger vessel. *Hebridean Princess*'s itineraries included cruises around the Western Isles of Scotland, the coast of Ireland and the Norwegian Fjords.

1.5.2 Safety management system

The document of compliance holder and manager for *Hebridean Princess* was Northern Marine Shipmanagement Limited. The company's SMS contained a Navigation Procedures Manual that included guidance on the conduct of pilotage and the use of tugs.

In the case of tugs the SMS required the mooring stations to be manned when tugs were attached, advising that ...*the vessel must only be operated at low speeds to the tug skipper's satisfaction*. The Navigation Procedures Manual did not advise mooring stations to have a means of cutting the tug's lines in an emergency.

On pilotage, the Navigation Procedures Manual provided guidance on safe embarkation/disembarkation and the support to be provided to the pilot and stated:

> *The presence of the Pilot does not relieve the Master or the Officer of the Watch of their duties and obligations. When under pilotage the vessel is to Master's orders and Pilot's advice.* [sic]

1.5.3 Crew

Hebridean Princess had 40 crew. At the time of the accident the pilot, master, chief officer and second officer were on the bridge, assisted by an able seaman on the wheel and a cadet recording events in the bell book. The crew comprised mixed nationalities and the working language on board was English.

The master had worked at sea since 1997. They joined the passenger vessel as a second officer, progressed to chief officer, and had served as master since 2011. The master held an STCW II/2 Master's Unlimited CoC and a Clydeport Pilotage Exemption Certificate (PEC) for the dockyard ports of Gareloch, Loch Long and the outer sea lochs. The PEC required the master to carry a Clydeport pilot whenever the vessel employed tugs that were made fast, or when the vessel operated to the east of Custom House Quay **(**see **Figure 2)**. This meant that the vessel always carried a pilot whenever it entered or departed James Watt Dock.

1.5.4 Navigation and propulsion

Hebridean Princess's bridge was of traditional design with a pelorus and wheel on the centreline. On the starboard side at the front of the bridge were radar and Electronic Chart Display and Information System (ECDIS) displays and there were two GPS systems mounted overhead. The vessel's primary means of navigation was paper charts and the ECDIS was used as a navigational aid. Signs showing engine orders alongside predicted speed were displayed on the bridge's forward bulkhead adjacent to the port and starboard telegraphs and on each bridge wing **(Figure 17)**. This manoeuvring data was also included as part of *Hebridean Princess*'s pilot boarding card.

Image courtesy of Hebridean Island Cruises Ltd

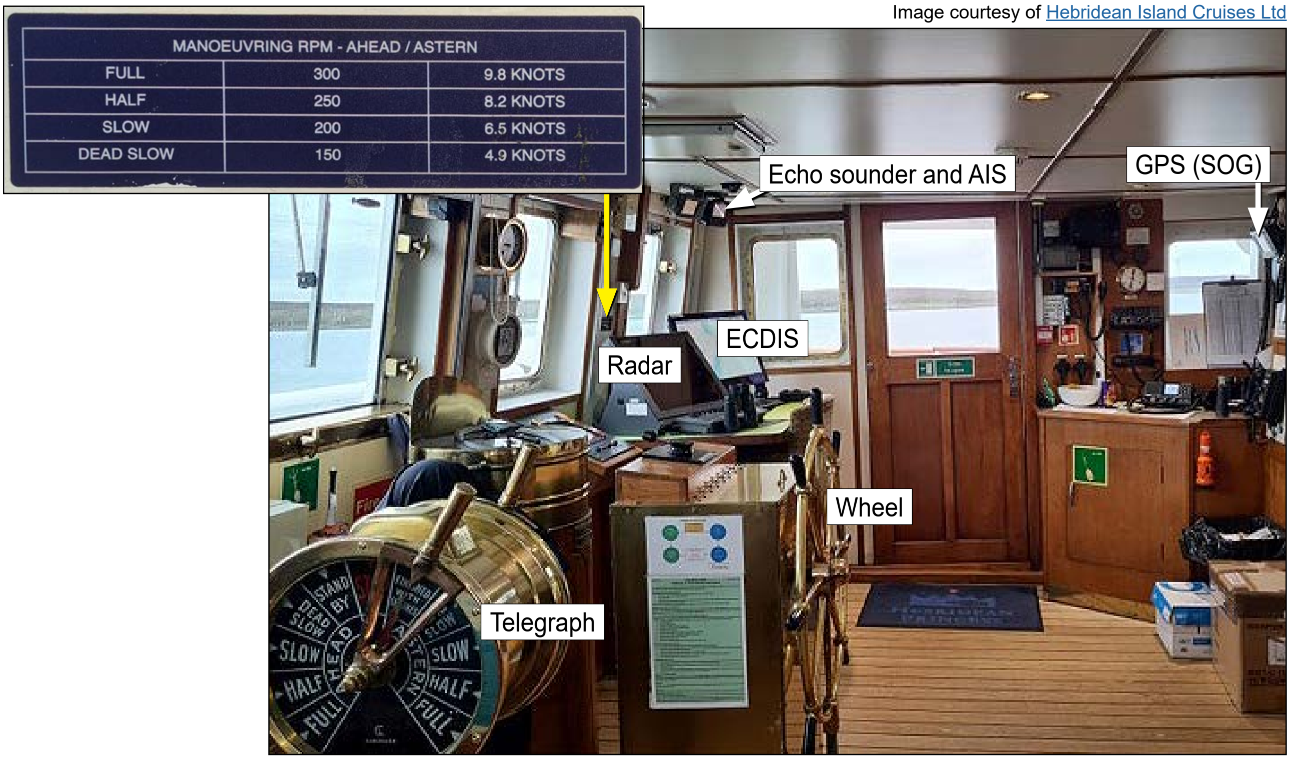

Figure 17: *Hebridean Princess*'s bridge and (inset) telegraph setting versus speed

Hebridean Princess was propelled by two Crossley reversing diesel engines driving two fixed pitch propellers through reduction gearboxes. Engine orders were passed from the bridge using mechanical telegraphs and the required shaft revolutions were set by the engineers in the engine room. At dead slow ahead on both engines, *Hebridean Princess*'s predicted speed was 4.9kts. If a slower speed was required, the conning officer would have to stop or go astern on one or both of the shafts. The vessel was also fitted with a bow thruster, which had a 30-second delay between successive movements. There was no electromagnetic or mechanical log to measure the vessel's speed; instead the pilot and crew used the SOG from either the radar, ECDIS or GPS receivers and tidal stream to estimate the vessel's speed through the water.

1.6 CLYDEPORT OPERATIONS LIMITED

1.6.1 Overview

Clydeport was the Statutory Harbour Authority (SHA) and Competent Harbour Authority (CHA) for the River Clyde where the accident took place. Clydeport's role as the SHA meant the company was legally responsible for the management of marine operations within the port area. As CHA, and in line with the Pilotage Act 1987, Clydeport was responsible for the authorisation of a suitably qualified marine pilotage service for its waters.

Clydeport oversaw the safe operation of the port in line with the UK Port Marine Safety Code (PMSC) and its supporting GTGP. The PMSC provided guidance for a national port safety standard and its aim was to enhance safety for those using or working in ports, their ships, passengers, and the maritime environment.

Clydeport provided advice to vessels operating within its SHA via Estuary Radio, its Local Port Service (LPS)[18] based in Liverpool, England. Estuary Radio did not have radar coverage of its waters and instead used AIS, CCTV and VHF reports to monitor vessel movements in the Clydeport area.

1.6.2 Clydeport pilotage

Clydeport employed 11 marine pilots, operating in two 1-week shifts of five pilots each. Each pilot was graded[19] based on their qualification and experience and allocated pilotage trips based on the vessel's length overall (LOA). Class 1 pilots, the most qualified and experienced, were authorised to pilot vessels of any size. Clydeport Pilotage Grade Limits restricted Class 4 pilots to vessels up to *100m LOA east of Greenock Ocean Terminal (GOT) cruise pontoon; 116m elsewhere*.

On the day of the accident, and in line with Clydeport's Pilotage Grade Limits, the company's Liverpool-based port's planning team allocated a Class 4 pilot for the movement of the 71.6m LOA *Hebridean Princess*, which would be operating to the east of the cruise pontoon.

[18] Marine Guidance Note (MGN) 401 (M+F) stated that the provision of LPS was designed to improve port safety and coordination of port services within the port community by dissemination of port information to vessels and berth or terminal operators.

[19] Pilots operating east of Greenock Ocean Terminal: Class 1 – unlimited; Class 2 – vessels up to 200m LOA; Class 3 – up to 146m LOA; Class 4 – 100m LOA.

Where a vessel was being towed as a dead ship, Clydeport ruled that the LOA was *the distance from the forward end of the towing vessel to the stern of the last vessel or object towed*[20].

The combined length of *Hebridean Princess* and the tugs was 158m[21]. This meant that a Class 2 pilot would have been allocated to the movement during a dead ship move.

1.6.3 Pilot training

The International Maritime Organization's (IMO) Resolution A.960(23) provided *Recommendations on Training and Certification and on Operational Procedures for Maritime Pilots other than Deep-sea Pilots*[22]. In the UK the IMO resolution led to the creation of the Port Skills and Safety National Occupational Standards (NOS).

Approved in 2012, the NOS detailed the syllabus for trainee marine pilots. On the employment of tugs, it was required that candidates:

- Know and understand:
    - the names, types, characteristics and operating procedures of the tugs within the port; and the theory, operational principles and limitations of tugs and towage[23].
- Must be able to:
    - plan an act of pilotage within their port making appropriate use of the available tugs and discuss the plan with appropriate stakeholders, which might include tugs.
    - work safely with tugs to manoeuvre vessels in harbours and their approaches considering the risk of girting, the safety of tugs while girting and the vessel's course and speed[24].

