Report on Safe Tug Procedures

Based on Pilot, Tug Master and Ship Captain Questionnaires

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FOREWORD

Mr. Tjibbe Joustra, Chairman Dutch Safety Board:

The cause of an accident is seldom just bad luck. In general, an accident is the total sum of a series of events which finally leads to an unfortunate outcome. Therefore, it is important to investigate the reasons behind an accident, the so-called root causes, in order to be able to prevent such accidents happening again.
The Dutch Safety Board carries out such investigations. The Board operates independently with just one goal: improvement of safety. This is only achievable if the investigation results find their way to the appropriate people and the relevant industry branches.
For that reason, the Board is pleased with the initiative taken by three members of the International Tug masters Association and The Nautical Institute following the publication of our investigation report "Collision and capsizing of tug Fairplay 22 on the Nieuwe Waterweg near Hook of Holland". This initiative shows that the industry sector has the ambition to learn as much as possible from accidents. The survey amongst pilots and tug masters confirms again that assisting ships and floating objects with tugs requires specific knowledge and competence, and that agreement about safe speeds and proper communications between parties are extremely important. The Board sincerely hopes that this initiative will have a positive effect and will contribute to increased safety levels in the towage sector.

Mr. René de Vries, (State) Harbour Master Port of Rotterdam:

A nautical accident which involves loss of life is the worst nightmare for every harbour master, since he or she is responsible for nautical safety in their port. There is little comfort in knowing that risks can never be completely eliminated and must be considered in terms of making them ‘as low as reasonably possible’. This means that accidents, and the eventual dramatic aftermath, may still happen no matter how hard we try to eliminate them. Shipping without risk does not exist, but we still have an obligation to continuously strive for safety improvement and risk reduction. It is an essential element in the role of a harbourmaster.

On the other hand, severe accidents may also be seen as wake up calls. The harbour master is frequently challenged by politicians, the public and commercial parties to prove the necessity for investment in risk control options and measures or regulations which may cost money or limit entrepreneurial short term goals. Of itself, there is nothing wrong with that, but a severe accident immediately makes every stakeholder aware of the necessity for constant improvement. Statistics and research are important, but do not have the same emotional effect as actual pain and damage. Beyond that, accidents often lead to new insights, lessons learned or comprehensive new research. This report is an example of such an initiative.

The report is very useful. It contains valid and useful suggestions, and clear conclusions are drawn. For a harbour master it is of great value to see that the port industry and the nautical service providers have the professionalism and responsibility to learn from accidents in order to improve safety.

Quality in the safety context is about being able to reflect on your own operations and procedures, and being open to assessment by others. Nautical safety is not a project with an ending, it is a continuous process which involves many human factors. Learning and being aware are key elements in reducing risk.

I sincerely hope and expect this report will contribute to safety awareness and risk reduction in our port and elsewhere.

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Cover photo *(courtesy Richard Wisse, the Netherlands)*
The tug *Holland* (twin screw; 29.00 x8.60 x 4.00 m; 33 tons bollard pull; built 1992) had the same kind of accident as the *Fairplay 22* during the night of 21 - 22 April 2000. When trying to make a towline connection with the car carrier *Tancred*, the stern of the tug touched the bow of the *Tancred*. The tug did not get free of the bow but swung to port across the bow, was then overrun by the ship and capsized. When she got free, she quickly righted herself. The tug suffered a lot of damage, but luckily there were no fatalities.

Report on Safe Tug Procedures

Based on Pilot, Tug Master and Ship Captain Questionnaires

Chapter 1 INTRODUCTION

The Dutch Safety Board recently investigated an accident involving the harbour tug *Fairplay 22* at Hook of Holland, the Netherlands. The accident took place during stormy weather on the 11th November 2010. The tug, while trying to make a towline connection at the bow of the ferry *Stena Britannica*, was trapped under the bow and capsized. Tragically, the captain and engineer were drowned.

In the investigation report [1] high speed is mentioned as one of the main causes of the accident. Speed is known to be a crucial factor for bow tugs, particularly when securing. In Rotterdam a working group was formed to investigate what should be considered a safe speed and safe procedures for such operations. The members of the working group are:

Captain Henk Hensen FNI. Patron ITA; Master Mariner F.G.; Marine Consultant.
Captain Daan Merkelbach FITA. Tug Master; Head QHSE Department; Nautical Manager.
Captain Fred van Wijnen MNI. Master Mariner F.G.; Secretary NI Netherlands Branch.

To assist the initiative, three questionnaires were devised - for tug masters, pilots and ship captains. An example of the pilot questionnaire is shown in the Appendix, and the other questionnaires were similar but focussed on the specific professions.

The questionnaires were circulated to several maritime organizations around the world and published in *Seaways*, the journal of the Nautical Institute (NI), and on the websites of the NI and the International Tug masters Association (ITA).

Tug masters, pilots and ship captains did not just answer the questions posed, but also made a large number of remarks including suggestions to improve the safety of tug operations. These remarks and suggestions are presented and summarised separately.

The results of the completed questionnaires and the findings derived from them are presented in this report.

It should be borne in mind that the respondents included ship captains, pilots and tug masters, all with different backgrounds and experience, including familiarity with various tug types, experience of similar tugs used in different ways, and exposure to different tug operating modes for ship assistance - a complex entirety which resulted in a large variety in answers.

Nevertheless, the authors have attempted to evaluate those answers in such a way that lessons can be learned from them.

Approximately 160 pilots, tug masters and ship captains contributed by responding to the questionnaires. They have played a very valuable role in this attempt to improve the safety of tug operations, and the authors are very grateful for their contribution.

The authors are also grateful to Captain Alan Loynd, Managing Director of Branscombe Marine Consultants in Hong Kong and Chairman of the ITA, for reviewing the text.

Finally, it is the authors' hope that this report will create a better understanding of the risks involved in harbour towage and will contribute in improving safety of towage operations in ports and port approaches, and as such improve safety of shipping in ports.

Note: All speeds mentioned in this report are speeds through the water.

SECTION 1

RESULTS OF QESTIONNAIRES

Chapter 2.0 RESULTS OF PILOT QUESTIONNAIRES

2.1 Interaction effects

- **All pilots** are aware of the risks of interaction effects.
- **All pilots** who answered the question say that interaction effects were included in their training.
- **55%** of the pilots report that interaction effects are not reproduced in a realistic way in manoeuvring simulators, while 15% say they are. It must be noted that pilots do not normally practise connecting tugs on simulators. In addition, simulators often use vector tugs which only represent tug forces.
- **25%** of the pilots have had a critical experience with interaction effects.

2.2 Communication procedures

- **All pilots** communicate with portable radio and VHF sets. Some also use the ship's whistle, hand whistle or mobile telephone in emergencies. A few pilots carry a spare radio set with them.
- **All pilots** communicate in the local language with tugs.
- **20%** of the pilots using the local language translate their communication into English for the captain, while 55% say they will do so when applicable or when requested by the captain. 13% are from ports where English is the local language.
- **90%** of all pilots who are non-native speakers of the English language prefer that communication is done in the local language to avoid possible mistakes and errors.
- **Most pilots** communicate the necessary information to tug masters, some in more detail than others. Information generally includes speed, SWL of bollards, where to make tugs fast, what side alongside, and sea conditions.
- **65%** of the pilots exchange information about safe speeds with the tug masters, while others only do so when speed is too high (15%), and some do not do it at all (10%). In some ports, safe speeds have been agreed upon between pilots and tug masters.
- **55%** of the pilots prefer to instruct the attending bow tugs to approach the bow only when the ship's crew is ready to send a heaving line**.** 40% of the pilots have no preference or rely on the experience of the tug masters.

