Appendix L

Ship Simulation Report

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in Federal documents be accessible to individuals with disabilities. The USACE has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the USACE at (409) 766-3108 or at SWG201900067@usace.army.mil if they would like access to the information.

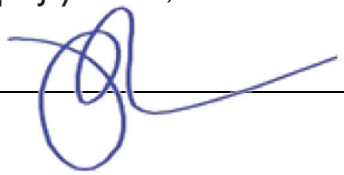
Environmental Impact Statement – Feasibility Study



Contents

Introduction 3
Legal Disclaimer 4
Process 5
Database Development 5
Simulation Run Matrix 12
Simulation Preparation, External Testing, and Validation 12
Simulation process & sequence of events 18
Participants 18
Sequence of events 19
Data collection Process 20
Recommendations and conclusions 27
Appendix A: Contract 30
Appendix B: Project Attendees 31
Appendix C: Run Matrix 32
Appendix D: CAD Drawings 33
Appendix E: Hydrodynamic Modeling Information 34
Appendix F: Pilot Cards 35
Appendix G: Pilot Questionnaire 36
Appendix H: Run evaluation forms 37
Appendix I: Simulator Log Files 38

Introduction

Study Name	Environmental Impact Statement – Feasibility Study
Project Location	Corpus Christi Ship Channel – Harbor Island, TX
Purpose	To assist Riben Marine and Freese and Nichols with simulation studies for completion of an Environmental Impact Statement (EIS).
Customer	Riben Marine, Inc. and Freese and Nichols
Vendor	Seamen's Church Institute of NY and NJ 50 Broadway Floor 26 New York, NY 10004
CME Contact	Center for Maritime Education 9650 High Level Road Houston, TX 77029 Stephen Polk T: (713) 674-1236 F: (713) 674-1239 spolk@seamenschurch.org
Release Date	March 1, 2022
Project Lead(s)	Capt. Stephen Polk, Director, Center for Maritime Education 
Authorized Signature	Capt. Jay Rivera, Riben Marine 

Legal Disclaimer

With respect to the Seamen's Church Institute (SCI) simulator, databases, and models used for this study, the inspection, review, accuracy, and acceptance is validated by the customer and the participants prior to the study. SCI cannot accept liability for the findings, conclusions, or recommendations provided by the participants in this simulation study, nor can SCI be responsible for errors within data provided by the clients, or third parties used for programming of the simulator, hydrodynamic models, and databases. Key to any successful simulation is the accuracy of the data programmed into the simulator. SCI creates its simulations based upon information provided and approved by the client. The quality of this data has an impact on the accuracy of these test results.

The 6DOF hydrodynamic-vessel VLCC models used in these simulations are based upon data supplied by the ship builder to Kongsberg Maritime, and validated to 'Pilot Grade' standards, the highest quality available. These models have been vetted by experienced pilots, mooring masters, subject matter experts, SCI staff members, and additional customers. These models provide an idealized approximation of the classes and types of vessels which would be used in real world conditions. Specific vessels in the real world could handle differently from the simulator vessels utilized based on varying specifications and equipment on board. While a set of worst-case environmental factors were tested based on supplied data, the model behaviors can vary based on the dynamics introduced by real world changes in current and wind forces.

While SCI's simulator system provides a close approximation of vessel squat in shallow water, additional safety margin needs to be used to consider channel depths, tidal action, vessel speed and other continuously changing environmental factors. Water currents were modelled by engineering firm, Baird for the Harbor Island area simulated. Current models were constructed using 3D bathymetric meshes to represent future with permit (FWP) profiles for the channel.

The ship models used for the study and model information can be found within Appendix F. The VLCC models selected for this study was VLCC18, an existing pilot grade model in which the draft of the hull was tuned to meet the project specifications for the following configurations:VLCC18Q – 52' even keel, VLCC18R – 68' even keel, and VLCC18L – fully loaded 73' 9" draft.

The tug used for the study was Tug60 which was recently validated by Kotug, Riben Marine, and SCI staff. The tug was designed by Robert Allan, Ltd. for Riben Marine, and built by the STAR Center in Dania Beach, FL modeled hydrodynamically by their hydrodynamicist on staff using the Kongsberg modelling tool (HDMT) licensed and supplied by Kongsberg Digital.

Due to the tug requirements and available ownship bridges we also used one simulated tug for the study. The simulated tug features of the simulator provide a realistic simulation of an assist tug but is not as accurate as a captain in a tug bridge on the full-mission simulator. A simulated tug controlled by the simulator operators were used to control the robot tug during the study.

The results assume that experienced pilots will be manning the seaworthy vessels during real world maneuvers, and all vessels will meet the minimum safety standards and practices.

Operational limits should consider the actual tug and ship capabilities, and the need for all local pilots and mariners to have experience. Limitations can be gradually reduced as pilots and tug masters gain experience.

Process

In February 2021, Riben Marine contracted the Seamen's Church Institute (SCI) for the performance of a port study and environmental impact statement to assist with feasibility for updated channel configurations and dredge profiles, current flow models, and validate tug requirements for safe transit, and determining operational environmental limits for fully loaded VLCCs.

Database Development

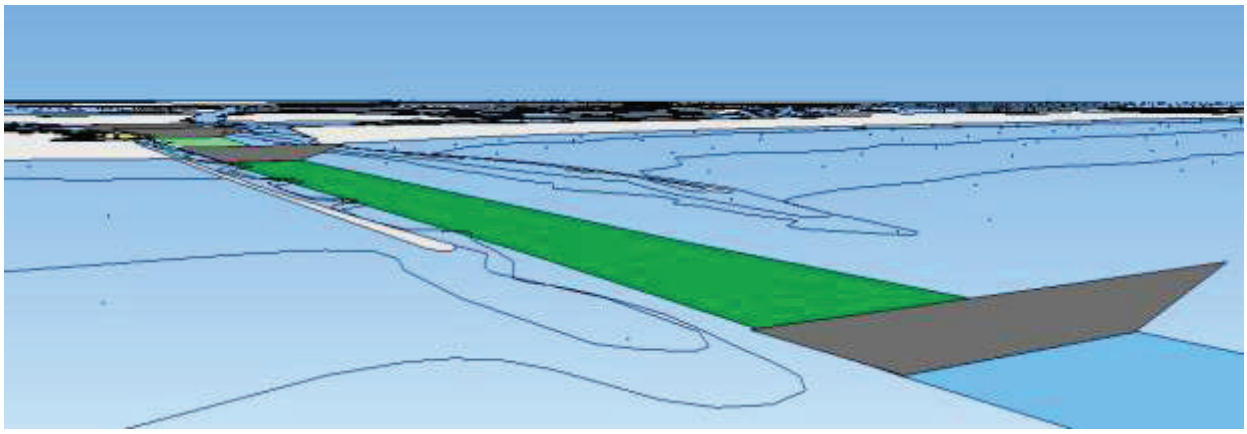
Accuracy of existing database area

This visual database of the Corpus Christi/Harbor Island area was produced and maintained by SCI in Houston. Matt Hyner serves as SCI's Visual Database and Development Manager at the Center for Maritime Education. Matt developed the Corpus Christi database in a Flat Earth projection and WGS84 datum based upon a 2019 NOAA ENC Chart, and SRTM Elevation data. Upon commencement of this project, SCI was sent CAD files curated by Freese and Nichols for the dredge profile of the Corpus Christi Ship Channel, including Harbor Island Crude Terminal (HICT) as well as the Axis Terminal.



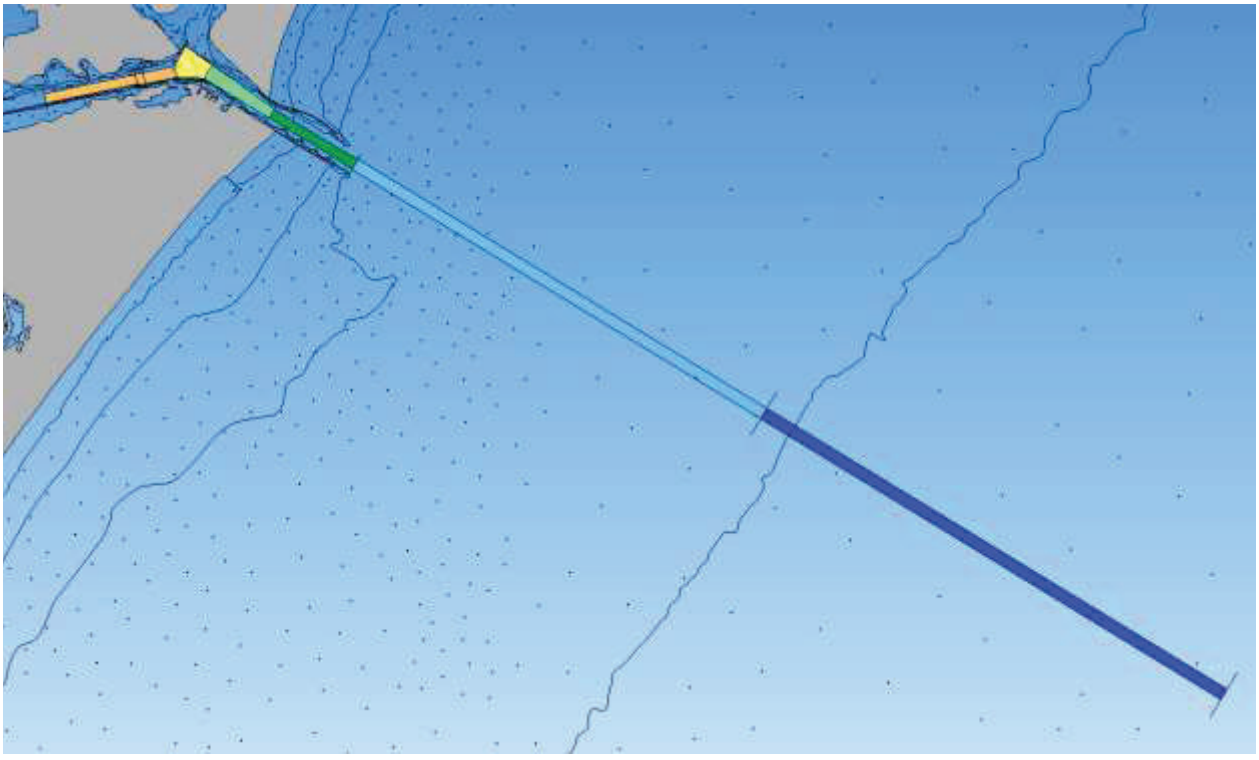
Area of the project

The source data for the database files were converted into WGS84/Flat Earth Projection to properly align them with Presagis and Kongsberg's database building tools. Upon inspection of the final CAD files, no issues were found with the alignment to SCI's existing visual database.



Depth Generation

This study involved the creation of a new depth file based upon the dredge profiles provided for this project in the source data, Appendix D, "PCCA_X-Sections_8.5x11 Final Channel Alignment for 75ft Ship.pdf". Measuring the base of the dredge slope, the widths were confirmed to match the CAD dimensions.



Dredge Profile Layout

New contours were traced along the 3D cutaway and integrated with NOAA's iENC chart data for the area. Additional contour modifications were next made to integrate the Harbor Island Crude Terminal (HICT) and Axis Terminal. The final dredge contours along with the charted depth contours were triangulated into a new mesh depth file using Kongsberg's area generation tools to create the final depth file for the area. These contours were then brought over to the Instructor Map to represent the new profile visually for the simulator operators during simulation runs. The visual 3D model of the area is based upon an existing SCI Training database as populated with trees and cultural features based on photographic reference material from a 2015 site survey when they database was initially created. Additions to the database for terminals at AXIS, HICT, South Texas Gateway and MODA were incorporated and based upon earlier updates to the original area.

Hydrographic Model

A MIKE3 Flexible Mesh Hydrodynamic Model (HD Model) was developed to simulate the hydrodynamic conditions in the Corpus Christi area by Baird for the Corpus Christi Ship Channel, the approaches, and Harbor Island area. The current model provides currents at each cell node within the domain and vertically at approximately 2m intervals. The currents within and adjacent to the channel were extracted for direct input to the ship simulation model. Additionally, Baird provided snapshots of modeled currents along the water column depth every two meters at five various data points A – F (shown below).



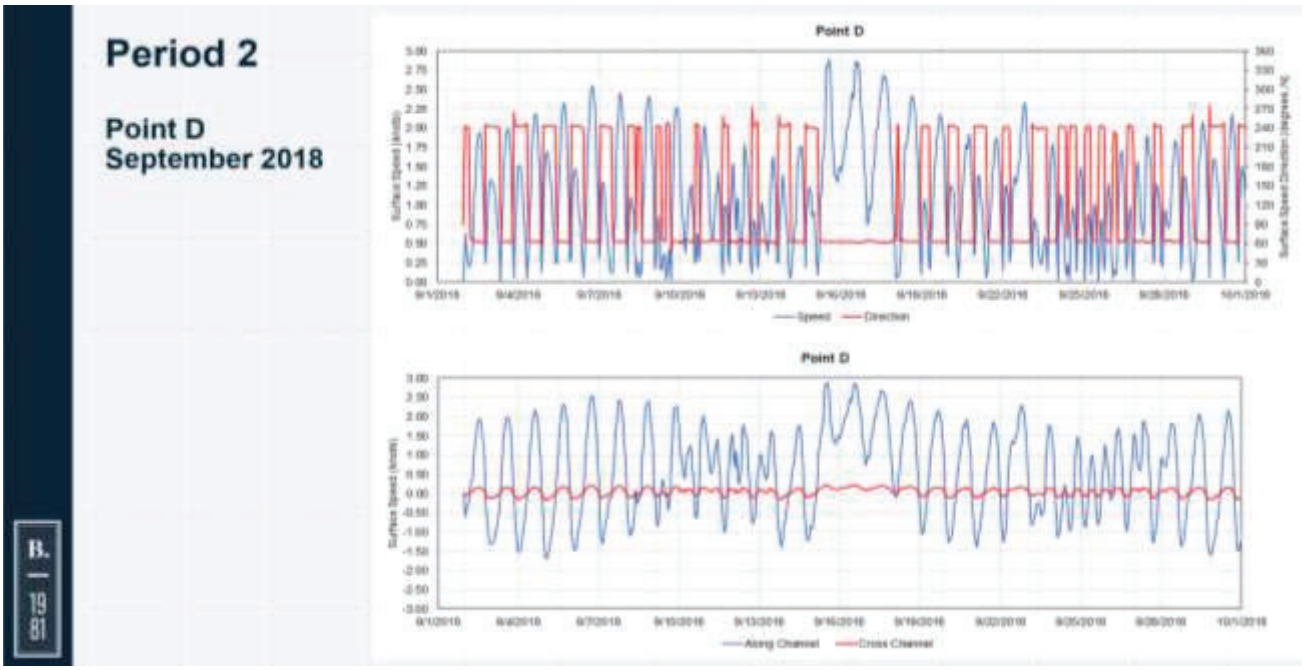
Current meter data points A through F

Data from the model was exported from MIKE into an ETD file, with velocity and heading updated every 15 minutes. Current models were constructed using 3D bathymetric meshes to represent a future with project – FWP dredge profile for a 75' MLLW maintained depth. The Baird current model was based on maintained channel depth, not including advanced

maintenance or allowable over dredge. The current data provided by Baird was kept in the original .ETD format and loaded for each corresponding run matrix parameters. Below illustrates the information for the current models provided.



Flow model showing data points and water strata (in red) 3D layered current



Corresponding data of the information from the flow model Sept 2018

Riben Marine and SCI staff reviewed three months of hydro analysis provided by Baird and found the best snapshots of six possible current profiles, Ebb – low, medium, and high, and

Flood – low, medium, and high; for the FWP profile. The information below are the snap shots chosen to simulate and validate the current flow models.

Offshore Currents			Inland Currents		
Flow	File & Time Stamp	Velocity	Flow	File & Time Stamp	Velocity
North high	P03 - 9/22/2020 @ 1000	0.9 knots	Ebb high	P03 - 09/22/2020 @ 1000	2.5 - 3.0 knots
North medium	P06 - 11/25/2018 @ 0400	0.5 knots	Ebb medium	P02 - 09/15/2018 @ 1300	2.0 - 2.4 knots
North low	P01 - 07/25/2020 @ 0800	N/A	Ebb low	P09 - 09/06/2018 @ 1600	1.3 - 1.6 knots
South high	P01 - 07/25/2020 @ 0300	1.5 knots	Flood high	P01 - 07/25/2020 @ 1500	2.5 - 3.1 knots
South medium	P10 - 09/13/2018 @ 1900	0.9 knots	Flood medium	P01 - 07/25/2020 @ 0800	2.0 - 2.4 knots
South low	P10 - 09/13/2018 @ 2100	0.6 knots	Flood low	P08 - 09/06/2018 @ 0400	0.9 - 1.3 knots

Development of Simulator Exercise Matrix and Study Objectives

A matrix of the exercises to be run, was carefully crafted, reviewed and refined to include those exercise conditions that would best cover the simulation study objectives, which include:

1. Validate channel configuration, approaches to any future terminal developments at Harbor Island;
2. Validate current models and their effects on vessels in the proposed channel. The current models will be created and provided by Baird. The model current's effect on the vessels transiting the channel will then be validated to ensure its realism and accuracy;
3. Develop and validate number and size of tugboats/assist vessels necessary for transit and stand by;
4. Determine operational environmental limitations (wind speed, current flow, current direction, visibility) for vessels approaching and departing facility, if any; and
5. Identify necessary vessel traffic control and vessel monitoring procedures to protect any future terminal developments on Harbor Island, monitor passing vessel traffic, and vessels engaged in cargo transfer operations at the facility.

The variables considered in the development of the run matrix included:

Vessel Types – Three versions of VLCC18 were used. The model VLCC18 was modelled after the "Elizabeth I. Angelicoussi" developed using source documents provided by Daewoo Shipbuilding & Marine Engineering Company, LTD, Project *Kristen 306,000 TDW Cruse Oil Tanker*, Project no. 5194. VLCC18Q was used to simulate the model in a 52' draft even-keel partially-loaded condition, VLCC18R was used to simulate the model in a 68' draft even-keel condition, and VLCC18L was used to simulate a 73' 9" draft fully-loaded condition.

Pilot cards for the vessels used in the study are in Appendix F. The "pilot grade" models were used for the simulations – which are described as having *high-hydrodynamic quality* and additionally have been validated by numerous pilot associations, mooring masters, ship owners, and research firms.

Ship models	Vessel Class & Type	DWT (mt)	Deepest Draft	Year Built	LOA	Beam	Engine & Propeller Type	Max Power (hp)	Rudder Type & Max Angle
VLCC18Q "Elizabeth I. Angelicousi" (52' even keel draft)	VLCC Tanker	257,855	15.8m	2004	332m	58m	Diesel, FPP	40,015	Semi, 35°
VLCC18R "Elizabeth I. Angelicousi" (68' even keel draft)	VLCC Tanker	306,229	20.73m	2004	332m	58m	Diesel, FPP	40,015	Semi, 35°
VLCC18L "Elizabeth I. Angelicousi" (Loaded)	VLCC Tanker	340,888	22.49m	2004	332m	58m	Diesel, FPP	40,015	Semi, 35°
TUG60 "ART120-35W" Rotor Tug	Harbor Assist Tug Boat	1,372	8.08	2021	36.25m	14.55m	Diesel, CPP	10,441	Azipod, 360°

Models used for the study

Tug size, horsepower, placement, and numbers used – Custom designed tugs by Robert Allan, LTD were used (Tug 60) based on customer requests. The decision to utilize 120 MT bollard pull rotor tug was based on project needs and pilot requests, and the decisions to utilize five tugs during the simulations was strictly based on pilot recommendations, procedures, precautionary measures, and local ordinary practice for the ACC Pilots. The target (tug 60) *simulator-tug* used with an understood max rating of 120-metric ton bollard pull instructor-controlled tug. With SCI's simulator configuration of 5-full mission bridges, one simulator as the ship bridge, and the other four bridges as ship-assist tug bridges, so that the simulations could maintain a minimum of five harbor tugs which were needed to perform this study. Additionally, hydraulic winch controls installed in the tug bridges provided tug captains the ability to easily heave in or payout hawsers as needed or required for ship assist work.



Tug 60



Outbound ship maneuvering with ship assist tugs

Wind Condition – Wind was a variable used within the matrix, North wind of 25 knots was used and SSE winds of 25 knots was loaded to either enhance the flood or ebb tidal current. The idea was to simulate the most challenging circumstances to help identify operational limits, safety margins, and what control measures may be needed to minimize risks.

Current condition – Current models used were provided by Baird for the simulations and loaded according to run matrix parameters.

Waves and swell condition – The Kongsberg system uses wind speed to model wave height according to the Beaufort scale. Using the UKC report provided by Baird, in appendix E, SCI programed two wave files in the simulator. The SSE wave file simulated 2m swell at 7.3s between the end of the jetties and the pilot boarding area. With a 1m wave at the end of the jetties, and minimal wave once inside the jetties. The N wave file simulated a 2m swell at 7.3s between the end of the jetties and the pilot boarding area, and a 1m wave at the end of the jetties. This information closely approximates the data provided by Baird for the same areas.

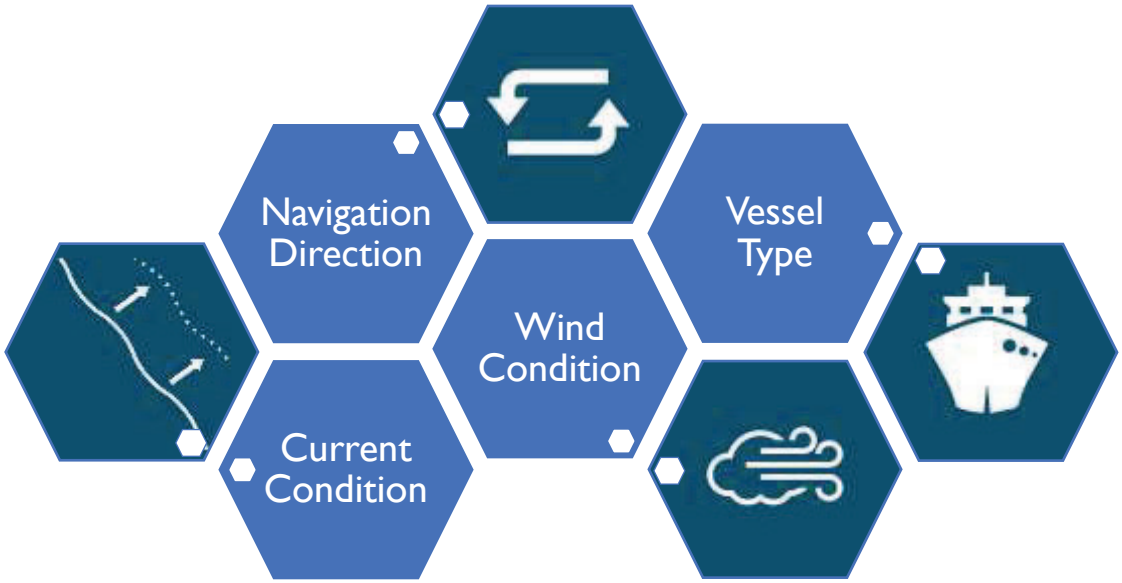
Navigation Direction – Vessels were run inbound and outbound, simulating typical arrivals and departures, for HICT, including VLCCs at various drafts.

Dredge profile configurations and channel dimensions – The depth and fairway files SCI used were built for future with permit (FWP) and that corresponding dredge profile.

We then loaded the VLCC models with the proper drafts according to the dredge profile needed and run parameters.

Simulation Run Matrix

To document the precise conditions encountered during each simulation exercise the team designed a matrix of run parameters (see Appendix C for all matrixes developed). This matrix outlines the various conditions tested, vessel types, sizes, wind, and tidal flows. The run matrix was designed to capture and test each variable to best capture and understand the various navigational safety requirements.



The plan is always to conduct each simulation run once, with the possibility of some runs being performed multiple times either due to complexity, challenge, or simply providing multiple pilots an opportunity to conduct it for themselves.

Simulation Preparation, External Testing, and Validation

Each simulator exercise was configured in accordance with the run matrix parameters agreed upon during preliminary phases. SCI expected each departure simulation to last approximately 12 to 15 minutes, with the approach simulations running about 20 to 40 minutes. Immediately following the simulation, participants would be given standard questions (run survey) which we updated in preparation for the actual study.

During the external testing and validation which occurred on January 10-14, 2022 with participation from Riben Marine, and various tug captains with operational knowledge of the harbor, the validation stage tested the conditions for in bound VLCCs with a 52' draft inbound and loaded VLCCs with a 68' draft outbound using the FWP current channel dredge profile and Baird's current files using tug60.

Run Matrix – planned

The run matrix planned (shown below) illustrates the final plan for the week. We eliminated the Axis runs and most "head-in" scenarios, due to the emphasis on running simulations which are most likely to occur.

run #	location	destination	Depth	Draft			Inshore Current				Offshore Wind Current					tug	
			81'	52'	68'	74'	2.5 N Ebb Med	2.5 N Ebb High	2.5 SE Flood Med	2.5 SE Flood High	N Med	N High	S Low	S Med	S High	120	comments
1	Sea	Jetties	x	x							x					x	familiarization
2	Sea	Jetties	x	x								x				x	familiarization
3	Sea	Jetties	x	x										x		x	familiarization
4	Sea	Jetties	x	x											x	x	familiarization
5	Jetties	HI W	x	x			x									x	max tug power
6	Jetties	HI W	x	x				x								x	low score
7	Jetties	HI W	x	x					x							x	max tug power
8	Jetties	HI W	x	x						x						x	max tug power
9	Jetties	HI E	x	x			x									x	max tug power
10	Jetties	HI E	x	x				x								x	low score
11	Jetties	HI E	x	x					x							x	max tug power
12	Jetties	HI E	x	x						x						x	max tug power
13	Ferries	Jetties	x	x			x									x	passing vessel speed
14	Ferries	Jetties	x	x				x								x	passing vessel speed
15	Ferries	Jetties	x	x					x							x	passing vessel speed
16	Ferries	Jetties	x	x						x						x	passing vessel speed
17	Ferries	Jetties	x		x		x									x	passing vessel speed
18	Ferries	Jetties	x		x			x								x	passing vessel speed
19	Ferries	Jetties	x		x				x							x	passing vessel speed
20	Ferries	Jetties	x		x					x						x	passing vessel speed
21	HI W	Jetties	x		x		x									x	max tug power
22	HI W	Jetties	x		x			x								x	low score
23	HI W	Jetties	x		x				x							x	max tug power
24	HI W	Jetties	x		x					x						x	failure
25	HI E	Jetties	x		x		x									x	low score
26	HI E	Jetties	x		x			x								x	low score
27	HI E	Jetties	x		x				x							x	max tug power
28	HI E	Jetties	x		x					x						x	max tug power
29	Jetties	Sea	x		x						x					x	not run
30	Jetties	Sea	x		x							x				x	not run
31	Jetties	Sea	x		x									x		x	max tug power
32	Ingleside	HI W	x	x			x									x	max tug power
33	Ingleside	HI W	x	x				x								x	max tug power
34	Ingleside	HI W	x	x					x							x	max tug power
35	Ingleside	HI W	x	x						x						x	max tug power
36	Ingleside	HI E	x	x			x									x	max tug power
37	Ingleside	HI E	x	x				x								x	max tug power
38	Ingleside	HI E	x	x					x							x	max tug power
39	Ingleside	HI E	x	x						x						x	max tug power
40	HI W	Jetties	x			x	x									x	failure
41	HI W	Jetties	x			x				x						x	failure
42	HI E	Jetties	x			x		x								x	not run
43	HI E	Jetties	x			x			x							x	not run

PCCA TUG STUDY run survey - Pilots

1. Pilot Name: _____

2. The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. *1 being the channel is inadequate and 5 being the channel is adequate.*
   ◯1 ◯2 ◯3 ◯4 ◯5

3. If the channel configuration was inadequate in any way, please explain why.

4. Did the ENVIRONMENTAL FORCES (current, wind, wave) exceed the operational limitations of your vessel?
   ◯ Yes ◯ No

5. If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.

6. The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. *Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.*
   ◯1 ◯2 ◯3 ◯4 ◯5

7. If the tug configuration was not adequate, please explain why.

8. The overall safety, stress and difficulty level of this run was: *Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging, and.*
   ◯1 ◯2 ◯3 ◯4 ◯5

9. If not safe, please explain why.

10. Run was _____ based on run parameters
    ◯ Successful ◯ Unsuccessful

11. If the run was not successful, please explain why.

PCCA TUG STUDY run survey – Tug Captains

ART 120-35W Validation – Tug Survey

1. Tug Captain Designator: _____

2. Tug Type: ◯ Robot Tug ◯ Rotor 90 MT ◯ Rotor 120 MT ◯ Rastar 80 MT

3. Tug Test – ***[drop drown]***

   Free running speed fwd
   Free running speed aft
   Free running speed athrwartship
   Bollard pull ahead
   Bollard pull astern
   Escort performance C/L aft
   Acceleration assist C/L fwd
   Acceleration assist/Escort performance off fwd winch P/S shoulder

4. Tug Location – Beginning: ***[drop down]***

   Center lead aft
   Port B1
   Port B2
   Port B3
   Port midship
   Port quarter
   Port transom
   Center lead front
   Starboard B1
   Starboard B2
   Starboard B3
   Starboard midship
   Starboard quarter
   Starboard transom

5. Tug Location – End: ***[drop down]***

   Center lead aft
   Port B1
   Port B2
   Port B3
   Port midship
   Port quarter
   Port transom
   Center lead front
   Starboard B1
   Starboard B2
   Starboard B3
   Starboard midship

Starboard quarter
Starboard transom

6. The tug perfomed/reacted as expected (COMPARISON TO DATA SET) to include (maneuverability, Z drive speed, thrust, vessel motions). *Please rate this statement based on – 1 being not as described and 5 equal to description and provided data).*
◯1 ◯2 ◯3 ◯4 ◯5

7. If the tug performance/beahvior were not as expected, please explain why.

8. Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?
◯Yes ◯No

9. If any of the environmental forces caused vessel operational limits to be exceeded, please explain why, and if the forces prevented you from performing any specific maneuver, what occurred.