On the assumption that all marine pilots would join with an STCW II/2 Master Unlimited CoC, Clydeport had commissioned the Glasgow College of Nautical Studies (GCNS)[25] to conduct a mapping exercise between the CoC and the NOS to identify the training requirement for new pilots. On the NOS working with tugs section the mapping exercise noted that:

> *The general principles may be discussed under STCW 95, but the depth of knowledge required for this outcome is well outwith the scope of anything contained within deck officer training. Would suggest that this area requires additional specialised training over and above a Class 1 CoC*[26] (equivalent to an STCW II/2 (Masters unlimited) CoC). [sic]

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20 Clydeport Towage Guidelines, section 1.1.3, page 5.

21 *Hebridean Princess* c.72m + *Bruiser* c.18m + *Biter* c.16m + 2 x 26m bridles = 158m.

22 This IMO resolution was adopted on 5 December 2003 and included the requirement for the syllabus to include the knowledge of *use and limitations of various types of tugs* (section 7.20).

23 Port Skills and Safety NOS MP101, K7.16, K8.20;MP105, K7.13; and MP107, K3.20.

24 Port Skills and Safety NOS MP101 P5.4, P13.1, P13.3, P19.2 and MP107, P19, P22, P24, P25.

25 Now the City of Glasgow College Maritime Education and Training.

26 Marine Pilot Mapping exercise: A comparison of the requirements of STCW 95 for the issue of Class 1 master mariners certificate of competency vs Marine Pilot Training Syllabus, page 12.

This GCNS mapping exercise led to the creation of a programme that required candidates to complete induction and safety training, alongside practical training under the supervision of experienced pilots, to understand how to safely manoeuvre vessels within the port. It also required trainee pilots to complete computer-based port assessments.

To ensure Clydeport pilots understood how to employ the tugs within the port, their training required them to visit both Svitzer and CMS tugs. A key element of this familiarisation process was to ensure that they understood *the ease with which a small tug can be girted*[27]. Trainees were also required to complete a trip on a CMS conventional tug while it was made fast to the assisted vessel.

1.6.4 The pilot

Hebridean Princess's pilot was a Class 4 pilot who held an STCW II/2 Master Unlimited CoC and had worked at sea for 20 years, which included periods as a ship's master. The pilot had joined Clydeport as a trainee pilot in March 2022 and had since been involved in 185 pilotage acts, which are summarised in **Table 2**.

Most of the pilot's practical experience controlling tugs was gained by employing ASDs or a combination of ASDs and a conventional tug; the pilot had observed two trips where the two conventional tugs *Biter* and *Bruiser* were employed to assist the move. Both trips were dead ship tows where vessels were towed between berths at slow speed without their own propulsion. Due to a lack of conventional tug ship assist moves, the pilot had not completed the required trip on a conventional tug. With the approval of the Clydeport training team, the pilot had instead completed a trip on one of the CMS ASDs while it was being operated by an experienced conventional tug master. The pilot's record of evidence from this trip noted that there was a greater risk of girting a conventional tug and that a gob wire could be used to reduce this risk. It did not discuss the need to limit the speed of the assisted vessel when operating with conventional tugs or describe the *peel off/drop back* manoeuvre.

The pilot's Grade 4 examination process (oral and written) tested their knowledge of local byelaws, navigational marks, passage planning considerations and berths; it did not assess their knowledge of tug characteristics, procedures and limitations. None of the pilot's assessed Class 4 trips or computer-based training assessed their ability to employ tugs.

Since being authorised as a Class 4 pilot on 29 September 2022, almost all of the pilot's trips had been piloting small coasters in and out of port without tugs. He had employed a single ASD tug on two occasions when environmental conditions required. On the day of the accident, the pilot's trip on *Hebridean Princess* was his first unsupervised pilotage act employing conventional tugs for ship assist towage.

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[27] Clydeport's Marine Officer/Pilot Training Programme, page 6, dated May 2020.

Trip type	Total number of trips	Trips with tugs	Remarks
Supervised	138	40 (29%)	2 trips were conducted using conventional tugs
Unsupervised as a Grade 4 pilot	47	2 (4%)	All ASD tugs
Total	185	42 (23%)	

Table 2: Summary of the pilot's experience

1.6.5 Towage

In line with the PMSC's GTGP Clydeport had produced 12 risk assessments for its towing operations, including unsafe speed and girting. These assessments led to the Clydeport Towage Guidelines, which described the safe operation of tugs within the port's area of responsibility.

The Clydeport Towage Guidelines included a *Towing Matrix* that defined the minimum towage requirements for the various berths and docks within the port. While the guidance for the James Watt Dock north wall required *Hebridean Princess* to take at least a single 10t bollard pull tug, the limitations with its bow thruster meant that the passenger vessel's master always employed a second tug.

The Clydeport Towage Guidelines provided guidance to vessel masters, towage operators, tug masters and pilots to *enhance the safety of marine towage operations and provide a framework to prevent accidents and enhance communications*[28]. The guidelines included the requirement for a pilot/tug exchange (PTX), during which the following information would be shared between the pilot and the tug master:

- The pilot would share details about the safe working load of the vessel's bollards; where the tugs would be connected and the planned speed for this process; the maximum speed of the tug; the berthing plan; the intended and emergency use of ship's anchors; any pertinent issues that might have emerged from the MPX; and, if appropriate, any shallow water or tidal effect that might affect the tug's load.

- The tug master would inform the pilot of any defects with their tug and share any concerns they had with the pilot's plan.

The Clydeport Towage Guidelines also advised on:

- <u>*Tug watertight integrity*</u> – *All watertight openings should be marked with a sign stating that they are to remain closed during towage operations. Any such openings used whilst moving about the tug during a towage operation should be re-secured immediately after use. The pilot / Master is to inform the tug if they observe any exterior openings on the tug that are not closed, and which may affect the tugs' watertight integrity.*[29]

[28] Clydeport Towage Guidelines, page 4.

[29] Clydeport Towage Guidelines, section 2.5.2

- *Girting – Vessel's Masters, Pilots and Tug Masters must have a clear understanding of girting and its consequences. Girting happens when the towline comes at right-angles to the tug. The tug is pulled bodily through the water by its tow, which can lead to deck-edge immersion, flooding and capsize; unless the towline is released in good time.*[30]

- *The use of gob rope – The use of a gob/gog rope for towage of vessels by conventional tugs within the Clydeport Harbour Authority is compulsory.*[31]

- *Safe speed – When making fast and letting go a conventional tug, speed and the orientation of the tug are critical factors. The Pilot is to ensure that speed is through the water NOT speed over the ground. It is generally accepted that 2 to 3 knots is appropriate for conventional tugs but the pilot should check with the tug master on a case by case basis.*[32] [sic]

On 14 February 2022, the Clydeport team conducted a remote[33] PMSC compliance check of CMS that examined the company's policies; its crew qualifications; risk assessments; safe systems of work; the organisation and the operation; and maintenance of CMS vessels. The check also included the ship assist towage procedures employed by CMS. Clydeport's findings resulted in improvements to incident reporting, drug and alcohol testing, toolbox talk records and the company's self-mooring procedures. On 18 March 2022, CMS provided Clydeport with evidence that these issues had been addressed.

1.7 TRAINING AND CERTIFICATION OF TUG MASTERS

The MCA did not always require tug masters to hold specific qualifications but supported and approved the following training schemes:

- Boatmasters' Licence with towage endorsement – The BML requirements were detailed in MSN 1853 (M) Amendment 1, *The Merchant Shipping (Boatmasters' Qualifications, Crew and Hours of Work) Regulations 2015*. The BML was required for the masters of small vessels, under 24m in length that carry no more than 12 passengers, which were not certified to operate under the MCA's Workboat Code. Master's holding a BML required a towage endorsement before they could carry out towing and pushing operations.

- Voluntary Towage Endorsement – Described in MGN 468 Amendment 1 (M), *Voluntary Towage Endorsement* (VTE) *Scheme*. The VTE was introduced jointly by the BTA and WA in 2013 to enable tug masters to demonstrate that they were suitably experienced and competent to carry out towing work.

Managed by the WA, VTE candidates were first required to complete a General Towage Endorsement, attained by completing a minimum 120 days' service on vessels engaged in general towage, to demonstrate their competence to conduct towing and pushing in categorised/coastal areas. Having gained this endorsement, candidates were then able to attain a further Ship Assist Towage endorsement by completing a further 120 days' service on vessels while engaged in ship assist operations. The VTE also offered a further qualification in *Sea Towage* (the towing

[30] Clydeport Towage Guidelines, section 4.4.1

[31] Clydeport Towage Guidelines, section 4.5.1

[32] Clydeport Towage Guidelines, section 4.7.1

[33] The PMSC compliance check was conducted remotely due to the COVID-19 restrictions in force at the time.

of vessels and floating objects at sea). MGN 468 Amendment 1 (M) listed one outcome of effective performance of the Ship Assist Towage Endorsement as the ability to *ensure that there are clearly defined safe work procedures/standing orders for conducting safe ship assist towage operations*.[34]

Holders of a VTE were not required to undertake the BML towage endorsement. Since the introduction of the VTE scheme 170 seafarers had been awarded a General Towage Endorsement, of whom 56 went on to attain the Ship Assist Towage Endorsement[35].

