

# Piloting challenges for Neo-Panamax ships on the Houston Ship Canal



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Many experts believe that the opening of the improved Panama Canal in December 2015 will bring ever larger container vessels to Gulf Coast ports in general, and Houston, US, in particular. The potential economic bounty that these ships could bring has prompted terminals and port authorities to plan, identify funding and invest in an infrastructure to accommodate this next generation of container ships. Likewise, the Houston Ship Pilots, as leaders in navigation safety and innovation, began planning nearly four years ago to overcome the challenges to navigational safety that the next generation of container ships will present.

## Overview of Houston Ship Channel

The Port of Houston is no ordinary port. It is consistently ranked first in the US in foreign water-borne tonnage, first in US imports, first in US export tonnage, and second in the US in total tonnage; it also has the second-largest petrochemical complex in the world. While there are over 20,000 ship movements along the 83km of the Houston ship channel (HSC) every year, there are over 125,000 inland tow movements as well. The larger beam vessels generally utilise the first 43 nautical miles of the HSC. This section has a channel width of 161.5m, making the HSC a unique shipping environment that combines a narrow channel with a substantial shipping and high inland tow-traffic density.

## How Houston pilots handle large vessels

Presently Panamax, Aframax, and the larger Suezmax (50m-beam ship) call on the Port of Houston. Any vessel over 36.6m beam is considered a widebody

vessel on the HSC and vessel length is restricted to 304.8m in length overall. To safely handle these vessels in a 24/7, two-way traffic environment, various navigational and safety guidelines are in place. These include daylight restrictions in some instances and maximum combined beam and draft limitations for ships meeting on the HSC. The Houston Pilots act as defacto harbour master or port scheduler; its 24/7 dispatch officer adjusts sailings and arrivals to prevent these wide-body ships from meeting in critical areas of the 161.5m-wide main channel.

As state licensed pilots, the Houston Pilots accomplish their mission of safely navigating these wide-body ships to and from their desired berths by striving to be the best trained and equipped mariners in the world.

## Pilot training

Initial training to become a Houston Pilot is a gruelling three-year process. The first six months includes piloting vessels under a senior pilot's supervision. After this time period, new pilots start off with smaller vessels and are gradually increased to a larger gross tonnage and draft incrementally each month. During their time off, they handle larger vessels (over their assigned tonnage) under the supervision of senior pilots again, being evaluated every time. Two senior pilots are utilised to supervise training on the wide-body ships. Trainees are also required to complete a training trip to every wide-body berth in Houston. The Houston Pilots have a comprehensive, continuing education programme that allows them to seek out training worldwide at a multitude of maritime training centres. Refresher 'core classes' can be taken every four years including manned, model ship handling,

emergency ship-handling, bridge resource management for pilots, and fatigue mitigation.

## Electronic navigation tools

Each of the Houston Pilots carries a Portable Pilot Unit (PPU) when boarding a vessel. For safety reasons they do not depend upon the ship's electronics alone. Instead, they carry their own hardware and software. Because they carry the same equipment every day, they are familiar with how to use it, its accuracy, and its limitations. The PPU system consists of a rugged laptop, software specifically written for ship pilots, a GPS, a rate-of-turn sensor, and an AIS device. The PPU is a more advanced version of the ship's ECDIS, providing the pilot with updated navigation charts and a plethora of traffic management and ship-handling tools. The PPU benefits the pilot by increasing safety, situational awareness, and decision speed.

To make these features effective in a narrow channel, you need to utilise an accurate positioning system. The Houston Pilots utilise DGPS with these PPUs to gain sub-meter accuracy when navigating. Each pilot carries his/her own DGPS/GPS antenna that is temporarily mounted outside with a clear view of the sky. In addition, each pilot is equipped with a rate-of-turn (ROT) device (also referred to as a swing meter) that provides accurate ROT information to the PPU (along with an AIS interface) utilising professional-grade gyro technology. This enables the pilot to fine-tune his ship handling skills during a turn or bend in the channel and assists the PPU software in generating an accurate, future-predicted position of the vessel.

The pilots utilise a secure, cloud-based network solution over the internet

A large container vessel on the Houston Ship Channel.



that publishes the positions of pilots in Houston to the other pilots, independent of AIS. This provides for accurate positioning between two vessels with pilots aboard, with update rates of about one second. This is crucial when vessels of this size are caught in unexpected periods of restricted visibility. This also enhances pilotage operations while addressing privacy concerns.