10. The tug configuration and performance were adequate. *Please rate based on - 1 being unsatisfied with the tug configuration and 5 being satisfied with the tug configuration.*
◯1 ◯2 ◯3 ◯4 ◯5

11. If the tug configuration and performance was not adequate, please explain why.

12. The overall safety, stress and difficulty level of this run was: *Please rate the based on –1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.*
◯1 ◯2 ◯3 ◯4 ◯5

13. If not safe, please explain why.

14. Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?
◯Yes ◯No

15. If Yes, please explain why.

16. Did you feel that you were asked to operate at max power for an extended period of time?
◯Yes ◯No

17. Run was _____ based on run parameters
◯Successful ◯Unsuccessful

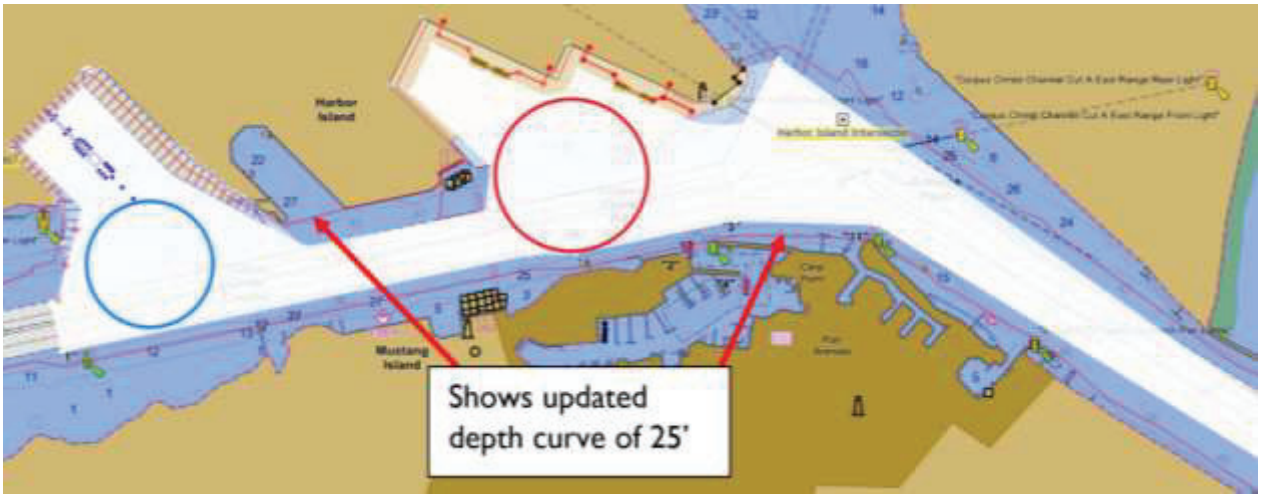
18. If the run was not successful, please explain why.

Pictured below is the base area we used for external testing and validation.



Instructor Station Area Map

The modified navigation chart below shows the updated dock facility and channel limits which was provided in each pilothouse to reflect changes not yet visible on a navigational chart. SCI staff generated a GPX file to be displayed onto Rosepoint ECS so that operators could tell when they were getting close to the edge of the channel to avoid running aground.



Base ECS chart view – with dock and database changes showing channel limits

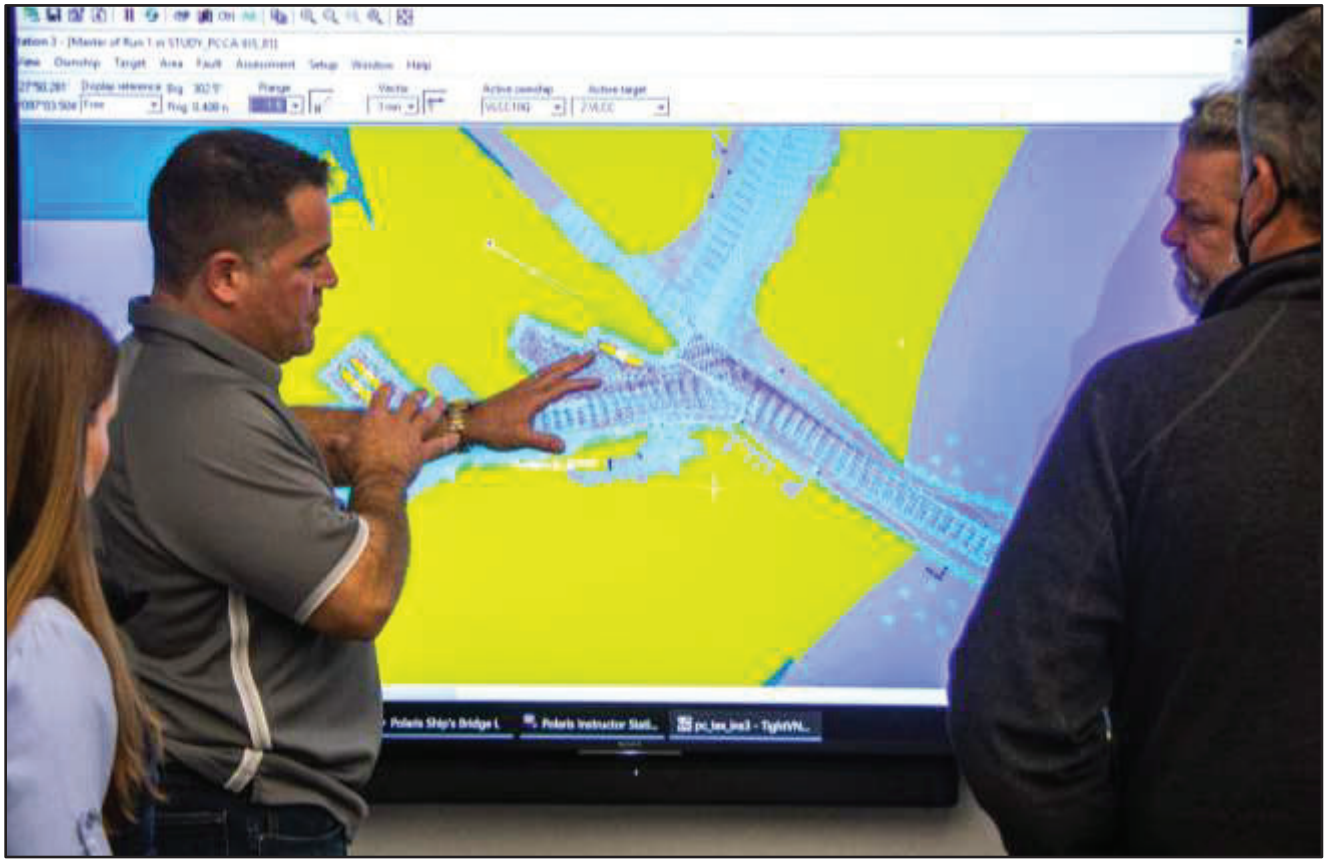
Adding this was helpful for the participants to do a comparison between the navigation chart and the database used at SCI showing the improved channel. The depth file (.DCS) used was provided by data supplied by Freese and Nichols.

Simulation process & sequence of events

Participants

For the simulation phase the project team assembled in Houston, Texas at SCI's facility on January 31 – February 3, 2022. Over the course of the 4-day session the following entities were represented:

- Capt. Mike Kershaw
- Riben Marine
- Aransas-Corpus Christi Pilots Association (ACC Pilots)
- Freese and Nichols
- Seamen's Church Institute (SCI)



Riben Marine debriefing the simulations with representatives from the ACC Pilots

Sequence of events

On commencement of the simulation phase of the project the participants of the study arrived at SCI where they filled out pilot questionnaires, SCI staff explained the run matrix, as well as the expected timeline of events. The team assembled in the briefing room, conducted a facility safety brief, everyone introduced themselves, and a project briefing was provided for the mariners participating in the study who were not present during the testing phase. SCI explained the process of how the study was to be conducted, the study objectives, vessel models used, tug configurations, and environmental conditions. SCI staff advised the group that the Kongsberg simulator can easily determine when *any* vessel runs aground, experiences a collision, or an allision during a simulation, and due to the close tolerances and the operational limits of the VLCC we can easily determine a PASS vs. FAIL. Therefore, if any vessel in a simulation harbor tug or VLCC experienced a problem it would be recorded as a "FAIL" and marked on the survey accordingly.

The sequence of simulation order was decided by pilot preference. Once SCI had the order of simulations to be performed, a pilothouse orientation was conducted. SCI performed a familiarization simulation allowing the participants to become familiar with operational aspects of the simulator. During the study if an exercise was needed to run multiple times, the numbering system was used: 1, 1.2, 1.3, 1.4, and so on. The actual runs performed, and their corresponding score (averaged) are shown below:

Averaged matrices for the week

Data collection Process



After each simulator run attempt from the matrix listed above the participants document their findings on detailed surveys. This process for data collection occurs after each simulation and is uploaded in real-time after each simulator run. Copies of the original and completed survey data can be found in Appendix H.

SCI needed to perform 44 runs over 4 days, therefore, we would need to conduct roughly 11-12 simulation runs per day, to allow for multiple attempts, if requested because of a fail or due to participant requests.

SCI staff reminded participants to exercise caution when working near the stern of a ballasted VLCC (pictured to the right), because of the difficulties operating in push mode near a due to the curvature of the hull. Tugs working at these problematic locations aft of the bridge wing were only operated in "pull" mode to account for this real-life limitation.



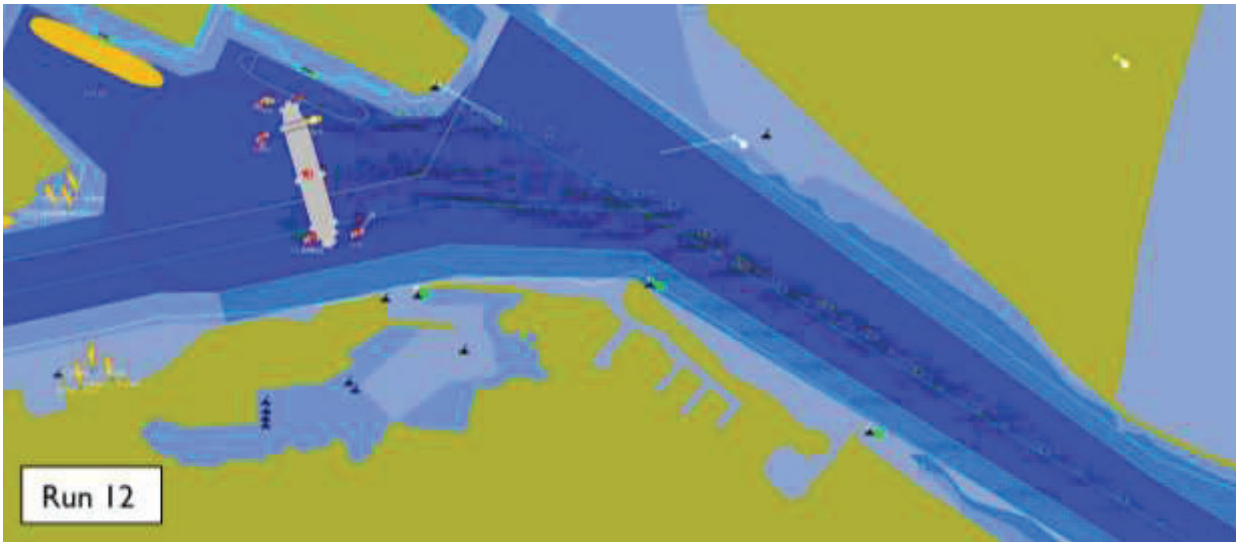
DAY ONE

On day one of the study, we performed 12 runs, specifically runs 2, 3, 3.2, 7, 7.2, 9, 12, 14, 15, 27, 32, and 34. The focus of day one is to target inbound runs to HICT with a VLCC loaded to 52' with medium current flows for pilot group one. The second objective was to slowly increase environmental conditions with a lighter loaded ship, prior to increasing to max flood and ebb flows with a fully loaded ship, which was scheduled for day two and day four for the respective pilot groups.

We experienced one failure on day one (run 3) pictured below, where the ship ran aground during a familiarization run, the rest of the simulations were successful runs for day 1.



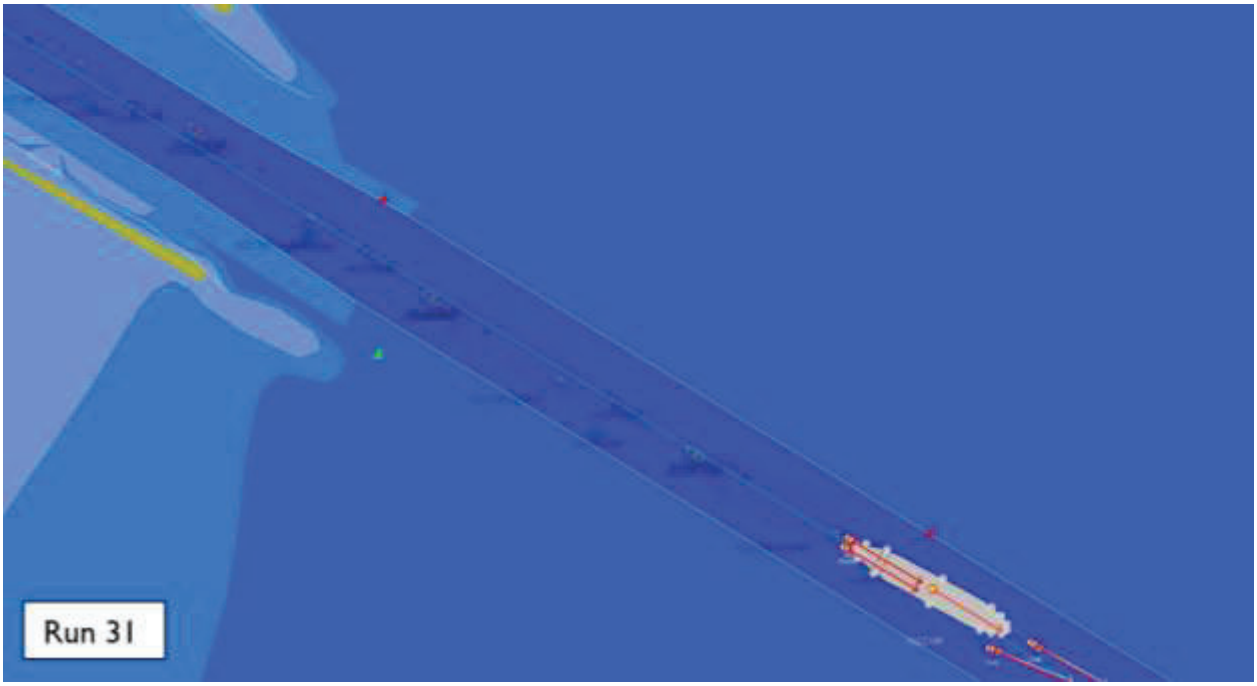
Shows stern of VLCC aground with medium flood velocity at the intersection



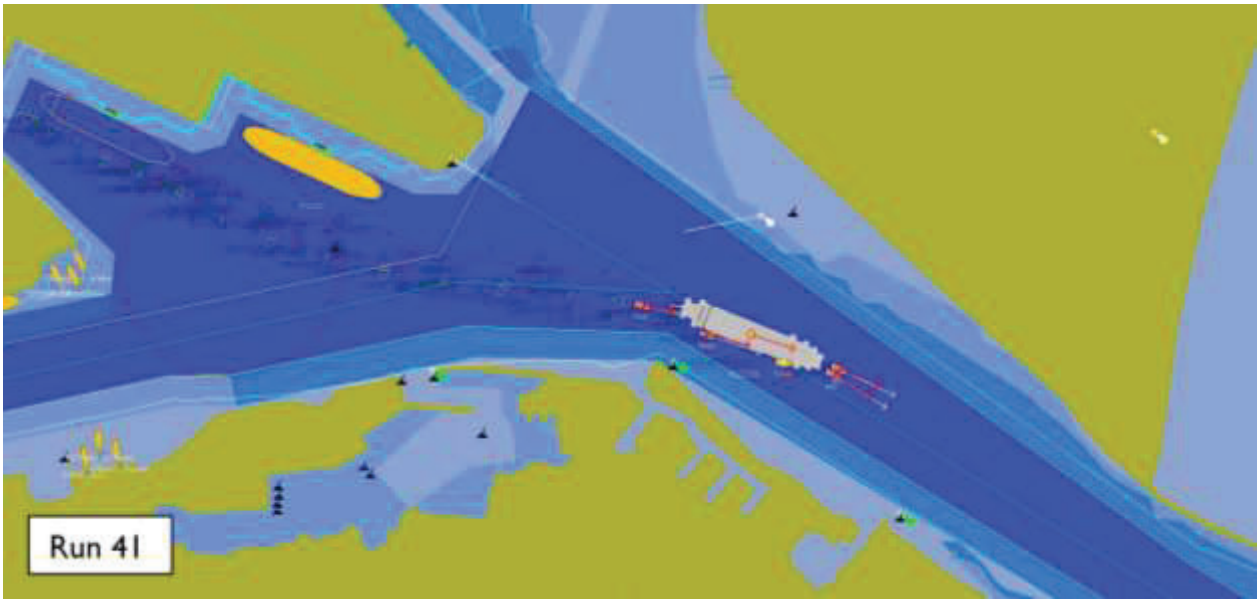
Showing a 52' VLCC maneuvering in a high flood tide to HI East Berth

DAY TWO

On day two of the study, we performed 12 runs, specifically runs 17, 20, 21, 24, 26, 30, 31, 37, 38, 40, 41, and 42. For day two scenarios we focused on running exercises with the fully loaded VLCC with a 68' draft and high flood and ebb tide environmentals. There were no failures on day 2 with pilot group one.



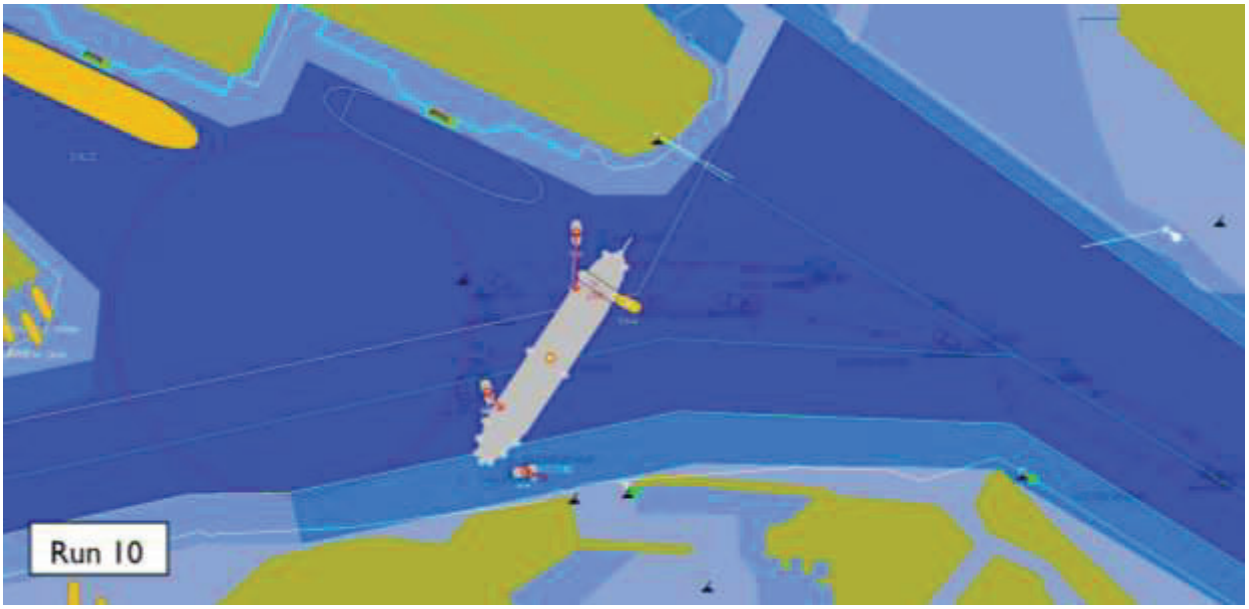
Fully loaded VLCC maneuvering with a 0.9 knot Southerly set near the end of the jetties



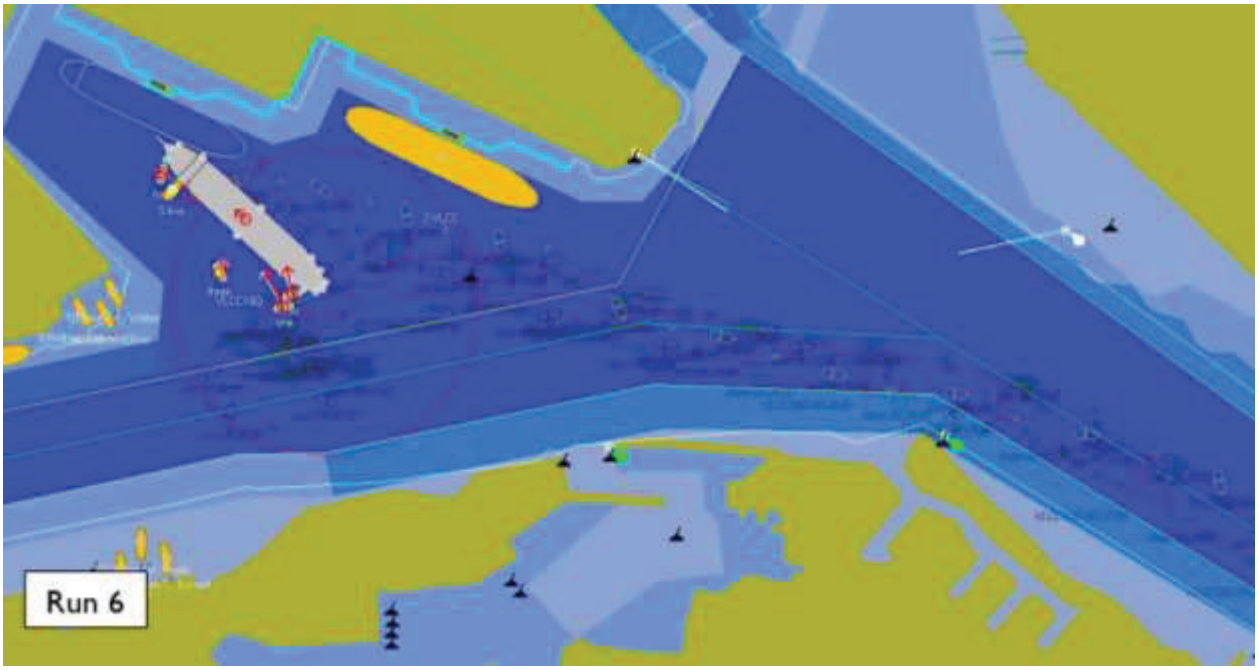
74' loaded VLCC outbound from HI-West with a high flood

DAY THREE

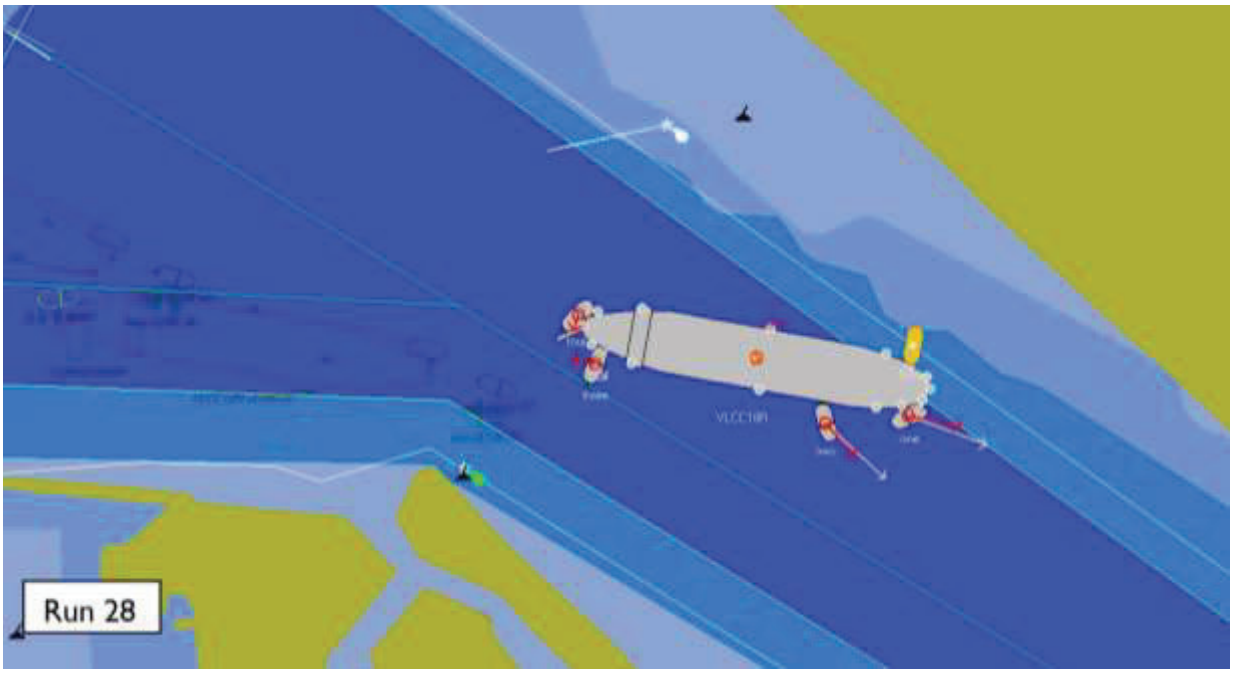
On day three of the study, we performed 16 runs, specifically runs 1, 1.2, 4, 4.2, 5, 6, 6.2, 8, 8.2, 10, 11, 13, 16, 18, 22, 28, 28.2, 28.3, 29, and 36. The focus of day three is to target inbound runs with a 52' loaded VLCC and medium current flows with the second pilot group. The other goal was to slowly ramp up the environmental conditions prior to increasing to max flood and ebb flows with a fully loaded ship, which is scheduled for day four.