- STCW Tug Master – Described in MGN 495 (M+F), *Certificate of Competency for Master and Officer of the Watch Tug less than 500 GT and 3000 GT near coastal and Certificate of Proficiency for Tug Rating*. This was a BTA sponsored training scheme that used both Maritime Studies Qualifications and STCW courses to enable deck officers and ratings to achieve tug qualifications. This scheme, and its small vessel engineer equivalent, were considered 'best practice' for mainstream towage operators of tugs more than 24m registered length, 150 GT, or 350 kilowatts.

The GTGP advised:

> *Organisations*[36] *should satisfy themselves that towage operators have suitable inhouse training and assessment schemes for their tug masters which address tug types and local conditions, skills and experience.*[37] [sic]

Clydeport Towage Guidelines did not require tug masters within the port to hold either VTE or STCW towing qualifications. The port's compliance check of CMS in December 2021 confirmed that crews held *the minimum level of national qualification for each operational role*, the evidence for which was a Royal Yachting Association Yachtmaster Offshore CoC with commercial endorsement or an MCA BML for masters of CMS's passenger vessels.

1.8 INDUSTRY GUIDANCE – PILOTAGE

1.8.1 Duties and responsibilities

On duties of the master, bridge officers and pilot, Annex 2 of IMO Resolution A.960(23) stated:

> *2.1 The pilot's presence on board does not relieve the master or officer in charge of the navigational watch from their duties and obligations for the safety of the ship. It is important that, upon boarding the ship and before pilotage commences, the pilot, master and other bridge personnel are aware of their respective roles in the safe passage of the ship.*
>
> *2.2 The master, bridge officers and pilot share a responsibility for good communications and understanding of each other's role for the safe conduct of the vessels in pilotage waters.*

[34] MGN 468 (M), Annex 2, A2.2.1

[35] Workboat Association figures.

[36] Statutory harbour authorities and operators of other marine facilities.

[37] Section 10.6.3

2.3 Masters and bridge officers have a duty to support the pilot and to ensure that his/her actions are monitored at all times. [sic]

Chapter 6 of the International Chamber of Shipping (ICS) *Bridge Procedures Guide* (BPG) provided industry guidance on the conduct of pilotage. The BPG stated that:

Pilots possess specialist knowledge and have ship handling and tug management skills to assist the bridge team during the most crucial and potentially hazardous phases of a voyage;

The presence of a pilot does not relieve the Master or the bridge team from their duties and responsibilities for the safe conduct of the ship[38]*;*

And,

Tugs and mooring boats should not be endangered by the actions of the ship…[39] [sic]

The guide then described the division of duties and responsibilities between the bridge team and the pilot. **Figure 18**, reproduced from the BPG to illustrate how the bridge team and pilot could work together, showed that the pilot was responsible to the master for directing the tugs.

Image courtesy of International Chamber of Shipping, Bridge Procedures Guide

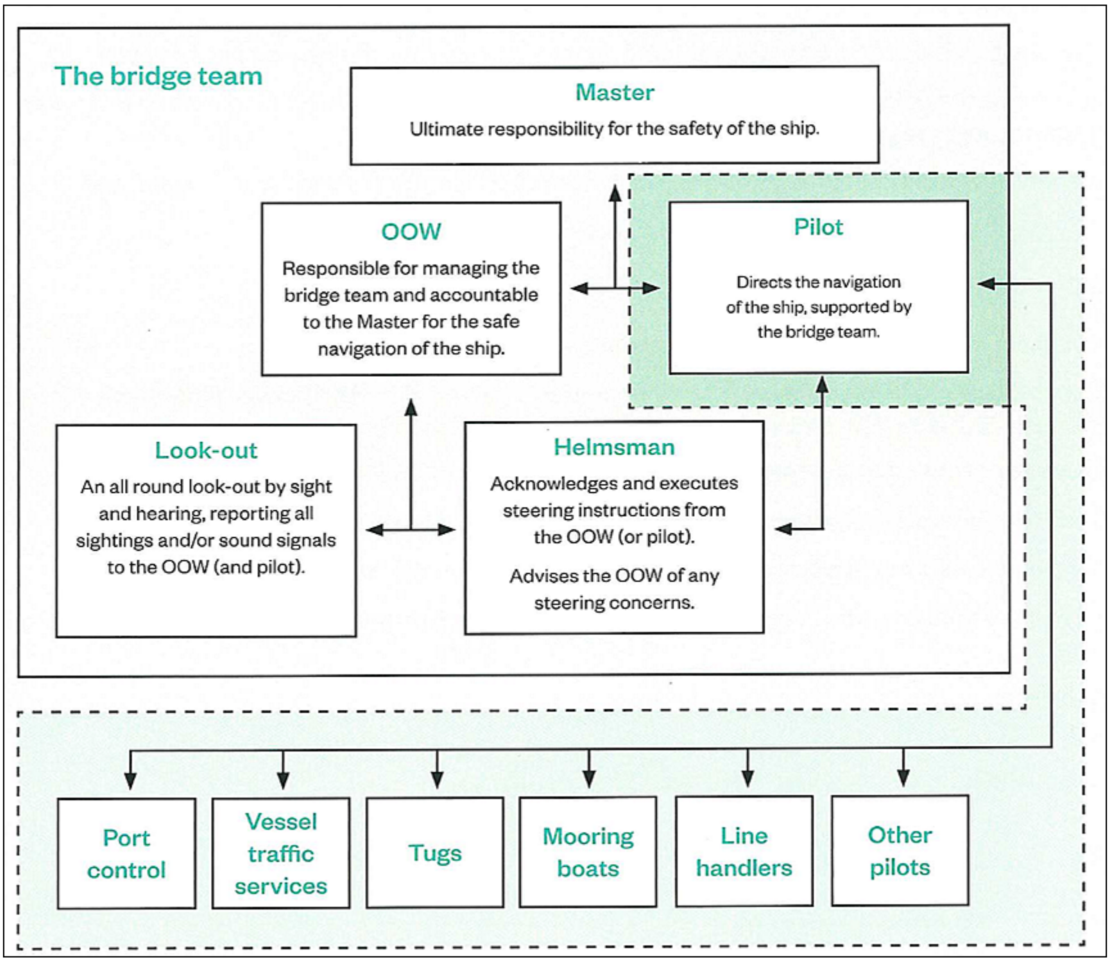

Figure 18: Bridge Procedures Guide illustration, showing how the bridge team and pilot could work together

[38] ICS BPG, section 6.1

[39] ICS BPG, section 6.6.2

1.8.2 Electronic master/pilot information exchange

Several ports in the UK and worldwide had adopted software to allow their pilots to create and share pilotage plans. This software often included the capability for the pilot to use chart extracts to construct and display the passage plan with the use of tugs. Once the plan was complete it could be shared with the vessel, tugs, berthing teams and local ports or vessel traffic services in advance of the movement. An example of such an electronic MPX document is at **Annex A**.

1.9 INDUSTRY GUIDANCE – TUG OPERATIONS

1.9.1 Pocket guide

The BTA, UK Maritime Pilots' Association and UK Chamber of Shipping publication *Pilots' Pocket Guide and Checklist, Working Safely with Harbour Tugs – Reducing the Risks in Port Towage*, contained detailed sections on checklists and communications, including pilot/ship master and pilot/tug master exchanges. It also summarised the advantages and disadvantages of, and typical use for, various tug types. The guide stated that while the advantages of conventional tugs included simpler design and shallower draught, the disadvantages included being less manoeuvrable and having a higher risk of girting due to the amidships towing point.

1.9.2 Speed

The United States Coastguard's *Navigation and Vessel Inspection Circular* (NVIC) *No. 12-83* published the results of research on intact stability criteria for towing and fishing vessels. This research showed that the heeling force exerted on a tug was proportional to the square of the towing speed and is summarised in **Table 3**. The heeling moment generated at 4.6kts was more than twice that generated at 3kts and five times that generated at 2kts.

Towing speed (V)	Factor affecting resultant heeling force (V^2)
2	4
3	9
4	16
4.6	21.2

Table 3: Towing speed vs factor affecting resultant heeling force

1.9.3 The Code of Safe Working Practices for Merchant Seafarers

The Code of Safe Working Practices for Merchant Seafarers 2015 edition – Amendment 7, October 2022 (COSWP) defined a competent person as:

> *someone who has sufficient training and experience or knowledge and other qualities that allow them to carry out the work in hand effectively and safely. The level of competence required will depend on the complexity of the situation and the particular work involved.*[40]

[40] COSWP, About this Code, paragraph 23.

On towing, Chapter 26 provided a range of advice, including:

> *Prior to towing operations being undertaken, the master (and pilot) should establish a suitable means of communication, exchange relevant information (e.g. speed of vessel) and agree a plan for the tow with the tug master.*[41]

On watertight integrity, Chapter 30 advised:

> *30.2.1 The watertight integrity of a tug should be maintained at all times. When the tug is engaged on any towage operation, all watertight openings should be securely fastened.*
>
> *30.2.2 All watertight openings should be marked with a sign stating that they are to remain closed during towage operations. Any such openings used whilst moving about the tug during a towage operation should be re-secured immediately after use.* [sic]

1.10 ELECTRONIC EVIDENCE

This investigation was able to use electronic evidence from *Hebridean Princess*'s voyage data recorder and its AIS to reconstruct the events leading up to the accident and the emergency response that followed. As a workboat certified to operate in area category of operation 3, *Biter* was not required to be fitted with AIS and had not been fitted with a transceiver. As a result, there was no record of the tug's position, course and speed.

1.11 PREVIOUS SIMILAR TUG ACCIDENTS

The BTA and WA assessed that in 2022 there were approximately 1,000 seafarers operating on 200 tugs around the UK. About 65 of these tugs were conventional tugs, less than 24m in length.

