

Report on the investigation of
the collision between
the Saint Vincent and the Grenadines registered
general cargo ship
Aroid
and the Antigua and Barbuda registered
general cargo ship
Anjola
in the River Trent
on 25 February 2002

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The Merchant Shipping
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The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the cause with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

CONTENTS

	Page
GLOSSARY OF ABBREVIATIONS AND ACRONYMS	
SYNOPSIS	1
SECTION 1 - FACTUAL INFORMATION	3
1.1 Particulars of <i>Arold/Anjola</i> and accident	3
1.2 Narrative	4
1.3 Environmental conditions	5
1.4 <i>Arold</i>	8
1.4.1 The ship	8
1.4.2 The pilots	8
1.5 <i>Anjola</i>	8
1.5.1 The ship	8
1.5.2 The crew	9
1.5.3 <i>Anjola's</i> pilot	9
1.6 Actions since taken by ABP Humber	9
SECTION 2 - ANALYSIS	11
2.1 Aim	11
2.2 The collision	11
SECTION 3 - CONCLUSIONS	13
3.1 Causes and contributing factors	13
3.2 Other findings	13
SECTION 4 - RECOMMENDATIONS	14
Annex 1 - Principles of Interaction - Canal Effect	

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ABP	-	Associated British Ports
m	-	metre
kW	-	kilowatt
UTC	-	Universal Co-ordinated Time
VHF	-	Very high frequency
VTS	-	Vessel traffic service

SYNOPSIS



At about 1712 (UTC) on 25 February 2002, the Saint Vincent and the Grenadines registered general cargo ship *Arold* collided with the Antigua and Barbuda registered general cargo ship *Anjola* in the River Trent. Humber Coastguard informed the MAIB of the accident at 1827 that day.

Arold had been chartered by ABP Humber to train pilots and was on a training exercise in the River Trent. A qualified pilot, three trainee pilots and a crew of six were on board. The ship was turned around at Keadby to make the return passage downriver to Hull. At this time *Anjola* was unberthing at Flixborough to move upriver to Gunness. A pilot and the master were on her bridge. On hearing that *Anjola* was leaving Flixborough, *Arold's* pilot called the other ship to say that he would wait for her to pass in the straight section of the river (the reach) between Bar and Amcotts Hook lights. *Arold* was slowed down to wait for *Anjola*.

As *Anjola* approached the wharves at Grove, she had to slow down for a ship, which was having problems berthing. *Arold* was still making headway and was approaching the tight bend in the river at Grove light. Her pilot called *Anjola* and asked if it would be possible to pass in or near the bight of the bend. *Anjola's* pilot replied that he would keep his ship as close to the northern bank as possible. *Arold's* speed was increased to half ahead and she began the turn to starboard around the bend. As the two ships approached each other, *Arold* stopped swinging to starboard and then began to swing to port towards *Anjola*. The pilot ordered hard to starboard and full ahead. However the ship was, by that time, swinging rapidly to port so, in an attempt to avoid a collision, the pilot ordered full astern.

When the pilot and master on *Anjola* suddenly realised that *Arold* was swinging to port, the pilot told the master to go full astern on the engine and, on doing so, her head swung to starboard. *Anjola's* stem collided with *Arold's* starboard bow. The two ships then separated and passed each other starboard to starboard.

The cause of the collision was that, while approaching *Anjola* in the bend of the river, control of *Arold* was lost because she suddenly turned (took a sheer) to port.

Since the accident, ABP Humber has taken a number of actions in an attempt to prevent a recurrence. These are listed in Section 1.6. In view of this, the MAIB has no additional safety recommendations to make.