2.3 Safe procedures and safe speeds

2.3.1 Safe procedures

- **55%** have safe procedures for securing tugs.
- **75% of the pilots** do not ask the captain to instruct the ship's officers to keep an eye on the tug(s) even when they might not be visible from the bridge, or they expect the crew to do so because it is good seamanship and should be a standard procedure on board. Some say all hands are too busy. Others trust the tug masters to report if necessary. On the other hand, some pilots think it is a good idea and say they will ask the captain to instruct his officers in the future.

- **Almost all pilots** find that when tugs are making fast, the ship has to be on a steady course and tugs should be warned about engine manoeuvres.

2.3.1 Safe speeds when making fast alongside

- **6 knots or less** is considered a safe speed for tugs making fast alongside by **70%** of the pilots who answered the question. In addition, most pilots say it depends on the capabilities of the tugs.
  6 - 7 knots is considered safe speeds for tugs making fast alongside by **20%** of the pilots.
  7 - 8 knots is considered safe speeds for making fast alongside by **10%** of the pilots.

2.3.2 Safe speeds when securing bow tugs

- **6 knots or less** is considered a safe ship's speed for securing bow tugs by **87%** the pilots, of which one third considers less than 6 knots to be appropriate.
- **More than 6 knots** is considered a safe speed by **13%** of the pilots (highest speed mentioned is 7.5 knots).

The following points should be noted with respect to securing at the bow:

- For several pilots safe speed depends on tug type. For instance if 5 knots is mentioned as the safe speed in the port, then for tractor tugs a higher speed is considered safe. Conversely, if 6 knots is mentioned for tractor tugs, then 5 knots is seen as a safe speed for conventional tugs. One pilot considers the tugs of the Fairplay 20 series to have a safe speed of 4 - 5 knots.
- Paying attention to the different tug types and weather conditions is very important. Several pilots say that for safe speeds weather conditions, wind, etc. should be taken into account as well.
- Another important factor is the tug master: one pilot reported a tug master who insisted on 4 knots.
- A ship's Dead Slow speed is seen as a criterion by only one pilot.
- Pilots often discuss safe speeds with tug masters.
- In some ports it is rare to connect bow tugs on a line when ships have headway.

- **45%** of the pilots prefer that tugs approaching the bow to make a towline connection are visible from the bridge as long as possible, although several say it is not always possible with large container vessels.

2.3.3 Safe Speeds when making fast at the stern

- **6 knots or less** is considered by **45%** of the pilots as a safe speed for making fast at the stern.
- **6 - 8 knots** is considered by **42%** of the pilots as a safe speed for making fast at the stern.
- **More than 8 knots** is found a safe speed for tugs making fast at the stern by about **13%** of the pilots.
- It must be noted that the lowest safe speeds mentioned often refer to conventional tugs. For other tug types somewhat higher speeds are seen as being safe.

2.4 Safe speeds(2)

- **45% of the pilots** discuss safe speeds with the attending tugs.
  20% do it sometimes, e.g. when the ship has a high Dead Slow speed, or when ship's speed is more than 6 or 7 knots.
- **Most pilots** estimate ship's speed by GPS, or GPS and ship's log, taking into account the current.
- **60% of the pilots** will slow down, and most of them will tell the tug master not to approach when ship's speed is too high.

2.5 Remarks and suggestions made by pilots

Pilots did not just answer the questions posed, but also made a large number of remarks including suggestions to improve the safety of tug operations. These remarks and suggestions are categorized below.

2.5.1 Safe procedures and communications

Following remarks and suggestions have been made by pilots regarding safe procedures and communications (par. 2.2 and 2.3):

- One pilot: the Port Authority and Pilotage Service have regular liaison meetings with tug companies and their tug masters, during which procedures are discussed and determined. However, a certain level of experience and expertise is assumed by all parties.
- Safe procedures from training and regular meetings between pilots and tug masters (3 pilots).
- See also Code of Practice for Ship Towage operations on the Thames: https://www.pla.co.uk/pdfs/maritime/CoP_Ship_Towage_2010_Web_Version.pdf
- Day-to-day communication topics: Alert tug masters to problems e.g. high Dead Slow speed, deep draft, bollard SWL, poor seamanship on board, etc. Allow tug master to assess proposed tie up position e.g. with respect to flared stern, sunken bitts too low, etc. (1 Australian pilot)
- Brief tug master on berthing plan. Attention required to tow line particulars, incl. SWL, bollard strength, bollards clear of obstacles, crew to remain clear particularly when full tug power is used, intended use for tugs, crew to report any concerns to pilot (1 Australian pilot).
- Several pilots pay attention to SWL of bollards/bp of tugs and proper heaving lines.
- Safe procedures should be implemented on board all vessels (one pilot). This is common seamanship practice, however the art of seamanship is slowly but surely dying out on ships (1 pilot).
- Proper heaving lines are rare (one pilot); ship's crews often create unsafe situations (1 pilot)
- One pilot reports that the towline is not always placed as low as possible on the bollard which reduces SWL.
- If there are concerns about SWL of bitts and chocks, these should be discussed with the ship's captain.
- One pilot says the knowledge of ship’s officers has declined dramatically.

- It is pointless and dangerous for a tug to be close to the ship's bow if the crew are not ready.
- Tugs should not approach the ship head on, but to one side.
- The heaving line should be led from the centre lead to whichever side the tug is on.

It should be noted that several pilots complain about the lack of good experienced crews on board ships these days (see underlined sentences above).

2.5.2 Reducing speed

Regarding reducing speed (par. 2.4) pilots made following remarks:

- If speed is too high I refuse to let tugs make fast.
- I try to slow down by stopping engine frequently.
- Stop engine for as long as possible and, if there is sufficient (sea) room, use fishtailing with rudder.
- Slow down or abort approach.
- Immediately make a dramatic change in ship's engine settings or stop.
- Maybe there is a possibility to connect stern tug to reduce speed.
- Put wheel hard over several times and stop engine (kick ahead if necessary to maintain required heading).
- Slow down the ship. If necessary, stop engines and/or prepare anchors for letting go.
- Many container vessels have a Dead Slow speed of 10 knots or more. Very dangerous!!

2.5.3 Safe speeds

Pilots made following important remarks regarding safe speeds:

- Speed to be 6 kn.
- Some ports have a pre-agreed maximum speed of 6 knots, or 5 knots for bow-to-bow connection.
- Some pilots say that they usually reduce speed to 6 knots, while others trust the tug masters' insight.
- One pilot has the opinion that tugs should always approach from the side so they can judge the ship's speed more accurately, much better than when approaching from ahead.

2.5.4 Additional remarks and suggestions regarding safe procedures.

About 55% of the pilots had no further remarks or recommendations to make it safer to connect tugs at the bow than those mentioned at the relevant questions (see par. 2.5.1 - 2.5.4). Various additional remarks made by the remaining pilots are again of interest and concern various important issues:

Too high ship's speed

- Even if I tell the tug masters about speed and when to make fast, they make fast when they like, even when ship's speed is too high.
- I don't expect any tug master to make fast at speeds he considers unsafe.

- Some (young) tug masters are too shy to say: SLOW DOWN. I WILL NOT CONNECT. Everything is on tape and after an accident the tug master can explain.
- No need to approach ships doing a high speed: they can be controlled easily and don't need the assistance of tugs; tugs cannot assist at high speed.