Between 1998 and 2024 the MAIB published seven investigation reports into conventional tug accidents. These accidents had resulted in seven crew fatalities.

1.11.1 *Trijnie* – capsize and foundering

On 8 September 1998, the tug *Trijnie* capsized and sank with the loss of one life while acting as the aft tug providing ship assist towage to the tanker *Tillerman* on approach to Milford Haven Docks, Wales (MAIB report published July 1999[42]). The investigation found that *Trijnie* did not have a gob rope rigged; the emergency towing hook release wire was not connected; and the operations manager who assigned *Trijnie* did not know what towing mode it would use. The investigation also found that *Tillerman*'s pilot could not see the tug from the bridge and assumed that it had been running with the ship stern-to-stern, from which position it would have been relatively easy for the tug to position itself on the ship's port quarter. Furthermore, the pilot was unaware that this was the first time that the tug coxswain had undertaken such an operation. The investigation also concluded that the improper securing of *Trijnie*'s engine room hatch cover contributed to the speed of the tug's sinking.

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[41] COSWP, section 26.6.3

[42] https://www.gov.uk/maib-reports/girting-capsize-and-sinking-of-workboat-tug-trijnie-while-assisting-petroleum-products-tanker-tillerman-in-approach-channel-to-milford-docks-port-of-milford-haven-wales-with-loss-of-1-life

1.11.2 *Flying Phantom* – loss of tug while towing

On 19 December 2007, *Flying Phantom* capsized and sank with the loss of three lives while acting as bow tug providing ship assist towage to the bulk carrier *Red Jasmine* on the River Clyde (MAIB report 17/2008[43]). The investigation found that the towline's emergency release system did not operate quickly enough to prevent the capsize; the procedure for testing the emergency release system varied between different tugs' crews; and the port side engine room door was left open.

1.11.3 *Ijsselstroom* – loss of tug while towing

On 14 June 2009, the tug *Ijsselstroom* capsized while acting as stern tug providing general/project towage to the barge *Tak Boa 1* as it approached Peterhead, Scotland (MAIB report 4/2010[44]). The investigation found that the tug owner relied too heavily on the individual knowledge and experience of its tug masters. The tug operator did not have a formal training programme and its tug masters' knowledge and experience had not been assessed. The investigation also found that *Ijsselstroom*'s lack of gob rope meant there was no physical safety device to prevent the tug from girting when directional control was lost.

Ijsselstroom's master was unfamiliar with the towline's emergency release system. They had not tested or witnessed its effect and did not operate it when the tug got into difficulties. The pilot, who was positioned on the lead tug, and *Ijsselstroom*'s master had not conducted a briefing before the operation. Consequently, the pilot was unaware of whether *Ijsselstroom* was towing over its bow or stern and had no knowledge of its operational limitations.

1.11.4 *Chiefton* – collision, capsize and foundering

On 12 August 2011, the tug *Chiefton* capsized while acting as the bow tug providing project towage to *Skyline Barge 19* on the River Thames, England with the loss of one life (MAIB report 12/2012[45]). The investigation found that the pilot and tug master lost situational awareness during the tow and that the port's risk assessment did not fully cover the operation. Further, those involved had limited experience of project tows and no one had been nominated in overall charge of the move.

1.11.5 *Asterix* – girting and capsize

On 30 March 2015, the mooring launch *Asterix* capsized while acting as aft tug providing ship assist towage to the tanker *Donizetti* to depart Southampton, England (MAIB 10/2016[46]). The investigation found that the tug master was unaware that the tanker was coming ahead; the master, pilot and tug master did not share a common understanding of the plan and key information was not exchanged; the tug operator's SMS did not contain sufficient detail to inform the crew on the correct use of the gob rope; and the tug crew did not drill the use of the emergency towing hook release.

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[43] https://www.gov.uk/maib-reports/girting-and-capsize-of-tug-flying-phantom-while-towing-bulk-carrier-red-jasmine-on-river-clyde-scotland-resulting-in-1-person-injured-and-loss-of-3-lives

[44] https://www.gov.uk/maib-reports/girting-and-capsize-of-tug-ijsselstroom-in-peterhead-bay-scotland

[45] https://www.gov.uk/maib-reports/capsize-and-sinking-of-tug-chiefton-after-a-collision-with-its-tow-at-greenwich-reach-river-thames-england-with-loss-of-1-life

[46] https://www.gov.uk/maib-reports/girting-and-capsize-of-mooring-launch-asterix

Asterix's master was released from the tug over an hour after the vessel had capsized. They survived because air had been trapped in the wheelhouse despite the wheelhouse entrance hatchway being open at the time of capsize.

The investigation made recommendations that led to the WA publishing guidance on towing operations and for harbourmasters to assess towing operations within their port.

1.11.6 *Domingue* – capsize of tug while towing

On 20 September 2016, the tug *Domingue* capsized while acting as aft tug providing ship assist towage to the UK registered *CMA CGM Simba* in Tulear, Madagascar with the loss of two lives (MAIB report 16/2017[47]). The investigation found that *Domingue* girted and capsized because its crew were inexperienced; the vessel was not fitted with a gob rope; there was no shared plan between the assisted vessel and the tug; and the tug was not warned when the assisted vessel manoeuvred ahead.

[47] https://www.gov.uk/maib-reports/girting-and-capsize-of-tug-domingue-while-assisting-container-ship-cma-cgm-simba-with-loss-of-2-lives

SECTION 2 – ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 OVERVIEW

This is the eighth MAIB investigation into the capsize of a tug since 1998, a series of accidents that have resulted in the loss of nine lives in total. All eight accidents involved conventional tugs and five, including *Biter*'s accident, occurred while the tugs were conducting ship assist towage.

Biter girted, capsized and sank while manoeuvring to take station astern of the passenger vessel *Hebridean Princess* and the two crew did not survive. This section of the report will discuss the accident and the safety issues that directly contributed to it, including: the performance of *Biter*'s gob rope; *Hebridean Princess*'s speed; the tug's watertight integrity; the passage plan and its execution; the pilot and tug crew's training; and the oversight of this movement by the port. It will also discuss other safety issues identified during the investigation that did not directly contribute to the accident.

2.3 THE ACCIDENT

When the Clydeport pilot gave the order for *Biter* to "*pull minimum dead astern*" *Hebridean Princess*'s speed was 4.6kts, equivalent to 2.3m per second. This meant that the tug, attached by two 26m bridles, had just over 10 seconds to reverse direction into its new position astern of the passenger vessel before its weight came onto the towlines. *Biter* did not complete this manoeuvre. Instead, and as the CCTV images showed, the tug's turn stalled, the bridle came under tension and its gob rope did not prevent it being towed sideways.

Once *Biter* was being towed sideways it took about 10 seconds for the tug to girt and capsize. After salvage the tug's towing hook release mechanism was found to operate correctly. It is highly likely that the rapid sequence of events as the vessel heeled, flooded and then inverted meant that *Biter*'s crew had insufficient time to respond by tripping the towing hook to release the bridle and potentially avert the capsize.

2.4 *BITER*'S GOB ROPE

Biter's gob rope was essential for the safe operation of the tug. The performance of the tug's gob rope was dependent on the loading placed on it by the assisted vessel's speed, the effectiveness of its securing arrangements and its design.

2.4.1 Speed

When *Biter* started its manoeuvre, *Hebridean Princess*'s speed exceeded both the 2kts to 3kts recommended by both industry and The Clydeport Towing Guidelines and the 3kts to 4kts limit in CMS's RA19. As shown on the CCTV images, the tug was approximately a quarter of the way through its 180° turn when the weight came onto the starboard towing bridle.

The effect of *Hebridean Princess*'s speed on the towline forces was significant. The passenger vessel was proceeding at 4.6kts which meant, as NVIC 12-83 described, that the towline loading was between two and five times greater than at the lower speeds recommended in the guidance. *Biter* was manoeuvring astern when the bridle came under tension, further increasing the load on the towlines and the heeling force acting on the tug. It is therefore highly likely that the starboard bridle, leading forward over the tug's port bulwark, came under significant load. The bridle's load then transferred to the gob rope, initially snatching the 1.5m gob rope eye and drawing it towards the tug's towing hook, then transferring the load onto the securing arrangements **(Figure 19)**.

Hebridean Princess's speed exceeded the port's guidelines and led to a significant load being placed on *Biter*'s gob rope and latterly onto its securing arrangements, almost certainly contributing to the subsequent rendering.

