

## Proposal for Global Standard Maneuvering Orders for Tugboats

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**ABSTRACT:** The use of "Standard Maneuvering Orders" for tugboats, vocabulary and phrases mutually pre-agreed between ships and tugboats, is essential for the former to provide clear direction for the latter when berthing or un-berthing safely. Tugboats will need time to change their posture before they take actions in response to orders from persons responsible for ships' maneuvering. Therefore, when giving directions to change tugboats' posture, persons who handle their ships are required to send out tug orders, with regard to "delay time," a gap between the orders from ships and the actions taken by tugboats. "Tug Orders" standardized and used in Japan are composed of the following three factors concerning towage work: tugboat's motion, direction and engine power, but the author's research shows that there are "Non-standard" special maneuvering orders other than those "standardized," which causes such problems as a gap in perception between pilots and tugboat's operators, etc. The purpose of this paper is to research the delay time between orders for and actions by tugboats and consider the appropriate and safe timing of providing instructions to them, and then to propose globally-authorized "Standard Maneuvering Orders for tugboats", discussing a problem involved in the use of the special orders used in Japan, and the way in which tug orders are used in other countries.

### 1 INTRODUCTION

Maneuvering orders for tugboats should be used with an advance agreement between the operators of ships and of tugboats, for the former operators to provide clear directions to those of tugboats employed, when ships' entering or leaving their berth. And it takes some time the operators of tugboats to initiate necessary actions and change their positions after receiving any tug maneuvering orders from the operators of ships. Therefore, any ship operators have to give tug orders in anticipation of this delay time when the posture change of a tugboat is required, which is essential for the security of both herself and a ship supported by her.

The purpose of this study is to research the time lag between when a maneuvering tug order is given and when any expected action is taken, and to examine a safer timing to give maneuvering orders to a tugboat. And also the purpose here is to propose the global standardization of maneuvering orders for tugboats, showing the problems caused by using special tug orders in Japan, and weighing how the orders for tugboats are employed in Japan and other foreign countries.

## 2 THE PRESENT CONDITIONS AND PROBLEMS OF THE TUG MANEUVERING ORDERS IN JAPAN

In harbors of Japan, maneuvering orders for a tugboat are given by using the commands mutually agreed beforehand between a pilot and a tugboat or by using "the Settled Term of Maneuvering Orders for Towing Work" set out by Japan Tug Owners' Association (hereinafter called, "Settled Term", in this paper), and in Japanese.

Here is Figure 1 which shows a flow chart of tug maneuvering orders set out in "Settled Term," in which they shall be provided in the following order: the instructions for the movement ("Push" or "Pull"), the engine power, and the direction (given by "Clockwise").

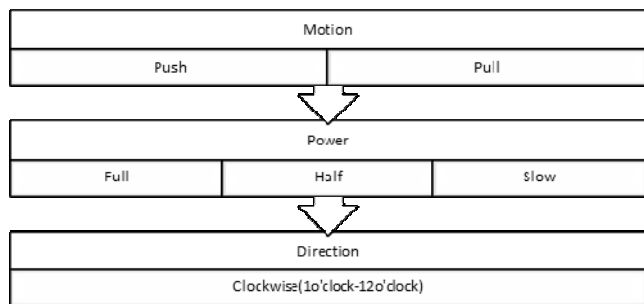


Figure 1. Flow chart of Tug orders in Japan

However, there are some other special tug orders for each of her movement, engine power, and direction than those in "Settled Term." And also the research reveals that the special orders to maneuver a tug and use her engine are more frequently used, and that there is a gap in perception between a pilot and a tug operator giving and receiving the orders. We will begin by considering the problems of the special tug orders relating to her movement and engine power in Japan, and the findings of our research on the orders for tugboats used in U.S.A. and Sri Lanka.

### 2.1 Tug orders (Movement) in Japan

In Japan, as Table 1 indicates, there are many special orders requiring a tugboat to prepare for next movements or to change her positions, and to use her engine at the same time. And also there are some different phrases of tug orders though they require the same movements for a tugboat.