Arold berthed at King George Dock, Hull, showing damage to starboard bow



Anjola berthed at Gunness, showing damage to stem

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *AROLD/ANJOLA* AND ACCIDENT

Vessel details	<i>Arold</i>	<i>Anjola</i>
Registered owner	: Inter Ocean A/S	Reederei Erwin Strahlmann
Port of registry	: Kingston	Emden
Flag	: St Vincent and the Grenadines	Antigua and Barbuda
Type	: General cargo	General cargo
Built	: 1965 in Norway	1977 in Germany
Classification society	: Norske Veritas	Germanischer Lloyd
Construction	: Steel	Steel
Length overall	: 59.87m	74.02m
Beam	: 9.48m	11.99m
Maximum draught	: 3.874m	3.976m
Gross tonnage	: 858	1,519
Engine power	: 809kW	728kW
Service speed	: 11 knots	9.5 knots
Other relevant info	:	Bow thruster

Accident details

Time and date	: 1712 UTC, 25 February 2002	
Location of incident	: Latitude 53° 36.5'N, Longitude 000° 43.3W near Grove light in the River Trent	
Persons on board	: 10	6
Injuries/fatalities	: None	None
Damage	: To starboard bow	To stem

1.2 NARRATIVE

All times are UTC.

At 0130 on 25 February 2002, *Arold*, which ABP Humber had chartered exclusively to train pilots, sailed from King George dock, Hull, for the lower reaches of the River Humber (**see chart extract 1**). Apart from her normal crew of six, there were one qualified pilot for the lower reaches and three trainee pilots on board. After reaching Spurn Point the ship returned to Riverside Quay at Albert Dock in Hull.

Later, at 1415, *Arold* sailed from Riverside Quay to the River Trent with the same pilots on board as in the morning. On this passage, one of the trainee pilots who was qualified for pilotage on the River Trent took the con, while the qualified pilot for the lower reaches of the Humber assumed the role of one of the trainee pilots.

The passage was uneventful and the ship was turned at Keadby (**see chart extract 2**) for the return journey. For training purposes only, because the tide was not strong, the turn to port was facilitated by putting the bows into the mud of the east bank of the river.

The Trent pilot, the Humber pilot, the master (at the telegraph), the chief officer, a trainee pilot (using two tillers) were on the bridge, and the other trainee pilot was in the chartroom.

The turn was made at 1700 and *Arold* began to proceed downriver. At this time two other principal shipping movements were on the river: *Anjola* moving from Flixborough to Gunness Wharf, and *Frakto* berthing at Grove Wharves. *Arold's* pilot made a general announcement to "Trent ships" on VHF radio channel 17 that she was proceeding out from the River Trent.

At about 1630, a pilot had arrived on board *Anjola* at Flixborough. He had allowed an hour to reach Gunness, as high water was at about 1800 at Keadby. In the 20 minutes before letting go, the pilot talked to the master about the traffic movements and the passage plan for the move to Gunness. When *Anjola* was let go at about 1650, the pilot could see that the tidal stream was easing. The ship had been berthed head downstream and she was turned off the wharf by use of a back spring. Once the turn had been completed, the pilot took the wheel and the master stationed himself at the telegraph/bow thruster. Then the pilot made a general announcement to "Trent ships" on VHF radio channel 17 that *Anjola* was proceeding upriver from Flixborough to Gunness.

By this time, *Arold* was passing Bar Light and on hearing *Anjola's* announcement, *Arold's* pilot slowed the ship's speed at about 1705. He called *Anjola* to say that he would wait for her to pass in the straight part of the reach between Bar and Amcotts Hook lights. Thereafter, the pilot used dead slow ahead movements to maintain control on the starboard side of the river. Slowly the ship crept ahead, eventually passing Amcotts Hook light.

Anjola's pilot announced to *Arold*, and to *Frakto*, which was in the process of berthing at Grove Wharves, that he was passing Neap House Wharves. However, it became apparent that *Frakto* was having a problem in her berthing operations in that she could not get her stern alongside. *Anjola's* pilot moved the ship over to the starboard side of the river and slowed her speed to a minimum. The pilot announced to "Trent ships" on VHF radio that he had slowed down for the berthing ship. By this time, *Arold* was closing the bend at Grove light. Her pilot told *Anjola* that it was becoming difficult to hold his ship in the reach and asked him to agree to his ship moving ahead, and for the two ships to pass in or near the bend. *Anjola's* pilot replied that he would keep his ship as close to the northern bank as possible, which he was doing already anyway.