Image courtesy of Police Scotland

For illustrative purposes only: not to scale

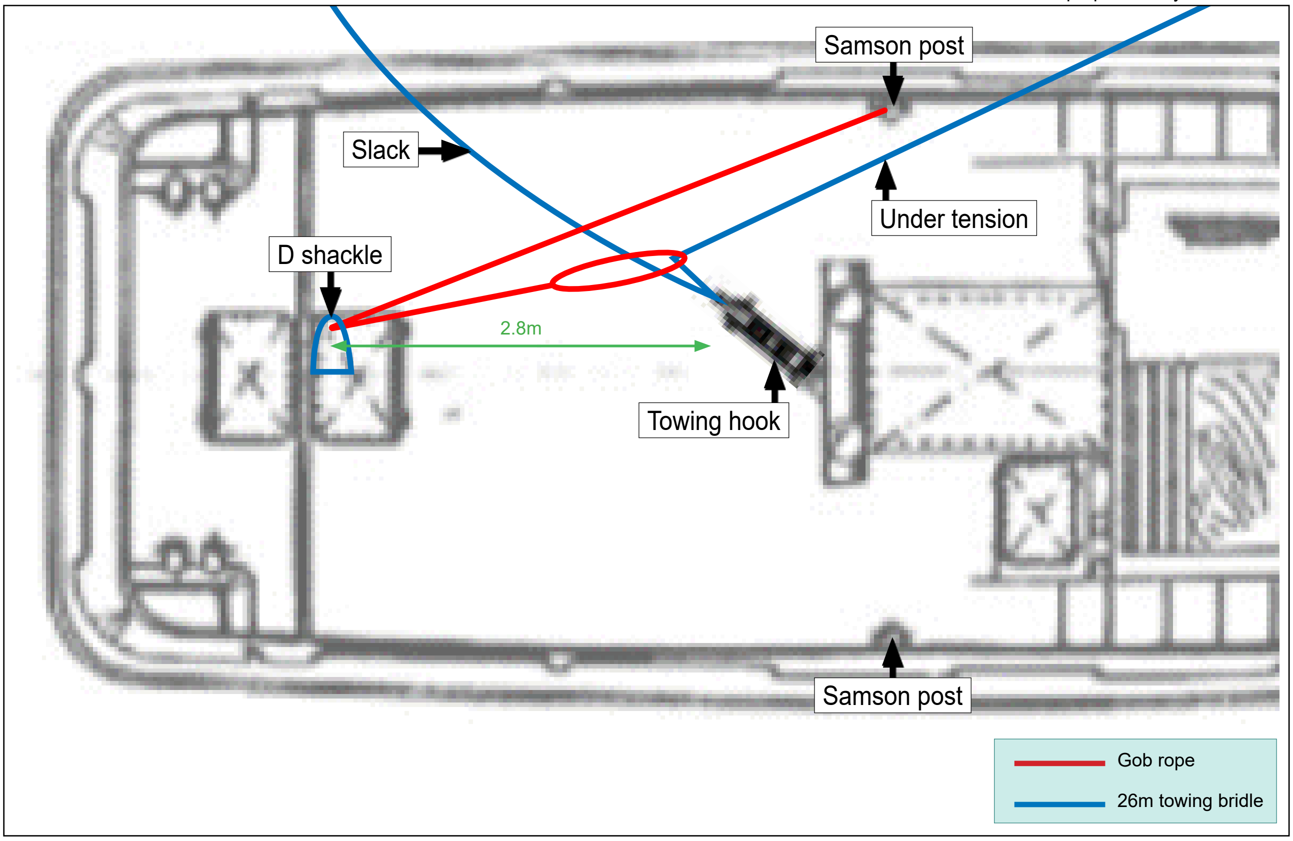


Figure 19: Illustration of the load on the towing bridle being transferred to *Biter*'s gob rope

2.4.2 Securing arrangements

The post-accident inspection of *Biter*'s gob rope found that over 2.5m of the rope had melted and fused in a location coincident with where it would have been secured to the samson post. Additionally, the dive survey found that the gob rope had been extended and the working eye was 3m rather than 1.5m beyond the bow shackle, and that although the gob rope was still wrapped around the samson post its locking turns were missing.

Given that the gob rope had been recently surveyed and was probably inspected by the tug master as he set the lines, it is highly likely that this damage was caused during the accident. The damage almost certainly resulted from the friction and heat created as the rope was pulled quickly round the samson post under tension. It is probable that as the gob rope rendered, the tug's towing point moved forward towards the hook. *Biter* was then trapped and unable to manoeuvre. The continued application of the towing force pulled the tug sideways and it girted.

The reason that the gob rope's securing arrangements were unable to withstand the load has not been identified. Potential causes include: the samson post securing arrangement, where the gob rope was wrapped 4 to 5 times around the post before locking turns were applied, was inadequate; or that the locking turns were inadvertently dislodged or lost during the manoeuvre. However, without guidance in the CMS SMS on gob rope securing arrangements the decision of how to secure the gob rope was left to the tug master. As a result, while most masters used the samson post, others placed figure of eights around the tug's towing hook frame **(**see **Figure 9)**.

It was critical that the gob rope system was secure or, as *Tug Use in Port* stated, *strong enough and fully reliable* to prevent this manoeuvre *becoming really dangerous for the tug*. However, as there had been no reported issues with *Biter*'s gob rope securing arrangements these configurations had not been tested or evaluated by the company. While it was not possible to determine exactly why *Biter*'s gob rope failed, the practice of securing *Biter*'s gob rope to a samson post, when combined with the low friction coefficient of the HMPE rope, might therefore have allowed the gob rope to render more easily than an alternative securing arrangement.

The investigations into the *Trijnie*, *Ijsselstroom*, *Asterix* and *Domingue* accidents found that it was essential that conventional tugs use a gob rope during towing operations and that, to be effective, this rope or line must be correctly set and secured to ensure the safety of the tug. The *Asterix* report also recommended that the tug operator should provide comprehensive instructions to its crews on the use of the gob rope.

2.4.3 Design

The arrangements for securing the gob rope in *Biter* meant that, unlike *Bruiser*, the rope was led through a bow shackle 2.8m behind the towing hook, about half a metre above the deck and over a metre from its transom. As a result, even without the gob rope rendering, there was the risk that under certain conditions the gob rope could be pulled towards the towing hook, moving the towing point forward and increasing the risk of the tug being towed sideways and girted.

To reduce the risk of this occurring on their vessels, several operators of similar conventional tugs had modified their gob rope arrangements to lead the rope beyond the anti-snag bar, as low in the vessel as possible and as close as possible to the tug's transom. Some had also replaced the manual gob rope with a gob line winch, which could allow it to be adjusted from the tug's wheelhouse, although not while under tension **(**see **Figure 12)**. These modifications moved the tugs' towing points as far aft as possible, increasing the effectiveness of the gob arrangements and reducing the likelihood of the tugs being towed sideways.

At about half a metre above the deck and only 2.8m from the towing hook, *Biter*'s gob rope arrangement was unlikely to be as effective as an adjustable arrangement rigged closer to the transom. It is therefore possible that this arrangement left *Biter* more vulnerable to being towed sideways and girted.

2.5 WATERTIGHT INTEGRITY OF THE TUG

Biter's vulnerability to flooding, capsize and sinking if its watertight integrity was compromised was identified in its stability information and incorporated into the CMS SMS. As a result, almost all the tug's doors and hatches were marked *KEEP CLOSED AT SEA* and the master was required to confirm that these openings were closed as part of the pre-sailing checklist.

It is unknown why *Biter*'s master left the watertight accommodation hatch open. Photographs of the tug suggest that masters' habitually operated the tug with the wheelhouse door clipped open. This was probably to allow deckhands easy access to the upper deck to tend the lines, as well as enabling the crew to communicate over the noise of the engines. In the case of the accommodation hatch, although the crew might have opened the hatch when they boarded the vessel to stow their gear, the need to close the hatch might have been overlooked by the crew when *Biter* got underway that afternoon. This oversight was made more likely as the warning to *KEEP CLOSED AT SEA* was obscured when the hatch was clipped open. While the tug master was almost certainly aware of the need to close the hatch, the opportunity to prompt the less experienced deck hand was therefore lost.

Biter's watertight integrity was compromised when it girted and capsized because the accommodation hatch was open. It is therefore highly unlikely that air would have been trapped in the wheelhouse when the vessel inverted, which might have limited the crew's chance of survival.

The investigations into the capsize of the *Trijnie*, *Flying Phantom* and *Asterix* found that the watertight integrity of these tugs had also been compromised when doors and hatches were left open. In the case of *Asterix*, air had fortunately been trapped in the tug's wheelhouse despite the open entrance hatchway, allowing the coxswain to be recovered alive over an hour after the capsize.

2.6 THE PASSAGE PLAN

2.6.1 Roles and responsibilities

The IMO Resolution A.960(23) made clear that the presence of a pilot does not relieve the ship's bridge team from their duties and obligations for the safety of the ship. The resolution specified that the master and bridge officers had a duty to support the pilot, and to ensure that the pilot's actions were monitored at all times.

The ICS BPG went further by stating that the presence of the pilot does not relieve the master or bridge team of their responsibility for the safe conduct of their vessel. It also stated that pilots *possess specialist local knowledge and have ship handling and tug management skills to assist the bridge team*. Specifically, it also recommended that the ship's team should monitor the pilot's communication with the tugs and that tugs should not be endangered by the actions of the ship[48].

This meant that, while the master was responsible for the safe arrival of *Hebridean Princess* in James Watt Dock, they were reliant on the pilot's specialist ship handling and tug management skills to help ensure that the tugs were not endangered. It was therefore essential that the ship's crew, pilot and tug masters shared a common understanding of the passage plan discussed during the MPX and PTX.

2.6.2 The master/pilot information exchange

The ICS BPG described pilotage as *the most crucial and hazardous phase of the voyage*. The MPX was a critical part of this process and allowed the master and pilot to agree the detail of the passage plan and how they were going to safely navigate the vessel to its berth. However, although the MPX conducted on *Hebridean Princess* discussed how to control the passenger vessel through the narrow entrance into James Watt Dock, it did not cover the capabilities, limitations, or hazards associated with the employment of the two conventional tugs. Nor did it discuss the port's guidance that the passenger vessel's speed should be limited to 2kts to 3kts when conventional tugs were attached.

The reason behind this omission is unclear, but a contributory factor might have been the limited nature of the Clydeport MPX passage record **(**see **Figure 3)**. This short form did not prompt the pilot to explain any of the details associated with the tugs. In contrast many ports in the UK and worldwide now use electronic MPX formats to ensure their pilots can easily share their passage plan in more detail with both ship and tug masters, an example of which is at **Annex A**.