Communications and information exchange

- Better communication between pilot and tug. If I sometimes want to delay the securing of the tugs, the tug master is already making fast. I don't need them at 9 kn speed.
- Don't know if towing companies have guidelines for maximum speed to approach a vessel, depending on tug type, etc. Better communication needed between tug master and pilot about safe speed.
- Always discuss any manoeuvre with the tug skipper before starting. Have regular pilot/crew seminars.
- Tugs should never approach a ship before being in VHF contact with master or pilot.
- Good communication is very important. Tug master should inform pilot if he thinks speed is too high. Pilots should inform crew to use good heaving lines, to follow instructions from tug master, tell tug crew when the line is on the bollard and keep the pilot informed.
- More and better communication and never assume!!!
- Clear and proper communication! Use line throwing guns on (bow) tugs. Use standard communication phrases for tugs and pilots. Have proper emergency communication procedures in case of communication breakdown (e.g. VHF failure) like in Rotterdam.
- Tug master should keep the pilot informed about what is going on. A camera at the bow is another possibility.
- Tugs should be on time. If not, inform pilot so he can slow down.

Safe procedures for connecting and releasing

- Use line throwing guns, so tug can stay out of danger zone while connecting.
- Too often tow lines are caught in tug propellers when tugs are released on ships making way. With respect to this one pilot gives several recommendations.
- When letting go the towline of a stern tractor tug, instruct crew to lower towline and messenger slowly on the tug, to keep it out of the thrusters.
- In the future I will have a final check whether the crew is ready before the tug is approaching.
- Tug should always have enough reserve power to escape. The use of proper heaving lines prevents the tug approaching too close to the bow. Make ship captains aware of the danger for tugs when making fast.
- Tugs should never secure when sailing astern, as with the ASD-tug `Fairplay 22', if the tug is not able to stay safely in that position.
- In case wave height has a large influence on tug manoeuvring when approaching the bow, make it possible to pass towlines inside the port area; pass heaving line from the forward panama fairlead to the tug when sea conditions improve and allow.

- We often use conventional tugs to make their bow fast to the ship's bow. This procedure is done when a vessel must back out of a berth. Before the vessel develops sternway, the tug is released. The tug will convey to the pilot whether there are any obstructions.
- Don't approach bow to bow, but from the side, and get the ship's crew to run the heaving line from the shoulder to the centre lead.

Training

- Better training of tug masters, with focus on PEC holders with limited training and less experience in tug use. More training for deck crew on this specific issue.

Finally

- Set up an international incident/accident database. Set up Formal Safety Assessments. Use Failure Mode & Effect Analysis for tugs to avoid single point failures, especially at the design stage. All to avoid possible catastrophic failures for the forward tug.

Chapter 3.0 RESULTS OF TUG MASTER QUESTIONNAIRES

3.1 Port related aspects

3.1.1 Tug types

The tug masters who responded operated the following tug types:

15% of the tug masters operated a **Voith Schneider** tug;
57% an **ASD-**tug operating over the bow;
13% an **ASD-**tug operating over the stern, as a conventional tug;
12% an **ATD** (azimuth tractor tug);
3% a **ROTOR** tug.

- **Almost all** tugs have a towing winch, except for one ASD-tug.
- **Two tugs**, one Voith Schneider and one ASD, use ship lines as well as tug lines. All others use only tug towlines.
- **Nearly all tugs** use heaving lines for passing a towline, but three do not.

3.1.2 Port regulations for maximum speed

- **50%** of those who replied have a maximum speed regulation in their port, either advised or regulated by guidelines or as common practice.
- About **20%** of the tug masters did mention the maximum speeds in their ports:
  6 knots is normally maximum speed, although lower speeds of **2 - 5 knots** can also be found as well as a very few ports with **7 or 8 knots** as maximum speed.

3.1.3 Towage companies' regulations for maximum speed

- **42%** of those who answered this question (which is 80% of the tug master respondents) have maximum speed restrictions or speed guidelines.
- Some tug masters did mention the maximum speeds:
  6 knots is mentioned mostly, with a very few extremes of **2 knots** and **8 knots**.
  11 knots for escorting.

Note:
It should be noted that 6 knots maximum speed can be problematic for certain ASD-tugs. If they are not equipped with speed modulating clutches it is about the minimum ahead speed with propellers clutched-in. This means that when speed of 6 knots has to be increased rpm should be increased, but when tug speed of 6 knots has to decrease the thrusters must be angled outwards to reduce forward thrust. This results in a rather unstable speed and is therefore risky when close to a ship's bow or bulb.

3.2 Tug assisting methods

3.2.1 Operating mode

- **Almost all tugs** operate at the ship's side and tow on a line fastened on the ship's bow or stern.

3.3 Interaction effects

- **All tug masters** are aware of interaction effects between tug and ship.
- **20% of the tug masters** were not instructed or trained about interaction effects. This is alarming as most of them serve on ASD-tugs which operate as conventional tugs.
- **25% of the tug masters** found that interaction effects were reproduced in a realistic way in the simulator, while almost **40%** said that this was not the case.

> Note:
> It depends on what simulator institute has carried out the training. Implementing interaction effects in a simulator is very complicated. Some simulators may not have interaction effects implemented, others in an approximate way only and a few in a more sophisticated way.

- **Nearly 30% of the tug masters,** across all tug types, had critical experiences with interaction effects.

Tug masters cope in different ways with interaction effects, depending on tug type. An overview of how they avoid critical situations is given below by tug type:

Voith Schneider tug

- Operate at a safe speed before starting the approach.
- In case of problems steer away from ship and start again.
- Anticipate, never oversteer, and gently overcome the interaction effects.
- Avoid interaction effects as much as possible.

ASD-tugs operating over the bow

- Be aware of interaction effects and keep away from risky areas such as the low pressure field near the bulb.
- To do this requires experience and knowledge of interaction effects. But even then you can get caught occasionally in a dangerous situation.
- Speed should be such that the tug has enough reserve power and can steer away from a dangerous situation.
- Through training, discussions among tug masters, and the literature you can learn about interaction effects and how to avoid critical situations.

ASD-tugs operating as conventional tug

- Stay out (of risky situations).
- Knowledge of conventional towing is very important.

ATD- tugs

- Training is needed to be able to anticipate interaction forces and turning moments; handle the tug in a safe way to cope with interaction effects.
- Wait until speed reduces and refuse to put tug in a dangerous situation.

ROTOR tugs

- Stay out of risky situations and react depending on the interaction effects. Reposition if necessary.

3.4 Ship approach procedures

3.4.1 Communications

- Communication between tug master and pilot is in almost all cases carried out by VHF. In general, relevant information for connecting the tug (s) is communicated.

3.4.2 Speed estimates

- Speed is estimated in different electronic ways, particularly by GPS and often by AIS. A very few respondents estimate the speed simply by experience.

3.4.3 Language

- **Tug masters** in non-English speaking ports prefer the local language for communicating with the pilot.

3.4.4 Safe speeds for making fast alongside

Various factors are mentioned in determining safe speeds, including tug type, securing position, bow or stern flare (more flare = lower speed), tug against hull or running free, etc. Below is an indication of the safe speeds mentioned:

- **6 knots or less** is regarded as safe speeds by 47% of the tug master respondents who answered this specific question.
- **6 - 7 knots** is regarded as safe speeds by **15%** of the tug master respondents.
- **7 - 8 knots** is regarded safe speeds by **22%** of the tug master respondents.
- **Maximum speed mentioned is 10 knots**, although one tug master answered that 10 - 12 knots is common for his port. These high speeds all apply to ASD-tugs operating over the bow.
- Sometimes safe speeds are related to a **percentage of maximum tug power**.

What to do if speed is too high for masking fast alongside

- **Almost all tug masters** will inform the pilot and will not connect if speed is too high.
- **A very few tug masters** will make fast at the upper range of tug's speed due to the large tide in the narrow approach channel to their port.