### Preparing for Neo-Panamax vessels

Although Neo-Panamax vessels exceed the current widebody and length criteria discussed previously, the Houston Pilots have been aggressively preparing for the

introduction of newer, larger vessels (up to 335.3m length and 45.7m beam) calling on the Port of Houston. Simulations have been funded and completed on full mission bridge simulators at the US Army Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi, and at the Maritime Institute of Technology and Graduate Studies in Baltimore, Maryland. These simulations included meeting situations on the channel and surge-and-sway simulations for vessels moored nearby while these larger ships pass.

Considering the 335.3m x 45.7m-size vessels would eventually be eclipsed by the Neo-Panamax vessels (365.7m x 48.7m), the Houston Pilots started two

more initiatives that included funding the development and construction of a Neo-Panamax 1/25th-scale ship model. This model ship not only accurately exhibits the same manoeuvring characteristics of a Neo-Panamax container ship in a shallow confined channel, but also reveals the obstructed visibility from the conning bridge common with this type of ship.

The auxiliary channel to one of the container berths in Houston has also been modelled at the training lake in Covington, Louisiana. Pilots are able to conduct manned model training in this scaled version of the Houston Ship Channel with a Neo-Panamax-size vessel. To enhance pilot training and



analysis of manoeuvres, the model is also fitted with a centimetre-accuracy RTK positioning system.

In addition to the manned model, the Houston Pilots initiated a collaborative agreement with a local college to purchase and operate a full-mission ship bridge simulator. The simulator, along with the manned model, will be used for both pilot training and to provide data for the future HSC and container terminal dredging so that they may eventually receive the Neo-Panamax vessels. The tested data will help to produce new channels that are safe, and cost effective for the Port of Houston.

The Houston Pilots Rules & Safety Committee members have travelled to Savannah, Georgia, where some of the Neo-Panamax-size vessels have already started arriving. They have conducted ship rides on these vessels and interviewed both onboard masters and local pilots to help ascertain manoeuvring aspects of these vessels, as well as increased mooring tug requirements for vessels of this size in restricted waterways.

### Going forward

The Houston Pilots have invested significant funds and man-hours to prepare for the eventual arrival of Neo-Panamax vessels. Ideally, the 161.5m main channel should be widened (dredged) to accommodate these extremely large vessels. Interim dock modifications and dock dredging are already underway at some of the container berths in Houston, however there are no plans to widen the main channel at this time.

Further study will be required to see if safety restrictions can be put in place at all to receive these vessels at the Port of Houston. This may include updated weather criteria and further, maximum, combined beam restrictions between larger vessels; and possibly one-way traffic. Traffic management may also be required so that all commerce will be

minimally impacted by the arrival/departure of these vessels.

As state licensed Pilots, the Houston Pilots remain committed to accomplish

their mission of protecting the public interest by considering all safety aspects for the arrival of any large vessel – even if that may be contrary to economic interests.

### About the authors

Captain Jonathan Samuell currently serves as eNavigation committee chairman for the Houston Pilots. He is also the representative for the Houston Pilots on the American Pilots Association NAVTECH committee. He is also an active Houston Pilot, conning vessels in and out of the Port of Houston on a regular basis. Captain Samuell holds an unlimited Master Mariner's license as well as an endorsement as offshore installation manager – unrestricted. He has more than 22 years working at sea.

Captain Plunkett graduated from the Coast Guard Academy in 1987 and has Masters degrees in Chemical Engineering, and National Security and Strategy. His 24 years in the US Coast Guard include serving as part of the US delegation to the IMO, responding to numerous high consequence oil and chemical spills as Federal On-scene Commander, and acting as captain of the port in Port Arthur, TX. He retired from the Coast Guard in 2011 and currently serves as port agent for the Houston Pilots.

### About the organisation

The Houston Pilots serve a crucial role in ensuring safety of vessels at the Port of Houston by boarding all ships departing or bound for Houston. They take direct command of these vessels or transfer directions to a ship's captain while navigating the 83km-long Houston Ship Channel. The primary responsibility of a Houston Pilot is to protect the public interest by facilitating the safe and efficient movement of vessels in State of Texas waters along the Houston Ship Channel and Galveston Bar. This includes not only the safety of the vessel they are conning, but also safeguarding all of the port's assets, including the docks, linemen, lineboats, tugboats utilised in docking/undocking, and facilitating the safe flow of commerce along the Houston Ship Channel.

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