The master of *Hebridean Princess* retained responsibility for the safety of their vessel and did not question the pilot about the plan for the tugs or the need to limit the vessel's speed during their manoeuvres. Consequently, the master and the bridge team were unable to effectively monitor and challenge the pilot's intended plan.

The plan prepared by *Hebridean Princess*'s master and the Clydeport pilot for the employment of the two conventional tugs was incomplete in that it did not explain the capability, limitations and risks associated with operating conventional tugs or agree the need to limit the passenger vessel's speed during this process.

2.6.3 The pilot/tug information exchange

The Clydeport pilot did not discuss their plan with the tug masters using the PTX format described in the *Clydeport Towage Guidelines*. This meant that *Bruiser*'s and *Biter*'s masters did not have the opportunity to contribute to or agree the pilot's plan for their employment assisting *Hebridean Princess* or inform the master and pilot of any concerns or limitations when employing their tugs.

[48] ICS BPG, section 6.6.2

The lack of detailed discussion about tug employment also meant that neither *Hebridean Princess*'s master nor the two tug masters had a shared understanding of the pilot's plan for the employment of the tugs. Moreover, it is unclear that anyone understood the extreme risks associated with *Biter*'s manoeuvre. Without a thorough PTX there was no opportunity for *Bruiser*'s and *Biter*'s masters to raise any concerns they might have had about the pilot's plan.

The need for the master, pilot and tug masters to agree and share a common understanding of the plan for the management of tugs during harbour movements was highlighted in section 26.6.3 of the COSWP. It was also a significant finding in the investigations into the capsize and foundering of *Trijnie*, *Ijsselstroom*, *Asterix* and *Domingue*.

2.7 EXECUTION OF THE PASSAGE PLAN

2.7.1 *Hebridean Princess*

<u>The pilot's understanding of *Biter*'s intended manoeuvre</u>

The investigation found that the pilot believed *Biter* would operate in a similar manner to an ASD tug and that the tug was already astern of *Hebridean Princess* when they gave the instruction to "*pull minimum dead astern*". The pilot's experience (see **Table 2)** showed that they had mainly operated using ASD tugs and had never seen a conventional tug conduct the *peel off/drop back* manoeuvre. During the exchange between the pilot and *Biter*'s master immediately before the manoeuvre, the pilot gave no indication that they recognised the tug would run alongside to pass towlines and then be "*swinging off*" to take up position astern. This lack of recognition indicated that the pilot did not understand the intended manoeuvre. Without this understanding, the pilot saw no need to move to the bridge wing to monitor the aft tug's position or reduce *Hebridean Princess*'s speed.

Critically, the pilot did not discuss how *Biter* would connect up and take position during the MPX or PTX. This omission meant that the opportunity for *Hebridean Princess*'s master and the tug masters to identify and challenge the pilot's erroneous assumption was missed. It also meant that when the pilot gave the order for the conventional tug to "*pull minimum dead astern*", they did not react to the tug master's question, the importance of which was missed as the pilot believed there was little risk to the tug.

A significant finding of the *Trijnie* investigation was that the pilot similarly did not visit the bridge wing to observe the tug and therefore assumed that it was already running stern-to-stern with the assisted vessel rather than alongside its starboard quarter.

<u>Control of *Hebridean Princess*'s speed</u>

The way the pilot controlled *Hebridean Princess*'s speed was a further indication that they did not understand *Biter*'s intended manoeuvre. The pilot understood the importance of seeking the tug masters' endorsement of the passenger vessel's speed when attaching. In contrast, they did not appreciate the hazard posed to *Biter* by the passenger vessel's speed when the tug conducted its *peel off/drop back* manoeuvre. The pilot planned to reduce *Hebridean Princess*'s speed to 3kts and had ordered dead slow ahead on both engines; however, this engine order delivered a predicted speed of approximately 4.9kts. It is therefore unclear whether the pilot understood the need to stop or go astern on one of the engines to reduce to 3kts, or was relying on the aft tug pulling dead astern to achieve the desired speed.

Hebridean Princess's master periodically reminded the pilot of the vessel's speed during the passage to James Watt Dock; the final update, that the vessel was doing just over 4kts, was about 3 minutes before the accident. *Hebridean Princess*'s master had not advised the pilot that dead slow ahead would deliver approximately 4.9kts, and not the 3kts mentioned in the pilot's earlier VHF communication with the tugs at 1518. Without a detailed understanding of the pilot's plan for *Biter*, the master was unaware that the pilot thought *Biter* was already in position astern of *Hebridean Princess* and so did not challenge the pilot's order of: "*Aft tug minimum dead astern*" while the tug was still running alongside the quarter and the passenger vessel's speed was 4.6kts. This was potentially a missed opportunity to influence the safe operation of the vessel.

2.7.2 *Biter*

Biter's master did not challenge the pilot's order to "*pull minimum dead astern*" and immediately began to manoeuvre his tug into position. This suggests that the tug master believed that it was safe to conduct the *peel off/drop back* manoeuvre and was not concerned with the speed.

It is possible that *Biter*'s master did not request that the pilot reduce *Hebridean Princess*'s speed because the tug's electronic navigational aids were covered, and he was therefore unaware that the passenger vessel's speed was so high. He might also have assumed that *Hebridean Princess* was now proceeding at 3kts following the pilot's VHF communication 9 minutes earlier. It is also possible that the tug master was content with the passenger vessel's speed and believed that he would be able to complete the manoeuvre safely provided that *Biter*'s gob rope held.

Whatever the explanation, this was a hazardous manoeuvre that had only been conducted three times in the last 12 months by CMS's conventional tugs. However, *Biter*'s master started the manoeuvre without challenge, indicating that he did not perceive excessive risk to his tug. The covered navigational aids might have led the tug master to simply underestimate the passenger vessel's SOG and so not appreciate that small increases in speed would greatly increase the heeling force exerted on his tug, raising the risk of its girting and capsize. Further, the increased load on the gob rope, discussed in paragraph 2.4.2, might have caused its securing arrangements to fail.

2.8 CLYDEPORT PILOTAGE

2.8.1 Pilot training and experience

Clydeport was responsible as CHA for the authorisation of a suitably qualified marine pilotage service for its waters.

Although the Clydeport pilot had taken part in 185 trips, of which 23% employed tugs, only two had employed conventional tugs assisting with dead ship tows and both of these trips were supervised. This meant that *Hebridean Princess*'s pilot had not previously witnessed the *peel off/drop back* manoeuvre attempted by *Biter*. Further, although the pilot had completed a familiarisation trip in a CMS tug during training, a shortage of conventional tug operations within the port meant this had been in an ASD tug. The pilot's record of evidence form compiled after the familiarisation trip discussed the increased risk of girting a conventional tug and the use of gob ropes but did not mention safe speed or how a *peel off/drop back* manoeuvre attempted by *Biter* should be conducted. Moreover, neither the oral nor written exam at the end of the pilot's training tested their tug or towage knowledge.

The Clydeport pilot training plan's reliance on ad hoc opportunities afloat and tug familiarisation trips meant that the pilot did not receive the conventional tug training they needed. The pilot's theoretical tug knowledge in this case was unexamined and their understanding of how to plan and work safely with conventional tugs was incomplete and unassessed. The port did not therefore manage this training shortfall effectively or put in place mitigation to prepare the pilot for a trip that expected them to conduct a manoeuvre they were untrained in. The pilot's knowledge, experience and understanding of the risks associated with operating with conventional tugs were also untested.

2.8.2 Pilot allocation

The Liverpool-based Clydeport planning team allocated *Hebridean Princess*'s pilotage trip to the recently qualified pilot based on the vessel's length. This meant that a Class 4 pilot used to controlling 90m coasters with the occasional assistance of an ASD tug was assigned a comparatively complex, high-risk move using conventional tugs.

In common with many UK ports Clydeport pilotage trips were allocated based on the ship's LOA. The exceptions to this were dead ship moves that required the planning team to consider the length of the tugs and their tows as well as the vessel's LOA. The total combined length of *Hebridean Princess*, the two tugs and the towlines exceeded the 100m limit for the Class 4 pilot. However, because *Hebridean Princess*'s engines were in use, this trip fell within the Class 4 limits and a more experienced pilot was not required.

In summary, Clydeport's Class 4 pilot was allocated *Hebridean Princess*'s move based on vessel length rather than the complexity and risk of the pilotage act. The port might have allocated a more experienced pilot had consideration been given to the combined length of the tug and tow, the pilot's inexperience with conventional tugs, and the complexity and risk of the operation.

2.9 TUG OPERATIONS

2.9.1 Tug crew training

Biter's master was an experienced conventional tug and workboat operator who held the mandated CoC for his role and had completed a variety of workboat-related training courses, but did not hold a VTE. In 2018, he had also completed CMS's internal familiarisation training as an ASD master and was a highly experienced conventional tug master primarily conducting dead ship tows. However, while he had annually completed about 20 ship assist towage tasks per year during 2018 and 2019, since 2020 these tasks had become less frequent and he had only completed three ship assist towage tasks in the 12 months preceding the accident.

The COSWP definition of a competent person was someone who had sufficient training and experience or knowledge to allow them to carry out the work safely and effectively. Since its introduction in 2013, the VTE scheme had offered operators an independent means of ensuring workboat tug masters have the requisite experience and knowledge to be judged competent for their role. Although *Biter*'s master was highly experienced, without a VTE qualification there was nothing to make sure that he fully understood the implications of the assisted vessel's speed on towing operations and the need to reliably secure the gob rope. Further, the adoption of the requirement of a ship assist VTE by either CMS or Clydeport would have ensured that conventional tug crews had detailed understanding of the effect of speed on towing operations.