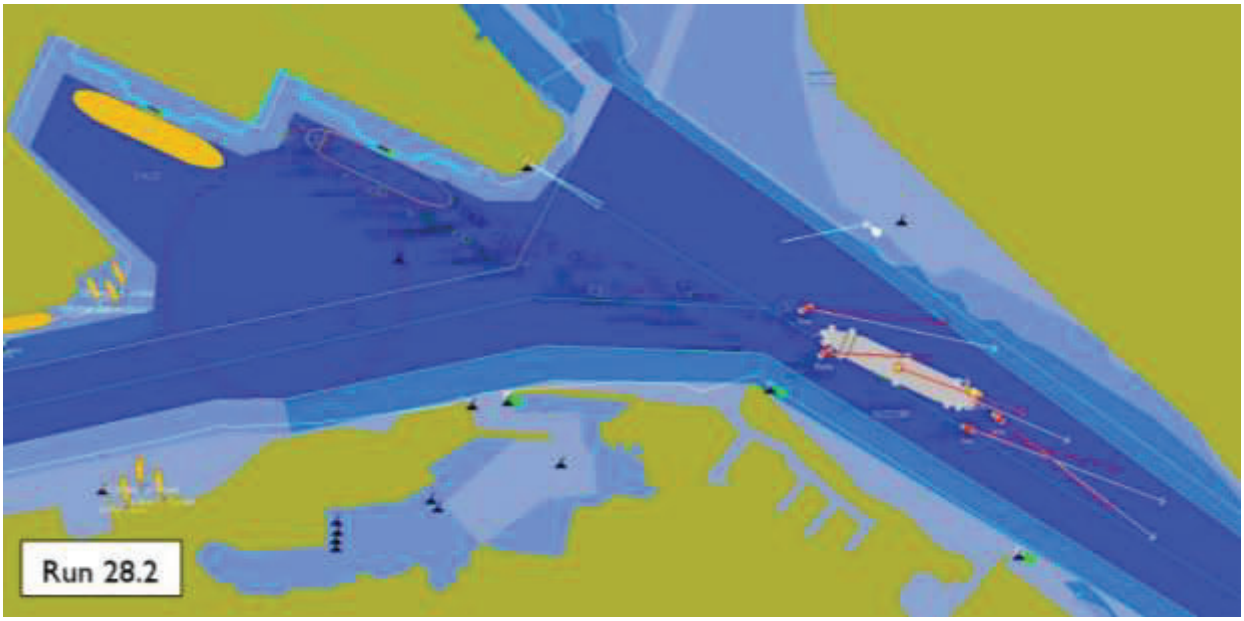
Bow aground while turning with an ebb high current (emergency run)



Successful run inbound with an ebb high current



Fully loaded VLCC ran aground at St. Joe Island on a high flood

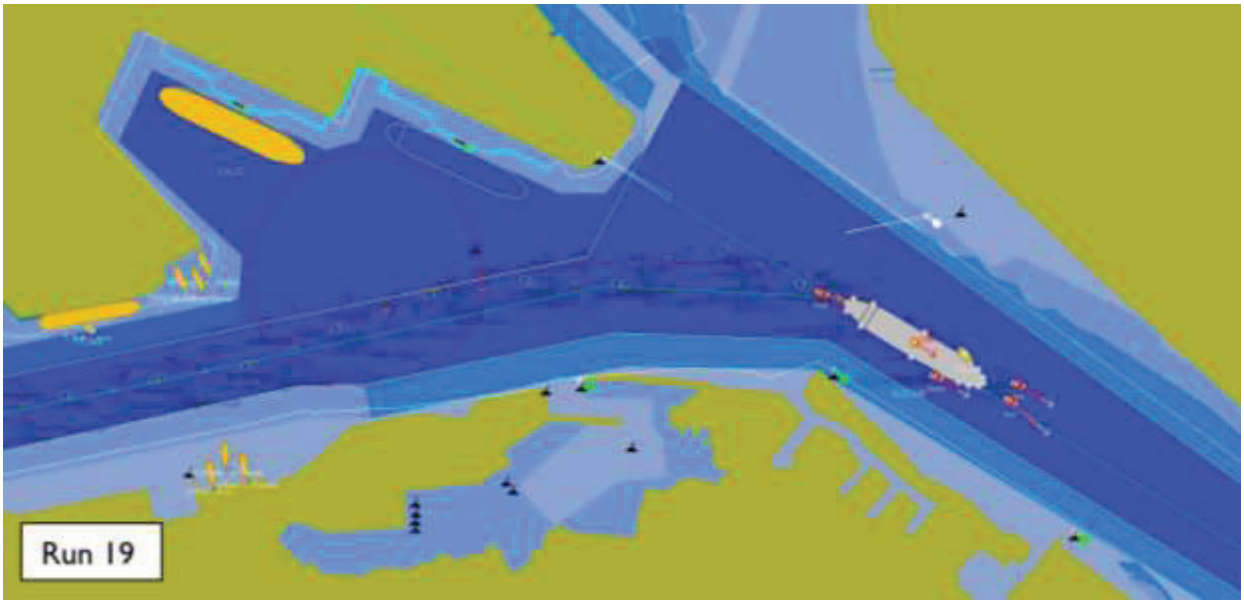


Second attempt of Run 28 with a high flood

During the second attempt of run 28 the fully loaded VLCC was able to overcome the max flood tidal conditions and complete the turn at Harbor Island outbound. Then they were able to hold up on the high side of the channel as the ship transited out to prepare for the southerly set just past the jetties. The picture above shows the ship under control with the max flood and the tugs which helped make the maneuver be successful and avoid grounding on the south side of the channel.

DAY FOUR

On day four of the study, we performed 9 runs, specifically runs 19, 23, 25, 33, 35, 39, 39.2, 43, and 44. The focus was on finishing up three of the inbound 52' VLCC runs from Ingleside to HI-W and E, with the high ebb and flood. After that, we planned to perform the rest of the 68' and 74' outbound runs. There were no failures on day 4.



68' VLCC outbound from the ferries with a medium flood tide

One of the objectives of the week was to better understand if a fully loaded VLCC could make the turn at harbor island at a slow rate of speed to accommodate ships berthed at HICT, which previous studies did not address. We ran at least eight simulations to evaluate if the turn could be made by slow steering, and understand at what tidal flow it was possible, and lastly if the tugs could overcome the tidal current forces on the ship's hull. The only failure was the first attempt of run 28, with a 68' loaded VLCC from HI East to the Jetties with a high flood current. Most of the runs were successful between 3-5 knots outbound and the tugs utilized were able to keep the ship under control the entire time.

Additionally, there was a need to perform more emergency runs with a fully loaded VLCC, which had not been adequately dealt with by previous studies. This was needed to better understand if operational risks were being addressed and proper safety margins were in place for common types of failures. During the week we incorporated nine emergencies ranging from jammed rudder on the ship, tug winch failure, broken tug hawser, tug sinking, tug experiencing black out conditions, and ship's loss of engine. All the emergencies experienced by participants occurred at the most stressful times during high-risk situations. It was important to note that there was only one failure (run 10) during the emergencies performed. During run 10 we simulated emergencies on two tugs at the same time, which resulted in a ship failure.

For all other emergencies performed when a tug experienced a casualty, the other tugs were adequate for maintaining control of the VLCC.

Over the course of the week, we were able to complete 44 runs. When study concluded, everyone was thanked for their time and dedication to the project. The simulation phase proved to be extremely useful in the development and transfer of understanding among participants. The range and number of simulations conducted adequately addressed the key parameters required to bring out the most important issues and objectives. The simulations conducted were challenging scenarios and any residual risks can be controlled by waiting on weather conditions to improve, adding additional pilots, requesting more tugs or more horsepower, and restricting traffic flow. Below are the project's recommendations and conclusions followed by a summary of each simulation from both sessions.

The remarks below are comments from the ACC Pilots participating in the study:

- Cross currents at the channel entrance offshore of the jetties and resulting leeway were manageable with minimal use of assist tugs.

- 120 MT rotor tugs provided adequate power for assisting fully loaded VLCCs in the currents within the ship channel and proposed Harbor Island terminal as represented in the simulation.

- Simulation models representing currents within the proposed Harbor Island Terminal Basin and Lydia Ann ebb currents not accurately represented. Pilots believe actual resulting currents in an as-built project will pose forces that will be more difficult to overcome. Current restrictions may be required.

- Overall, the pilots believe the project is feasible in terms of safe margins for maneuvering as represented in the simulations.

Recommendations and conclusions

Recommendations

1. The future with permit (FWP) channel dimensions, depth profile, and ship channel currents used were found to be acceptable for operating fully loaded VLCCs out of HICT. Run data and participant feedback recommended using 5–120-ton rotor tugs. Pilots and tug captains found the conditions tested to be highly accurate and provided acceptable margins of safety.

2. As dredging in the port continues, additional analysis of the currents will be needed. Pilot feedback currently supports this recommendation. During the study the pilots commented that tidal current velocities have increased as channel dredging progresses. Pilot feedback gathered varied regarding the strength of the currents and effect on VLCCs at the Harbor Island intersection. During the debriefs there was continued discussion of adding current meters at or near the Lydia Ann Channel for additional reference points. There were eight comments from participants about the fidelity of the current model. Comments for four of the runs (2, 3, 4, and 35) state the current was favorable, realistic, true to life, and that it felt correct. While comments on another four runs (11, 13, 23, and 28) state that the currents were extreme, weaker than expected, stronger than expected, or more than anticipated during the maneuvers. If the currents in the area are expected to be stronger in real life, then reducing the operational parameters of the terminal or VLCC when max flood or max ebb conditions exist may be required to offset the effect of the current flow.

3. Pilot comments recommend the use of 5-120T rotor tugs for the FWP runs and a 52' VLCC. The 120-ton bollard pull tugs were found to be necessary – based on participant feedback and tug power data gathered. The use of five rotor tugs rated at 120-ton bollard pull VLCCs with 52' draft runs for maneuvering in the FWP profile greatly enhances safety and allows for operating in more difficult environmental conditions.

4. During the FWP runs using a 68' VLCC, most pilots used five tugs. Tug power graphs for a majority of the runs show the 120T rotor tugs using short bursts of power, and not operating at maximum capacity for extended periods of time. Some of the inbound runs show maximum engine usage, during the inbound transit when the ship is at 12 knots or more. Additionally, 8 of 17 outbound runs with the 68' loaded VLCCs show tug power at or near maximum power, however 2 of the 8 simulations were emergency scenarios, and 4 of the 8 scenarios were evaluations of slow speed maneuvers outbound to better understand if the turn at harbor island can be made at reduced speeds, when a loaded ship is largely dependent on tugs and tug power. The tug power graphs are shown in appendix H.

5. The study revealed that all of the 74' runs were successful according to the data and the UKC was adequate. Tug performance data, scores, and participant feedback collected during those runs show the ship and tug operating parameters were pushed to the maximum. Pilot feedback call for operational restrictions for maneuvering ships at that draft at certain tidal flows to allow for acceptable margins of safety.
6. Regarding traffic management, when operating VLCC ships, it is recommended for the Corpus Christi Channel to employ one way traffic, with no meeting or overtaking of any vessels other than harbor-assist tugs when in transit.
7. Concerning simulations in which an emergency occurred, we performed 44 simulations total, and 7 runs included 9 emergencies such as ship rudder failure, ship engine failure, broken tug hawser, tug winch failure, tug experiencing a black out condition, and a tug sinking. Four runs were VLCCs with a 52' draft inbound for HICT. 1 out of the 7 emergency runs resulted in a failure when the ship ran aground (run 10) the lowest scoring simulation of the 44 conducted. This is a critical finding due to it being an emergency where two tugs experienced casualties, therefore, the ship was not able to maintain control with just three remaining tugs. For the 6 other emergencies conducted during runs the simulations were successful and scored well 4.5 out of 5 or better.
8. One of the study objectives was to better understand what the tug power needs are for a slow speed maneuver of an outbound partially or loaded VLCC shaping up for a turn at Harbor Island. We conducted 8 maneuvers where the objective was to make the turn at slower than normal speed to see if the tugs could overcome the environmental conditions. 3 of the 8 runs were with a 52' VLCC and 5 of the runs were with the 68' VLCC, the slowest speed transited safely was roughly 3 knots, and there were a few situations where the tugs towed the ship out with no engine and no rudder successfully. All slow speed maneuvers were successful using the 5-120T rotor tugs.

Conclusions

1. Failures summarized: 3 out of 44 simulations were *unsuccessful*, resulting in failure. Run 10 – 52' VLCC inbound from Jetties to HI-E with a high Ebb current, ship grounded after two tugs experienced failures. Run 3 – with a 52' VLCC from Sea to Jetties with a South Medium set, the ship ran aground when it could not overcome the environmental conditions. Run 28 – a 68' VLCC departing HI-E to the Jetties with a high flood current, got too close to Cline Point, ran across the channel and ran aground on the other side.
2. Successful runs: 41 of 44 *successful* runs were with environmental conditions described as very difficult and challenging, the use of 5 rotor tugs rated at 120 MT bollard pull are sufficient for handling up to fully loaded VLCCs. Out of 44 runs over the 4 days of simulation, we experienced 9 emergencies during 7 runs, of which 6 with successful outcomes.

3. The study concludes that the FWP channel dimensions are adequate, depth and currents were accurate in the channel areas, operating the VLCC with a 68' draft was possible, and the pilots could do it safely and reliably using the 5-120 MT Rotor Tugs. The simulations proved that the vessels could operate at maximum flood and ebb conditions. During the maneuvers data shows that the tugs used were not operating at maximum power for extended periods of time, and that there was power left in reserve to account for unforeseen risks. More training for tug masters with subject matter experts would be beneficial once the rotor tugs are in service, this would maximize tug use and operational output of the vessel.

4. It is a challenge to handle VLCCs in confined narrow waterways with shallow draft. In addition to the various forces affecting the vessel there is also high volume of commercial and recreational traffic. With more restrictive environmental fuel and engine regulations on the horizon success of these types of maneuvers will largely be dependent on the tugs available and the tug master's ability and skill. Having the 5-120T rotor tugs available combined with a competent operator will greatly increase safety and reliability of the maneuvers. In summary, we conclude the use of 5-120 MT Rotor Tugs was proven to be necessary and effective for safe navigation when fully loaded VLCCs are operating in the channel with the environmental conditions simulated.

Appendix A: Contract

Please see Appendix A in Appendixes folder.



SEAMEN'S CHURCH INSTITUTE CENTER FOR MARITIME EDUCATION

Simulation and Facilities Information

Executive Qualifications

The Seamen's Church Institute (SCI) utilizes the latest in computer simulation technology to assist in maritime planning to promote a safer environment for mariners by performing feasibility studies for various government, commercial, and private agencies. SCI's studies focus on projects that impact navigation, including waterfront development and bridge spans.

SCI feasibility studies have typically save millions of dollars towards project costs. One engineering firm estimates that an initial study done at SCI in Paducah saved $50M, and in a follow-up study saved another $10-15M.

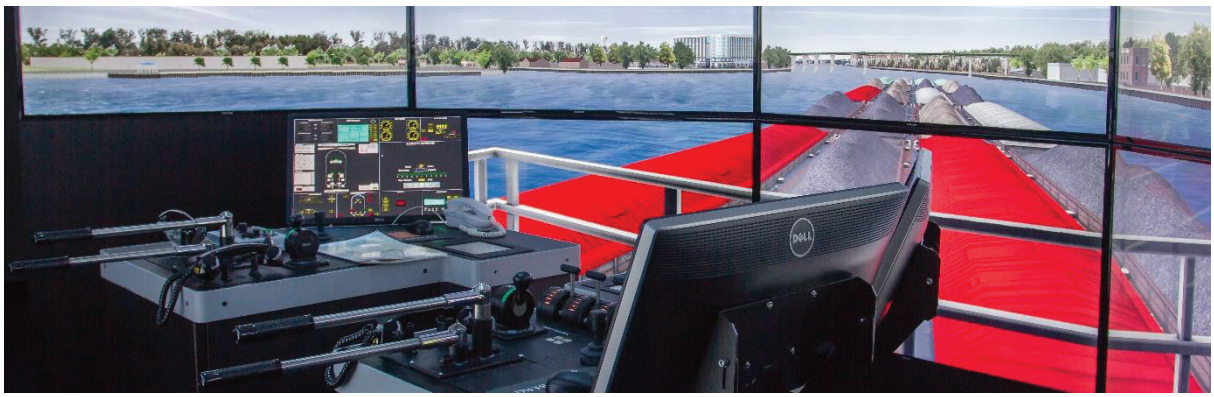
Feasibility studies make construction easier and satisfy industry representatives and the US Coast Guard on navigation and safety matters. Our studies can also reassure project investors that capital invested in the facility will meet project design assumptions and operate as efficiently as possible. Costs for feasibility studies are miniscule in relation to potential savings, and because SCI is a not-for-profit mariners' service agency, SCI's concern is for the mariner, seeking to make safer transits on our waterways.

Utilizing simulated geo-specific visual databases, and ship models SCI offers the means to assist engineers, architects and other project stakeholders by leveraging the power of real-time simulation to examine:

- New port designs
- Pier or channel modifications
- Suitability of a design for specific vessels or vessel types
- Maritime Vessel Hydrodynamic Prototyping

With the power of SCI's Maritime Simulators located in Houston, TX and Paducah, KY, ship and river pilots may perform various maneuvers within the proposed site alternatives. Throughout the exercise, pilots can test navigability through multiple situations considering variables such as medium or high flow currents, day or night situations, fully loaded or empty vessels, and up river or down river scenarios. After each run, captains and pilots are debriefed, commenting on the ease or difficulty of the scenario and the safety margins that could be expected if a facility or bridge was built in that position.

At the end of our studies, SCI will produce a final report documenting our findings, as well as suggestions offered by mariners to help make waterways safer for seafarers and the general public all the while saving millions of dollars in construction costs.



Certifications

The Center for Maritime Education passed rigorous third-party audits at its facilities in Houston, TX and Paducah, KY, contracting with WCS Quality Registrars, LLC for the evaluation and certification of its Quality Management System to ISO 9001:2015. This makes CME the first maritime training center in the United States to receive ISO 9001 certification.

The ISO 9001 quality management system is recognized by the USCG as a Quality Systems Standard and significantly strengthens SCI's multi-faceted maritime education program. The scope of certification is: the Provision of Marine Simulator Training, Online Courses, Marine Feasibility Studies, Marine Incident Recreation and Solution Development, USCG License Assessments, and other related services.

Study Scope and Overview

- Proposed project's impact to navigation: ATON's needed, traffic flow, dredging profiles
- Select the best berth orientation, proximity to other berths, barge docks, room for harbor tugs
- Ship size validation, test/validate economic and efficiency assumptions for the waterway
- Test, evaluate, the risks and control measures for maximum environmental conditions (wind and current) possible for safe operations
- Identify the ideal harbor tug horsepower and tug arrangements
- Channel modifications needed for turning basins or maneuvering areas
- Assist with current modelling

Project Resume

- I-74 Bridge – Quad Cities, Iowa – Bridge Study
- Abraham Lincoln Bridge – Louisville, KY – Bridge Study
- East End Bridge – Louisville, KY – Bridge Study
- I-70 Bridge – St Louis, MO – Bridge Study
- Route 190 Bridge - Baton Rouge, LA – Bridge Study
- Bolivar Roads Inbound Alternate Route, Houston Ship Channel – Navigation Assessment
- Wellsburg Bridge – Wellsburg, West Virginia – Bridge Study
- BOSTCO Terminal – Houston, TX – Port Study
- Texas Port Recycling – Houston, TX – Port Study
- Smithland Bridge - Smithland, KY – Bridge Study
- Blackhawk Bridge – Lansing, IA - Bridge Study
- I-69 Crossing – Evansville, IA – Bridge Study
- Suezmax Feasibility Study – Corpus Christi, TX inner harbor
- VLCC Corpus Christi - Corpus Christi, TX – Navigation Assessment
- Occidental Terminal – Corpus Christi, TX – Port Study
- Bluewater SPM – Gulf of Mexico – Terminal Study
- Axis Terminal, Corpus Christi, TX – Port Study
- MODA Terminal – Corpus Christi, TX – Port Study
- South Texas Gateway Terminal – Corpus, Christi, TX – Terminal Study
- Harbor Island Crude Terminal – Corpus Christi, TX – Port Study
- US 51 Cairo Bridge Replacement – Cairo, IL – Bridge Study

- I-49 Arkansas Bridge – Fort Smith, AR – Bridge Study
- Port of Corpus Christi Tug Study – Corpus Christi, TX – Navigation Study
- Environmental Impact Statement – Corpus Christi, TX – Waterway Study

Facilities & Technology

SCI has created two first-class facilities for the Western River and GIWW towing communities, each training over 1,000 mariners per year in classes ranging from Bridge Resource Management to Radar Renewals.

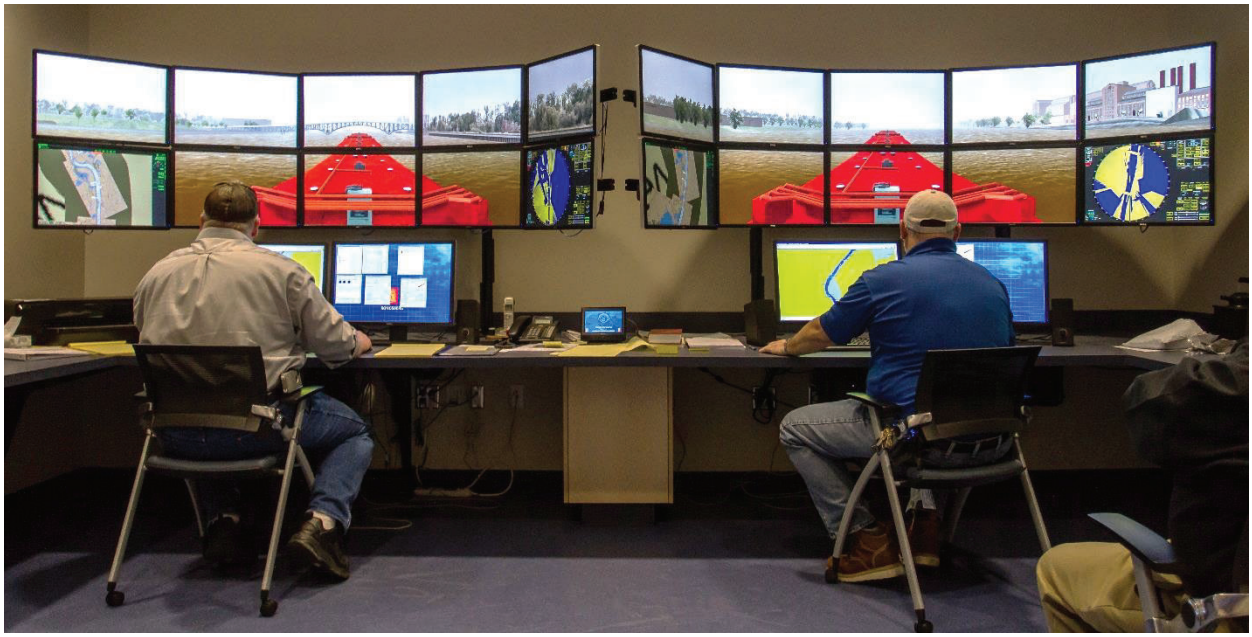
- SCI – Paducah is in the heart of Downtown Paducah, opened for training in June of 1997.
- SCI – Gulf Region is located at 9650 High Level Road inside the Port of Houston directly across from the Port Authority building.

Since opening the Center for Maritime Education, over 35,000 Inland Mariners have come to train with SCI. SCI's simulators house full-mission bridges, type-approved domestically by the USCG and class-approved by classification societies such as ABS and DNV.

Maritime Simulation

SCI's Centers for Maritime Education use Kongsberg Polaris full mission ship bridge simulators consisting of fully equipped interactive ship's bridges with visual systems. The simulators meet the simulation requirements of STCW Section A-1/12- Performance Standards for Simulators used in Training. Simulation and monitoring capabilities include:

- Four wheelhouses, each with twelve 65-inch LCD/LED TV monitors, 8 channels looking forward and 4 channels looking aft, strengthening close-quarter maneuvering for locking, docking and vessel transfer, while retaining long-distance perception for bridge and lock-chamber setup
- Breakthrough night simulation capacity
- Hydrodynamic calibration of 23 vessels—large and small, loaded and unloaded, dry bulk and tank barge to VLCC—to sync with latest software, providing realistic navigation "feel" to pilots
- Interchangeable traditional steering levers and azimuth thruster Z-drive propulsion systems.



Simulation and Study Development

Beginning from CAD, GIS, photographic data and printed drawings as well as information from NOAA and US Army Corps of Engineers, our staff can assemble a site-specific 3D visual database of any study area. Our visual databases consist of a three-dimensional visual representation of the existing site as well as proposed design alternatives linked to simulated radar and depth sounding information. The ship models utilized in the simulation are not only a three-dimensional representation but behave realistically due to the hydrodynamic properties attached to them allowing the vessels to perform and maneuver like there real-world counterparts.

At the beginning of each study, staff from SCI will work with the project stakeholders to define the overall scope of the simulations objectives, and the area to be modeled. From these discussions, areas will be identified to be modelled in high, medium, or low levels of detail based on the distance from the focus area.



Once the scope has been determined, data will be located to generate the area including:

- Electronic Navigation Charts
- Photographs and videos from shore and vessel
- Elevation Data
- CAD and GIS data
- Aerial Photographs
- Current Flow Analysis



The study area will be generated from this material and can be later modified as necessary to alleviate any navigational issues that come up in the study allowing for a dynamic environment to experiment with different proposed configurations.

CME Team and Subject Matter Experts (SME)

SCI provides the overall management of our facilities. Instructors are trained in exercise development, simulator use, and education philosophy. The managers and instructors work with company-provided facilitators in making company-specific changes to the curricula developed by SCI and the individual companies. Captain Stephen Polk, SCI's Director of Maritime Education, manages the operations and direction of both facilities. The resources of each Center are available to the other Center.



Captain Stephen Polk, MNI, *Director, Maritime Education & Training*
Captain Stephen Polk supervises SCI's Center for Maritime Education. Before joining SCI, he was a Senior Port Captain for Kirby Inland Marine, LP and managed several types of inland towing vessels in the Canal Division. Captain Polk is a certified Crew Endurance Management System (CEMS) expert and holds a United States Coast Guard 3rd Mate Unlimited Tonnage, Oceans License and a Master of Towing Vessel and 300-ton Master-Oceans endorsement on his license. Stephen previously worked as an Able-Seaman (A.B.) for Polar Tankers and as a Third Mate. He graduated from Texas A&M University at Galveston in 1997 with a B.S. in Marine Transportation.

Captain John Arenstam, *Assistant Director, CME Paducah*
John Arenstam retired from the U.S. Coast Guard with the rank of Captain after 27 years active duty. He served in Coast Guard ships all around the country, sailing along every coast and all 5 Great Lakes. His assignments included Captain of the icebreaker PENOBSCOT BAY on the Hudson River, and the seagoing buoy tender FIREBUSH out of Kodiak, Alaska.

Capt. Arenstam spent most of his Coast Guard career in waterways management, aids to navigation and bridge administration at offices in Virginia, New Orleans, and Washington DC, and aboard "black hulls" around the nation. John represented the USCG at the International Association of Aids to Navigation and Marine Authorities (IALA). During his time in Washington he worked for the USCG Director of International Affairs, and gathered considerable worldwide exposure, while conducting analysis and training overseas. John most recently served as the Deputy Sector Commander in New Orleans and as the Director of Western Rivers for the Eighth Coast Guard District. John graduated from the US Coast

Guard Academy in 1987 with a BS in Mathematics and earned his MS in Operations Research from The George Washington University in 2001.

Captain David T. Howell, *Assistant Director, CME Houston*
Having worked on the waters for three decades, and the majority of that time as a captain, Captain David Howell brings wide-ranging experience and knowledge to his position as Simulator Instructor at SCI–Houston. A lead or senior captain for most of his career, for 24 years Captain Howell worked on supply boats, offshore towing boats, and wire boats. He has experience up and down the east coast, gulf coast, and many ports internationally. Capt. Howell spent several years at John E. Graham & Sons, Mag Marine Service, Brown Water Marine, Bud's Boat Rentals and North Bank Towing training and mentoring younger mariners. Before joining SCI, he worked as Lead Captain at Buffalo Marine Service, where his leadership impacted the budding careers of many towboat crews. Captain Howell holds a number of licenses and certifications, including US Coast Guard Master 200 Ton Near Coastal, US Coast Guard Master of Towing Vessels, Western Rivers and Inland Waters, and Unlimited Radar.