Approaching the ship if the tug has to make fast alongside

- **Most tug masters** will keep pace with the ship and move in, and some will approach the securing position from behind at a faster speed than the ship.

3.4.5 Safe speeds for making fast at the bow of a container ship

- **6 knots or less** is seen as a safe speed by **68%** of the respondents, including all the tug masters operating ASD-tugs as a conventional tug. The lowest speeds mentioned are 3 - 4 knots.
- **6 - 8 knots** is seen as a safe speed by **20%** of the tug masters. This includes mainly masters of Voith Schneider tugs, ASD-tugs operating over the bow and ROTOR tugs. Tug masters of the ROTOR tugs mentioned the highest speed.
- Sometimes safe speeds are related to a **percentage of maximum tug power**.

See also the note at section 3.1 about the critical 6 knots speed for certain ASD-tugs.

What to do if ship's speed is too high for making fast at the bow

- If ship's speed is too high **all tug masters** will not connect and/or inform the pilot.

The approach when making fast to the bow of a containership

- **45%:** keeping pace with the ship and steering slowly towards the bow. This approach manoeuvre is independent of tug type or operating mode.
- **13%:** wait right in front of the ship till the ship comes closer and then manoeuvre towards the bow. This approach is mentioned by tug masters who are NOT operating an ASD-tug in the conventional way.
- **19%:** wait in front of the ship and somewhat to port or starboard, which is less risky than the foregoing method. This approach is also mentioned by tug masters who are NOT operating an ASD-tug as a conventional tug.
- **15%:** overtake the ship and manoeuvre carefully towards the bow. This is mainly used by ASD-tugs that operate as a conventional tug.
- **A very few** tug masters use various approach manoeuvres and one uses a rocket gun.

Preferred location for picking up the heaving line at the bow of a container ship

- There is a large variety of answers. Some tug masters prefer to keep all options open depending on the situation, and one manoeuvres his tug to a position where he can see the flat ship side.
- Several tug master answer that they pick up the heaving line on the lee side. One picks up the heaving line at the windward side.
- Preferred positions are directly in front of the ship and forward near the shoulder. The latter is favoured by ASD-tugs operating in the conventional way.
- **20%** say they pick up the heaving line at the most forward position.

3.4.6 Safe speeds for making fast at the bow of a loaded tanker or bulk carrier

- **6 knots or less** is considered as safe speed by almost **80%** of the tug masters.
- **6- 8 knots** is considered as safe speed by **11%** of the tug masters, mainly of ASD-tugs operating over the bow
- Sometimes safe speeds are related to a **percentage of maximum tug power**.

What to do if ship's speed is too high for making fast at the bow

- If ship's speed is too high all tug masters will not connect and/or inform the pilot, or wait until the ship slows down.

The approach when making fast to the bow of a bulk carrier or tanker

- **50%:** keeping pace with the ship and steering slowly towards the bow. This approach manoeuvre is independent of tug type or operating mode.
- **12%:** wait right in front of the ship till the ship comes closer and then manoeuvre towards the bow. This approach is NOT favoured by tug masters of ASD-tugs that operate as a conventional tug.
- **20%:** wait in front of the ship and somewhat to port or starboard, which is safer than the above manoeuvre. Also this approach is NOT favoured by tug masters of ASD-tugs that operate as a conventional tug.
- **16%:** overtake the ship and manoeuvre carefully towards the bow. This is mainly used by ASD-tugs that operate in the conventional way.

Preferred location for picking up the heaving line at the bow of a loaded tanker or bulk carrier

- There is again a large variety of responses. Some tug masters answer that it depends on the situation, while one tug master manoeuvres his tug to a position where he can see the flat ship side.
- Several tug masters answer that they pick up the heaving line on the lee side. There is, however, one who picks up the heaving line on the windward side.
- There is more preference for a position near the shoulder. This applies in particular to ASD-tugs operating in the conventional way.
- **16%** say they pick up the heaving line at the most forward position.

3.4.7 Approaching the stern of a ship to make fast

- Various answers are given, but most tug masters stay out of the propeller wash when approaching the stern.

3.5 Remarks and suggestions made by tug masters

Tug masters did not just answer the questions posed, but also made a large number of remarks including useful suggestions and recommendations to improve the safety of tug operations. They are categorized below.

3.5.1 Speed estimates

Regarding speed estimates (par. 3.4.2) following remark has been made by a tug master:

- With matching ship's speed, it is clear what safety margin you have with respect to tug power.

3.5.2 The approach when making fast to the bow of a containership

The few remarks made by tug masters regarding this issue (par. 3.4.5) are the following:

- Keeping pace with the ship allows you to feel the pressure wave.
- The pressure wave (in front of the bow) gives the tug additional speed. Be aware.

3.5.3 The approach when making fast to the bow of a bulk carrier or tanker

A remark from a tug master regarding this issue (par. 3.4.6) is mentioned below:

- Overtaking the ship and then manoeuvring carefully towards the bow is acceptable, but keep clear of the pressure wave near the shoulder.

3.5.4 Further remarks and suggestions

Tug masters made a large number of additional remarks, suggestions and recommendations particularly with respect to safe tug procedures. They are categorized below by tug type and are again of interest.

<u>Voith Schneider tugs</u>

- Safe ship's speed, skilled captain and proper communications are crucial factors.
- Good training is essential.
- Ship crew should be ready with heaving line.
- When connected ship's speed will increase; carefully monitor changes to ship's speed.
- Tug-ship contact near shoulder is ok, but tug-ship contact further forward is dangerous.

<u>ASD-tugs operating over the bow</u>

- With respect to training and tug knowledge:
  - Compulsory simulator training for all tug masters is a must, as well as certification of tug masters; it will make tug operations safer.
  - Know your tug, the capabilities and limitations, the local conditions and the interaction effects. Tug master skill and ship's speed are key elements.
  - Training on interaction is a must.
- With respect to speed:
  - Know the speed, ask the pilot/ship's captain to slow down if speed is considered too high.
  - Always keep enough reserve power in order to be able to drive out of danger.
  - Towing companies and harbour authorities should set maximum speed for bow-to-bow operations.
  - Pilot organisations, port authorities and towing companies should set a maximum speed.
  - Maximum 6 knots is safe.
  - Do not be afraid to ask pilot to slow down if speed is considered too high.
  - The slower the safer.

  - Patience is a virtue.
- With respect to safe tug operations:
  - Why bow-to- bow? Use only tractor tugs.
  - Why on the bow and not push-pull, which is much safer?
  - Read Henk Hensen's `Bow tug operations by Azimuth Stern Drive tugs'.
  - Keep distance and use line thrower.
  - Safe speed to be based on what speed a tug master can drive his/her tug in a controlled manner (particularly going astern for bow-to-bow) on one engine. Once this speed is established for the specific tug, prevailing conditions and competency of the tug master, I recommend taking one knot off the figure and we are getting close to determining the safe connection speed.
- With respect to communications:
  - Communicate with pilot.
- Various:
  - Do not oversteer when waiting in front of the ship.
  - When vessel swings, first push her round before connecting.
  - Never connect side tugs before front tug is connected so it can run along the side in case of engine failure.
  - We have problems with vessel crews not using heaving lines; so we need to wait in a critical position before an appropriate line is presented. Safe use of tugs and how to (dis-)connect properly should be part of the SMS!!
- Finally:
  - Speak up if you dislike a job, situation or pilot.