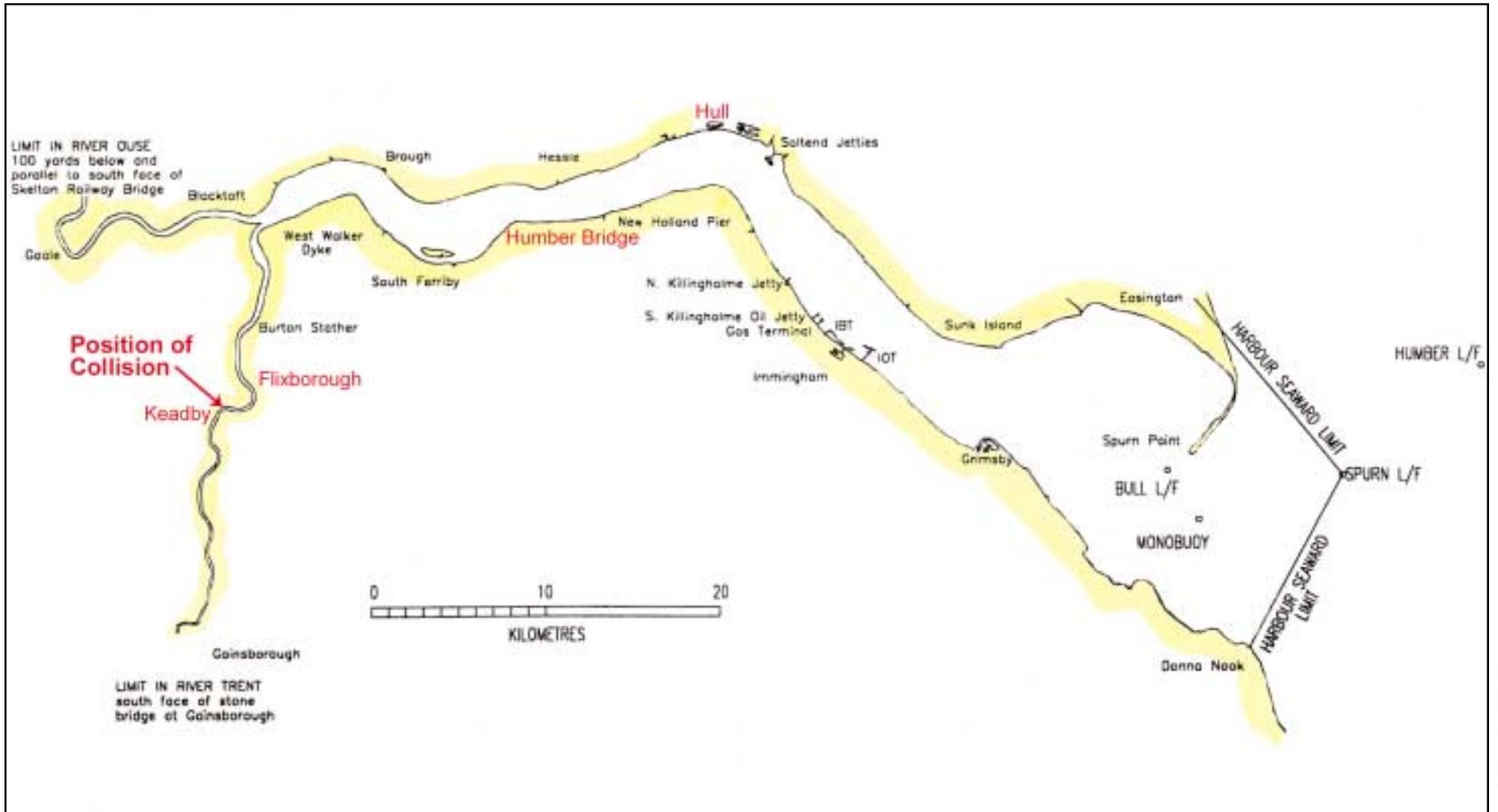
Arold's speed was increased to half ahead and, at the same time, the upper works of *Anjola* could be seen over the land. *Arold* began the turn to starboard around the bend, with the pilot giving helm orders by reference to prominent points on the land. *Arold* stopped swinging to starboard and then began to swing to port. At this time she was between 100m and 200m downriver of the Grove light, and midstream. The pilot looked at the rudder indicator which was indicating 20° to starboard so he ordered hard to starboard and full ahead. However, the ship was now swinging rapidly to port. When she had swung about 70° to port of the original heading, the pilot ordered full astern. The master tried to put the engine astern but, initially, made the movement too quickly for the engine to engage astern mode. He tried a second time and was successful.