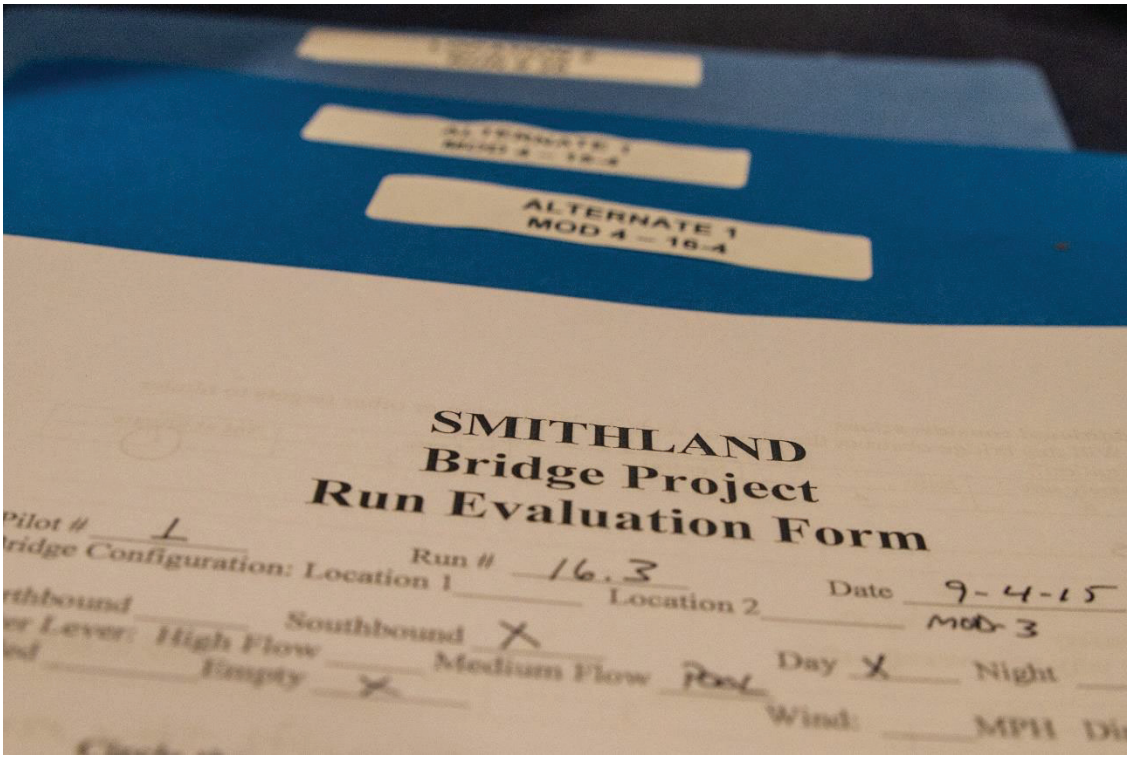
Captain Thomas Chivers, *Instructor*
Captain Thomas Chivers worked in the inland river industry for over 30 years. Starting as a deckhand and working his way up to Captain, he spent over 25 years in the wheelhouse. Thomas has worked on the vast majority of the inland waterways and Western rivers and holds a Master of Towing on Inland Waterways (MMC). Thomas spent five years as a trip pilot and joined SCI's Center for Maritime in Education as an Instructor in January 2018.

Matthew Hyner, *Simulation & Database Manager*
Matthew Hyner brings his background in computer graphics and multimedia development, specializing in the use of real-time 3D computer environments and Geographic Information Systems. A graduate of Pratt Institute's department of Computer Graphics and Interactive Media, he has worked over the years on simulation projects focusing on urban planning, architecture and training in the past for several government agencies, educational institutions, and private corporations including the FAA, US Air Force, Department of Transportation, Federal Transit Authority and Housing and Urban Development.

Since joining SCI, he worked to assist in developing simulation areas based upon proposed engineering drawings for use in feasibility and navigation studies for maritime construction projects which may pose potential hazards to marine navigation and safety

Captain Kelly F. Jones, *Instructor*
Captain Kelly F. Jones brings nearly ten years of experience in the maritime industry to her role at CME Houston. Most of her experience has been on towboats pushing chemical barges on the Western Rivers, Gulf Intracoastal Waterway, and inland waterways where she previously worked as Relief Captain for Kirby Inland Marine.

Capt. Jones graduated with a BS in Marine Operations from New York Maritime College. She brings a scope of knowledge spanning both inland and offshore aspects of the industry. Her licenses include: Master of Towing, Great Lakes, Inland Waters, and Western Rivers; Master Unlimited, Inland Waters; and Second Mate Unlimited, Oceans.



Budget

Item (EIS quote)	Units	Cost Per Unit	Total
Database modifications	1	$10,000	$10,000
Simulation trials per day	5	$25,000	$125,000
Crewing Costs	1	$40,000	$40,000
Custom vessel models - Pilot Grade	3	$15,000	$45,000
Admin, support, metrics, and data collection	1	$7,000	$7,000
Internal testing	2	$10,000	$20,000
External testing and validation	1	$10,000	$10,000
Final report	1	$8,000	$8,000
			$265,000

Schedule and Milestones

The proposed work will be completed by the agreed upon date at time of booking the simulator and billed in installments at the following milestones.

Phase	**Billing**	**Working Days**
Contract Signing	50%	30 days
Completion of Project	50%	30 days

Validity and Acceptance

This proposal is valid for acceptance until November 1, 2021, after which time SCI reserves the right to review the cost and schedule.





SCI, Stephen Polk

Capt. Jay Rivera, Riben Marine

Appendix B: Project Attendees

Please see Appendix B in Appendixes folder.

Participants

For the simulation phase the project team assembled in Houston, Texas at SCI's facility on January 31 – February 3, 2022. Over the course of the 4-day session the following entities were represented:

- Capt. Mike Kershaw
- Riben Marine
- Aransas-Corpus Christi Pilots Association (ACC Pilots)
- Freese and Nichols
- Seamen's Church Institute (SCI)

Appendix C: Run Matrix

Please see Appendix C in Appendixes folder.

run #	Day	location	destination	Depth	Draft			Inshore Current				Offshore Wind Current					Tug	
				81'	52'	68'	74'	25 N Ebb Med	25 N Ebb High	25 SE Flood Med	25 SE Flood High	N Med	N High	S Low	S Med	S High	120	comments
2	1	Sea	Jetties	x	x								x				x	familiarization
3	1	Sea	Jetties	x	x										x		x	familiarization
7	1	Jetties	HI W	x	x					x							x	max tug power
9	1	Jetties	HI E	x	x			x									x	max tug power
12	1	Jetties	HI E	x	x						x						x	max tug power
13	1	Ferries	Jetties	x	x			x									x	passing vessel speed
16	1	Ferries	Jetties	x	x						x						x	passing vessel speed
17	1	Ferries	Jetties	x		x		x									x	passing vessel speed
27	1	HI E	Jetties	x		x				x							x	max tug power
32	1	Ingleside	HI W	x	x			x									x	max tug power
34	1	Ingleside	HI W	x	x					x							x	max tug power
15	2	Ferries	Jetties	x	x					x							x	passing vessel speed
20	2	Ferries	Jetties	x		x					x						x	passing vessel speed
21	2	HI W	Jetties	x		x		x									x	max tug power
24	2	HI W	Jetties	x		x					x						x	failure
26	2	HI E	Jetties	x		x			x								x	low score
30	2	Jetties	Sea	x		x							x				x	not run
31	2	Jetties	Sea	x		x									x		x	max tug power
37	2	Ingleside	HI E	x	x				x								x	max tug power
38	2	Ingleside	HI E	x	x					x							x	max tug power
40	2	HI W	Jetties	x			x	x									x	failure
41	2	HI W	Jetties	x			x				x						x	failure
42	2	HI E	Jetties	x			x		x								x	not run
1	3	Sea	Jetties	x	x							x					x	familiarization
4	3	Sea	Jetties	x	x											x	x	familiarization
5	3	Jetties	HI W	x	x			x									x	max tug power
6	3	Jetties	HI W	x	x				x								x	low score
8	3	Jetties	HI W	x	x						x						x	max tug power
10	3	Jetties	HI E	x	x				x								x	low score
11	3	Jetties	HI E	x	x					x							x	max tug power
14	3	Ferries	Jetties	x	x				x								x	passing vessel speed
18	3	Ferries	Jetties	x		x			x								x	passing vessel speed
22	3	HI W	Jetties	x		x			x								x	low score
28	3	HI E	Jetties	x		x					x						x	max tug power
29	3	Jetties	Sea	x		x						x					x	not run
36	3	Ingleside	HI E	x	x			x									x	max tug power
19	4	Ferries	Jetties	x		x				x							x	passing vessel speed
23	4	HI W	Jetties	x		x				x							x	max tug power
25	4	HI E	Jetties	x		x		x									x	low score
33	4	Ingleside	HI W	x	x				x								x	max tug power
35	4	Ingleside	HI W	x	x						x						x	max tug power
39	4	Ingleside	HI E	x	x						x						x	max tug power
43	4	HI E	Jetties	x			x			x							x	not run
44	4	Jetties	Sea	x		x										x	x	not run

run #	old Run	location	destination	Depth	Draft			Inshore Current				Offshore Wind Current					Tug		
				81'	52'	68'	74'	25 N Ebb Med	25 N Ebb High	25 SE Flood Med	25 SE Flood High	N Med	N High	S Low	S Med	S High	120	Current file	comments
1	32	Sea	Jetties	x	x							x					x	11/25/2018 @ 0400	familiarization
2	33	Sea	Jetties	x	x								x				x	9/22/2020 @ 1000	familiarization
3	35	Sea	Jetties	x	x										x		x	9/13/2018 @ 1900	familiarization
4	36	Sea	Jetties	x	x											x	x	7/25/20 @ 0800	familiarization
5	45	Jetties	HI W	x	x			x									x	9/15/2018 @ 1300	max tug power
6	46	Jetties	HI W	x	x				x								x	9/22/2020 @ 1000	low score
7	47	Jetties	HI W	x	x					x							x	7/25/20 @ 0800	max tug power
8	48	Jetties	HI W	x	x						x						x	7/25/2020 @ 1000	max tug power
9	49	Jetties	HI E	x	x			x									x	9/15/2018 @ 1300	max tug power
10	50	Jetties	HI E	x	x				x								x	9/22/2020 @ 1000	low score
11	51	Jetties	HI E	x	x					x							x	7/25/20 @ 0800	max tug power
12	52	Jetties	HI E	x	x						x						x	7/25/2020 @ 1000	max tug power
13	new	Ferries	Jetties	x	x			x									x	9/15/2018 @ 1300	passing vessel speed
14	new	Ferries	Jetties	x	x				x								x	9/22/2020 @ 1000	passing vessel speed
15	new	Ferries	Jetties	x	x					x							x	7/25/20 @ 0800	passing vessel speed
16	new	Ferries	Jetties	x	x						x						x	7/25/2020 @ 1000	passing vessel speed
17	new	Ferries	Jetties	x		x		x									x	9/15/2018 @ 1300	passing vessel speed
18	new	Ferries	Jetties	x		x			x								x	9/22/2020 @ 1000	passing vessel speed
19	new	Ferries	Jetties	x		x				x							x	7/25/20 @ 0800	passing vessel speed
20	new	Ferries	Jetties	x		x					x						x	7/25/2020 @ 1000	passing vessel speed
21	61	HI W	Jetties	x		x		x									x	9/15/2018 @ 1300	max tug power
22	62	HI W	Jetties	x		x			x								x	9/22/2020 @ 1000	low score
23	63	HI W	Jetties	x		x				x							x	7/25/20 @ 0800	max tug power
24	64	HI W	Jetties	x		x					x						x	7/25/2020 @ 1000	failure
25	65	HI E	Jetties	x		x		x									x	9/15/2018 @ 1300	low score
26	66	HI E	Jetties	x		x			x								x	9/22/2020 @ 1000	low score
27	67	HI E	Jetties	x		x				x							x	7/25/20 @ 0800	max tug power
28	68	HI E	Jetties	x		x					x						x	7/25/2020 @ 1000	max tug power
29	69	Jetties	Sea	x		x						x					x	11/25/2018 @ 0400	not run
30	70	Jetties	Sea	x		x							x				x	9/22/2020 @ 1000	not run
31	72	Jetties	Sea	x		x									x		x	9/13/2018 @ 1900	max tug power
32	82	Ingleside	HI W	x	x			x									x	9/15/2018 @ 1300	max tug power
33	83	Ingleside	HI W	x	x				x								x	9/22/2020 @ 1000	max tug power
34	84	Ingleside	HI W	x	x					x							x	7/25/20 @ 0800	max tug power
35	85	Ingleside	HI W	x	x						x						x	7/25/2020 @ 1000	max tug power
36	86	Ingleside	HI E	x	x			x									x	9/15/2018 @ 1300	max tug power
37	87	Ingleside	HI E	x	x				x								x	9/22/2020 @ 1000	max tug power
38	88	Ingleside	HI E	x	x					x							x	7/25/20 @ 0800	max tug power
39	89	Ingleside	HI E	x	x						x						x	7/25/2020 @ 1000	max tug power
40	90	HI W	Jetties	x			x	x									x	9/15/2018 @ 1300	failure
41	91	HI W	Jetties	x			x				x						x	7/25/2020 @ 1000	failure
42	new	HI E	Jetties	x			x		x								x	9/22/2020 @ 1000	not run
43	new	HI E	Jetties	x			x			x							x	7/25/20 @ 0800	not run

run #	old run #	day	location	destination	Depth	Draft			Inshore Current				Offshore Wind Current					Tug			Pilot Average	Tug Average
					81'	52'	68'	74'	25 N Ebb Med	25 N Ebb High	25 SE Flood Med	25 SE Flood High	N Med	N High	S Low	S Med	S High	120	Current file	comments		
2	33	1	Sea	Jetties	x	x								x				x	9/22/2020 @ 1000	familiarization	4.5	5.0
3	35	1	Sea	Jetties	x	x										x		x	9/13/2018 @ 1900	familiarization	4.0	4.1
7	47	1	Jetties	HI W	x	x					x							x	7/25/20 @ 0800	max tug power	4.5	5.0
9	49	1	Jetties	HI E	x	x			x									x	9/15/2018 @ 1300	max tug power	4.8	4.9
12	52	1	Jetties	HI E	x	x						x						x	7/25/2020 @ 1000	max tug power	5.0	4.8
13	new	1	Ferries	Jetties	x	x			x									x	9/15/2018 @ 1300	passing vessel speed	3.5	5.0
16	new	1	Ferries	Jetties	x	x						x						x	7/25/2020 @ 1000	passing vessel speed	5.0	5.0
17	new	1	Ferries	Jetties	x		x		x									x	9/15/2018 @ 1300	passing vessel speed		5.0
27	67	1	HI E	Jetties	x		x				x							x	7/25/20 @ 0800	max tug power	4.3	4.7
32	82	1	Ingleside	HI W	x	x			x									x	9/15/2018 @ 1300	max tug power	5.0	5.0
34	84	1	Ingleside	HI W	x	x					x							x	7/25/20 @ 0800	max tug power	4.5	5.0
15	new	2	Ferries	Jetties	x	x					x							x	7/25/20 @ 0800	passing vessel speed	4.8	5.0
20	new	2	Ferries	Jetties	x		x					x						x	7/25/2020 @ 1000	passing vessel speed		4.9
21	61	2	HI W	Jetties	x		x		x									x	9/15/2018 @ 1300	max tug power	4.8	4.9
24	64	2	HI W	Jetties	x		x					x						x	7/25/2020 @ 1000	failure	4.5	4.7
26	66	2	HI E	Jetties	x		x			x								x	9/22/2020 @ 1000	low score	5.0	5.0
30	70	2	Jetties	Sea	x		x							x				x	9/22/2020 @ 1000	not run	5.0	5.0
31	72	2	Jetties	Sea	x		x									x		x	9/13/2018 @ 1900	max tug power	4.5	5.0
37	87	2	Ingleside	HI E	x	x				x								x	9/22/2020 @ 1000	max tug power	4.5	4.8
38	88	2	Ingleside	HI E	x	x					x							x	7/25/20 @ 0800	max tug power	5.0	4.9
40	90	2	HI W	Jetties	x			x	x									x	9/15/2018 @ 1300	failure	4.8	5.0
41	91	2	HI W	Jetties	x			x				x						x	7/25/2020 @ 1000	failure	4.5	4.7
42	new	2	HI E	Jetties	x			x		x								x	9/22/2020 @ 1000	not run	5.0	4.6
1	32	3	Sea	Jetties	x	x							x					x	11/25/2018 @ 0400	familiarization	5.0	5.0
4	36	3	Sea	Jetties	x	x											x	x	7/25/20 @ 0800	familiarization	4.8	5.0
5	45	3	Jetties	HI W	x	x			x									x	9/15/2018 @ 1300	max tug power	4.5	5.0
6	46	3	Jetties	HI W	x	x				x								x	9/22/2020 @ 1000	low score	4.8	5.0
8	48	3	Jetties	HI W	x	x						x						x	7/25/2020 @ 1000	max tug power	4.5	5.0
10	50	3	Jetties	HI E	x	x				x								x	9/22/2020 @ 1000	low score	2.3	4.1
11	51	3	Jetties	HI E	x	x					x							x	7/25/20 @ 0800	max tug power	4.0	5.0
14	new	3	Ferries	Jetties	x	x				x								x	9/22/2020 @ 1000	passing vessel speed	4.8	4.9
18	new	3	Ferries	Jetties	x		x			x								x	9/22/2020 @ 1000	passing vessel speed	4.8	5.0
22	62	3	HI W	Jetties	x		x			x								x	9/22/2020 @ 1000	low score	3.8	4.8
28	68	3	HI E	Jetties	x		x					x						x	7/25/2020 @ 1000	max tug power	2.8	3.0
28.2	68	3	HI E	Jetties	x		x					x						x	7/25/2020 @ 1000	max tug power	4.0	5.0
29	69	3	Jetties	Sea	x		x						x					x	11/25/2018 @ 0400	not run		5.0
36	86	3	Ingleside	HI E	x	x			x									x	9/15/2018 @ 1300	max tug power	5.0	5.0
19	new	4	Ferries	Jetties	x		x				x							x	7/25/20 @ 0800	passing vessel speed	4.3	5.0
23	63	4	HI W	Jetties	x		x				x							x	7/25/20 @ 0800	max tug power	4.8	5.0
25	65	4	HI E	Jetties	x		x		x									x	9/15/2018 @ 1300	low score	4.8	5.0
33	83	4	Ingleside	HI W	x	x				x								x	9/22/2020 @ 1000	max tug power	4.3	5.0
35	85	4	Ingleside	HI W	x	x						x						x	7/25/2020 @ 1000	max tug power	5.0	5.0
39	89	4	Ingleside	HI E	x	x						x						x	7/25/2020 @ 1000	max tug power	4.8	5.0
43	new	4	HI E	Jetties	x			x			x							x	7/25/20 @ 0800	not run	4.8	5.0
44		4	jetties	sea	x			x									x	x			4.8	5.0

Appendix D: CAD Drawings



NO.	DESCRIPTION	DATE	APPR
A	ISSUED FOR REVIEW	08/10/21	KEM

ISSUED FOR REVIEW

AXIS MIDSTREAM HARBOR ISLAND
CORPUS CHRISTI, TX

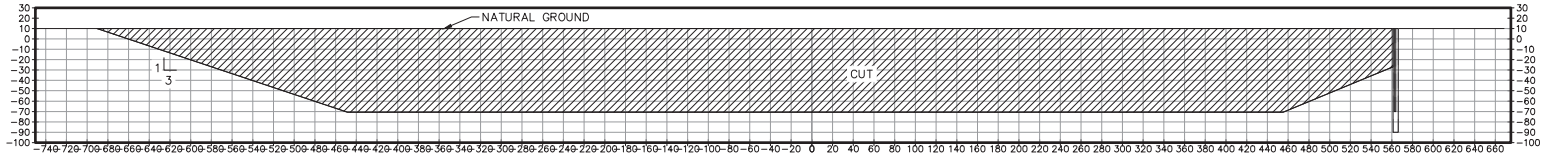
OVERALL SITE LAYOUT

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

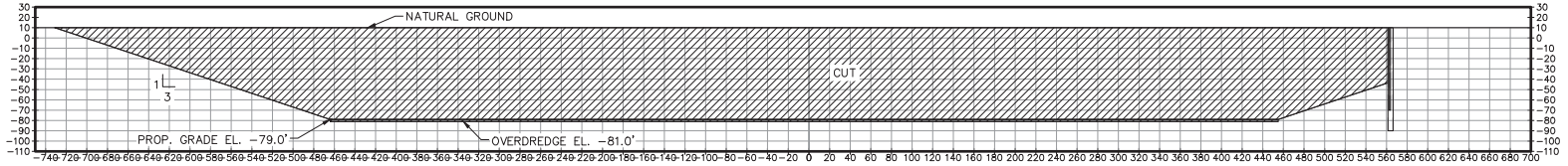
DESIGN BY:	KEM
DRAWN BY:	JB
DATE:	11-28-2018
SCALE:	AS NOTED @ 22"X34"
SHEET:	01 OF —
DRAWING NO:	01
REV.	A

FILE NAME: L:\LD Projects\Axis Midstream\V6.0 Drawings\Conceptual\OPTION 3\AXIS MIDSTREAM – DREDGING (-)79+2\01 OVERALL SITE LAYOUT.dwg PLOTTED: 8/11/2021 11:38:59 AM USER: JESUS BENITEZ

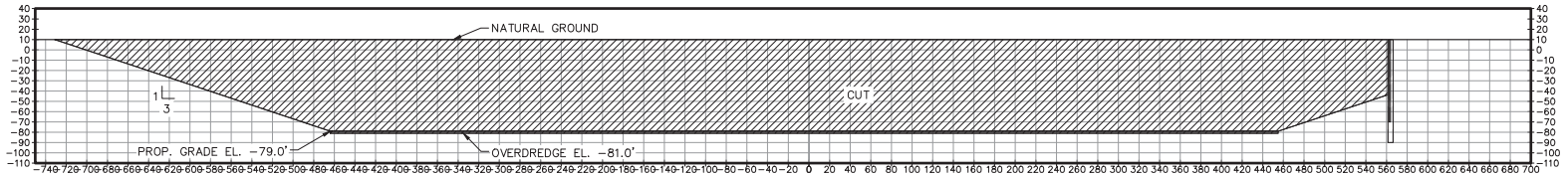
2+00.00



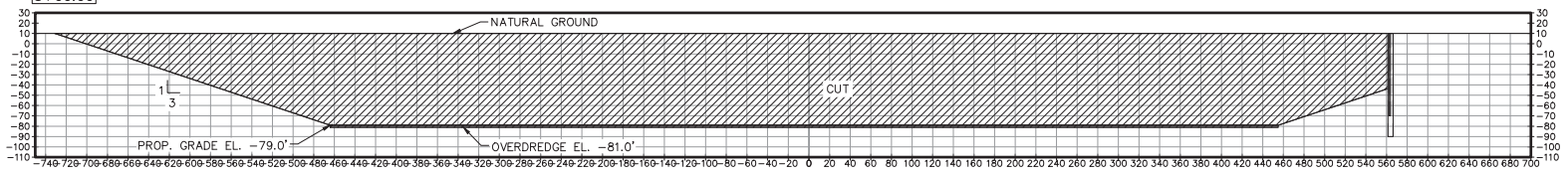
3+00.00



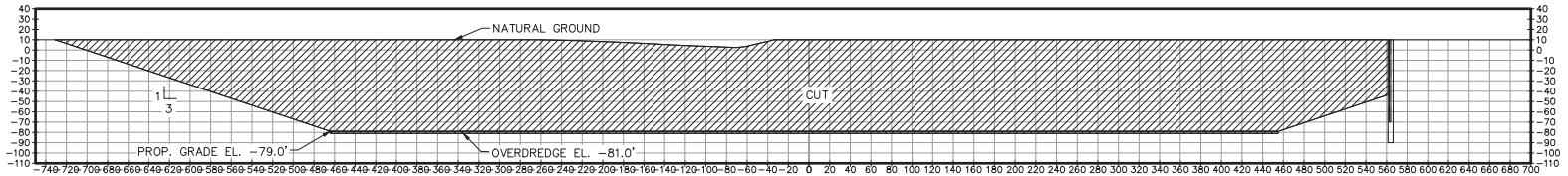
4+00.00



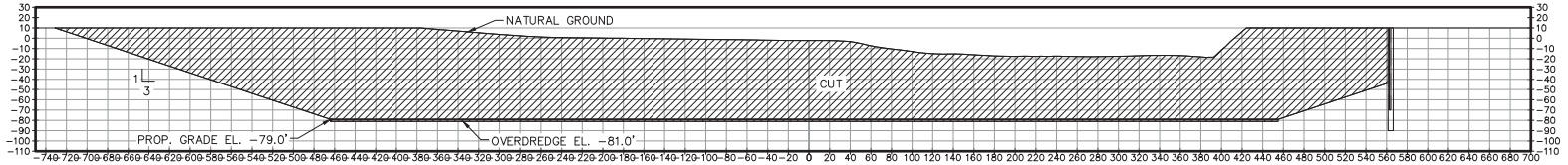
5+00.00



6+00.00



7+00.00



NO.	DESCRIPTION	DATE	APPR
A	ISSUED FOR REVIEW	08/10/21	KEM

ISSUED FOR REVIEW

AXIS MIDSTREAM HARBOR ISLAND
CORPUS CHRISTI, TX

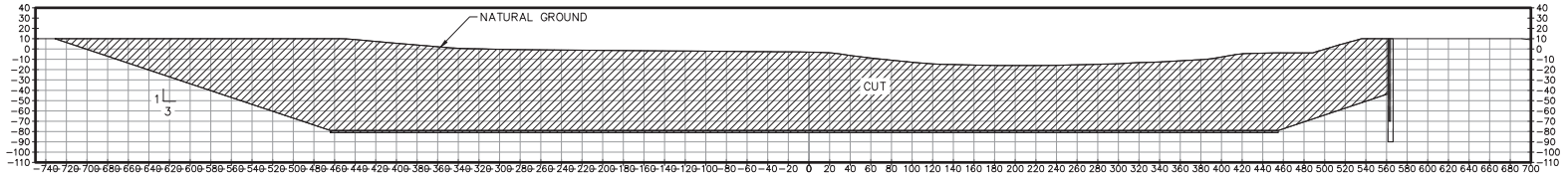
CROSS SECTIONS 1 OF 4

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

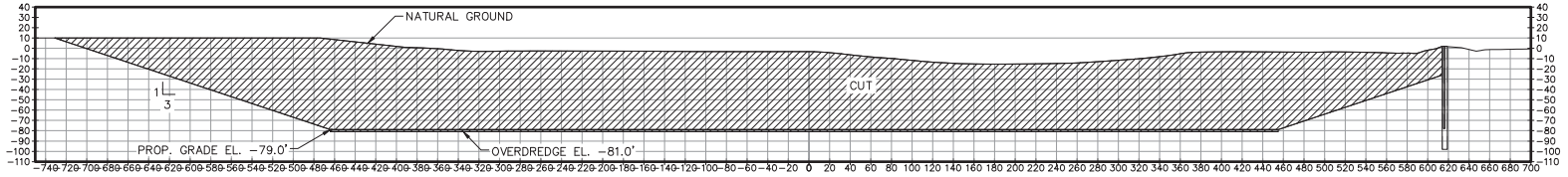
DESIGN BY:	KEM
DRAWN BY:	JB
DATE:	11-28-2018
SCALE:	AS NOTED @ 22"X34"
SHEET:	02 OF 04
DRAWING NO:	02
REV.	A

FILE NAME: z:\all projects\axis midstream\6.0 drawings\conceptual\OPTION 3\axis midstream - dredging (-)79+2\02 CROSS SECTIONS 1 OF 4.dwg PLOTTED: 8/11/2021 11:18:19 AM USER: JESUS BENITEZ

