Mooring the Ferry m/f "Gryf" in Extreme Hydro and Meteorological Conditions

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ABSTRACT: The paper introduces some possible manoeuvres of the ferry „Gryf" in difficult hydro and meteorological conditions, in which standard methods do not permit execution of mooring and unmooring. Brief characteristics of the ferry m/f „Gryf" have been presented. Typical and most often met extreme hydro and meteorological conditions have been described for Świnoujście and Ystad. Examplary techniques of manoeuvres have also been presented for both ports of operation.

1 INTRODUCTION

The ferry m/f "Gryf" left building shipyard in year 1990 as typical ro-ro passenger ship. It was bought in year 2004 and has been modernized and rebuild. Since January 2005 being operated by Unity Line Ltd. M/f "Gryf", it has been adapted to transport beyond 100 lorries on three closed decks. Simultaneously it can also carry passengers together with cars. Her construction enables shipping without region's limits.
The ship has two propellers. Each medium speed main engine drives one controllable-pitch propeller trough transmission gear. Behind each of them double, flap rudders are situated. Both are coupled.
Ferry main particulars:

- length overall 157, 9 m,
- width 24 m,
- maximum draft 5, 90 m,
- M_m power of main engines 2 x 3960 kW,
- M_s sum of power two bow thrusters 1536 kW,
- area exposed wind pressure near 3 thousand m^2.

After comparisons of ferry m/f "Gryf" to ferry m/f "Polonia" (also property of Unity Line Ltd., most modern ferry operated by Polish Ship Owners) one can name some differences, which have to be taken into consideration by Captain manoeuvring the vessel. M/f "Polonia" can navigate practically in every hydro and meteorological conditions occuring in her region of operating. M/f "Gryf" possessing smaller size has unquestionably smaller coefficients of indicatory power to lengths overall as well to the area exposed to wind pressure [1].
Experience in manoeuvring the ferry was assembled on the line Świnoujście-Ystad in years 2005 and 2006. The ferry in Świnoujście is moored port side on position No 4 of Ferry Terminal. Bow ramp was laying down on the shore adjustable platform. In Ystad the ferry was always moored starboard side at "Polen I" with the stern ramp ashore.
With a dose of simplification, we can define regular hydro and meteorological conditions (wind and current) in which ferry can execute all expected manoeuvres individually by means of routine setting of own engines, thrusters and helms.
A good and universal test defining regular conditions is 360^o turning executed in the area of turning circle. At the beginning and after completion of the test, the ferry should be stopped in relation to the bottom. The initial course of wind should be around 90^o. For obvious reasons it is very difficult to execute the test in the port's area and in the real turn circle area. It is safest to carry out the test for example in gulfs or in areas sheltered from waves but not from the wind. The Pilot Navigational System or an electronic chart in suitable scale have to be used for registration and for controlling of execution of manoeuvres. Additional limits for settings of engines and thrusters can result from the construction of the bottom and wharfs. Here will be determine maximum, admissible speed of propeller stream at the bottom [2].
The aim of this paper is not to determine the maximum unfavourable conditions in which

manoeuvring is yet possible. The goal of this paper is to describe techniques used during manoeuvring of the ferry in extremely difficult hydro and meteorological conditions.

2 MANOEUVRING OF FERRY M/F "GRYF" IN PORT ŚWINOUJŚCIE

2.1 *Mooring*

In typical circumstances the ferry m/f "Gryf" without turning approaches Terminal stand No 4 parallel to wharf on course about 208o. The right engine works astern to slow down runing of the ferry. Composition of the left engine working forward together with the rudder adjusted on starboard causes moment pushing stern to the wharf. Linear speed is controlled by the engine working astern. Suitable adjustment of bow thrusters and the main rudder control transverse speed of approaching the quay by the ferry. Approximately 20 m from the position of mooring the ship will be stopped at the fenders. Then first lines (forward spring and stern line) pass ashore. The vessel starts shifting forward and during the running next lines (stern spring and head line) will be on shore. All options of manoeuvrering in all extreme weather conditions will be the same from the first contact with the fenders. Differences will only occur until this stage.
Ferry Terminal Stand no 4 is relatively well secured from squally winds. Unfortunately in Świnoujście river port stormy winds on open waters accompany changes of water level causing strong outward and inward currents. Currents speed in period of collecting empirical data reached sometimes to 6 knots. It is necessary to realize that close to stand no 4 rotation of direction and current speed changes appear. It is caused by advancing the end of stand into centre line of port channel and also further deviation of wharf line by as many as 20 degrees in relation to stands 5 and 6. Strong currents cease in the area about 15 m from the fenders line.
During moorings with strong inward currents it is necessary to slow down the ferry before reaching Ferry Terminal It causes serious problems with keeping the ship on desirable position according to manoeuvre plan when running with minimum and steerability speed. Classic approach, parallel to wharfs causes loss of stern control and it is necessary to repeat all approach to the quay once again.
In average strong inward currents conditions the only efficient activity is to approach on courses deviated into the right from the wharf line direction.. Dependent upon the information about current conditions received from station VTS Świnoujście, deviation from course 208^{o} should be out from 10 to 30 degrees to the right. In this manner we obtain additional moment pushing stern to quay in spite of comparatively low coefficients of indicatory power to lengths overall as well to area exposed to wind pressure.