Anjola's pilot first saw *Arold* rounding the bend when he was passing Grove Wharves. The intended passing manoeuvre seemed satisfactory, as he could see *Arold* turning to starboard. However, when the two ships were about a cable away from each other, *Anjola's* pilot and master suddenly realised that *Arold* was swinging to port, and towards their ship. The pilot told the master to go full astern on the engine, which made her head swing to starboard. *Anjola's* stem collided with *Arold's* starboard bow. As *Anjola* went astern the bow thruster was placed to full to port to clear *Arold's* stern. Once separated, the ships passed and cleared each other starboard to starboard.

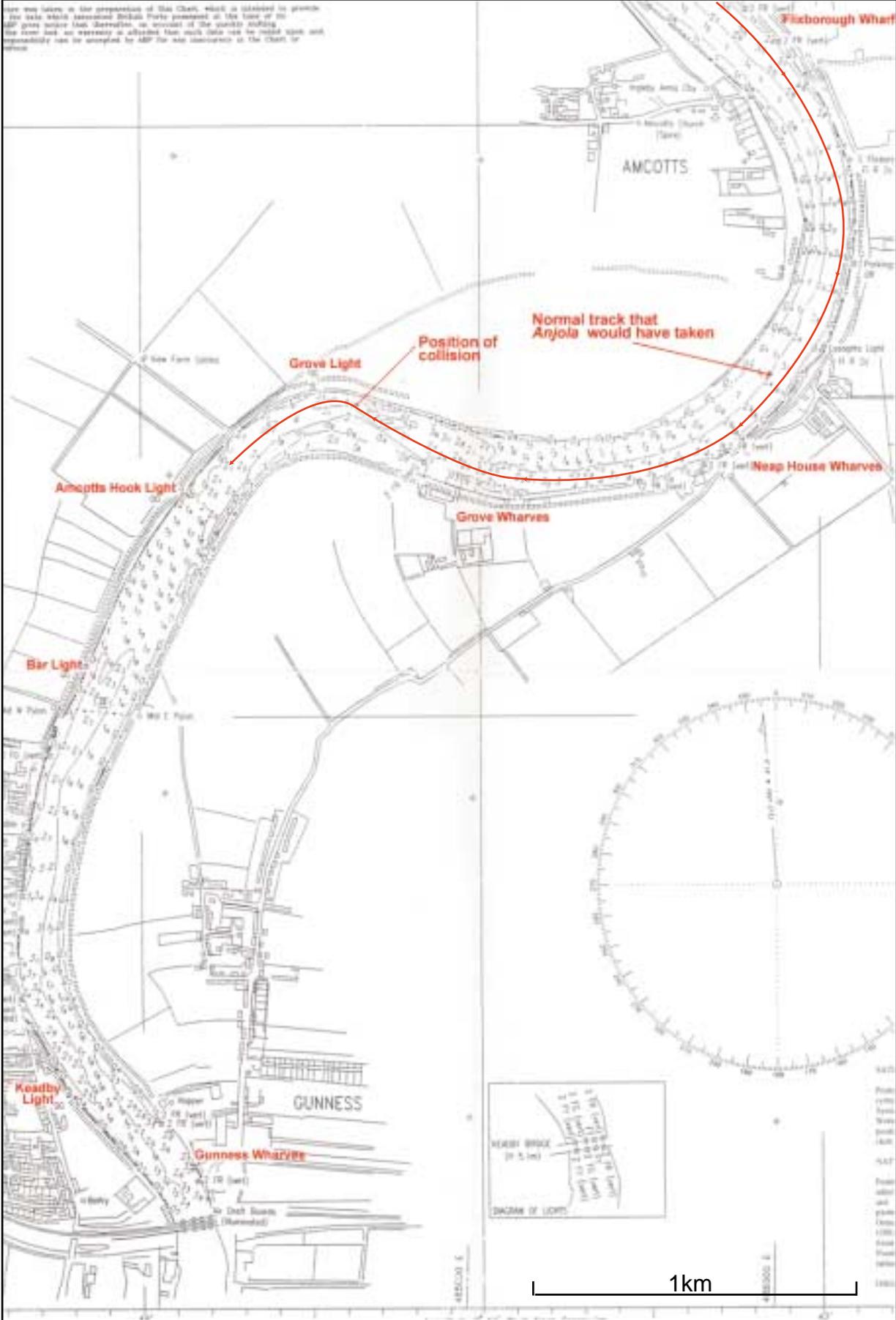
Anjola berthed at Gunness and *Arold* returned to King George Dock, Hull.