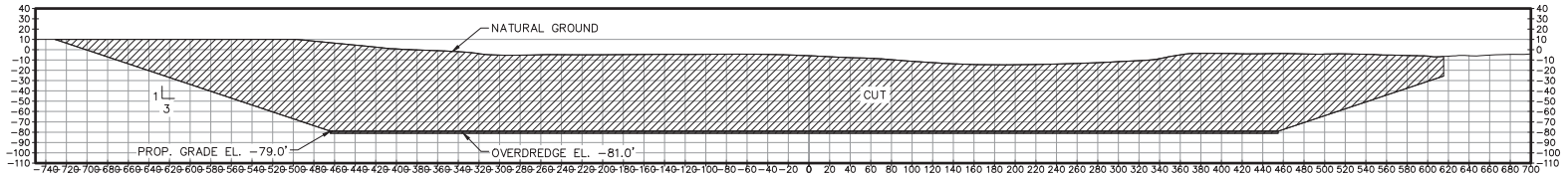
8+00.00



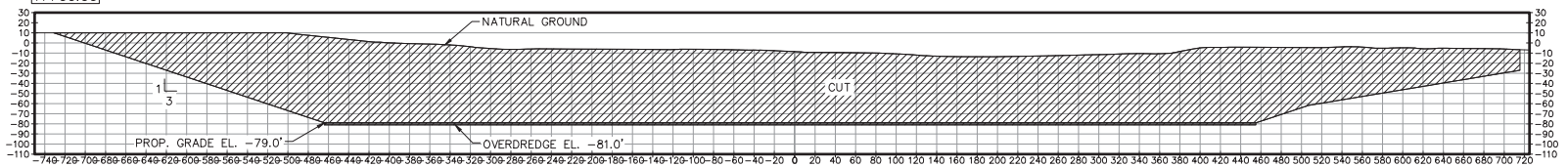
9+00.00



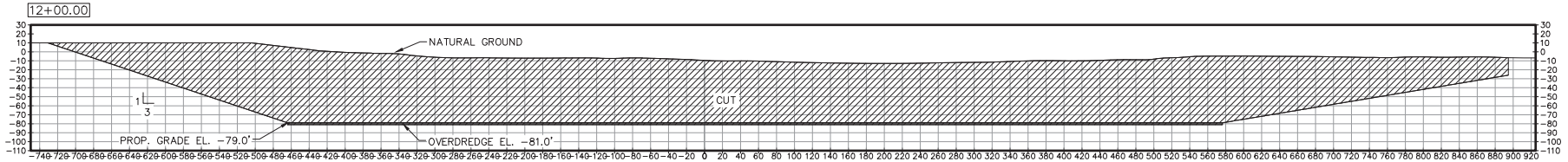
10+00.00



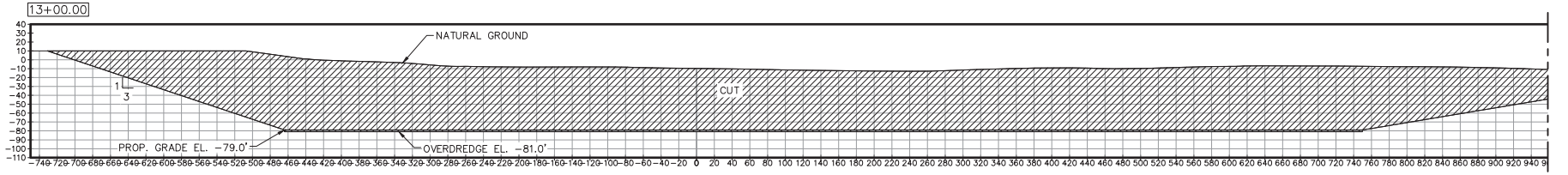
11+00.00



12+00.00



13+00.00



NO.	DESCRIPTION	DATE	APPR
A	ISSUED FOR REVIEW	08/10/21	KEM

ISSUED FOR REVIEW

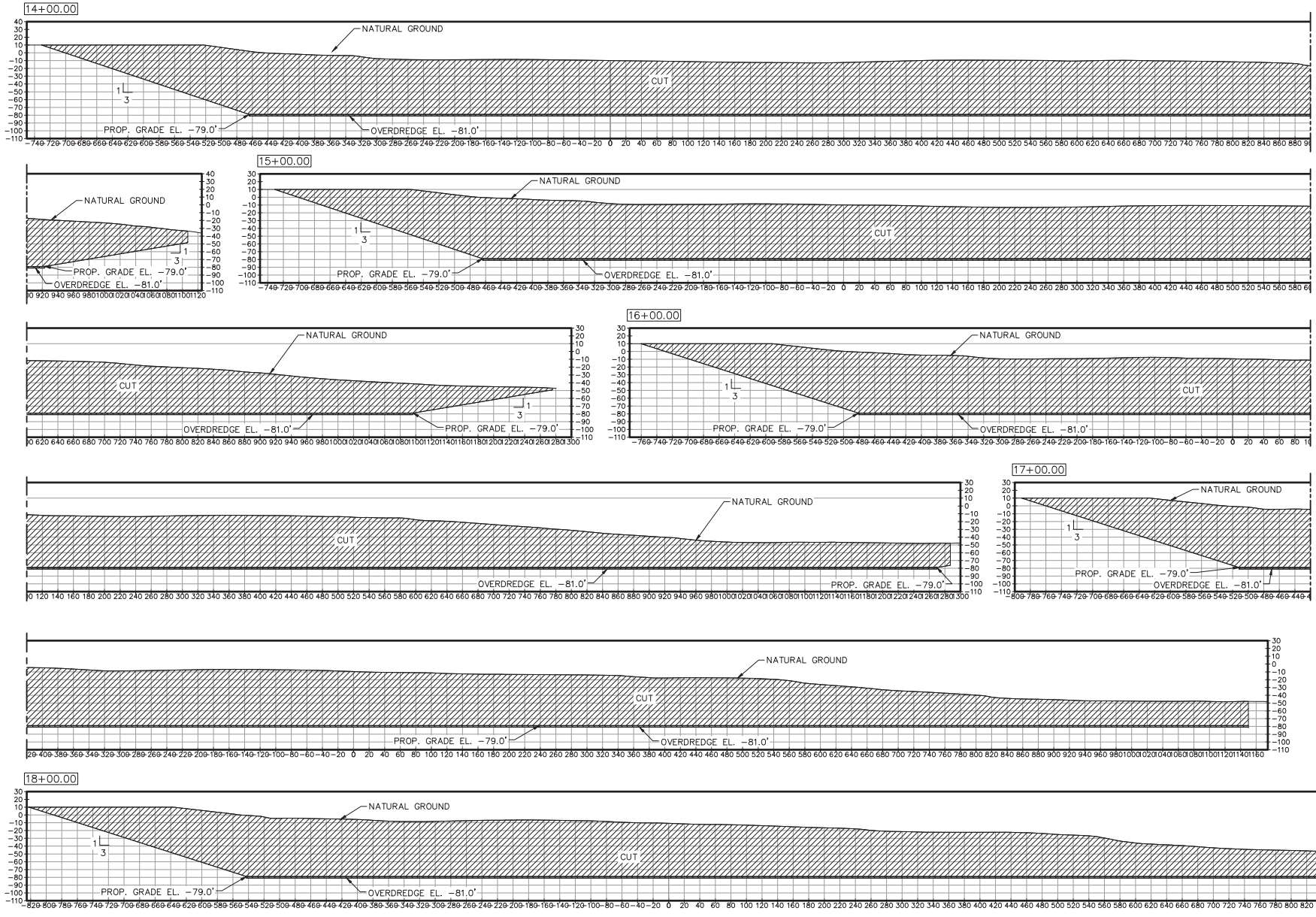
AXIS MIDSTREAM HARBOR ISLAND
CORPUS CHRISTI, TX

CROSS SECTIONS 2 OF 4

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

DESIGN BY:	KEM
DRAWN BY:	JB
DATE:	11-28-2018
SCALE:	AS NOTED @ 22"X34"
SHEET:	03 OF 04
DRAWING NO:	03
REV. A	

FILE NAME: z:\all projects\axis midstream\6.0 drawings\conceptual\OPTION 3\axis midstream - dredging (-79+2)\03 CROSS SECTIONS 2 OF 4.dwg PLOTTED: 8/11/2021 11:18:56 AM USER: JESUS BENITEZ



NO.	DESCRIPTION	DATE	APPR.
A	ISSUED FOR REVIEW	08/10/21	KEM

ISSUED FOR REVIEW

AXIS MIDSTREAM HARBOR ISLAND
CORPUS CHRISTI, TX

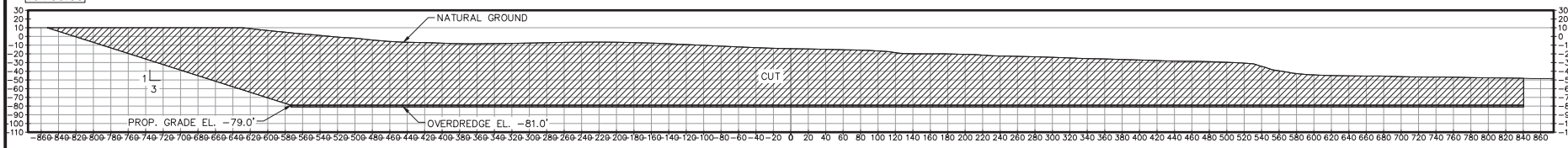
CROSS SECTIONS 3 OF 4

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

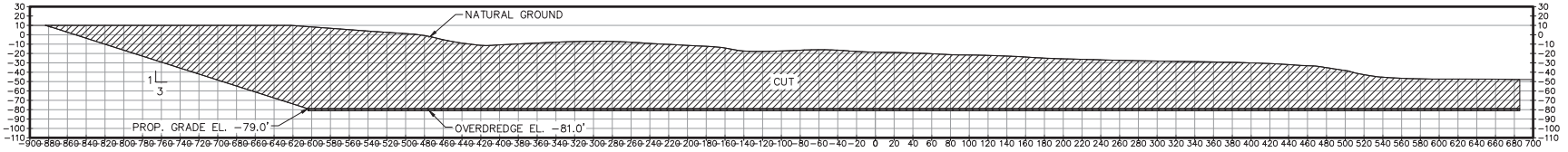
DESIGN BY:	KEM
DRAWN BY:	JB
DATE:	11-28-2018
SCALE:	AS NOTED @ 22"X34"
SHEET:	04 OF 04
DRAWING NO:	04
REV.	A

FILE NAME: z:\all projects\axis midstream\60 drawings\conceptual\OPTION 3\axis midstream - dredging (-)79+2\04 CROSS SECTIONS 3 OF 4.dwg PLOTTED: 8/11/2021 11:19:42 AM USER: JESUS BENITEZ

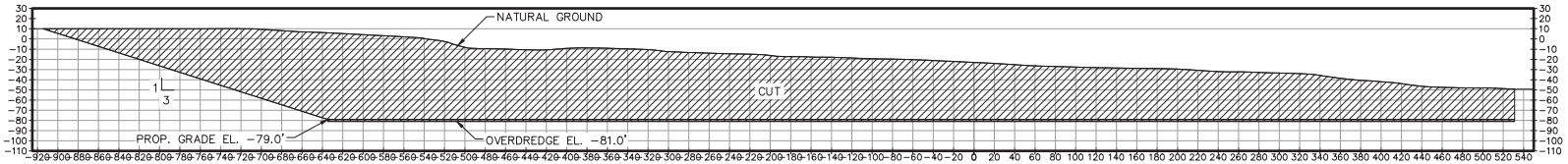
19+00.00



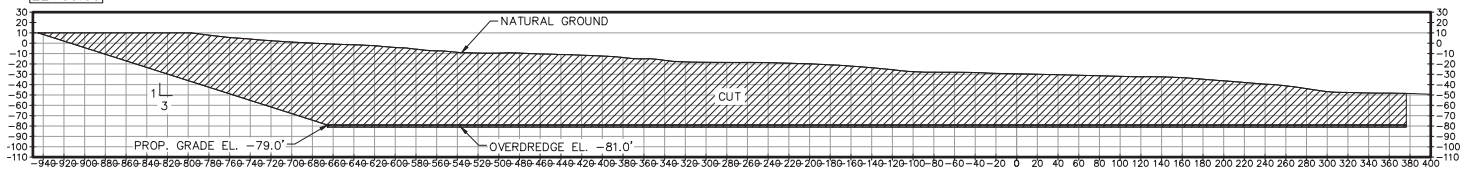
20+00.00



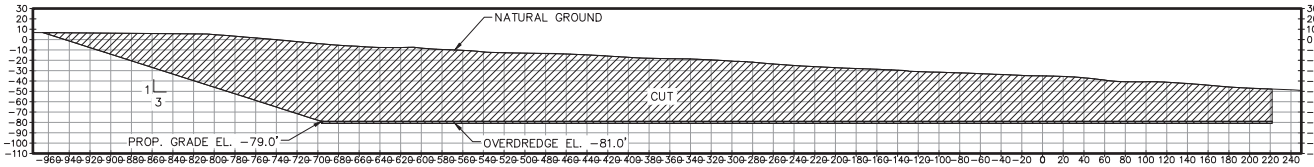
21+00.00



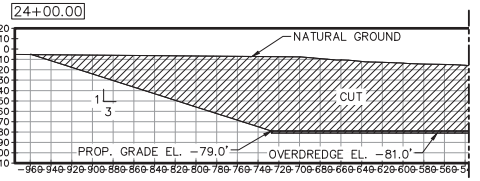
22+00.00

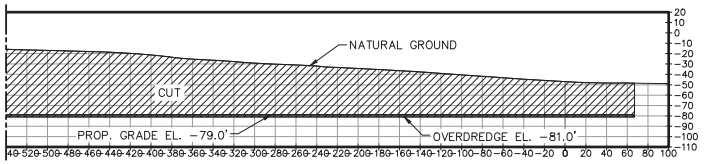


23+00.00

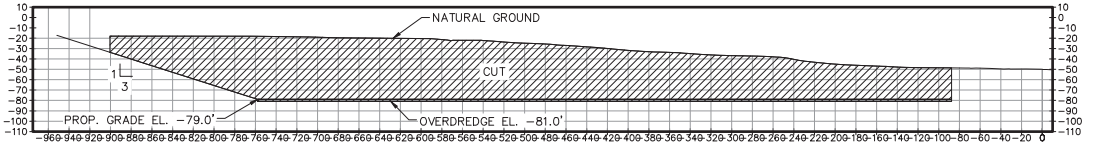


24+00.00





25+00.00



NO.	DESCRIPTION	DATE	APPR.
A	ISSUED FOR REVIEW	08/16/21	KEM

ISSUED FOR REVIEW

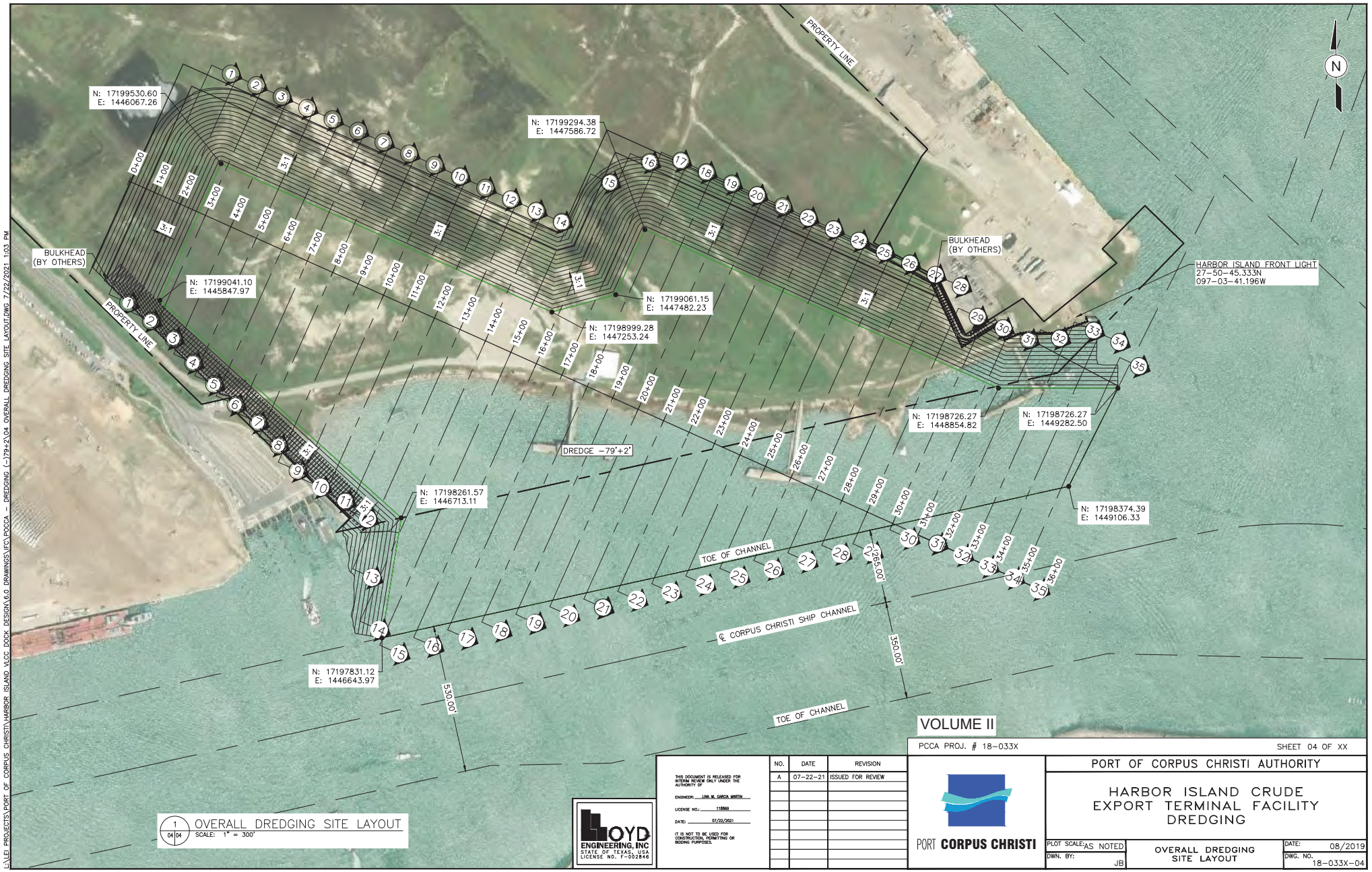
AXIS MIDSTREAM HARBOR ISLAND
CORPUS CHRISTI, TX

CROSS SECTIONS 4 OF 4

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

DESIGN BY:	KEM
DRAWN BY:	JB
DATE:	11-28-2018
SCALE:	AS NOTED @ 22"X34"
SHEET:	05 OF 05
DRAWING NO:	05
REV. A	

FILE NAME: z:\all projects\axis midstream\6.0 drawings\conceptual\OPTION 3\axis midstream - dredging (-)79+21.05 CROSS SECTIONS 4 OF 4.dwg PLOTTED: 8/17/2021 11:20:35 AM USER: JESUS BENITEZ



L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-79+2)\04 OVERALL DREDGING SITE LAYOUT.DWG 7/22/2021 1:03 PM

1 / 04|04 OVERALL DREDGING SITE LAYOUT
SCALE: 1" = 300'

VOLUME II

PCCA PROJ. # 18-033X

SHEET 04 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

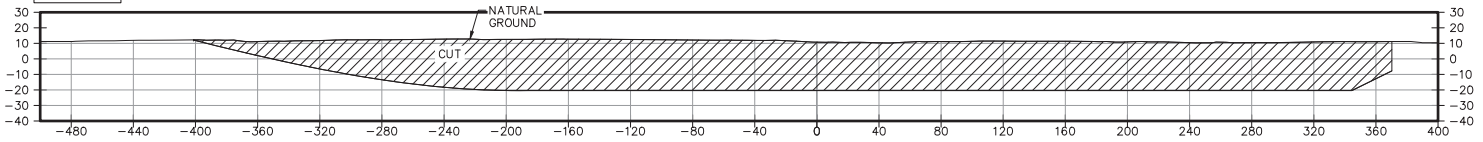
PLOT SCALE: AS NOTED
DWN. BY: JB

OVERALL DREDGING SITE LAYOUT

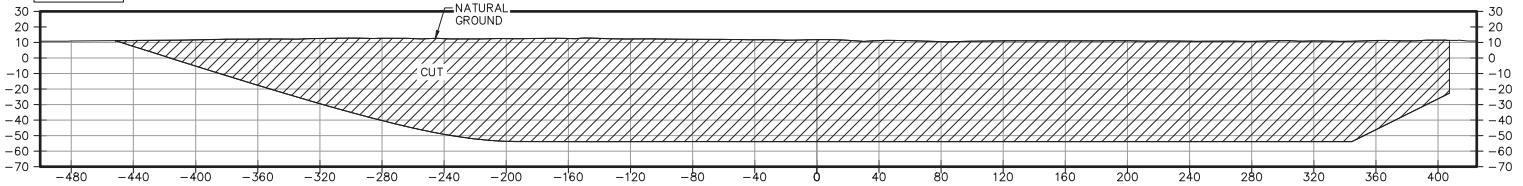
DATE: 08/2019
DWG. NO. 18-033X-04

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (—)79+2\05 GROSS SECTIONS 1 OF 12.DWG 7/22/2021 1:03 PM

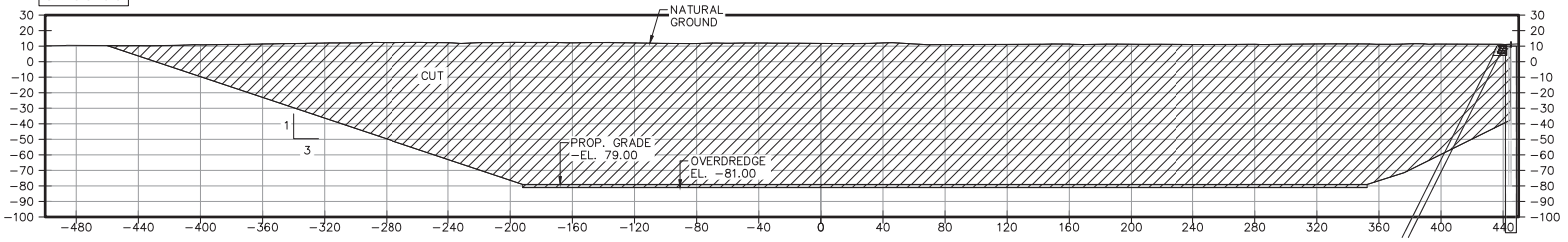
1+00.00



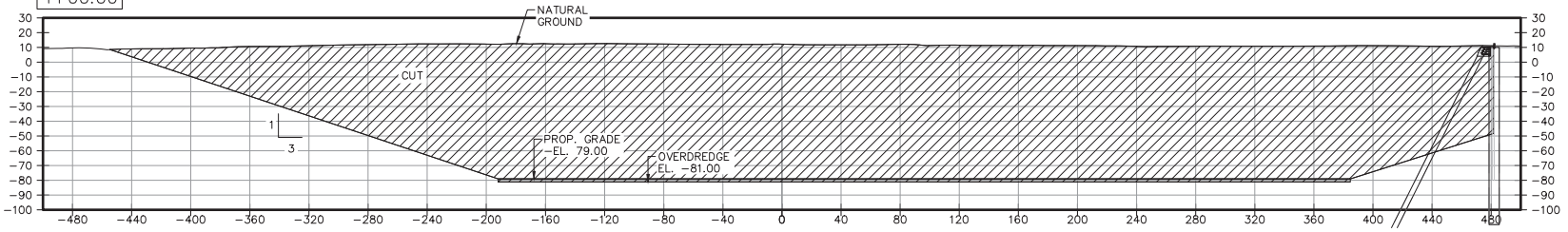
2+00.00



3+00.00



4+00.00



PCCA PROJ. # 18-033X

SHEET 05 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

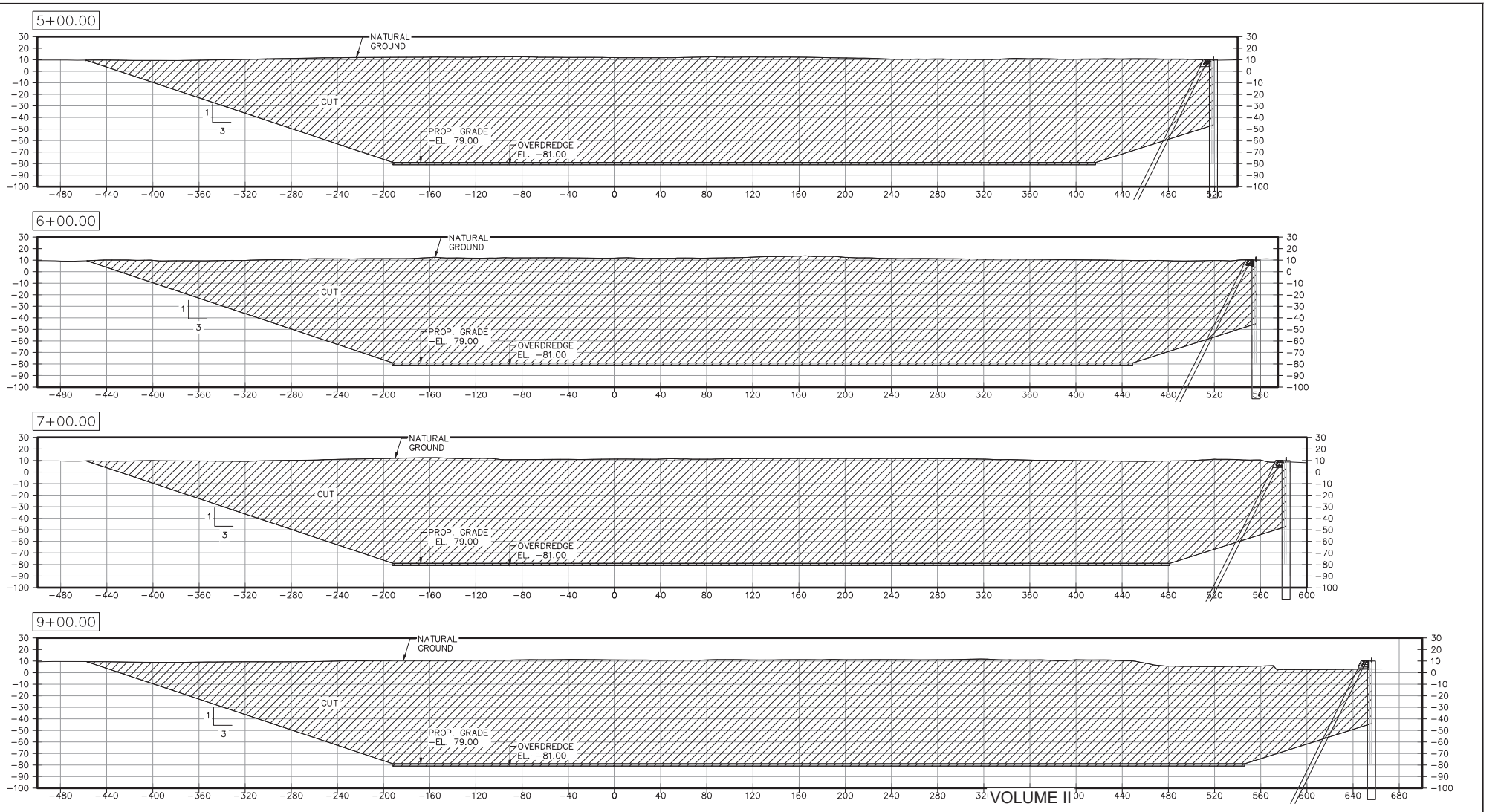
PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED
DWN. BY: JB

CROSS SECTIONS 1 OF 12

DATE: 08/2019
DWG. NO. 18-033X-05



VOLUME II

PCCA PROJ. # 18-033X

SHEET 06 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

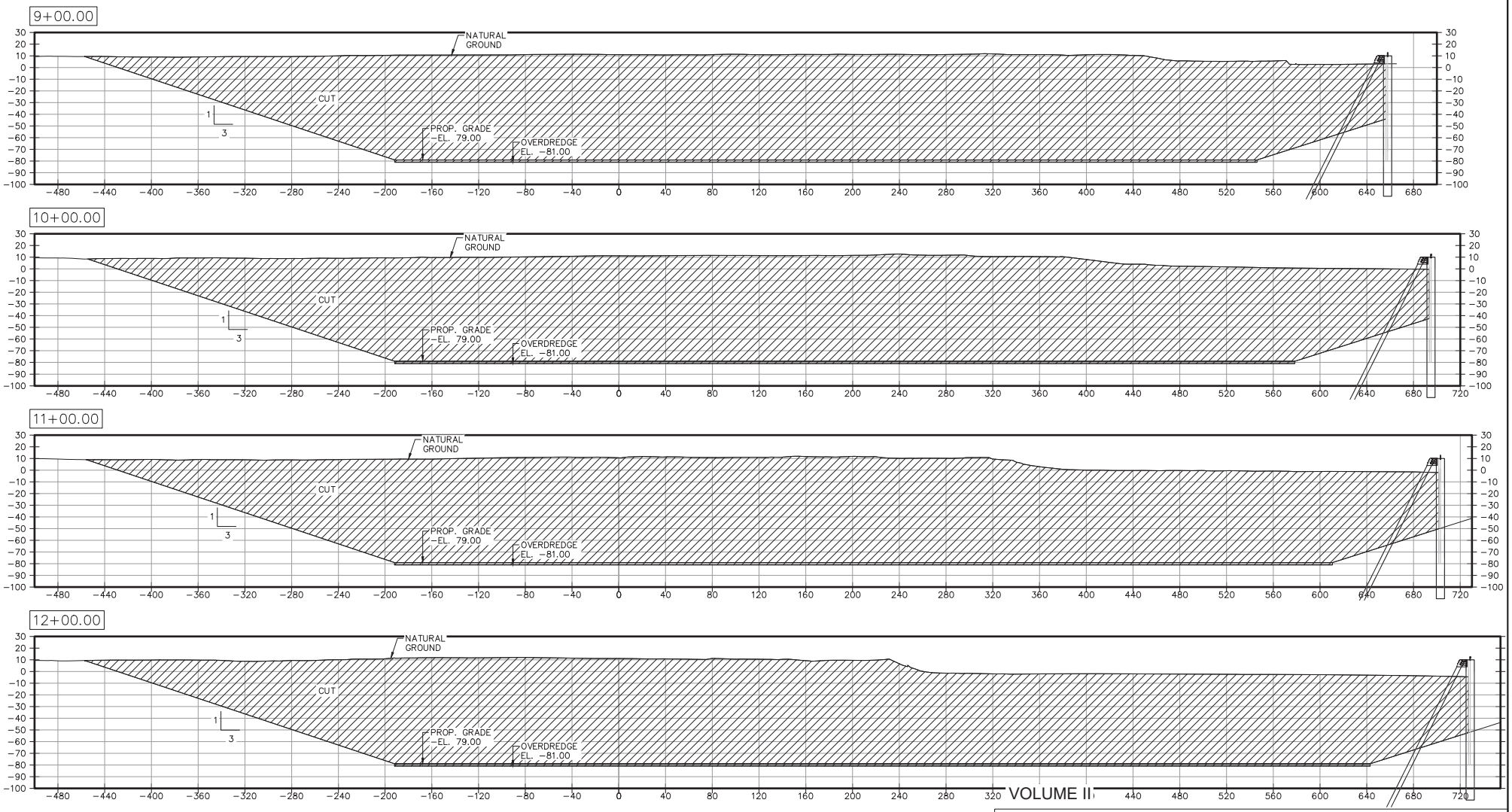
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED
DWN. BY: JB