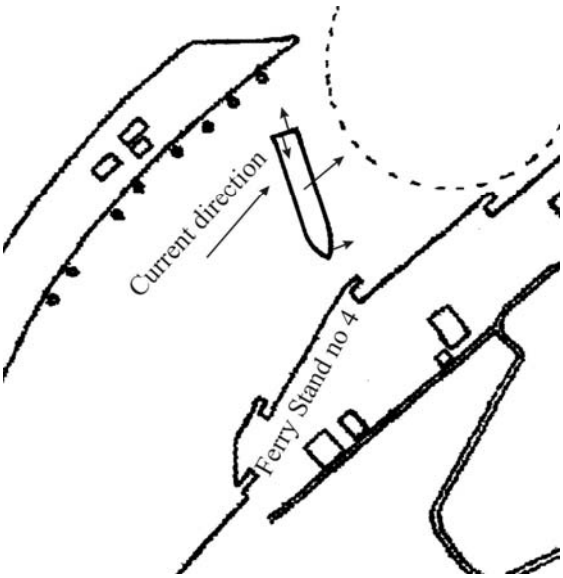

Fig. 1. Świnoujście mooring with strong inward going currents. Arrows on stern represents pull direction of both main engines. Arrow on bow symbolize bow thrusters direction. Vector in a centre showing shifting direction of the ferry

In these circumstances as a consequence of the necessitity to continuously stop the ferry with the right engine and resulting from this weak possibilities of working forward with left engine, we obtain an efficient method of "supporting of stern".
The usage of the above described manoeuvres at more strong entering currents enforces so heavy "support of stern" effect, that it will demand sometimes reversing main engines direction and also a change of the position of main rudder for pushing out the stern from wharf. When activity of current already begins to cease close to the quay, it is necessary to reverse the engine and the rudder again for pushing the ferry to wharf.
At very strong currents the only solution is to use the tug and mooring it on stern. The tug will be ordered to slow down the ferry and if possible to simultaneously tow at the direction of the. In this manner the ferry will obtain additional possibility for "forward" working of main engines. Then the main rudder will be used in the direction of the quay and the vessel has big possibility of moving parallel to the quay.
Not one can give concrete values of currents at which we decide to approach with stern pushing first to the wharf. Not one can recognize such power of entering current during this option of manoeuvre when it is necessary to reverse the engine and the rudder to counteract running the stern into the wharf.

These decisions are to be made by the captain under taking into account his/her experience, unpredictable direction of currents, gusts, and wind direction that are at acceptable navigational risk.
Mooring at extremely strong out going current require continuous control of stern position pushed by current into the wharf. Turning moment of main engines should be adjusted to pushing the ferry out from the quay. At more strongest out going currents its take into consideration usage of tug moored on stern.
In certain hydro and meteorological conditions the risk will be too large to undertake manoeuvres of mooring. Awaiting for conditions improvement will be necessary.

2.2 *Unmooring*

In typical circumstances the ship after dropping the lines, runs away from wharfs and begins simultaneous backwards and parallel to quay movement until the bow passes the end of terminal stand no 4 (close to shore adjustable platform of the stand 5). At this moment the ferry begins turning in the left-hand direction with backward movement maintained. Manoeuvres of unmooring permit large relative speed of propellers streams that enable control of a good position of the ferry stern.
Entering to centre of 310 m turning circle is not necessary because the length and draft of m/f "Gryf" permits safe turning in practically all regions of the port - channel. At stronger out going currents, it is advisable to change the direction of turning. Then all manoeuvres instead of drift will be executed in the turning circle area.
At strong transverse winds one can push the ferry into wharf with the use of the springs using the current to move vessel in the direction opposite to the wind and for reducing the course to the wind.

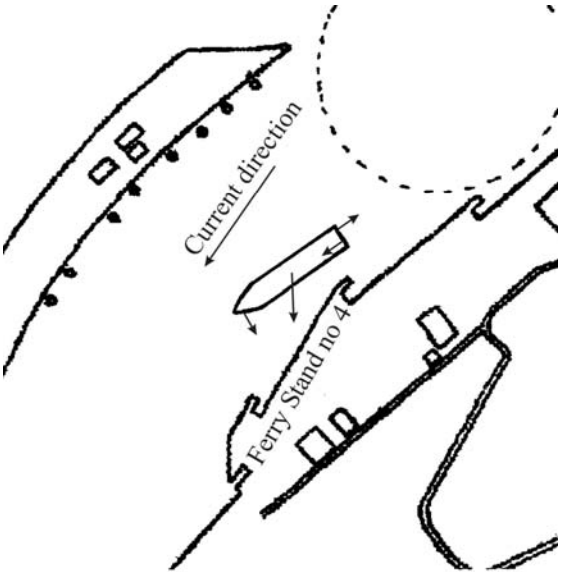

Fig. 2. Świnoujście unmooring with out going currents. See comments below figure 1

Ferry Terminal in Świnoujście is relatively well secured from squally winds. One can even assume that appearance of any hydro and meteorological conditions on open sea in of which shipping is safe for ferry m/f "Gryf" will bring about minimum safety conditions for unmooring and turning of the ship.