Table 1. Tug orders (Movement) in Japan

Motion	Phrases (in Japanese)	Their Meaning (in English)
Positioning order only	HIKU-YOUI	Stand by Pulling
	OSU-YOUI	Stand by Pushing
	YOKONINARE	Side by side
Positioning order add in Engine Power	HARIAWASERU	Give a tension
	BURASAGARE	Apply load
	ATAMA-O-TUKERU	Attach the bow
	OSITUKE	Keep a pushing
	MOTAREKAKARE	Keep a pushing
	YORIKAKARE	Keep a pushing
DAKITUKE	Side by side	

### 2.2 Tug orders (Engine Power) in Japan

As for engine power, there are more than a dozen non-standard orders other than "Settled Term," such as, in descending order, Dead Slow, Half of Dead Slow, Quarter of Dead Slow, Minimum, and Omega (driving Clutch), etc., all of which are weaker than so-standardized "Slow" in "Settled Term." And also in the case of engine power, there are different phrases of orders requiring the same power output for a tug, as is the case in orders for her movements. There are such orders as "One Eighth of Dead Slow" or "3% of Maximum Power" other than all of these non-standard engine orders requiring engine power of less than Dead Slow (25%).

Table 2. Special tug orders in Japan (Power)

Motion	Phrases (in Japanese)	Tug Orders	Their Meaning (in English)
Power based on Engine Telegraph	DEAD SLOW-NO-HANBUN		Half of Dead slow
	DEAD SLOW-NO-1/2~1/8 OMEGA		Half of one eighth of Dead slow Using OMEGA slipping Clutches
It is not based on Engine Telegraph	KARUKU		Lightly
	MINIMUM		At a minimum level
	GOKUGOKU BISOKU		Very soft Very slow

### 2.3 Tug orders in U.S.A. (Los Angeles, Long beach)

In U.S.A. (Los Angeles, Long beach), the standard tug orders shall be given in the following order: the instructions for movements ("Push" or "Pull") first, followed by engine power and direction (given by "Angle" based on ship) of a tugboat.

Compared to the case in Japan, a distinguished difference is that there are only six kinds of engine power orders in U.S.A., as shown in Figure 2, and that special tug orders as used in Japan are hardly employed. Another difference is that, in U.S.A., a tugboat responds to a pilot with a whistle while transceiver used in Japan.

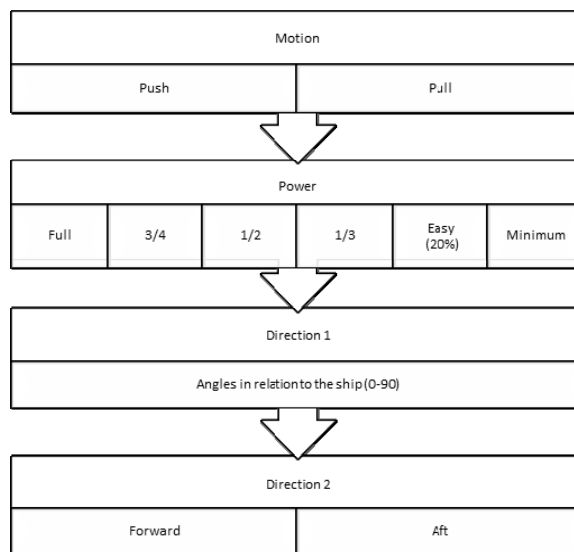


Figure 2. Flow chart of Tug orders in U.S.A.(Los Angeles, Long beach)

## 2.4 Tug orders in Sri Lanka

In Sri Lanka, the flow of the standard tug orders is, as follows: the instructions for tug's movements (using "Push" or "Pull"), engine power and direction (given by "Clockwise"), in this order. The orders for the preparation for tug's movements, which is not standardized as "Settled Term" in Japan, are those among the standard tug orders in Sri Lanka.

And also there are only six kinds of tug order for engine power (shown in Figure 3), as is in the case of U.S.A., and special tug orders, which are very often used in Japan, are hardly employed.

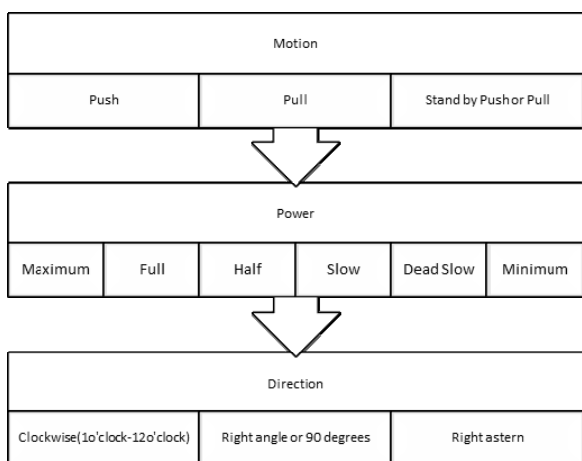


Figure 3. Flow chart of Tug orders in Sri Lanka

## 2.5 Communication among bridge team

The common language used on the bridge should be English, as required in the International Convention for the Safety of Life at Sea, 1974, and therefore SMCPs is developed in English.