<u>ASD-tugs operating over the stern</u>

- Proper simulator training and refresher courses are absolutely vital.
- Some ASD-tugs are not suitable for operating bow-to-bow.
- Knowledge of towing in the conventional way is being lost and this can be dangerous.
- Planners must know tug's limitations.
- Designate a maximum speed, and send tug masters for training.

<u>ATDs</u>

- Training is needed, including knowledge of interaction effects.
- Push-pull is safer.
- Always be aware that pilots are not familiar with tug types, and you are in command of the tug, not the pilot
- Vessel crew has most difficulty in getting the heaving line on the tug, due to lack of seamanship of crew and improper heaving lines.

<u>ROTOR tugs</u>

- Approach from side to estimate ship speed and have spare power available.

Chapter 4.0 RESULTS OF SHIP CAPTAINS QUESTIONNAIRES

4.1 Interaction effects

- **All captains** know about interaction effects and are aware of the risks of interaction on tugs operating in close proximity to ships.
- **All captains** say that interaction effects were part of their training.
- **Some of the captains** trained on a simulator say that interaction effects are implemented in a realistic way, while others say that this is not the case.
- **Some captains (40%)** have experienced interaction effects.

4.2 Communication procedures

- **In most ports** communication with tugs is done in the local language. If the pilot communicates in a local language with the tugs, it is seldom translated for the captain unless important or he requests it.
- **All captains** say that communication with tugs should be done only in English. It is considered very important.
- **Most captains** (often via the pilot) pass the tugs information regarding where to secure, safe approach speed, SWL of bollards, mooring plan, etc. However, different captains provide different information and there is no uniform system.
- **Most captains** (70%) say they exchange information (often via the pilot) about safe ship speeds for the assisting tugs.
- **Most captains** (70%) tell the tugs (often via the pilot) they should approach the bow only when ship's crew is ready.

4.3 Safe procedures and safe speeds

- **Nearly all captains** have or suggest safe procedures for securing tugs. Suggestions focus mainly on proper communication.
- **Almost all** captains say that ship's officers should keep an eye on the tugs when they are not visible from the bridge during securing. One captain even says: "if not, the officer should be sacked".
- **All captains** have instructed their officers to keep an eye on the tugs (or they expect the officers to do so) and inform the captain immediately if something is going wrong during the securing of tugs.
- **Safe speeds** for fastening **at the bow, stern or alongside** should be very low.
  5 knots or less (90% of the captains) is most often mentioned as maximum speed. Only in one case a maximum speed of 8 knots was mentioned for securing alongside or for a Voith tug fastening at the bow, and 10 knots for when a stern tug is making fast. A very few captains say it depends on the tugs.
- **Nearly all** captains are aware that when tugs are making fast at the bow and/or stern the ship has to be on a straight course and tugs should be warned about engine manoeuvres.

4.4 Safe speeds (2)

- **40% of the captains** say it is the pilots who communicate with the tugs about safe speeds, while **60%** say that they ask the tug masters (often via the pilot) what they want as safe speed.
- **70% of the captains** obtain their speed by GPS/DOPPLER/LOG, while others judge it by experience or by manoeuvring table.
- **All captains** will reduce the speed, and/or abort the manoeuvre, if ship's speed is too high for the tugs.

4.5 Remarks and suggestions made by ship captains

Ship captains did not just answer the questions posed, but also made a large number of remarks including suggestions and recommendations to improve the safety of tug operations. They are categorized below.

4.5.1 Securing tugs

With respect to securing tugs ship captains made following remarks:

- One captain explains clearly the risks for bow tugs.
- Proper communication needed between tug and crew regarding securing towlines.
- The tail rope (messenger) should be at least 2m long. Tug boat crew should be receptive to communication while heaving and lowering towline.

4.5.2 Additional remarks

Captains have the following remarks and suggestions to make it safer to connect tugs:

- On container vessels fitted with a bow thruster the tug, if needed at the bow, should be made fast as late as possible, preferably when the vessel is stopped.
- Lighter towing lines with higher SWL are needed.
- Good relations between pilots and tugs is vital.
- One captain mentioned several aspects of safe handling of tow ropes (similar to the OCIMF guidelines).
- Pilots need to explain tug commands in English to the captain and should advise him about safe speeds for the tugs.
- Training, training, training. Practice, practice, practice.

SECTION 2

SUMMARIES

Chapter 5.0 SUMMARY

5.1 Summary of answers of pilots, tug masters and ship's captains

The most important aspects will be summarized below.

5.1.1 Tug types

Tug master respondents operated the following tug types and modes:
15% of the tug masters operated a Voith Schneider tug;
57% an ASD-tug that operates over the bow;
13% an ASD tug that operates over the stern, as a conventional tug;
12% an ATD (azimuth tractor tug);
3% a ROTOR tug.
These tugs operate at the ship's side as well as on a line at the ship's bow or stern.
All except three tugs use heaving lines for passing the tow line.

5.1.2 Interaction effects

- All ship captains, tug masters and pilots know about interaction effects and the risks for tugs when operating in close vicinity to a ship.
- Several ship captains experienced interaction effects and a large percentage (25%) of pilots and tug masters had critical experiences with these effects.
- For ship captains and pilots, interaction effects were covered during their studies. However, 20% of the tug masters had not been trained or instructed about interaction effects. A large proportion of these are tug masters on ASD-tugs that operate as a conventional tug!
- The majority of pilots, tug masters and ship captains say that interaction effects are not represented in a simulator in a realistic way.

5.1.3 Communication

- All pilots and most of the tug masters prefer to communicate in the local language. Possible mistakes and errors are mentioned by the pilots as reasons.
- On the other hand, all captains say that communication with the tugs should be done in English.
- Information communicated to tug masters includes SWL of bollards, where to secure tugs, mooring plan, etc.
- A majority of the pilots/ship captains discuss safe ship speeds with tug masters. It must also be noted that several ports already have rules regarding safe speeds. Please, see below.

5.1.4 Speed regulations in ports

- Half of the tug masters say there are speed limits in their ports, either through regulation, by guidelines, or established practice.
- A maximum speed of 6 knots is most common, with 7 or 8 knots in a very few ports.

- Pilots report that some ports have a pre-agreed speed of 6 knots through the water, or 5 knots for bow-to-bow operations. Some pilots say that they usually reduce speed to 6 knots, while others trust the tug masters' insight.
- 40% of tug masters who answered the question reported that their towing companies have maximum speed restrictions or guidelines. A maximum speed of 6 knots is mentioned most often, and 11 knots for escorting.

5.1.5 Safe procedures for securing tugs

- About half of the pilots and all ship captains say they have safe procedures for securing tugs.
- It should be noted that several pilots complain about lack of good experienced crew members on board ships today.
- All ship captains say they have instructed their officers to keep an eye on the tugs in general and when they are not visible from the bridge.
- Most pilots do not ask the captain to keep an eye on the tugs when securing even if they might not be visible from the bridge. They expect the ship's crew to do so since it should be standard procedure. Some pilots find it a good idea and will do so in future.
- Almost all captains and pilots state that when tugs are making fast the ship should be on a steady course and the tugs should be warned about engine manoeuvres.