1.3 ENVIRONMENTAL CONDITIONS

The weather was fine and clear with south-westerly winds of force 4 to 5. High water at Flixborough Wharf was at 1741 with a height of 4.3m. High water at Keadby was at 1759 with a height of 4.1m. The flood tide runs for about 3 hours, while the ebb tide runs for about 9 hours. The day of the accident was 3 days before springs.



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1.4 AROLD

1.4.1 The ship

Arold was an ice-strengthened general cargo ship, fitted with one hold forward and her accommodation superstructure and engine room aft. The ship's draught at the time of the accident was 3.5m aft and 3.25m forward. She had a conventional right-handed, fixed-blade propeller.

She was one of four ships which had been chartered by ABP Humber to train pilots in the lower reaches of the Humber and the Trent and Ouse rivers. She was scheduled to go off charter the day after the accident.

1.4.2 The pilots

Arold's pilot was 52 years old. He first went to sea in 1969 as deck cadet with Esso Petroleum, during which time he was promoted to third and then second mate. He left the sea to run a business for 6 years, after which he returned to sea to serve on coastal vessels as chief officer with various companies. After gaining a command endorsement (extended European) with his second mate's foreign-going certificate, he was promoted to master with Union Transport in the early 1990s. He also served with Scott Line and Carisbrooke Shipping.

In November 2001, he gained employment with ABP Humber as a trainee pilot. At the end of that month he spent a day and a half on one of its training ships on the Ouse and the lower reaches of the Humber. He then spent a week on an induction course, in which he studied the tidal predictions and data. He spent a month with a qualified pilot in the Trent and the lower reaches of the Humber, after which he qualified as a Class 3 pilot for the River Trent to Hull Roads. He intended qualifying eventually for all areas and had qualified for the lower reaches of the Humber on the morning of the accident.

The second qualified pilot on board *Arold* had served on large ferries on the Fishguard to Rosslare and the Dover to Dunkerque routes. He was a qualified Class 2 pilot for the lower reaches of the Humber River and was familiarising himself with the navigation lights for the Trent to Hull reaches during the incident.

1.5 ANJOLA

1.5.1 The ship

Anjola was an ice-strengthened general cargo ship, with one hold forward and her accommodation superstructure and engine room aft. She had a conventional right-handed, fixed-blade propeller.