Although there is no record that *Biter*'s deckhand had completed the required induction training, it is likely that he received a briefing on his role from the tug's master on the day of the accident. However, given that this was his first day of towing operations on a conventional tug it is likely that he had limited confidence in the role.

2.9.2 Tug allocation

Hebridean Princess's departure on the morning of the accident was assisted by a conventional and ASD tug; however, the master had ordered two tugs to assist the vessel to berth in James Watt Dock in the afternoon. As usual, CMS assigned two conventional tugs. This was *Hebridean Princess*'s customary tug configuration and met the requirement of the port's Towage Matrix, which relied solely on bollard pull.

The limited space in James Watt dock and proximity to other moored vessels meant that a small conventional tug like *Biter* was probably better suited than an ASD, to acting as the aft tug for the planned afternoon move. However, although conventional tugs were ideal for dead ship tows and manoeuvring vessels in confined locks, docks and harbours, they had a higher risk of girting than the more modern ASDs and the intended manoeuvre was itself noted to carry a girting risk for conventional tugs. Consequently, the allocation of *Biter* as the stern tug placed the tug at greater vulnerability to girting than an ASD tug in the same situation.

Clydeport's *Towing Matrix* assigned tugs within the port on the basis of bollard pull. Combined with CMS's customary practice of assigning two conventional tugs, this meant that the risks associated with operating different types of tugs had not been fully considered by the port.

2.10 MEDICAL FITNESS OF THE TUG MASTER

The postmortem examination of *Biter*'s master found codeine in his bloodstream. Although the level of codeine was within the range for therapeutic use its side effects (dizziness and sleepiness) it had the potential to affect his fitness to safely operate the tug. However, as the master had been prescribed this drug for about 10 years, it is likely that he had developed a level of tolerance to its side effects. Further, there had been no reports over this period that *Biter*'s master was anything other than alert when at work. It is therefore unlikely that the codeine found in the master's bloodstream affected his ability to operate the tug.

Biter's master had undergone surgery in January 2023 and his GP had declared him fit to work 27 days later, on 2 February. The guidance on the reverse of the ENG1 medical fitness certificate only required seafarers to contact an MCA approved doctor if they were off sick for more than 30 days or their medical fitness changed significantly. It is therefore highly likely that *Biter*'s master did not inform the approved doctor of his codeine prescription or his operation because the MCA guidance did not require him to do so.

2.11 THE FITTING OF AUTOMATIC IDENTIFICATION SYSTEMS TO HARBOUR TUGS AND WORKBOATS

Biter had not been fitted with an AIS transceiver because it was a workboat certified to operate in area category of operation 3. This meant that the investigation was unable to reconstruct *Biter*'s course and speed during the accident or assess how the tug had been handled during similar jobs in the past. Further, it also meant that Clydeport's LPS and other mariners operating on the River Clyde and Firth of Clyde were unable to monitor the movement of the tug.

Fitting AIS to workboats and other commercial vessels operating in port areas can improve maritime safety by making them more visible to other mariners and allowing their movements to be accurately monitored within the port. Although *Biter*'s lack of AIS did not directly contribute to this accident, it would be sensible for Clydeport to mandate its carriage in tugs and other small commercial vessels operating within its waters to improve navigational safety.

SECTION 3 – CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. *Biter* girted and capsized because it was unable to reverse direction to operate directly astern of the passenger vessel before the tug's weight came on to the towing bridle and when this happened its gob rope did not prevent it being towed sideways. [2.3]

2. Given that *Biter*'s emergency tow release mechanism was found to operate correctly post-accident, with just 10 seconds between the tug girting, flooding and inverting, it is likely that its crew had insufficient time to release the tow ropes before the situation became irretrievable. [2.3]

3. *Hebridean Princess*'s speed of 4.6kts meant that the load on *Biter*'s towlines was between two and five times more than it would have been at the recommended lower speed of 2kts to 3kts. The higher speed meant that there was significant load on the gob rope securing arrangement, which almost certainly contributed to the gob rope rendering and the subsequent girting. [2.4.1]

4. It has not been possible to determine exactly why *Biter*'s gob rope rendered; however, the practice of securing its gob rope to a samson post was untested and, combined with the low friction coefficient of the HMPE rope, might have allowed the gob rope to render more easily than if it had been secured by other means. [2.4.2]

5. The configuration of *Biter*'s gob rope, anchored over a metre from the vessel's transom and about half a metre above the tug's deck, increased the tug's vulnerability to being towed sideways and girted. [2.4.3]

6. *Biter*'s watertight integrity was compromised when it girted and capsized because the accommodation hatch was open. This meant that it is highly unlikely that any air was trapped in the wheelhouse when the vessel inverted, limiting the crew's chance of survival. [2.5]

7. Although *Hebridean Princess*'s master was responsible for the safety of the passenger vessel, they relied on the pilot's specialist ship handling and tug management skills to safely complete the passage and ensure that the actions of the ship did not endanger the tugs. This meant that a shared understanding between the master, the pilots and the tug masters was essential for the safe manoeuvre into James Watt Dock. [2.6.1]

8. *Hebridean Princess*'s master and the Clydeport pilot's master/pilot information exchange was incomplete and did not discuss the capability, limitations and hazards of operating the two conventional tugs. [2.6.2]

9. The Clydeport pilot did not conduct a pilot/tug information exchange in line with the port's towage guidelines. As a result, the two tug masters did not have a timely opportunity to influence the pilot's intended plan for their employment. [2.6.3]

10. The Clydeport pilot believed that *Biter* was operating in the same manner as an ASD and therefore did not understand *Biter*'s intended manoeuvre to take station astern of the passenger vessel. [2.7.1]

11. Although *Hebridean Princess*'s master periodically reminded the pilot of the vessel's speed during the passage to James Watt Dock, without a detailed understanding of the pilot's plan for the tugs, the master was unable to effectively challenge the pilot's directions to *Biter*. [2.7.1]

12. *Biter*'s master started the *peel off/drop back* manoeuvre, judging the speed by eye, without challenging the pilot. This indicated that he did not perceive excessive risk to his tug. [2.7.2]

13. The Clydeport pilot's training had not adequately prepared the pilot to work safely with conventional tugs employed in ship assist towage. [2.8.1]

14. The recently qualified Clydeport pilot had been allocated *Hebridean Princess*'s move because the passenger vessel was less than 100m in length and the complexity of the pilotage act and the risks associated with employing conventional tugs were not considered relevant. Had the move been assessed using the same criteria as a dead ship tow then a more experienced pilot would have been allocated to this job. [2.8.2]

3.2 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. Had the tug master held a formal towage qualification, such as a Voluntary Towage Endorsement, he might have had a better understanding of the implications of the critical importance of the assisted vessel's speed during this manoeuvre. [2.9.1]

2. *Biter*'s deckhand had not completed the required induction training and this was his first day towing on a conventional tug at CMS. As a result, it is likely that his confidence in the role was limited. [2.9.1]

3. Clydeport's *Towing Matrix* assigned tugs within the port solely on the basis of bollard pull, rather than matching the capability of the tug to the intended task to ensure that the most appropriate tugs were assigned. [2.9.2]

4. The guidance on the back of the seafarer's medical fitness certificate (ENG1) was unclear and probably led to the decision by *Biter*'s master not to inform the approved doctor of his codeine use or hospital treatment. [2.10]

5. There was no evidence that the tug master's medication affected his ability to operate the tug. [2.10]

6. *Biter* was not fitted with an AIS. As a result, the investigation was unable to accurately reconstruct the tug's movements when outside CCTV coverage. Further, the lack of AIS in workboats and tugs meant that Clydeport's Local Port Service and other mariners operating on the River Clyde and Firth of Clyde were unable to identify and monitor the movement of these tugs. [2.11]

SECTION 4 – ACTION TAKEN

4.1 ACTIONS TAKEN BY OTHER ORGANISATIONS

The **Maritime and Coastguard Agency** has Issued Marine Information Note 701 (M+F) MLC[49] and ILO[50]188: *Reportable medical conditions during validity period of a medical certificate*. This provides further guidance on medical conditions that must be reported to seafarer medical certificate issuing authorities.

Clydeport Operations Limited has advised towage and workboat operators within the port that it intends to publish a General Direction for the port that requires all tugs and workboats to carry AIS transponders. It has also commenced a review of its towage risk assessments and guidelines

[49] Maritime Labour Convention.

[50] International Labour Organization.

SECTION 5 – RECOMMENDATIONS

Clyde Marine Services Limited is recommended to:

2024/157 Review the company's safety management system to provide clear guidance on the safe speed for conducting the peel off/drop back manoeuvre and the rigging of tug gob ropes.

2024/158 Adopt an appropriate training and qualification scheme for its tug masters that is demonstrably equivalent to those specified in MGN 468 (M) and MGN 495 (M+F).

Clydeport Operations Limited is recommended to:

2024/159 Commission an independent review of its tug training for pilots within the port.

2024/160 Formalise the conduct of pilot/tug information exchanges and ensure that they are routinely carried out within its port.

2024/161 Conduct a risk-based review of the Pilot Grade Limits and the Tug Matrix within its waters.

2024/162 Consider requiring all tugs and workboats, that routinely operate within its statutory harbour area, to be fitted with and operate AIS transponders.