5.1.6 Tug approach manoeuvres

- Most captains say that tugs should only approach the ship for securing when the crew is ready. More than half of the pilots prefer to instruct the attending bow tugs to approach the bow only when the ship's crew is ready to send a heaving line. Some rely on tug masters' experience.
- In general most tug masters keep pace with the ship; some will approach the securing position at the ship from behind.
- If securing at the bow of a container ship, almost half the tug masters will keep pace with the ship and will steer slowly towards the bow, regardless of tug type.
- Other tug masters (15%) may wait right in front of the ship till it comes closer, while 19% will wait in front of the bow and somewhat to port or starboard, which is much safer in case the tug suffers engine failure.
- ASD-tugs that operate in the conventional mode will overtake the ship and will then carefully manoeuvre towards the bow.
- If securing at the bow of a loaded bulk carrier or tanker, the same approach manoeuvres as with container ships are used by approximately the same percentage of tug masters.
- There are a large variety of answers regarding the preferred location to pick up the heaving line, due to the different tug types and operating modes.
  In case of securing at the bow of a container ship, the position straight in front of the bow is often preferred, but the position near the forward shoulder is also popular, particularly for ASD-tugs operating in the conventional way. For bulk carriers and tankers there is more preference for the forward shoulder. 15 -20% of respondents pick up the heaving line at the most forward position. The lee side is often mentioned as the preferred location, which is understandable.

5.1.7 Safe speeds

This is the most important subject. It should be kept in mind that tug type and suitability play an important role with respect to safe speeds.

Safe speeds for making fast alongside	Pilots	Tug masters ***)		Ship captains
≤ 6 knots	70%	47%		90%
6 - 7 knots (this includes 2x a speed range of 5 - 7 knots)	20%	15%		
7 - 8 knots (this includes 2x a speed range of 6 - 8 knots)	10%	22%		1x: 8 knots
>8 knots		12% 1x: 10-12 knots is common in our port		-
Safe speeds for making fast at the bow				
<6 knots				100% *) (1x: in case of Voith Schneider tug 8 knots
≤ 6knots	87% (35% considers even 6 knots a too high speed	68% (for container ships) This includes all tug masters operating an ASD tug in the conventional way	80% (for loaded bulk carriers/tankers) This includes all tug masters operating an ASD tug in the conventional way, ATD and ROTOR tugs	
6- 8 knots	13%	20% (container ships) This includes mainly tug masters of Voith Schneider tugs, ASD tugs operating over the bow and ROTOR tugs	11% (loaded bulk carriers/tankers) This includes mainly tug masters of Voith Schneider tugs and ASD tugs operating over the bow.	
Safe speeds for making fast at the stern				
≤6 knots	45%	-		90% **)
6 - 8 knots	42%	-		-
>8 knots	13%	-		1 x 10 knots (less if requested by the tug)

*) Several ship captains find a speed of about 3 - 4 knots a safe speed.
**) Several captains prefer a speed much less than 6 knots.
***) Some tug masters say they use a certain percentage of tug power rather than an absolute value for safe speed.

Taking account of the majority responses of tug masters in the first place and comparing this with the majority responses of pilots and ship captains, the following can be concluded with respect to safe speeds:

6 knots or less is considered a safe speed for securing at the bow and
Maximum 6- 8 knots is considered a safe speed for securing alongside and at the stern.

These figures may be adjusted depending on tug type and tug performance. For instance, for certain ASD-tugs operating over the bow, even a speed of 6 knots is too high. For tugs operating over the stern as conventional tugs, lower speeds generally apply.
For ASD-tugs without speed modulating clutches, 6 knots is a critical speed because it is normally the minimum speed with both engines clutched-in.

All the information indicates that, in general, 6 knots can be regarded as a safe speed, and several ports have already adopted it. However, the decision should only be made after considering the capabilities and limitations of the tugs involved.

5.1.8 If speed is too high

- 60% of the pilots will slow down if speed is too high and most of them will tell the tug masters to wait till speed has dropped. The pilots mentioned several methods of reducing ship's speed.
- Almost all tug masters will inform the pilot and will not connect if speed is too high. A very few will make fast at the upper range of tug's speed for tidal reasons.
- All ship captains will slow down or abort the manoeuvre if they see that ship's speed is too high for the tugs.

5.2 Summary of remarks and suggestions made by pilots, tug masters and ship's captains

The remarks and suggestions made by tug masters, pilots and ship captains are very valuable. The remarks are categorized below and they may be read in more detail in the relevant sections above.

5.2.1 How to cope with interaction effects

- Operate at a safe speed, be aware of interaction effects and be careful.
- Most important: Training, knowledge of interaction effects, discussion among tug masters.

5.2.2 Safe connecting procedures

- Regular meetings between port authority, pilots and tug masters about proper procedures.
- Day-to-day communication between pilots and tug masters to alert tug masters to problems e.g. high Dead Slow speeds, deep draft vessels, SWL of bollards, poor seamanship on board ships, etc.
- Optimum communication needed between ship's crew and tug.
- Training should include safe procedures.
- Ship should have safe procedures and implement them.

Complaints:

- Improper heaving lines used.
- Ship's crew often creates unsafe situations.
- Towline eye is not positioned on the lowest part of bollard.
- Knowledge of towing in the conventional way is being lost.

5.2.3 Safe speeds

- Safe speeds depend on tug type. For instance, safe speeds for tractor tugs can be higher than for conventional tugs. Weather conditions and tug master experience play a role as well.
- Discussion between pilots and tug masters is very useful.
- Not all ports operate with bow tugs towing on a line.
- Safe speed to be based on what speed a tug master can drive his/her tug in a controlled manner (particularly going astern for bow-to-bow) on one engine. Once this speed is established for the specific tug, prevailing conditions and competency of the tug master, it is recommended to take one knot off the figure and that will be close to the safe connection speed.

5.2.4 How to reduce speed

The following manoeuvres are mentioned to reduce speed if it is too high:

- Stop engine frequently for as long as safety permits. If there is sufficient room, use fish-tailing with rudder. Abort approach and prepare anchors if necessary.
- Apart from the above suggestions a very good solution is to make a stern tug fast to assist in reducing speed.

Complaints:

- Many container ships have a Dead Slow Ahead speed of 10 knots or more.

5.2.5 Final remarks

- Proper communication and information exchange needed (and emergency communication sets).
- Proper heaving lines should be used.
- Training is a must for everyone involved. Refresher courses. Experience.
- Know your tug capabilities and limitations (this applies to planners as well), local conditions and interaction effects.
- Tugs should be on time and ship's crew ready.
- Know the speed and ask to slow down if speed is too high.

- Sometimes tug masters make fast if speed is too high, even if they are told by the pilot not to do so.
- Young tug masters are sometimes too shy to ask the pilot to slow down.
- Keep sufficient reserve power.
- Towage companies, port authorities and pilot organisations to set maximum ship speeds for tug operations in general and for bow-to-bow operations in particular.
- Line throwing systems needed.
- Released towlines to be lowered carefully and slowly to the tugs.
- Lighter towlines with higher SWL needed.
- Set up an International Incident/Accident database. Set up a means of Formal Safety Assessment. Instigate Failure Mode & Effect Analyses for tugs to avoid single point failures, especially at the design stage. All these will help to avoid possible catastrophic failures for the forward tug.
- Why bow-to-bow? Use tractor tugs, or push pull method.
- Never connect a side tug before front tug is connected.
- Knowledge of towing in the conventional way is disappearing, and the knowledge is not being passed on, which can be dangerous.

SECTION 3

CONCLUSIONS AND RECOM-MENDATIONS

Chapter 6.0 CONCLUSIONS

The main purpose of the questionnaires was to find out what is regarded as a safe speed when tugs have to make fast at the bow of a ship having headway. A second reason was to obtain information about safe procedures currently in use.
Apart from the direct answers, the completed questionnaires contained many very valuable remarks and suggestions. The main conclusions of the analysis of the questionnaires are mentioned below.

All ship captains, tug masters and pilots know about interaction effects and the risks for tugs when operating in close vicinity to a ship. Several ship captains had experienced interaction effects and a large percentage of pilots and tug masters had critical experiences with these effects.
For ship captains and pilots, interaction effects were covered during their studies. 20% of the tug masters had not been trained or instructed about interaction effects. The majority of pilots, tug masters and ship captains say that interaction effects are not represented in a simulator in a realistic way.