1.5.2 The crew

Six crew members were on board at the time of the accident, of which the master and the chief engineer were Polish, the chief officer was Russian and the cook, able seaman and ordinary seaman were Filipino.

After attending sea school in Szczecin for 3 years the master served on foreign-going ships, starting as an able seaman and progressing to chief officer. In 1986, he obtained his master's certificate of competency but he had already sailed in this capacity since 1984 on coastal vessels for a Polish Baltic shipping company. He had been on *Anjola* for about 2 months.

1.5.3 *Anjola's* pilot

Anjola's pilot was 32 years old. He first went to sea in 1986 as trainee deck hand, serving on dry cargo coastal ships. He became an able seaman and, after gaining a Class 4 certificate of competency, was promoted to mate in 1991. In 1994 he served on multi-role vessels in the offshore industry. Several years after gaining the limited command endorsement, he was promoted to master on supply/stand-by vessels.

He gained employment with ABP Humber as a trainee pilot in November 2001. He spent his training on the chartered vessels, learning the Trent to Hull reaches and the lower reaches of the River Humber. He became a Class 3 Trent pilot on 12 December 2001.

1.6 ACTIONS SINCE TAKEN BY ABP HUMBER

Following the collision on 25 February 2002, ABP Humber has taken several steps in an attempt to prevent a recurrence. They include the following:

1. A general notice to pilots was issued on 5 March 2002, which highlighted the following points:
 - *Vessels should avoid passing in bights. The vessel navigating against the tide to give way and enable safe passing in a reach.*
 - *Clear and concise communication between vessels is essential and appropriate passing manoeuvre should be agreed and adhered to by both parties.*
 - *Pilots should ensure they possess a good general awareness of all movements within their vicinity including vessels berthing at or leaving wharves. Prior to leaving a berth a pilot should ensure that it is safe to do so without impeding other vessels. Again communication is key to safe operations.*

2. Plans have been drawn up for improved VTS surveillance above the Humber Bridge of the rivers (Humber, Ouse and Trent).
3. ABP Humber is searching for selective videos on the subject of bank effect (**see Annex 1**), and interaction in general, for the ongoing training of all pilots.
4. Pilots on training ships have received extra training on bank effect and how to avoid it, and emphasis has been placed on holding a ship in position in the river against the tide in various reaches.

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 THE COLLISION

Between Flixborough and Gunness, the Trent is between 150m and 200m wide. In the straight sections (reaches), the deepest parts are generally in the centre. However, around the bends in the river the deepest parts are on the outward curves. During the passage upriver, *Anjola's* pilot normally kept to the deepest parts of the river, if there was no other traffic. After leaving Flixborough, the ship moved to the port side of the river for the Neap House bend, and then moved over to starboard side for the Grove bend. Normally a ship passed relatively close to the Grove Wharves (**see chart extract 2**).

The bend at Grove is the tightest and narrowest in the navigable part of the River Trent. At its greatest extent, the shallow section, on the southern side, extends northwards for about 50% of the width of the river, thereby constraining the navigable part to nearly 100m. At this point lies the deepest part of the river between Flixborough and Gunness with a depth of 7.6m. This shows that the flow of the river is strong in the bend at Grove, creating a trench on the north side and a shelf on the south side.

Arold's pilot's initial plan was to slow down and wait for *Anjola* to pass in the reach between Grove and Keadby. This was the safest part of the river for two ships to pass. Passing while negotiating a bend is more hazardous. *Arold* did not have to arrive at her destination at any particular time and, therefore, there was no need to press on.

The initial plan changed because *Anjola* had to slow down for *Frakto*, whose stern was protruding into the river while attempting to berth at Grove Wharfs, and also because *Arold* had to make enough headway to maintain steerage. *Arold's* pilot might have been made aware earlier of the delays ahead if *Frakto* had announced to "Trent ships" that she was having a problem in berthing and that she was possibly impeding the passages of ships navigating in the river. *Arold's* pilot considered using the anchor to hold position but thought that, with the south-westerly wind and the weak tidal flow, the ship's stern would set into the east bank. As *Arold* approached the bend, the opportunity for the vessels to pass in the reach was diminishing.