In November 2001, the Assembly of the International Maritime Organization adopted as Resolution A.918 (22), the IMO Standard Marine Communication Phrases (SMCPs) intended to replace the Standard Marine Navigational Vocabulary (SMNV) adopted in 1977 and amended in 1985. The purpose of SMCPs is to standardize the English terms and phrases commonly used in bridge-to-bridge and bridge-to-shore communication, and then to contribute a safer navigation.

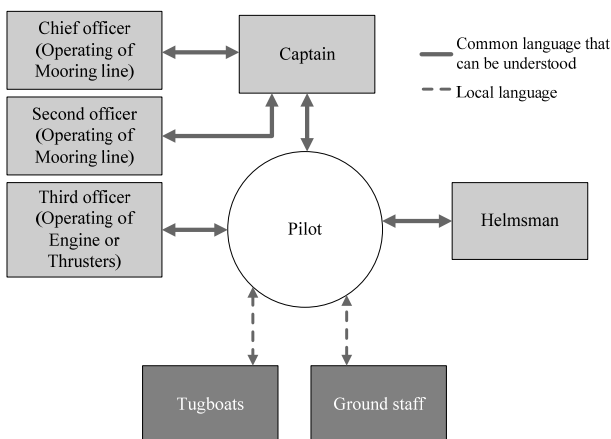


Figure 4. Information flow in Navigation Bridge

However in Japan, the communication between a ship and a tugboat engaged in the operations to enter and leave berth is established in Japanese. When a pilot and a tugboat use their local native language in any foreign ports of call, the captain of the ship and her crew cannot understand what they are talking about, and then have to let the pilot completely maneuver the ship, where they cannot have any doubt about the pilot's maneuvering intentions.

According to Japan Coast Guard, there were 2,187 marine accidents (Except for accidents caused by force majeure (346 vessels)) in total in 2011 (within a single year), in fact 332 of which occurred in harbors. They also say that 1,681 of 2,187 marine accidents occurred because of "human error" (the rate of occurrence of 77%).

Many shipping companies in Japan have introduced the Bridge Resource Management training (hereinafter called, "BRM," in this paper) to prevent a chain of "human error" which is the main factor of marine accident. In addition, the BRM training has been mandated for seafarers as minimum requirements for certification of officers in charge of a navigational watch by the 2010 Manila amendments to the STCW Convention and Code (Table A-II/1).

Pilots use the language which the key personnel on board the ship can understand when explaining their intentions to them. However, as in Japan, pilots may use a local language understandable for operators of tugboat and grand staff on wharf or pier when conveying their intentions or giving the instructions to them by transceiver. Figure 4 shows the information flow chart on board the ship entering or leaving berth with the service of tugboats employed, where pilots perform the berthing operations, playing a pivotal role as a key person to give orders to tugboats or ships and to share information with ground staff on a wharf or pier. Generally speaking, standard maneuvering orders, mutually agreed between a pilot and an operator of tugboat beforehand, are used in their communication. However, our research reveals that these orders are not globally standardized, but employed only as locally-limited orders agreed between pilots and tugboats. In some cases, the orders not agreed between their users may be used in Japan. In these situations, the crew on board cannot understand what a pilot and an operator of tugboat or ground staff are communicating about, where, although the pilot possibly makes a human error, the crew cannot realize their dangerous situation because of the language difficulties.

## 3 POSITION CHANGE ORDERS FOR TUGBOAT AND ITS DELAY TIME

### 3.1 Method of research

We used the data of front-affixed video cameras on bridge and the AIS position data derived from tugboats in the ports of Tokyo and Yokohama from January 2011 to July 2012. These video data include their shooting date, time, and also sound. By using the shooting dates recorded in the video data, we measured a gap between when a position change

order for a tug from a pilot is given and when necessary actions for the order are completed.

### 3.2 Results of research

The results of the research on the amount of time spent on tugs' changing their positions are shown in Figure 5. Such tug orders as "Push" or "Pull" are generally given after the advance announcement of actions are given to tugboats by using the tug orders such as "Stand by to push" or "Stand by to pull," which are not standardized in Japan. However, the orders of "Stand by to push" or "Stand by to pull" may be followed by "Push" or "Pull" without any gap.

Each average value of the time length spent on tugs' changing positions is, as follows in the descending order: "Stand by to pull" to "Push," "Stand by to push" to "Stand by to pull," "Stand by to push" to "Pull," "Stand by to pull" to "Pull," and "Stand by to push" to "Push." In each case, there are 5 to over 10 seconds of delay time on average.