Opinions on which language should be used for communication with the tug masters differs widely. Pilots and tug masters say the local language should be used, while ship masters prefer the use of English.

Safe procedures for ship crews when securing tugs require attention. Safe procedures should also include ship’s officers keeping an eye on the tugs when securing in case something goes wrong.

Most captains and more than half of the pilots prefer that tugs approach the bow only when the ship's crew is ready to send a heaving line.

How the approach to the bow should be carried out in a safe way depends on the tug type and the operating mode of ASD-tugs which can operate over the bow or over the stern.
Waiting directly ahead of an approaching ship in order to pick up the heaving line is hazardous if there is a tug engine or steering failure or a misjudgement of ship's speed.
The preferred place to pick up the heaving line at the bow depends on tug type, operating mode and ship type.

According to a large majority of respondents, safe speeds are:
A maximum of 6 knots for securing at the bow.
A maximum of 6- 8 knots for securing alongside and at the stern.
The capabilities and limitations of the tugs should, however, be known.

In several ports there are speed restrictions or guidelines. The maximum speed in most cases is 6 knots.

Tug masters want towage companies, port authorities and pilot organisations to set maximum ship speeds for tug operations in general and for bow-to-bow operations in particular.

Pilots mentioned various methods to decrease ship's speed if speed is too high for the tugs.

Pilots had several complains about the often low level of seamanship of ship's crews.
Tug masters of ASD-tugs operating as conventional tugs say that knowledge of towing in the conventional way is being lost and this can be dangerous.

The main conclusion is that there is a great need for proper training of tug masters, including refresher courses, and for safe procedures; the latter not only for tug masters, but for ship crews as well. Communication and regular meetings between pilots and tug masters is of great importance.

The conclusions result in a large number of recommendations. They are mentioned in the next chapter, and include several valuable suggestions made by the respondents.

Chapter 7.0 RECOMMENDATIONS

7.1 Recommendations based on answers and remarks of respondents

The whole report boils down to a few crucial indispensables:

- TRAINING
- EXPERIENCE
- COMMUNICATIONS
- SAFE PROCEDURES

Most essential:

- KNOW YOUR TUG. KNOW THE CAPABILITIES AND LIMITATIONS. KNOW THE CIRCUMSTANCES

It is strongly recommended that all parties involved in harbour towage operations pay the greatest attention to these essential aspects for safe towage operations.

In more detail:

7.1.1 Safe speeds

- Recommended safe speeds are:
  Maximum 6 knots for securing at the bow, and
  maximum 6- 8 knots for securing alongside and at the stern.
  The capabilities and limitations of the tugs should be known and taken into account, as well as weather conditions and tug master experience.
- Speed regulations are a very important aspect of tug safety. It is strongly recommended that ports, towing companies and pilot organisations create standards for safe speeds for tugs making fast to a ship having headway and when fastened.
- When speed regulations and/or guidelines are in effect in a port, it is vital to confirm regularly that they are complied with.
- It is strongly recommended to verify if the following method can be used to determine the safe connection speed for a specific tug that has to secure at the bow of a ship:
  Safe speed to be based on what speed a tug master can drive his/her tug in a controlled manner (particularly going astern for bow-to-bow operations) on one engine. Once this speed is established for the specific tug, prevailing conditions and competency of the tug master, it is recommended to take one knot off the figure and that should be close to the safe connection speed.

7.1.2 Safe tug procedures and communications

- Towing companies and tug masters, if possible together with pilots, should develop safe procedures for how to approach a ship for picking up a heaving line and for passing a tow line. It is recommended that these procedures include an instruction that tugs only approach the bow when the crew is ready.

- In case of a too high ship speed it is recommended to secure the stern tug first, in case a stern tug would be used, and when ship speed has dropped to an acceptable level the forward tug(s) can be secured.
- There must be safe and effective communication procedures between pilots and tug masters. Communication should include issues such as safe speeds, when and where to make fast to the ship, SWL of bollards and fairleads, intended manoeuvres, mooring details and all other relevant information.
- It should be made standard that a pilot translates communications with the tugs into English, unless the ship captain speaks the same language as the pilot.

7.1.3 Training of tug masters

- Training of all tug masters is vital and should include refresher courses. Training should include the capabilities and limitations of tug types in use, safe procedures, safe speeds, knowledge about interaction effects and their effect on tugs, teaching the right attitude (particularly for young tug masters), and all other important aspects of safe towing. Training, regular refresher courses and competency checks should be carried out by certified institutes and trainers.
- Interaction effects between tug and ship, including pressure waves (see bow wave figure 3 Appendix), should be replicated in a realistic way in simulators used for training. Simulated interaction effects should be accurate for various hull forms, speeds, draughts, under keel clearances, tug locations with respect to the attended ship and distances between tug and ship.
- Regular meetings between tug masters and pilots, and groups of tug masters, are needed so they can discuss all relevant matters with respect to tug assistance.
- Pilots should always alert tug masters to problems e.g. regarding ships with high Dead Slow speeds, deep draft vessels, SWL of bollards, poor seamanship on board ships handled, and any other relevant information.

7.1.4 Training of pilots

- It is recommended that pilots (including PEC -Pilot Exemption Certificate- holders are trained on the same subjects as mentioned above, such as with regards to the capabilities and limitations of tug types in use, safe tug and communication procedures, safe speeds, knowledge about interaction effects and their effect on tugs, and all other important aspects of safe towing.

7.1.5 Safe procedures shipping companies and ship captains

- Shipping companies and ship captains should implement rules for safe procedures regarding the securing and releasing of tugs, including safe speeds, use of suitable heaving lines and proper handling of heaving lines and tow lines in a safe and efficient way, SWL of bollards and fairleads, proper bollard use with respect to towlines, and keeping an eye on the tugs when fastening and releasing. Ship's crew should be trained in all these issues.

7.1.6 Line throwing systems

- It should be investigated whether line throwing systems can safely and effectively be used for passing a heaving line to a tug.

7.1.7 Bow camera

- It is recommended to investigate whether a camera on the ship's bow can help in monitoring the tugs.

7.1.8 Safe tugs and safe operating modes

- Safety of bow tug operations can be greatly improved by using tractor tugs and/or by using the push-pull system.

7.1.9 Finally

- Learn from accidents.

References

[1] Aanvaring en kapseizen sleepboot Fairplay 22 op de Nieuwe Waterweg te Hoek van Holland. De Onderzoeksraad voor Veiligheid. Den Haag. maart 2012.
English version: Collision and capsizing of tug Fairplay 22 on the Nieuwe Waterweg near Hook of Holland. Report March 13, 2012.
http://www.onderzoeksraad.nl/en/index.php/onderzoeken/sleepboot-omgeslagen-hoek-van-holland-11-november-2010/

APPENDIX

This includes an example of the questionnaires

Safe Tug Procedures

Questionnaire C
for
Pilots

Around a ship having way are varying forces and turning moments working on a tug when sailing in close proximity to the ship. These forces and turning moments are caused by interaction effects between ship and tug and increase with the square of the ship's speed and decreasing distance between ship and tug.
The interaction effects will vary by ship's type, draught, trim, underkeel clearance and confinement of the fairway.
A tug also uses more power to keep pace with the ship when sailing close to her than it does at a greater distance off. The extra tug power varies with distance off and tug's position, e.g. near the shoulders more power is needed than halfway along the mid-body.
The interaction effects are most pronounced near the bow and can present a risk for tugs when preparing to pass a towline.
When a tug is approaching the ship it is difficult to judge what the effect of interaction forces will be and how to cope with them. Much depends on the tug master's experience, but the lower the ship's speed, the smaller will be the effect of interaction forces and turning moments on the tug.