3 MANOEUVRING OF FERRY M/F "GRYF" IN PORT YSTAD

3.1 Mooring

During routine manoeuvres the ship enters the port on course 036^{o} proceeding along the leading marks line. When the stern passes the right head of internal breakwater together with lineal movement forward, the ferry begins turning left, in order to clear of "Revhuskajen" corner with stern from a distance of about 25 m.
Continuing turning left of the vessel, from this moment ferry can begin also astern linear motion proceed along to quay "Polen I". Course of the wharf is 263°. Mooring with starboard. Currents in internal port do not exist.
At extremely strong SW winds during turning the ferry should keep away form "Polen I". The idea is to create possible large area for strong wind drift and time for turning the ferry to wharf course. All ferry captain's activities at circulation of wind from directions SW and S are directed at reaching the quay fenders with minimum energy, best with zero longitudinal speed of the ferry.
The situation is much more difficult when mooring is accompanied by winds from N - NE directions. In such situations it is necessary to move ferry so close to the corner of "Pollen I" that it is possible to passing any line from bow to the corner of the quay. Then after transferring ship's point of turning forward, and with the same power on stern we have more profitable ferry turning moment. Dependent upon the force of wind when approaching to quay, passing the first line does not have to occur in the same moment when ferry is parallel to wharfs. The act of passing the line can be more effective when the ship is during turning closer to the northerly courses, when the course to the wind is lower.

3.2 *Unmooring*

Routine departure of the ferry means proceeding with bow thruster pushing the bow into the left direction and simultaneously very slowly

accelerating the ship. The stern should be held at constant, safe distance from wharf by use of main engines settings and the rudder. After passing the right side internal breakwater, the speed of the ferry should be strongly accelerated to obtain appropriate course stability.
With strong winds pushing back from quay, unmooring proceeds similarly to routine manoeuvre. Activities should counteract drift caused by the wind.

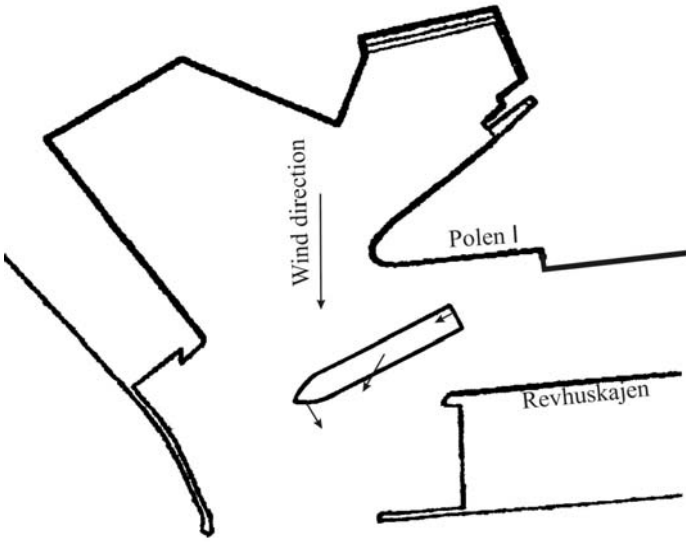

Fig. 3. Ystad unmooring with out going wind direction. Left engine stopped. See comments below figure 1

In the final phase after turning by bow thrusters, the ferry has to be accelerated a little earlier to oppose drift done by the wind. Safety of manoeuvre is emphasized by the fact that between heads of the internal and external breakwaters on eastern side there is a wider fairway . That creates more space for unexpectable drift.
It is considerably more difficult to manoeuvre the ferry during strong winds pushing ferry to the quay. Captain's activity should aim at shifting the point of turning closer to the stern and to as quick as as possible diminution of courses to the wind. In such as situation while working with bow thrusters on pushing out, it is necessary to choose ship stern area safe point of support at the quay. Stern spring may be left on bollard. Operations with main engines and rudder settings intended to push back the stern and dropping the stern spring line should be carried out to obtain lowest possible course to the wind. In this situation the ferry should have full controllable manoeuvres on forward and stern. After passing the line of right side internal breakwater the ferry should continue moving to the left to obtain suitable spare height and then the speed has to be strongly accelerated to obtain good course stability.

4 CONCLUSIONS

Liner trade shipping, and in especially ferry trade enforces on time sailings to the ports. Usage of other than routine methods of manoeuvring permits increasing safety and regularity of shipping which improves economic results.
It is captain's experience in manoeuvre, his/her constant estimation of navigational risk and based on this making the right decisions has crucial influence on correct operation of ferry has. One can conclude based on the presented examples of solving the mooring problems results that one of the manners of enlarging abilities of ferries manoeuvre, except direct enlarging power of engines and bow thrusters, enlarge experience of captains and using other than routine manoeuvring manners. This can be achieved in many ways depending upon different strategies of crew qualifications improvement.

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