In addition, when a ship is navigating on a long tug line is used, it takes some more time a tugboat to change her positions. Taking for instance the case in which a tugboat changes her positions from "Stand by to pull" to "Push," the time length spent on her changing positions is shown in Figure 6 when a ship is navigating and in Figure 7 when a tug line of various lengths is used. It is essential to maneuver a ship with a prediction based on this delay time when she is navigating on a long line is used on board the ship which has higher freeboard.

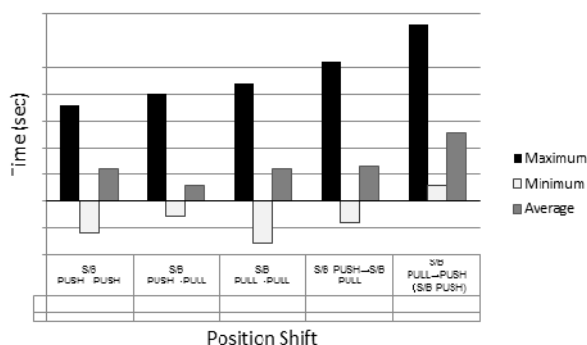


Figure 5. Transition time between tug boat's actions

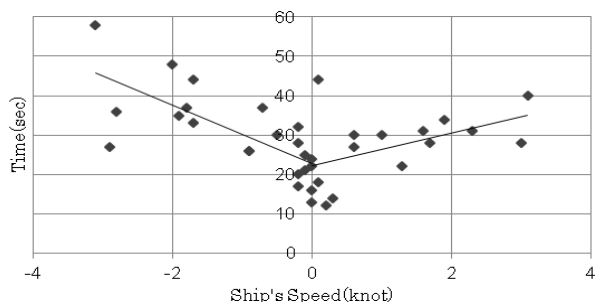


Figure 6. Transition time between tug boat's actions (S/B Pull → Push) by ship's speeds

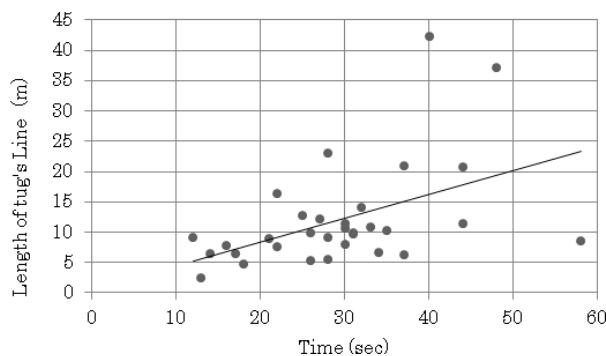


Figure 7. Transition time by every length of tug's line (From S/B Pull to Push)

## 4 CONCLUSIONS

In Japan, U.S.A., and Sri Lanka, as our research shows above, maneuvering orders for a tugboat are commonly given in the following order: motion, engine power, and direction. As for the orders for tug's movements, "Push" and "Pull" are used as the common terms in ports of all the countries.

However, the tug orders for her engine power and direction varies in each country. Especially in ports of Japan, some special terms of the orders for engine power and direction are used, and, moreover, pilots and tugboats communicate in Japanese, their local language. And it takes a certain amount of time for a tugboat to change her positions after her maneuvering orders given. The length of this time delay tends to become longer when the tugboat have to change her positions drastically (as in the case of her changes of motion from "Push" to "Pull" or vice versa), when there is a rather long distance between a ship and a tugboat (in which a correspondingly long tug line is used), or when the ship is moving though very slowly.

## 5 PROPOSAL

In the communication between a pilot and an operator of tugboat, some standard orders mutually agreed beforehand between them are general used, but these tug orders, as our research reveals, are not globally standardized yet, and these orders are used with rather locally agreed between them. In Japan, some maneuvering orders even not agreed between their users may be employed.

In the berthing operations, pilots are playing a pivotal role as a key person to provide necessary maneuvering orders to tugboats and ships, and to share information with ground staff on a wharf or pier. And also pilots are required to handle various operations at the same time while maneuvering a ship because they have to give engine power orders to each of the operators of multiple tugboats and the officers or quartermasters on board the ship. Moreover, they have to give tug maneuvering orders in anticipation of a time lag between when an order is given and when any necessary actions are taken and

completed, so it is absolutely essential for bridge team members to double-check the maneuvering intentions on pilots' side in order to ensure navigational safety. Here we recommend and propose that globally-standardized orders for maneuvering a tug are settled and included in SMCPs for the bridge team to serve its function for maritime safety.

## REFERENCES

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