Several tug accidents have happened when tugs were operating near the bow of seagoing vessels, often with tragic consequences for one or more crew members. Too much speed is the most common direct cause for such accidents, while tug type is also an important factor.
During the past 45 years, research studies have been carried out to get a better insight into the effects on a tug operating close to the bow of a ship having headway, and how such accidents can be avoided.

Worldwide there are different tug types. They can generally be classified into tugs with the propulsion units aft, the so-called conventional tugs and azimuth stern drive (ASD) tugs, and tugs with propulsion units under the bow, the so-called tractor tugs.
If tugs with their propulsion units aft are very close to the ship's bow or bulb and want to get clear, they use their rudder(s) or propulsion units to steer away. This has, however, partly an opposite effect because the tug's stern will come closer to the ship, which increases the suction forces and consequently the risk of hitting the bow or bulb. If a tug is thus forced alongside the bow, it will almost impossible to get free safely. This explains why most accidents near the bow have involved tugs with propulsion aft.

It must be noted that the way tugs operate differs from place to place. There are basically two ways of ship assistance: push-pull, and towing on a line. In the push-pull mode, tugs are made

fast alongside the ship and interaction forces generally play only a small role. When towing on a line the tug is fastened to the bow or stern, so interaction forces play a major role when trying to make a towline connection, in particular near the bow. A combination of both methods is also possible.

The purpose of this questionnaire is to find out what is considered a safe ship's speed when tugs are making fast and what safe procedures, based on tug type and assisting mode in the port, are used. If there is a speed limit in the port you describe, please report this also.

The questionnaire is an initiative of the International Tug Masters Association and the Nautical Institute Netherlands Branch.

With the help of your answers we hope to develop safer tug procedures.
Similar questionnaires are being sent to tug masters (A), ship captains (B) and pilots (C), although there are slight differences based upon their different perspectives.

Working Group - **I**nternational **T**ug Masters **A**ssociation & **N**autical **I**nstitute
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Date: 24 May 2012

Questionnaire C

All questions below refer to ships having headway.
If there is not room enough for your answers, please use a separate blank page

	ANSWERS
A. INTERACTION EFFECTS	
1. Are you aware of interaction effects between ship and tug?	
2. Are you aware of the risks of these interaction effects for tugs when operating in close proximity to your ship?	
3. Were these interaction effects part of your study or training?	
4. If you were trained on a simulator, were the effects on the tug(s) included in the simulator in a realistic way?	
5. Did you have any critical experience with these interaction effects?	
B. COMMUNICATION PROCEDURES	
1. What means of communication are used between pilot and tug master(s)?	
2. Do you as pilot communicate with the tugs in the local language or in English?	
3. If you as pilot communicate in a local language, do you translate for the captain?	
4. If you as pilot communicate in a local language, would you prefer that it would be done in English?	
5. What issues do you communicate as pilot with the tug master(s) before tugs are making fast?	
6. Do you as pilot exchange any information with the tug master(s) about safe speeds for the tugs that have to be secured?	
7. Do you prefer to instruct the attending bow tug(s) to approach the bow only then when the ship's crew is ready to send a heaving line?	
C. SECURING TUGS	
1. Do you have or suggest safe procedures for securing tugs, such as with regard to the use of proper heaving lines, communication between ship's deck crew and tug crew, the use of proper bollards with adequate strength, etc. ?	
2a. When tugs have to make fast *alongside the ship*: Do you ask the captain to instruct a ship's officer to keep an eye on the tug(s) in case something might go wrong?	
b. Will the ship's officers also be instructed to inform the captain immediately if something goes wrong?	
3. When tugs have to make fast *alongside a ship*: What do you consider as a safe ship's speed?	

4a. When tugs have to make fast *at the bow* various approach manoeuvres can be used by the tug(s), depending on ship's type, tug type and/or tug master's experience (see figures 1-3). What do you consider as a safe speed ship's speed when tugs are making fast at the bow?	
b. Do you prefer that the tug(s), when approaching the bow to make a towline connection, are visible from the bridge as long as possible?	
5. If tugs have to make fast *at the stern:* What do you consider as a safe speed?	
6. When tugs are making fast at the bow and/or stern the ship has to be on a straight course and tugs should be warned about engine manoeuvres. Are you aware of the need of these tug safety measures?	
7a. When tugs are making fast at the bow or stern, they might not be visible from the bridge. Do you as pilot ask the captain to instruct the ship's officers forward and aft to keep an eye on the tug(s) in case something goes wrong?	
b. Will the ship's officers also be instructed to inform the captain immediately if something is going wrong?	
D. SAFE SPEEDS	
1. Do you ask the tug master(s) of the attending tugs what they want as safe speed when making fast?	
2. How do you estimate ship's speed through the water?	
3. If ship's speed is higher than is considered as safe by the tugs, what would you do?	
E. Port name Could you mention your port?	
F. Finally Do you have any other remarks or do you have any further recommendations to make it safer to connect tugs at the bow?	

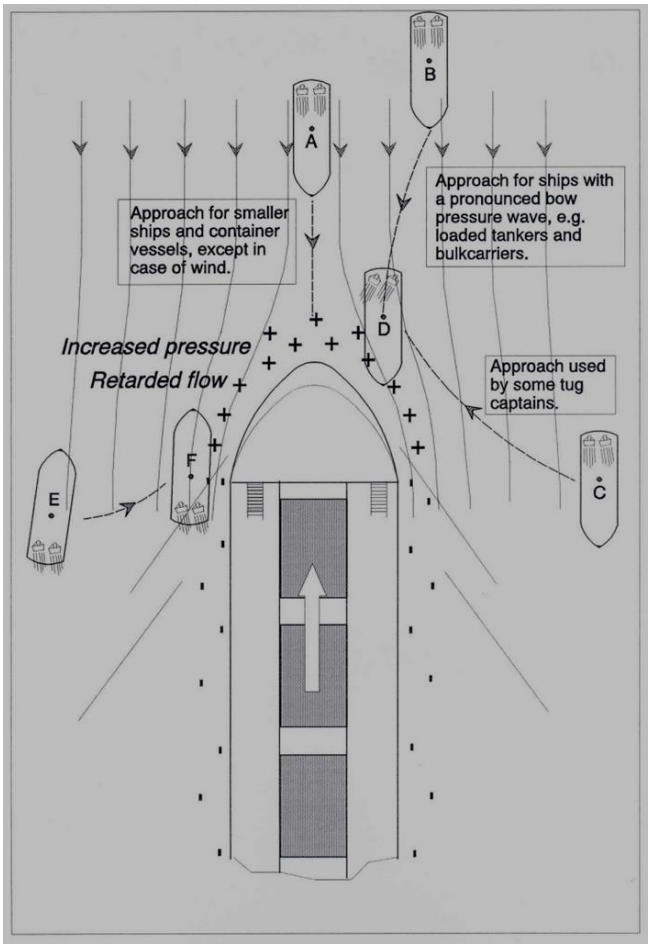

Photo: Henk Hensen

Figure 1
An ASD tug preparing to pass a tow line for operating bow-to-bow

Figure 2 (Left) Some approach manoeuvres of an ASD-tug when working over the bow and when over the stern. Source: `Bow tug operations with azimuth stern drive tugs' NI. Henk Hensen.

Figure 3 (Below). The high bow pressure (bow wave) can clearly be seen at the bow of the loaded bulk carrier.