CROSS SECTIONS
2 OF 12

DATE: 08/2019
DWG. NO. 18-033X-06

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\06 CROSS SECTIONS 2 OF 12.DWG 7/22/2021 1:03 PM



VOLUME II

PCCA PROJ. # 18-033X

SHEET 07 OF XX

PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

CROSS SECTIONS
3 OF 12

PLOT SCALE: AS NOTED
DWN. BY: JB
DATE: 08/2019
DWG. NO. 18-033X-07

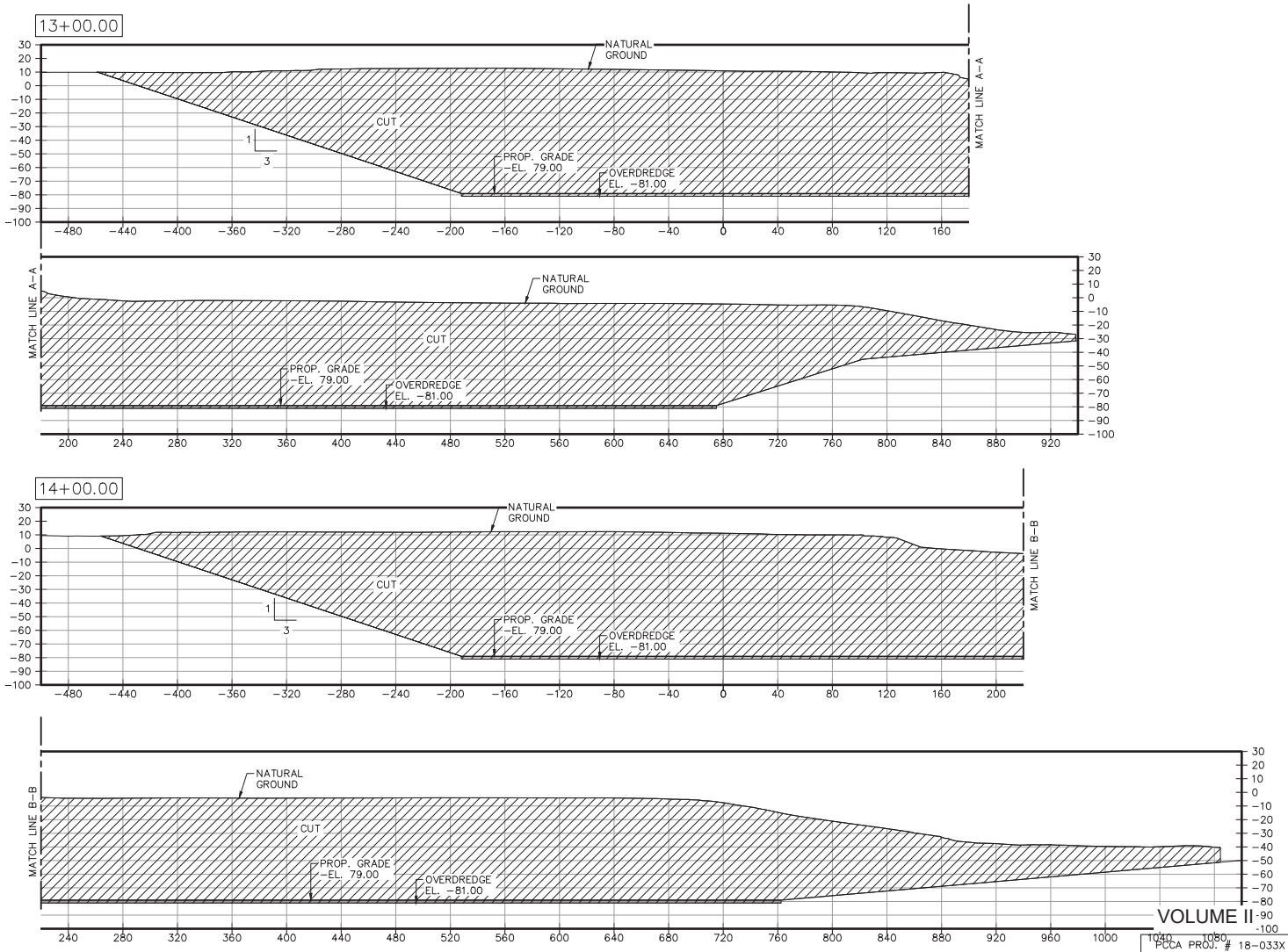
NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

PORT CORPUS CHRISTI

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\07 CROSS SECTIONS 3 OF 12.DWG 7/22/2021 1:03 PM



VOLUME II

PCCA PROJ. # 18-033X

SHEET 08 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

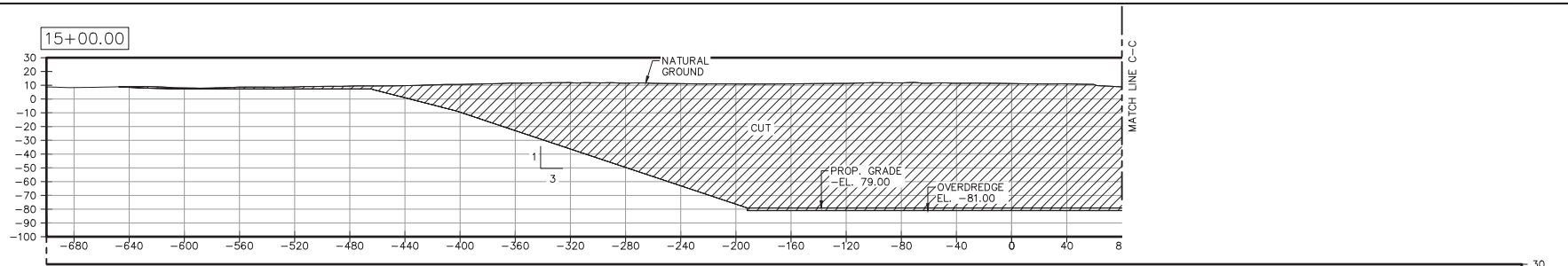
PORT CORPUS CHRISTI

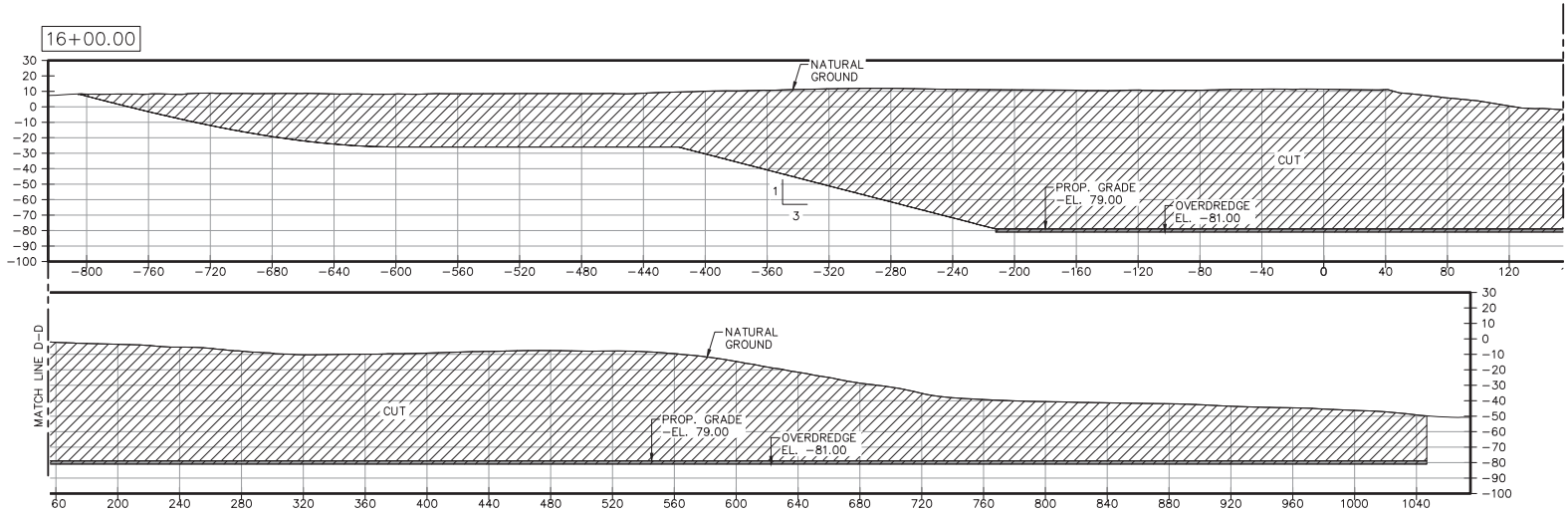
PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED	CROSS SECTIONS 4 OF 12	DATE: 08/2019
DWN. BY: JB		DWG. NO. 18-033X-08

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\08 CROSS SECTIONS 4 OF 12.DWG 7/22/2021 1:04 PM





VOLUME II

PCCA PROJ. # 18-033X

SHEET 09 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

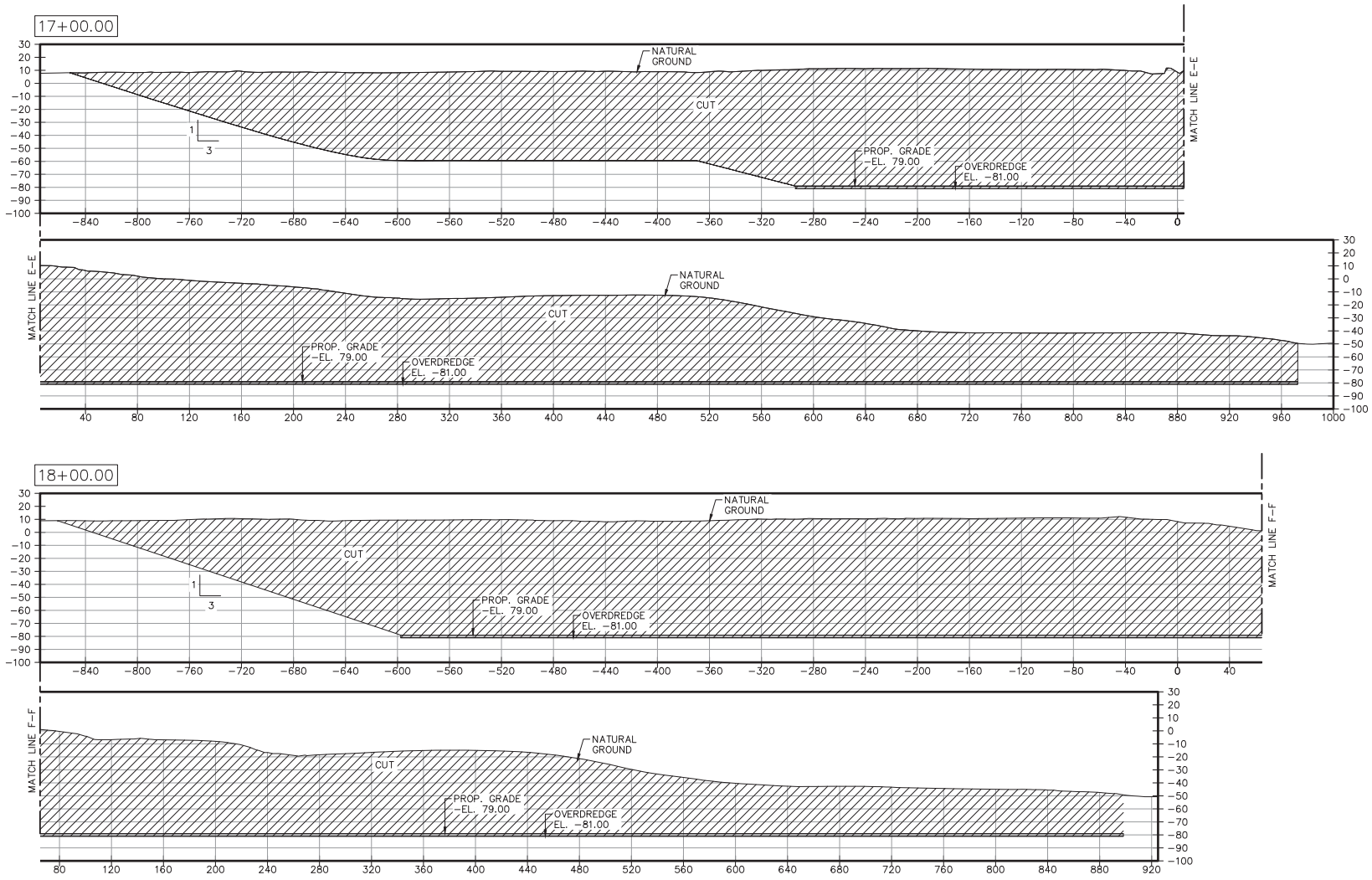
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED
DWN. BY: JB

CROSS SECTIONS
5 OF 12

DATE: 08/2019
DWG. NO. 18-033X-09

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\09 CROSS SECTIONS 5 OF 12.DWG 7/22/2021 1:04 PM



VOLUME II

PCCA PROJ. # 18-033X

SHEET 10 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002844

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

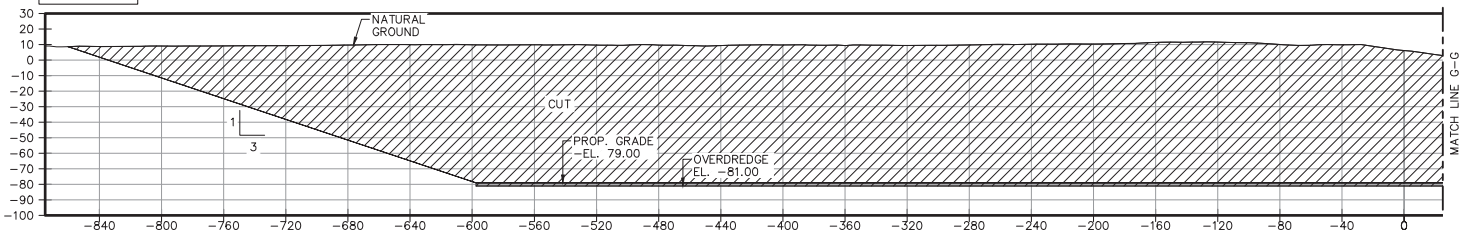
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

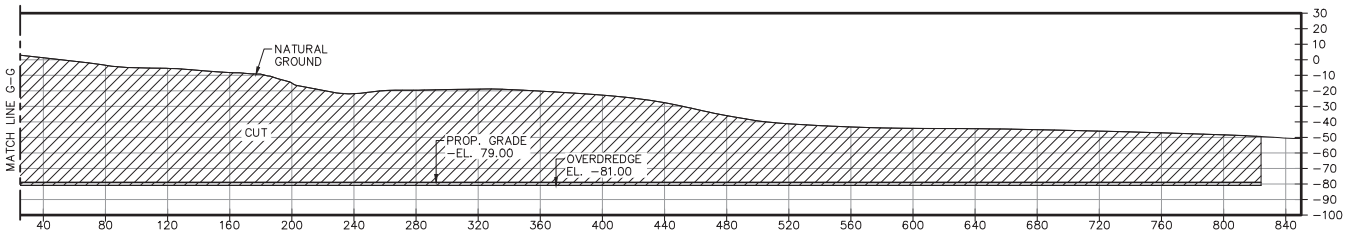
PLOT SCALE: AS NOTED	CROSS SECTIONS 6 OF 12	DATE: 08/2019
DWN. BY: JB		DWG. NO. 18-033X-10

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\10 GROSS SECTIONS 6 OF 12.DWG 7/22/2021 1:04 PM

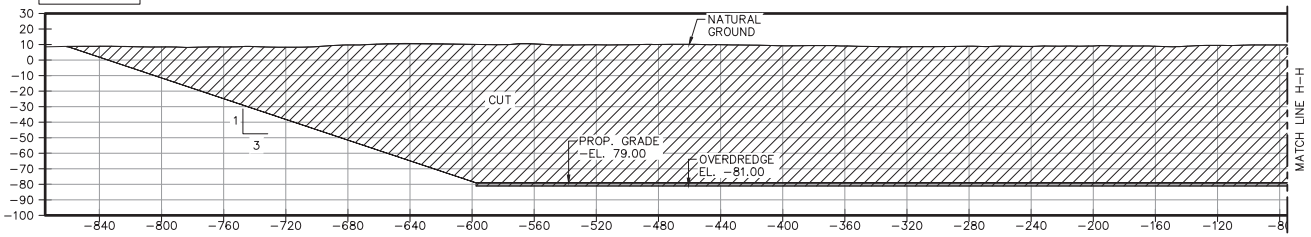
L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\11 CROSS SECTIONS 7 OF 12.DWG 7/22/2021 1:04 PM

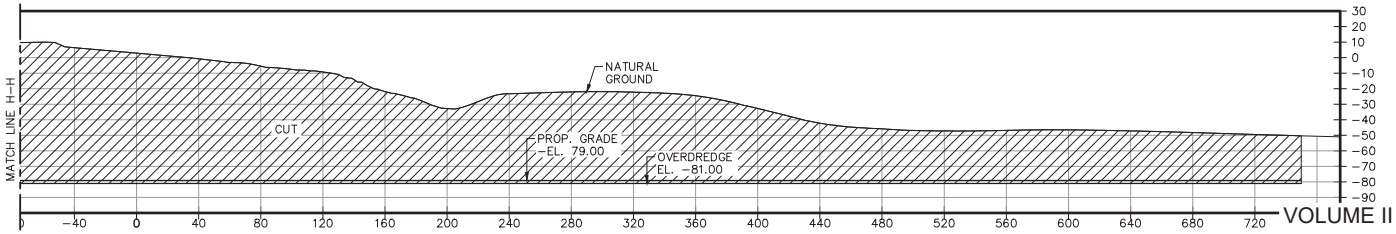
19+00.00





20+00.00





VOLUME II

PCCA PROJ. # 18-033X

SHEET 11 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

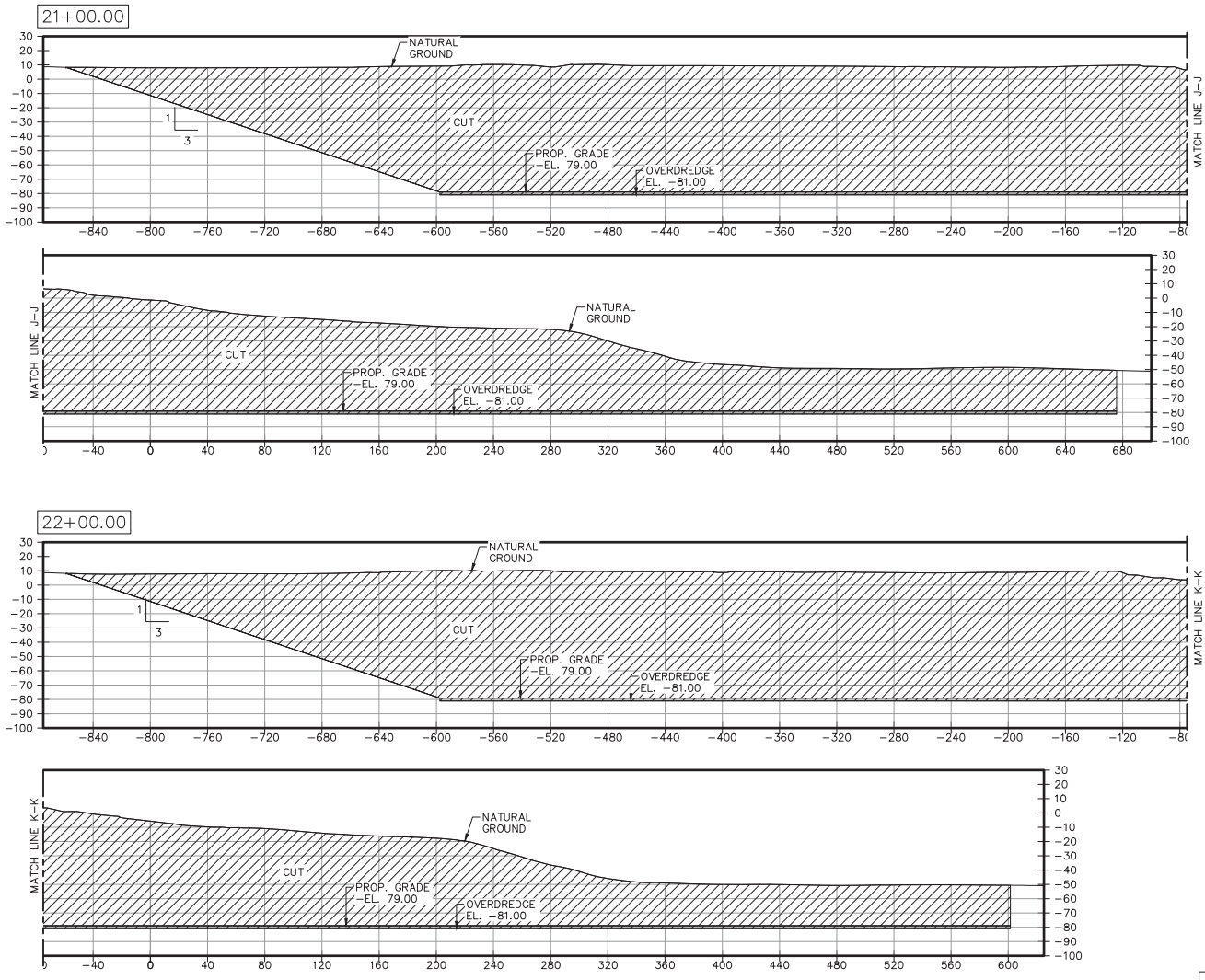
NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED	CROSS SECTIONS 7 OF 12	DATE: 08/2019
DWN. BY: JB		DWG. NO. 18-033X-11



VOLUME II

PCCA PROJ. # 18–033X

SHEET 12 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F–002846

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07–22–21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED
DWN. BY: JB

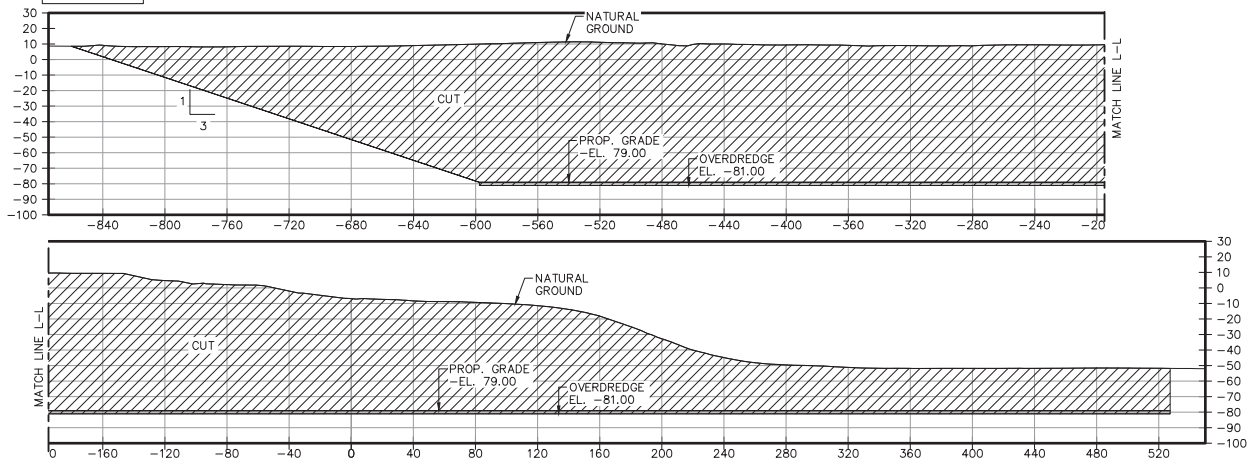
CROSS SECTIONS
8 OF 12

DATE: 08/2019
DWG. NO. 18–033X–12

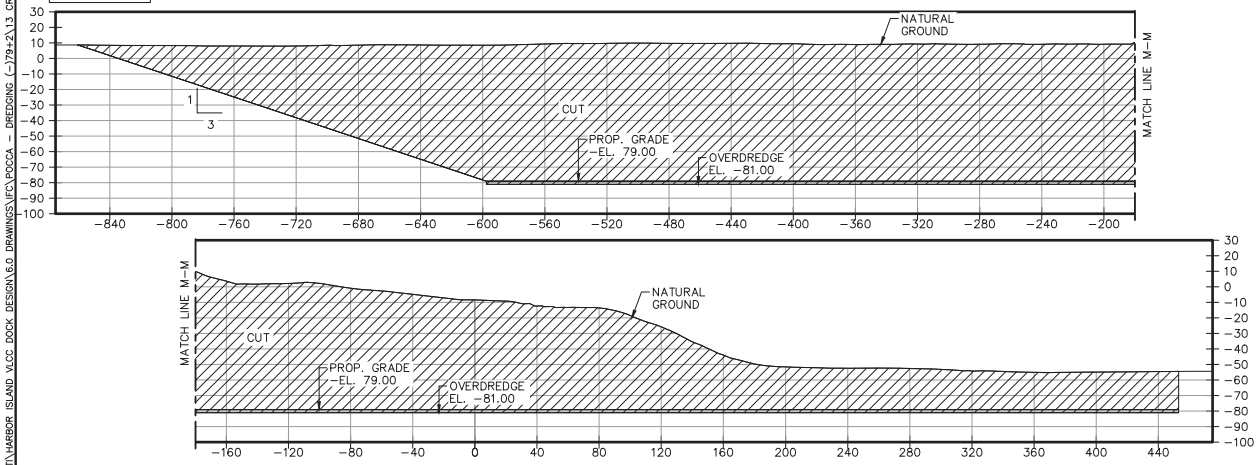
L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (–)79+2\12 CROSS SECTIONS 8 OF 12.DWG 7/22/2021 1:05 PM

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\PCCA - DREDGING (-79+2\13 CROSS SECTIONS 9 OF 12.DWG 7/22/2021 1:05 PM

23+00.00



24+00.00



VOLUME II

PCCA PROJ. # 18-033X

SHEET 13 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

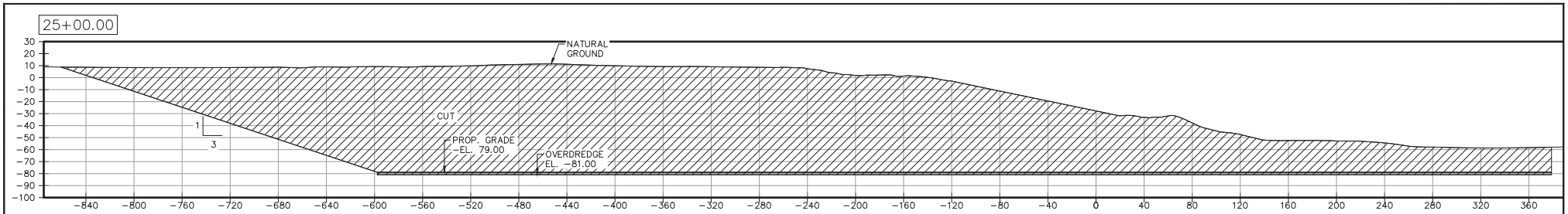
PORT OF CORPUS CHRISTI AUTHORITY

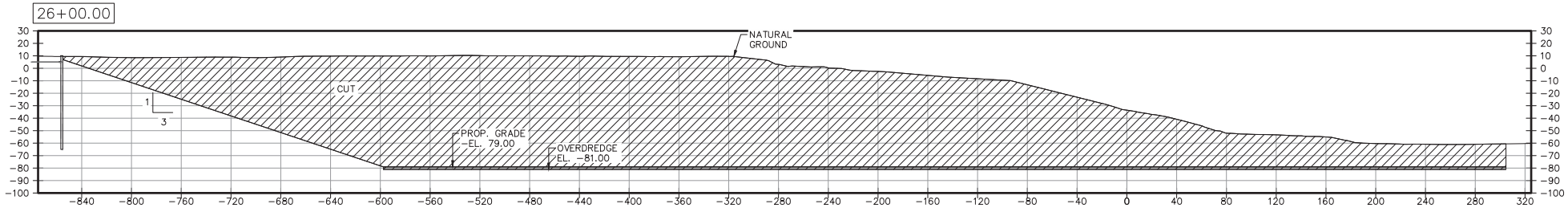
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