Arold's pilot decided to keep going ahead, rather than anchor, consequently the vessels had to pass either on the bend or off Grove Wharves. He expected the latter passing point. As *Arold* negotiated the bend and approached *Anjola*, she smelt the ground and took a sheer to port; this took everyone on the bridge by surprise. *Arold's* pilot had not expected that amount of sheer, given the ship's speed (**Annex 1**). Once the sheer had started, the opposing tidal flow acting on the starboard bow increased the speed of the sheer, especially as the flow was stronger as it swept around the outer curve of the bend. Actions to reduce, or stop, the sheer, were insufficient to counteract the forces acting on the hull. Therefore, control of *Arold* was lost and a collision with the approaching *Anjola* ensued. It is probable that the increase in *Arold's* speed to half ahead contributed to the sheer.

Arold's pilot had much experience as a coastal master, and was fully aware of bank effect. During his pilotage-training period, he was shown bank effect during an exercise when one of the training ships was run parallel to the bank in the Ouse. It was demonstrated that, when a ship is sailing close to a bank, the rudder should be applied towards it. The closer to the bank and the greater the speed, the more helm was required to hold the course. It was also demonstrated that a small reduction in speed greatly decreased bank effect.

Anjola was actually following the starboard side riverbank closely to allow *Arold* to pass on the port side. *Anjola's* pilot had agreed that the two ships would pass in or near the bend, which he was aware was not ideal. If he had made his concerns known to *Arold's* pilot, the latter might have taken alternative actions to avoid the risk of passing in the bend.

Humber VTS does not extend to the River Trent and the river is not under radar or VHF radio surveillance (**see Section 1.6**). Ships in the river make general announcements by use of the term "Trent ships", followed by the nature of the manoeuvre and/or passing point. VTS surveillance might have prevented the vessels passing in the bend.

SECTION 3 - CONCLUSIONS

3.1 CAUSES AND CONTRIBUTING FACTORS

1. The cause of the collision was that, while approaching *Anjola* in the bend of the river, control of *Arold* was lost, because the ship took a sheer to port. [2.2]
 - *Arold's* pilot's decision to pass *Anjola* in or near the bend of the river. [2.2]
 - *Anjola's* reduction in speed for a ship which was having problems in berthing. [2.2]
 - *Arold's* pilot's decision to maintain headway while waiting for *Anjola* to pass upstream of the bend. [2.2]
 - *Arold* smelling the ground, while approaching *Anjola* in the bend of the river. [2.2]
 - *Arold's* increase in speed, which probably increased the sheer. [2.2]
 - Actions to reduce, or stop the sheer, were insufficient to counteract the forces acting on the hull. [2.2]

3.2 OTHER FINDINGS

1. The reach was the safest part of the river for two ships to pass. [2.2]
2. The opposing tidal flow acting on the starboard bow increased the speed of the sheer, especially as the flow was stronger as it swept around the outer curve of the bend. [2.2]
3. *Arold's* pilot might have been made aware earlier of the delays ahead if *Frakto* had announced to "Trent ships" that she was having a problem in berthing and that she was possibly impeding the passages of ships navigating in the river. [2.2]
4. If *Anjola's* pilot had made his concerns known to *Arold's* pilot, the latter might have taken alternative actions to avoid the risk of passing in the bend. [2.2]
5. VTS surveillance might have prevented the vessels passing in the bend. [2.2]

SECTION 4 - RECOMMENDATIONS

In view of the actions taken by ABP Humber since the accident (listed in Section 1.6), the MAIB has no additional safety recommendations to make.

**Marine Accident Investigation Branch
October 2002**

Annex 1 - Principles of Interaction

The following is an extract from The Admiralty Manual of Navigation Volume 6.