The **UK Maritime Pilots' Association**, in conjunction with the **British Ports Association**, **UK Harbour Masters' Association**, **British Tugowners Association** and **The Workboat Association**, is recommended to:

2024/163 Develop guidance for inclusion in the Port Marine Safety Code's Guide to Good Practice and other appropriate publications that emphasises the importance of conducting a pilot /tug exchange, in addition to the master/pilot exchange, to ensure that the pilot, bridge team and tug crew have a common understanding of the intended arrival/departure manoeuvre, the potential hazards and their respective roles in managing them.

The **UK Harbour Masters' Association** in conjunction with the **UK Maritime Pilots' Association**, **British Tugowners Association** and **The Workboat Association** is recommended to:

2024/164 Develop for inclusion in the Port Marine Safety Code's Guide to Good Practice, best practice guidance on matching the capability of the tug to the intended task to ensure that the most appropriate tugs are assigned.

2024/165 Develop for inclusion in the Port Marine Safety Code's Guide to Good Practice, guidance that harbourmasters require tugs and workboats that routinely operate within their statutory harbour area to be fitted with and operate Auto Identification System transponders.

The **British Tugowners Association** and **Workboat Association** are recommended to:

2024/166 Develop guidance on the testing of gob ropes and towlines used during harbour towage.

Safety recommendations shall in no case create a presumption of blame or liability

Extract from an electronic master/pilot exchange

Courtesy of Fowey Harbour Commissioners

eMPX MPX DOCUMENT - FOWEY HARBOUR NOT FOR NAVIGATION

Pilotage

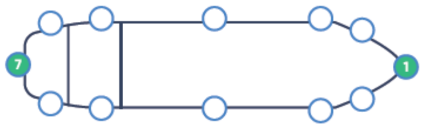
DATE	[redacted]
TIME	[redacted]
TIMEZONE	UTC+01:00
MVT	Arrival
FROM	Pilot station
TO	Underhills buoy
ROUTE	150m Swing Outside Pilot Station to Underhills
SIDE TO	Port
MAX. DRAFT	7.90 m
FWD. DRAFT	-- m
AFT DRAFT	7.90 m
DISPLACEMENT	-- t
AGENT	
PILOTAGE MODE	Direct
TRANSFER METHOD	Pilot Launch

[redacted]

PRIMARY PILOT [redacted]

[redacted]

SECONDARY PILOT [redacted]



1: MORGAWR 23t 7: CANNIS 32t

Vessel

NAME	[redacted]
IMO	8919245
LOA	219.00 m
BEAM	31.00 m
HOA	-- m
S. TO BRIDGE	-- m
B. TO BRIDGE	-- m
GROSS TONNAGE	55877.00 t
NET TONNAGE	-- t
CPP/FIXED	CPP
PROP EFFECT	Not known
ROTATION	Inwards
RUDDER	Conventional
THR. FWD	3440.00 kW
THR. AFT	1720.00 kW
MAIN ENGINE	24000.00 kW
BITTS (SWL) AFT	-- t

Risk Assessment

PUNCH CROSS ROCKS
Type: Tide_UKC

FOWEY HARBOUR 218° FLOOD 1.5 - 1.75 kn (STRONG)

TIME	06:50
AVAILABLE DEPTH	9.18 m
REQUIRED DEPTH	8.90 m
STATIC UKC	1.28 m
REMAINING UKC	0.28 m

NO 2 SWING BUOY
Type: Tide_UKC

FOWEY HARBOUR 218° FLOOD 1.5 - 1.75 kn (STRONG)

TIME	07:10
AVAILABLE DEPTH	9.51 m
REQUIRED DEPTH	8.90 m
STATIC UKC	1.61 m
REMAINING UKC	0.61 m

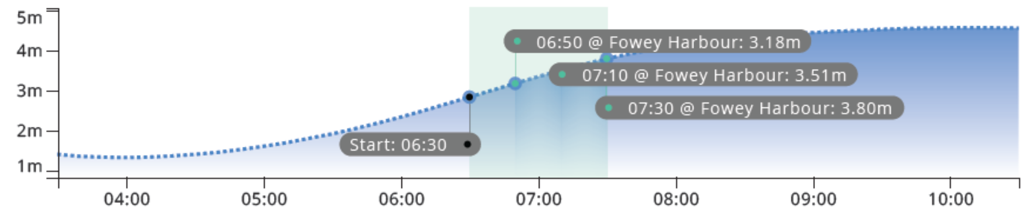
UNDERHILLS BUOY
Type: Tide_UKC

FOWEY HARBOUR 218° FLOOD 1.5 - 1.75 kn (STRONG)

TIME	07:30
AVAILABLE DEPTH	11.80 m
REQUIRED DEPTH	8.90 m
STATIC UKC	3.90 m
REMAINING UKC	2.90 m

Predicted Conditions

Tidal conditions predicted for beginning of pilotage **06:30**

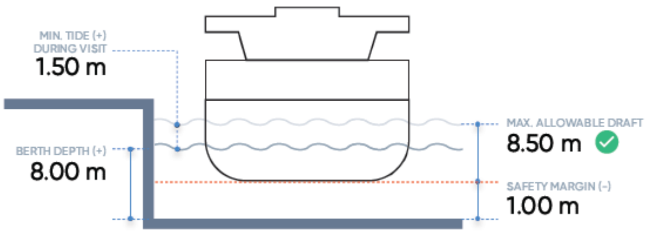


Fowey Harbour Range 3.30 m

▼	23 Aug	03:59	1.3m
▲	23 Aug	10:11	4.6m
▼	23 Aug	16:14	1.5m
▲	23 Aug	22:19	4.6m

Berthing Conditions

Berthing conditions predicted for ship's visit at the port from arrival at berthing constraint 23/08 07:30 until 48h later (25/08 07:30)



Courtesy of Fowey Harbour Commissioners

Checklist

PASSAGE PLANNING CHECKLIST (PRE-BOARDING)

- Vessel Details Checked
- Tidal Constraints Checked/Verified
- Traffic Information and Planned Passes Confirmed - *No other moves*
- Weather Forecast Checked - *Fine and calm*
- PPU Ready - *Na*
- Pilot Ladder Information passed to ship (Side, Height, Speed) - *Stbd 1.5m above water*

Pass/Caution Checklist

MASTER/PILOT EXCHANGE

1. Post-boarding Checks

- Confirm Draught
- Defects Noted and Reported
- Confirm Berth and Side To
- Confirm Towage

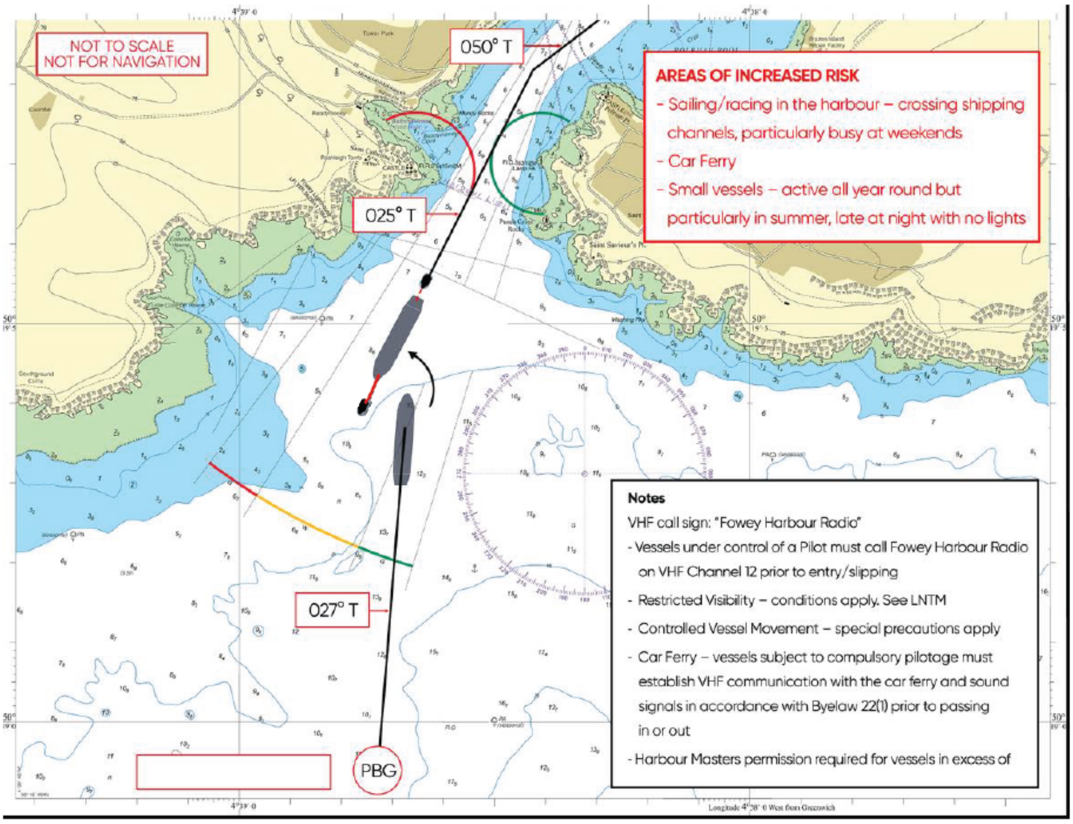
2. Passage Plan Discussion

- Vessel Pilot Card Sighted
- Passage Plan Discussed
- Contingencies and Abort Points Discussed
- Weather & Tidal Strength/Direction Discussed
- Ship Handling Characteristics & Limitations Discussed

3. Manoeuvre and Mooring Discussion

- Use of Towage Discussed, SWL Bitts Noted
- Manoeuvre & Mooring Plan Discussed

Passage Plan



Marine Accident Report

INVESTORS IN PEOPLE