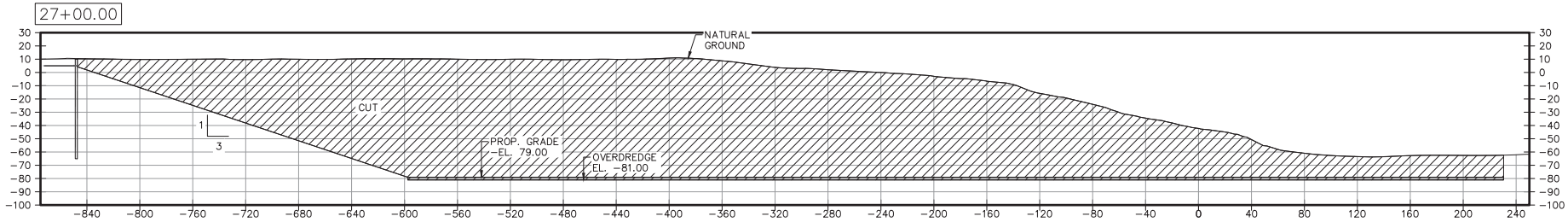
PLOT SCALE: AS NOTED
DWN. BY: JB

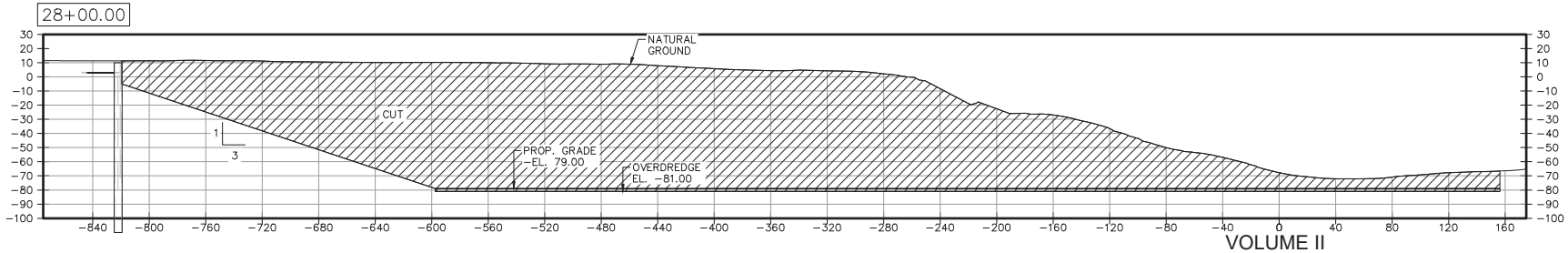
CROSS SECTIONS 9 OF 12

DATE: 08/2019
DWG. NO. 18-033X-13









VOLUME II

PCCA PROJ. # 18-033X

SHEET 14 OF XX

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF

ENGINEER: LINA M. GARCIA MARTIN

LICENSE NO.: 118869

DATE: 07/22/2021

IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

HOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED

DWN. BY: JB

CROSS SECTIONS 10 OF 12

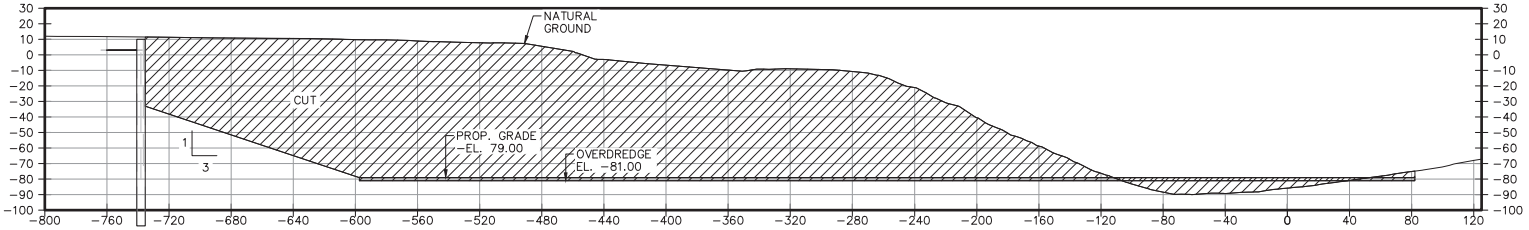
DATE: 08/2019

DWG. NO. 18-033X-14

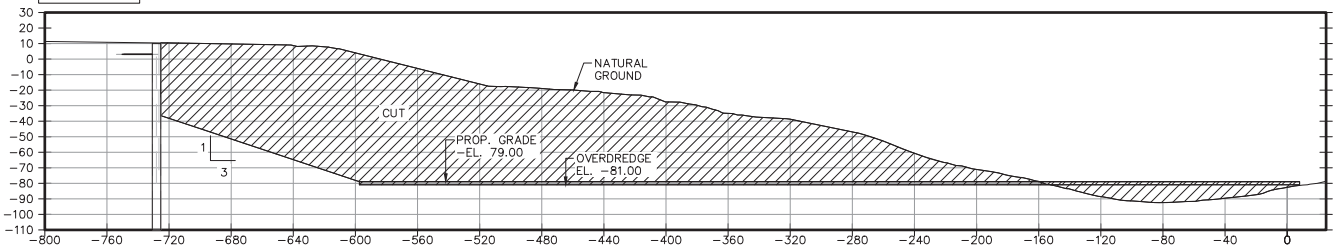
L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\IFC\PCCA - DREDGING (-)79+2\14 CROSS SECTIONS 10 OF 12.DWG 7/22/2021 1:05 PM

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FC\PCCCA — DREDGING (-)79+2\15 CROSS SECTIONS 11 OF 12.DWG 7/22/2021 1:05 PM

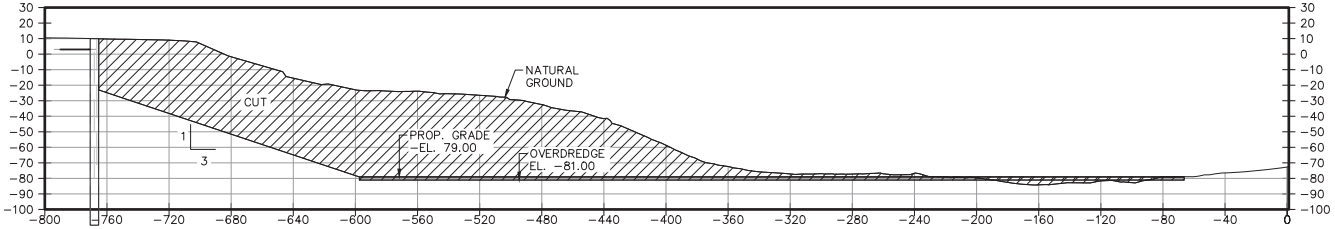
29+00.00



30+00.00



31+00.00



VOLUME II

PCCA PROJ. # 18-033X

SHEET 15 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002646

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

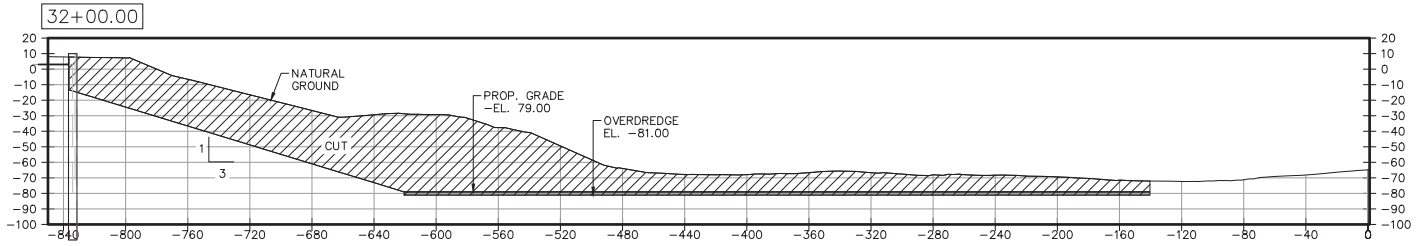
PORT OF CORPUS CHRISTI AUTHORITY

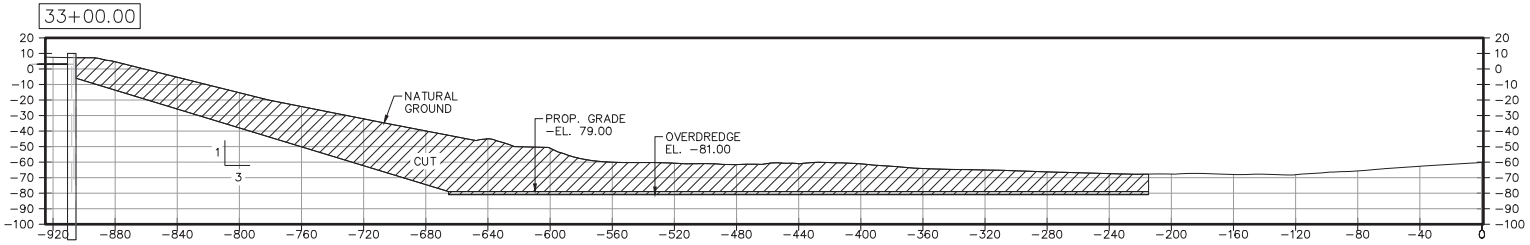
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

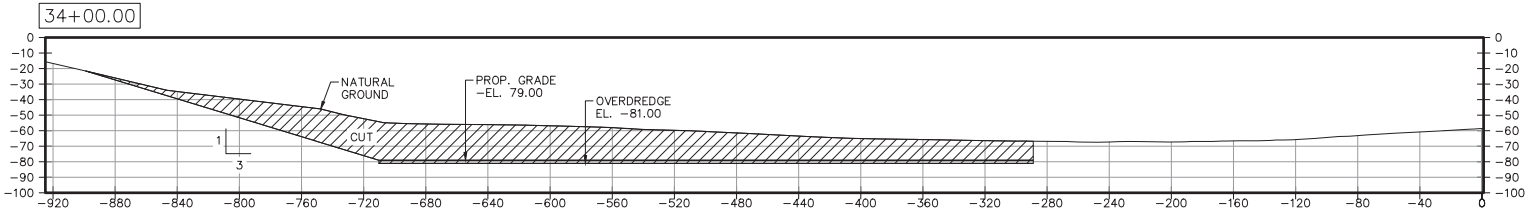
PLOT SCALE: AS NOTED
DWN. BY: JB

CROSS SECTIONS
11 OF 12

DATE: 08/2019
DWG. NO. 18-033X-15







VOLUME II

PCCA PROJ. # 18-033X

SHEET 16 OF XX

LOYD ENGINEERING, INC
STATE OF TEXAS, USA
LICENSE NO. F-002846

THIS DOCUMENT IS RELEASED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF
ENGINEER: LINA M. GARCIA MARTIN
LICENSE NO.: 115869
DATE: 07/22/2021
IT IS NOT TO BE USED FOR CONSTRUCTION, PERMITTING OR BIDDING PURPOSES.

NO.	DATE	REVISION
A	07-22-21	ISSUED FOR REVIEW

PORT CORPUS CHRISTI

PORT OF CORPUS CHRISTI AUTHORITY

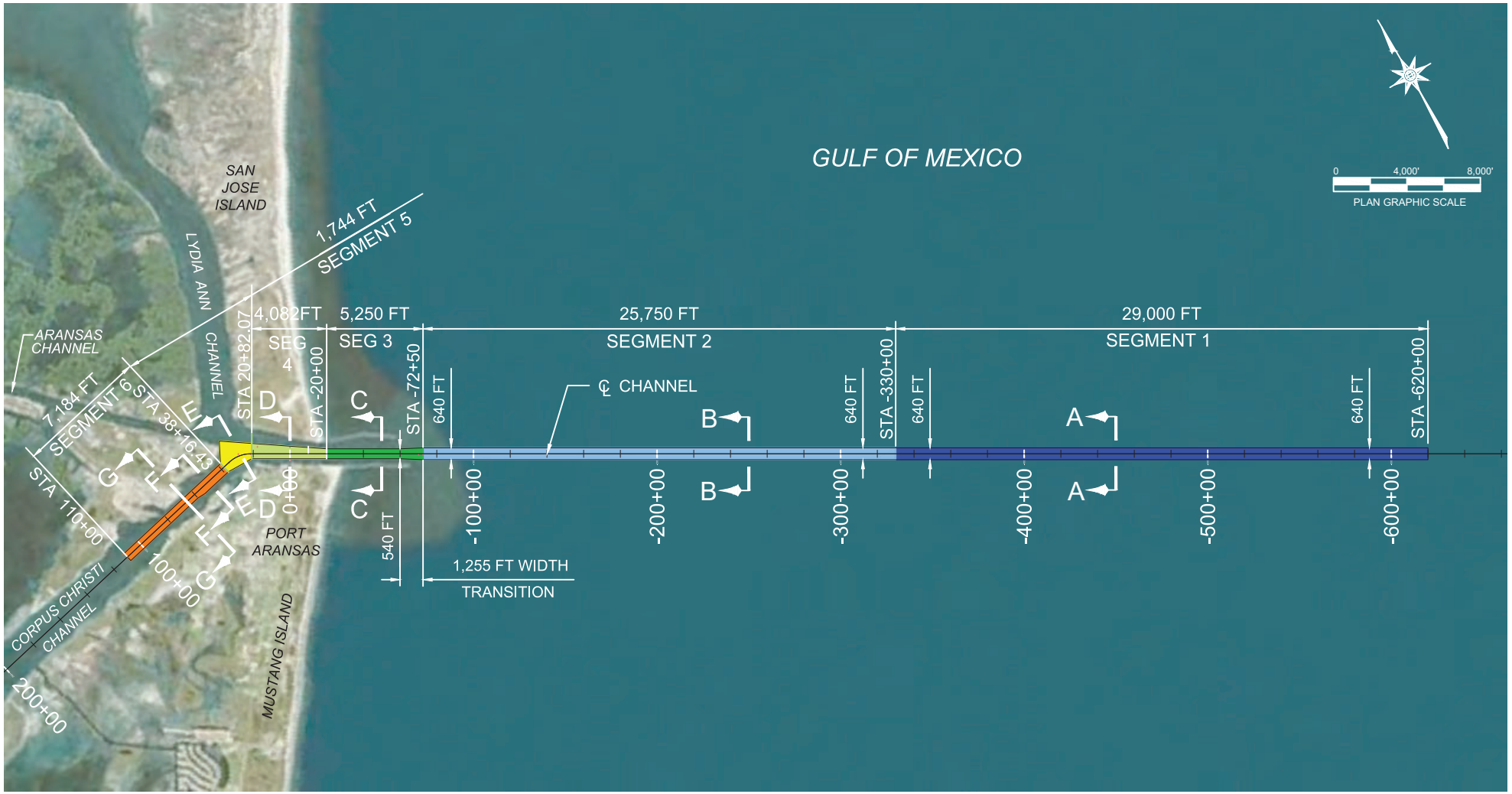
HARBOR ISLAND CRUDE EXPORT TERMINAL FACILITY DREDGING

PLOT SCALE: AS NOTED
DWN. BY: JB

CROSS SECTIONS 12 OF 12

DATE: 08/2019
DWG. NO. 18-033X-16

L:\LEI PROJECTS\PORT OF CORPUS CHRISTI\HARBOR ISLAND VLCC DOCK DESIGN\6.0 DRAWINGS\FCV\PCCCA — DREDGING (-)79+2\16 GROSS SECTIONS 12 OF 12.DWG 7/22/2021 1:06 PM



DREDGING PLAN

SCALE: 1" = 8000'

SEGMENT	STATIONING (@ CHANNEL CL)		*DEPTH (FT BELOW MLLW)	DESCRIPTION	PLAN VIEW LEGEND
	FROM	TO			
1	STA -620+00	STA -330+00	-77.0	*Outer Channel*	
2	STA -330+00	STA -72+50	-77.0	*Approach Channel*	
3	STA -72+50	STA -20+00	-75.0	*Jetties to Harbor Island Transition Flare*	
4	STA -20+00	STA 20+82.07	-75.0	*Harbor Island Transition Flare*	
5	STA 20+82.07	STA 38+16.43	-75.0	*Harbor Island Junction*	
6	STA 38+16.43	STA 110+00	-75.0	*Corpus Christi Channel*	

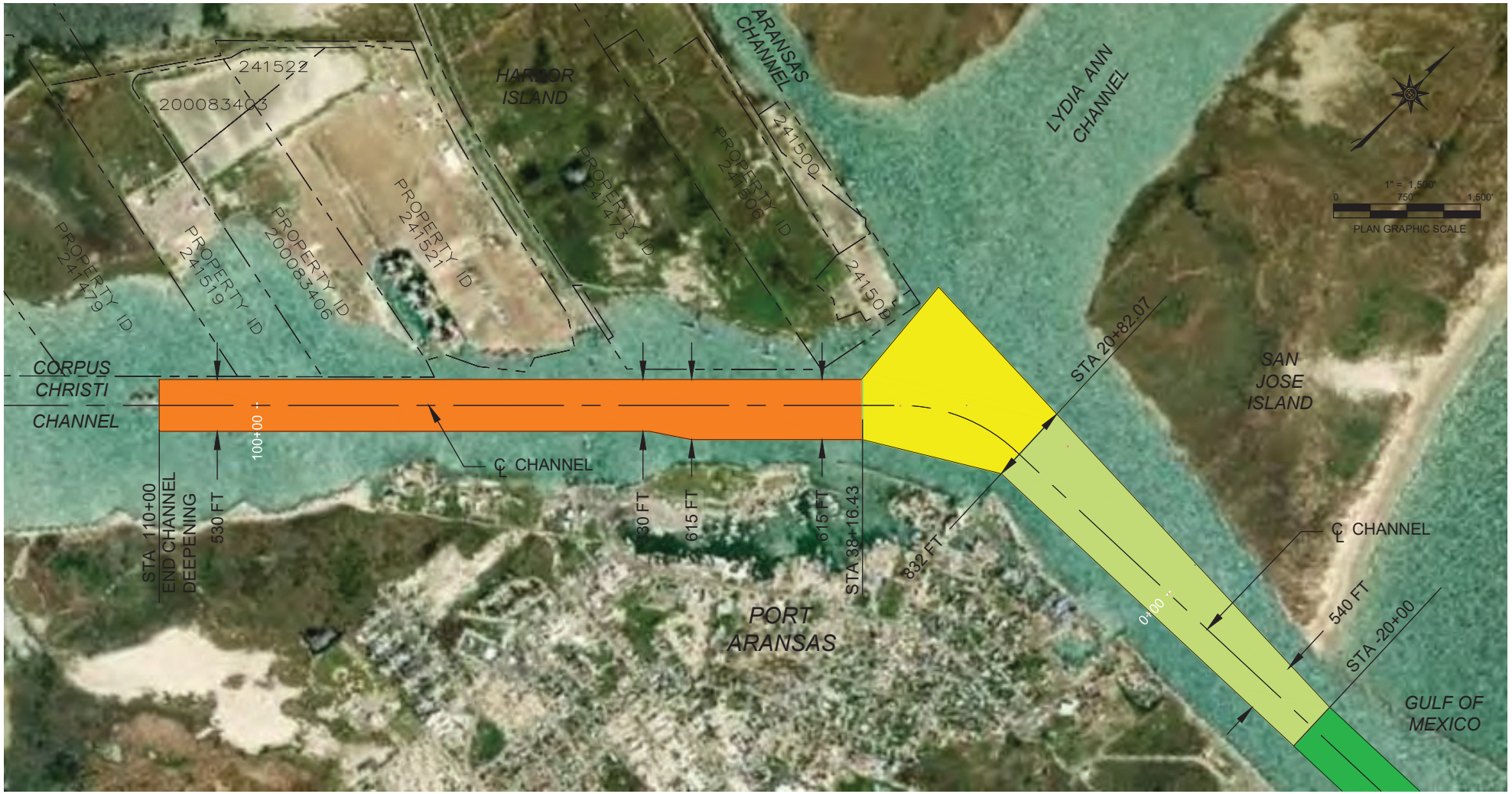
* DESIGN DEPTH SHOWN. DOES NOT INCLUDE 2.0 FT ADVANCED MAINTENANCE DREDGING OR 2.0 FT ALLOWABLE OVER DREDGE.

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020



Property ID	OWNER
241479	STATE OF TEXAS
241519	ERF PORT ARANSAS INC
200083403	ERF PORT ARANSAS INC
200083406	ERF PORT ARANSAS INC
241521	ERF PORT ARANSAS INC
241522	ERF PORT ARANSAS INC
241473	PORT OF CORPUS CHRISTI AUTHORITY
241506	PORT OF CORPUS CHRISTI AUTHORITY
241509	MARTIN OPERATING PARTNERSHIP LP
241500	MARTIN OPERATING PARTNERSHIP LP

GENERAL NOTE:

PARCEL LINES WERE RETRIEVED FROM NUECES COUNTY APPRAISAL DISTRICT WEBSITE DATED 2018.

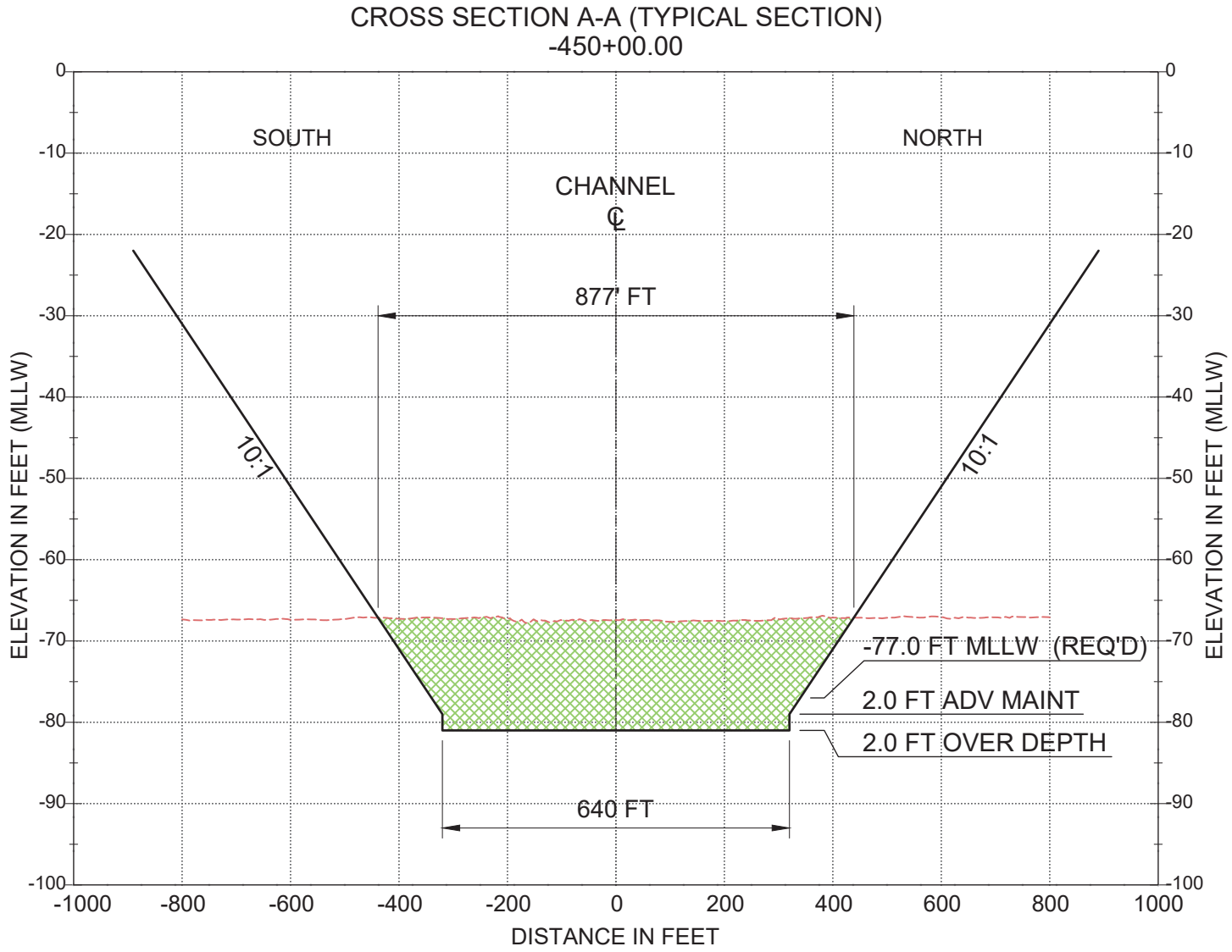
PARCEL LINES

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Turning Basin and Flare View

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: May 2019



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

VERTICAL: 1" = 20

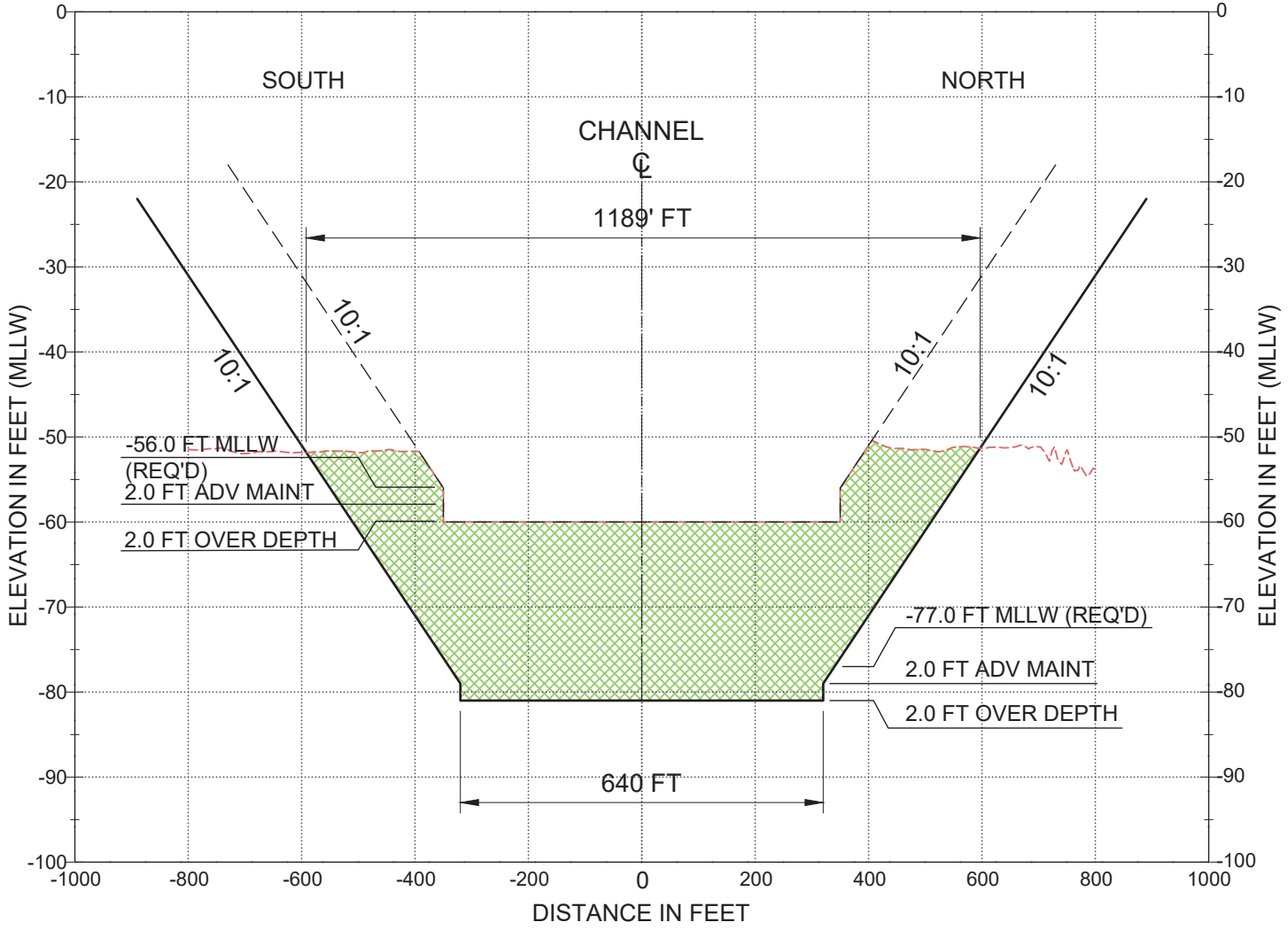
Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section A-A STA -450+00.00