Canal Effect

- a. **Hydrodynamic Forces in a Canal.** The hydrodynamic forces on a ship are intensified in a canal because the water is both shallow and confined, with the ship continuously close to the solid banks and bottom. In addition to the *Squat* experienced in confined waters, the loss of speed made good is more substantial, a powerful wave pattern is generated both ahead and astern, and the lateral forces arising from the ship's movement in relation to the banks (known as *Bank Effect*) can have a profound effect on steering.
- b. **Bank Effect in Canals.** Consider a vessel which moves off the centre line of a canal (Fig 2-7 Position 1) and towards the right hand bank.(Fig 2-7 Position 2) The flow of water between its starboard side and the nearer bank becomes confined and, from the *Bernoulli Phenomenon*, it will be seen that the *Velocity* of the water flow will be greater on the starboard side than on the port side, and thus lower *Pressure* (greater *Suction*) will occur on the starboard side. This *Suction* will tend to pull the ship to starboard towards the nearer bank. However, the *Suction* forces are not uniformly distributed along the ship's length, and their resultant acts somewhere abaft amidships. This is equivalent to a force acting aft of the *Centre of Gravity* which also creates a *Turning Moment*, deflecting the ship's head away from the bank – in this case to port (Fig 2-7 Position 3). In practice this *Turning Moment* overrides bodily *Suction* towards the bank and the ship will start moving away from it – sometimes so violently that a sheer towards the opposite bank is generated. A ship being deflected away from a solid bank or wall is sometimes said to be being 'pushed off by the bow *Pressure Zone*'. A convenient analogy but not an exact description of the cause of this phenomenon.

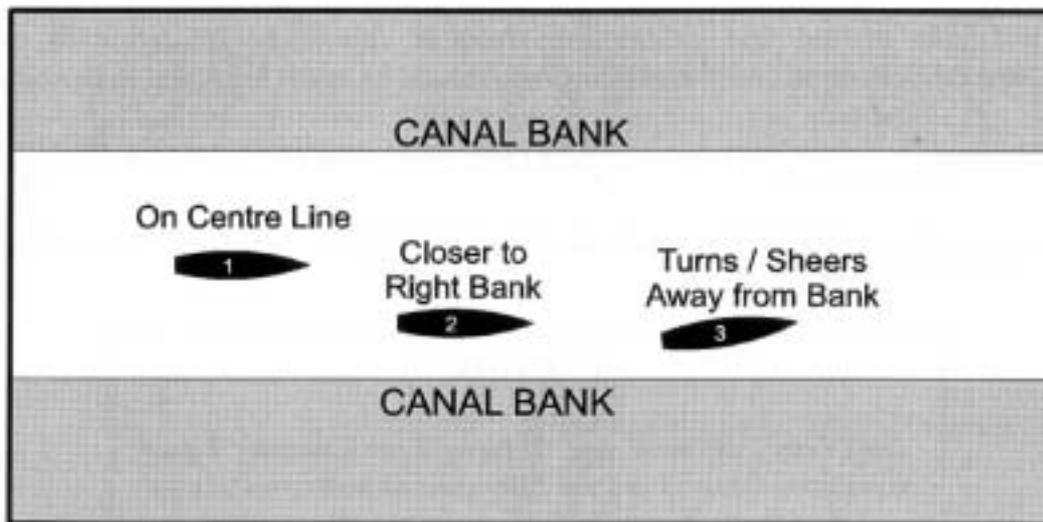


Figure 2-7 Bank Effect - (Suction Aft of C of G) Turning Ship Away from Bank

- c. **Smelling the ground.** A similar situation to *Bank Effect* arises with a submerged bank or shoal. Some rivers and canals have channels that shelve steeply on one side only. Passing close to an unseen shallow patch may produce the effect known as *Smelling the Ground*, where the sudden change of water flow caused by the submerged obstruction generates unequal *Pressure* on either side, which causes the ship to sheer unexpectedly away from the underwater slope that it is passing.

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