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020

CROSS SECTION B-B (TYPICAL SECTION)
-250+00.00



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

VERTICAL: 1" = 20

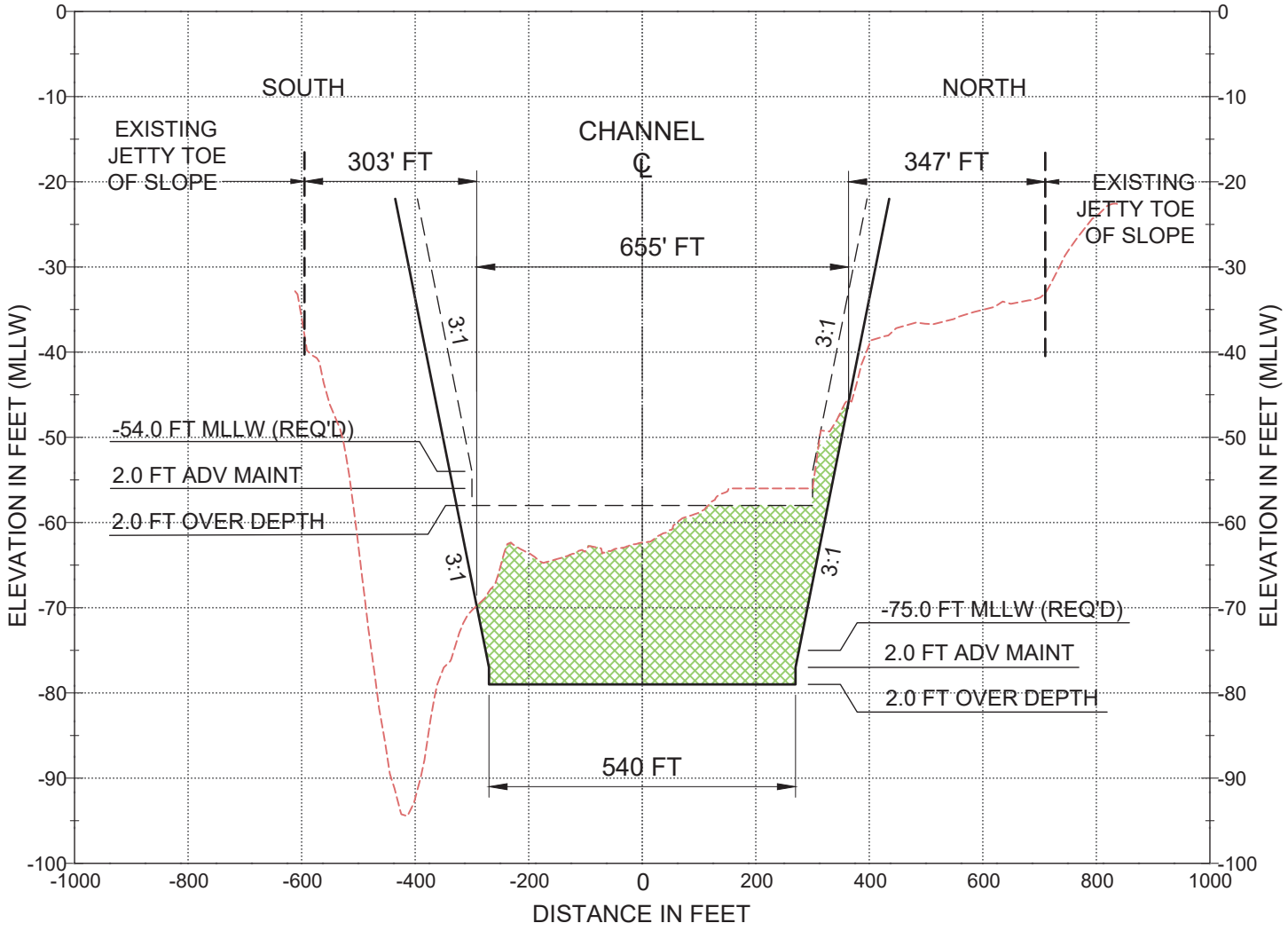
Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section B-B STA -250+00.00

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020

CROSS SECTION C-C (TYPICAL SECTION)
-50+00.00



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

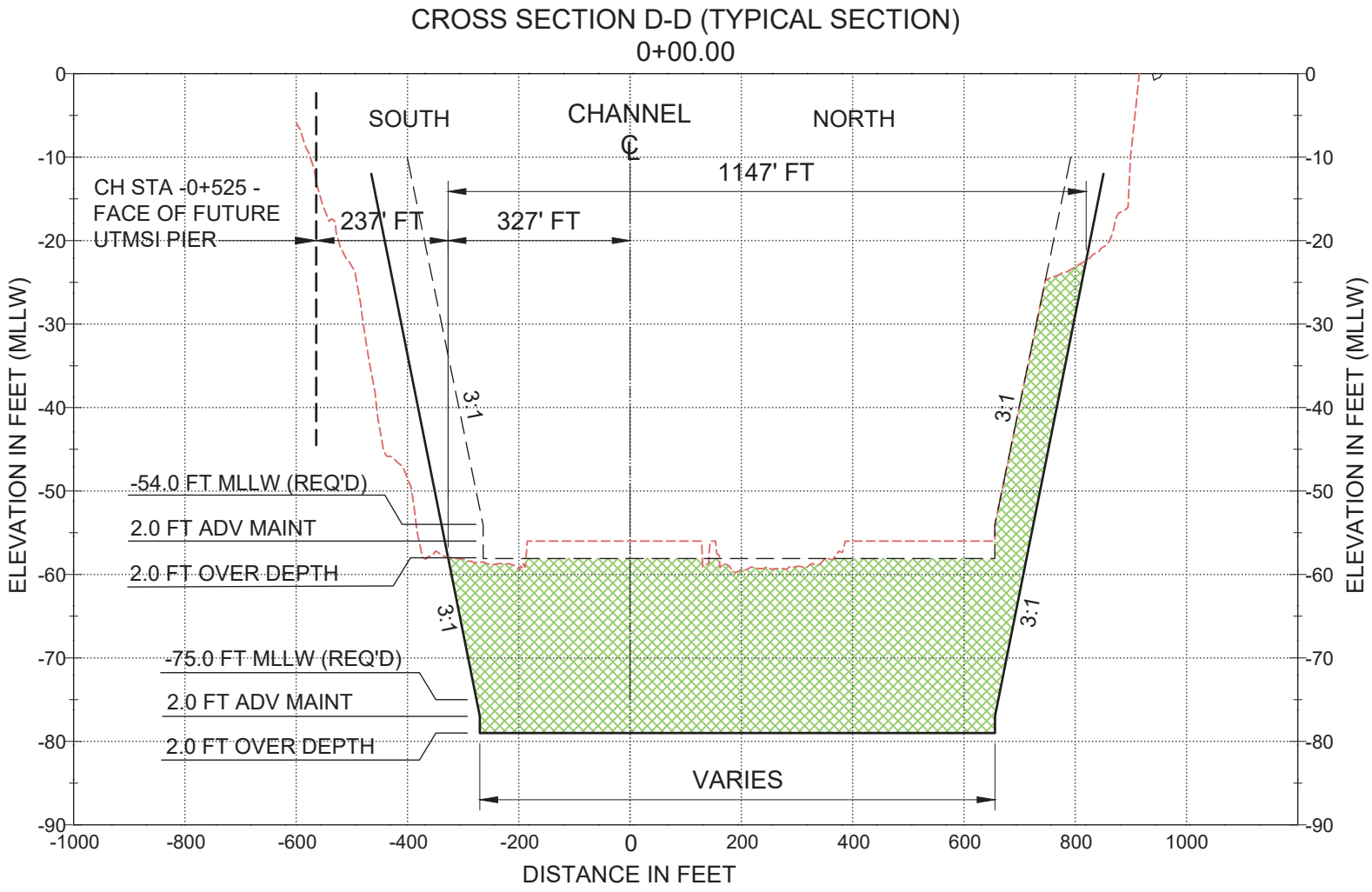
VERTICAL: 1" = 20

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section C-C STA -50+00.00

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

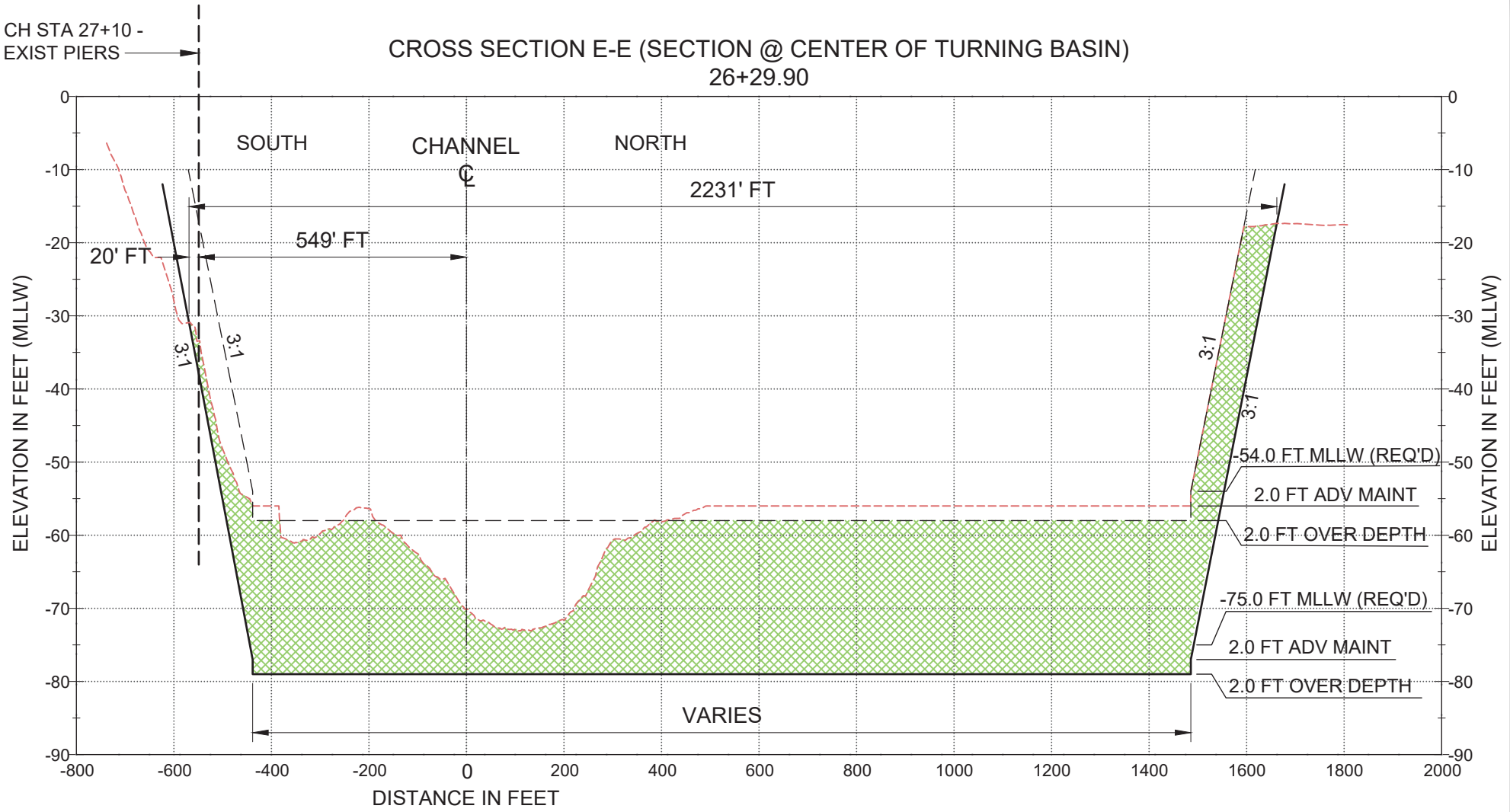
VERTICAL: 1" = 20

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section D-D STA 0+00.00

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

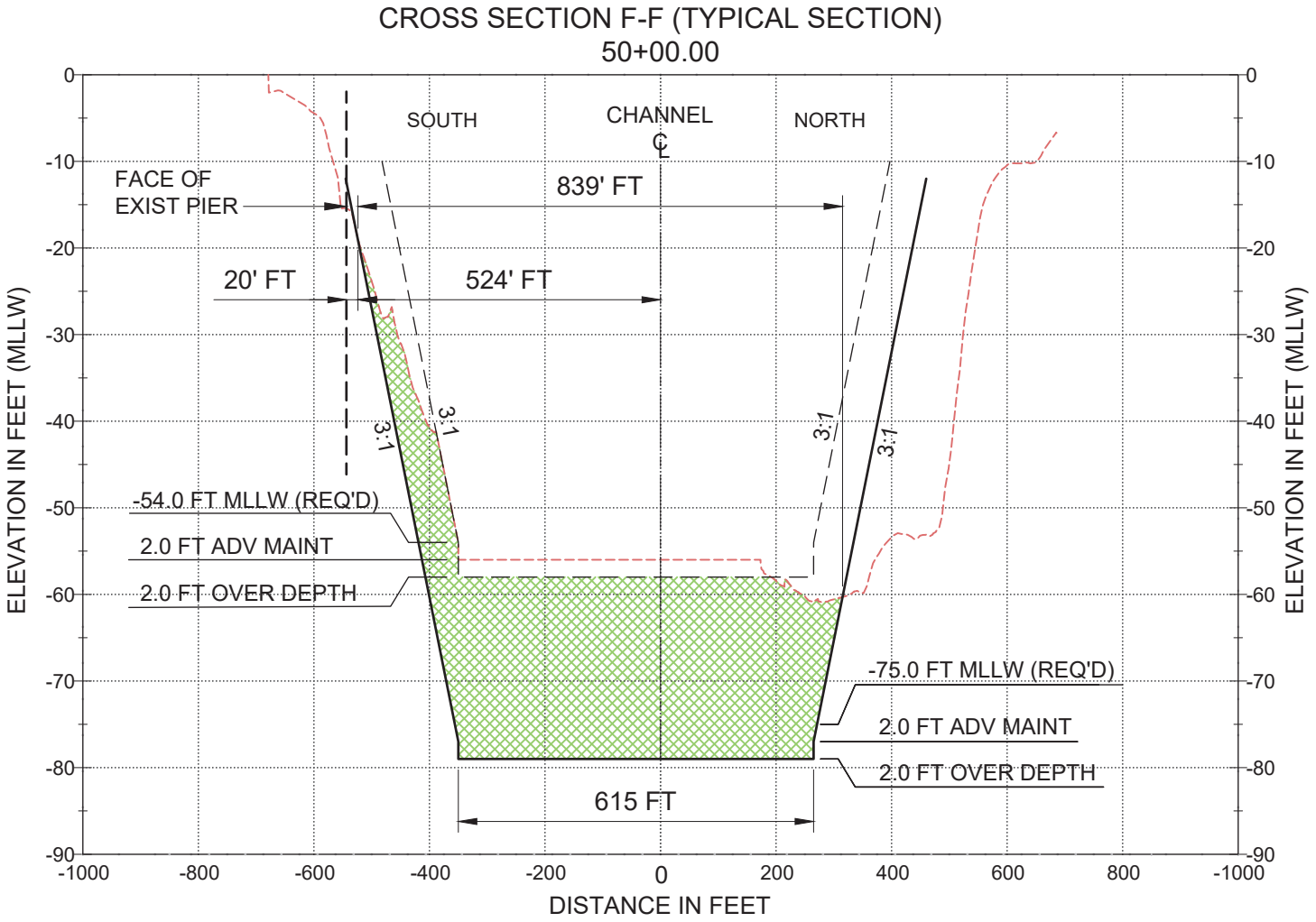
VERTICAL: 1" = 20

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section E-E STA 26+29.90

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

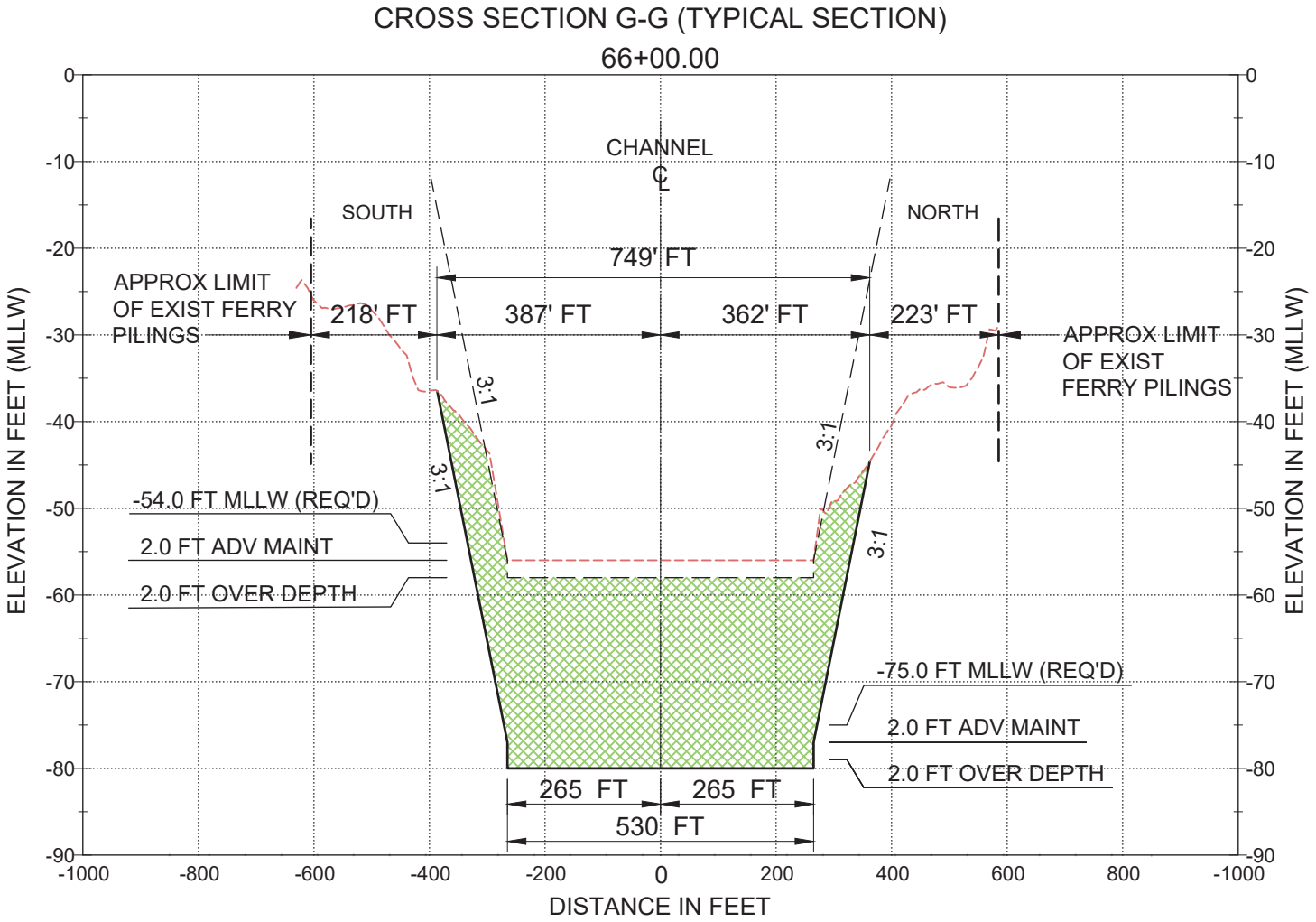
VERTICAL: 1" = 20

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

Preferred Channel Alternative Dredging Cross Section F-F STA 50+00.00

County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

State: Texas
Date: April 2020



CROSS SECTION LEGEND:

- EXISTING BOTTOM
- EXISTING CHANNEL DREDGE TEMPLATE
- PROPOSED CHANNEL
- PROPOSED AREA TO BE DREDGED

CROSS SECTION GRAPHIC SCALES:

0 100' 200' 300' 400' 500'

HORIZONTAL: 1" = 300'

0 10' 20' 30'

VERTICAL: 1" = 20

Corpus Christi Ship Channel Deepening Project
Individual Permit Application SWG-2019-00067

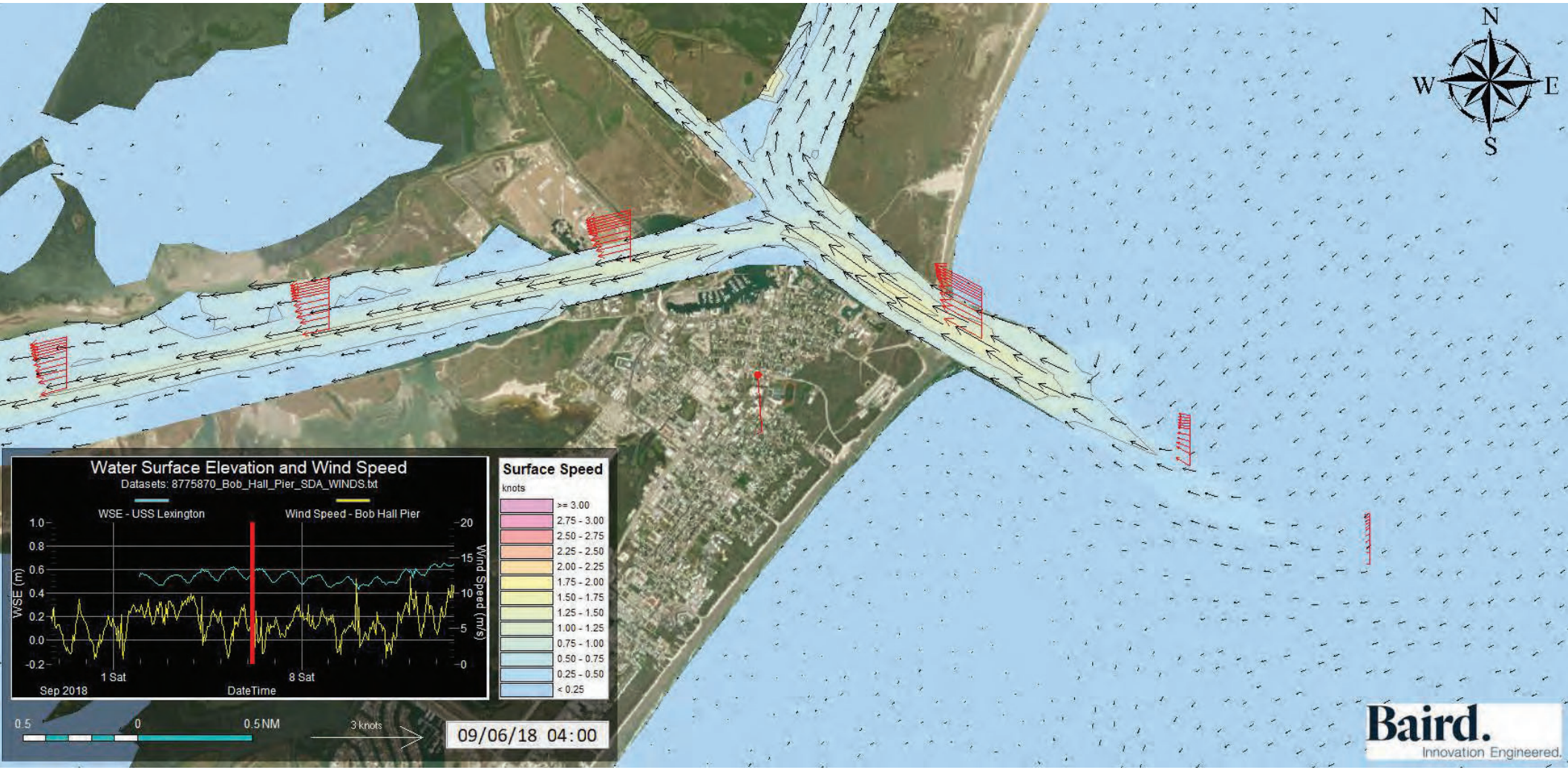
Preferred Channel Alternative Dredging Cross Section G-G STA 66+00.00

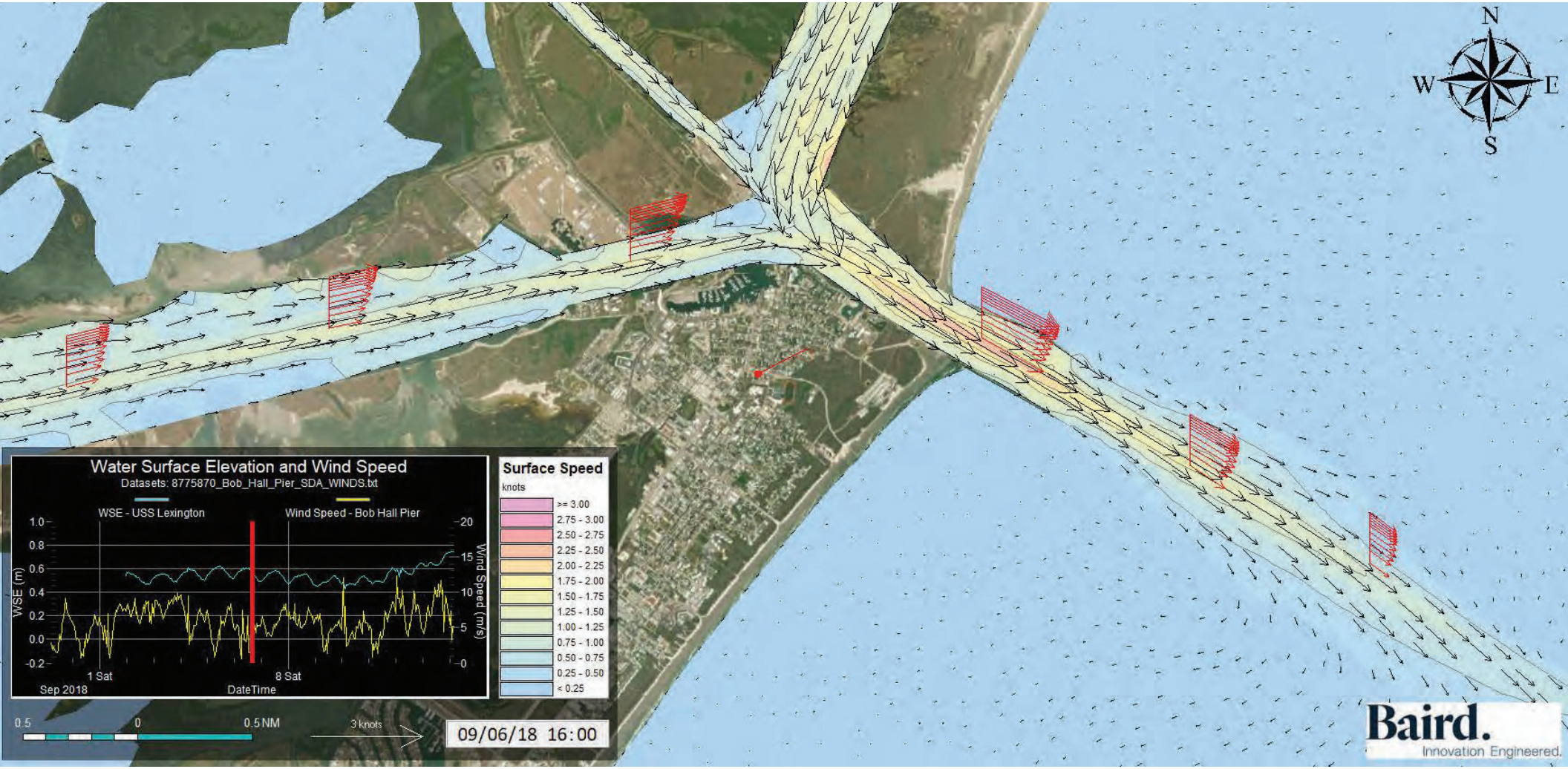
County: Aransas and Nueces
Application By: Port of Corpus Christi Authority

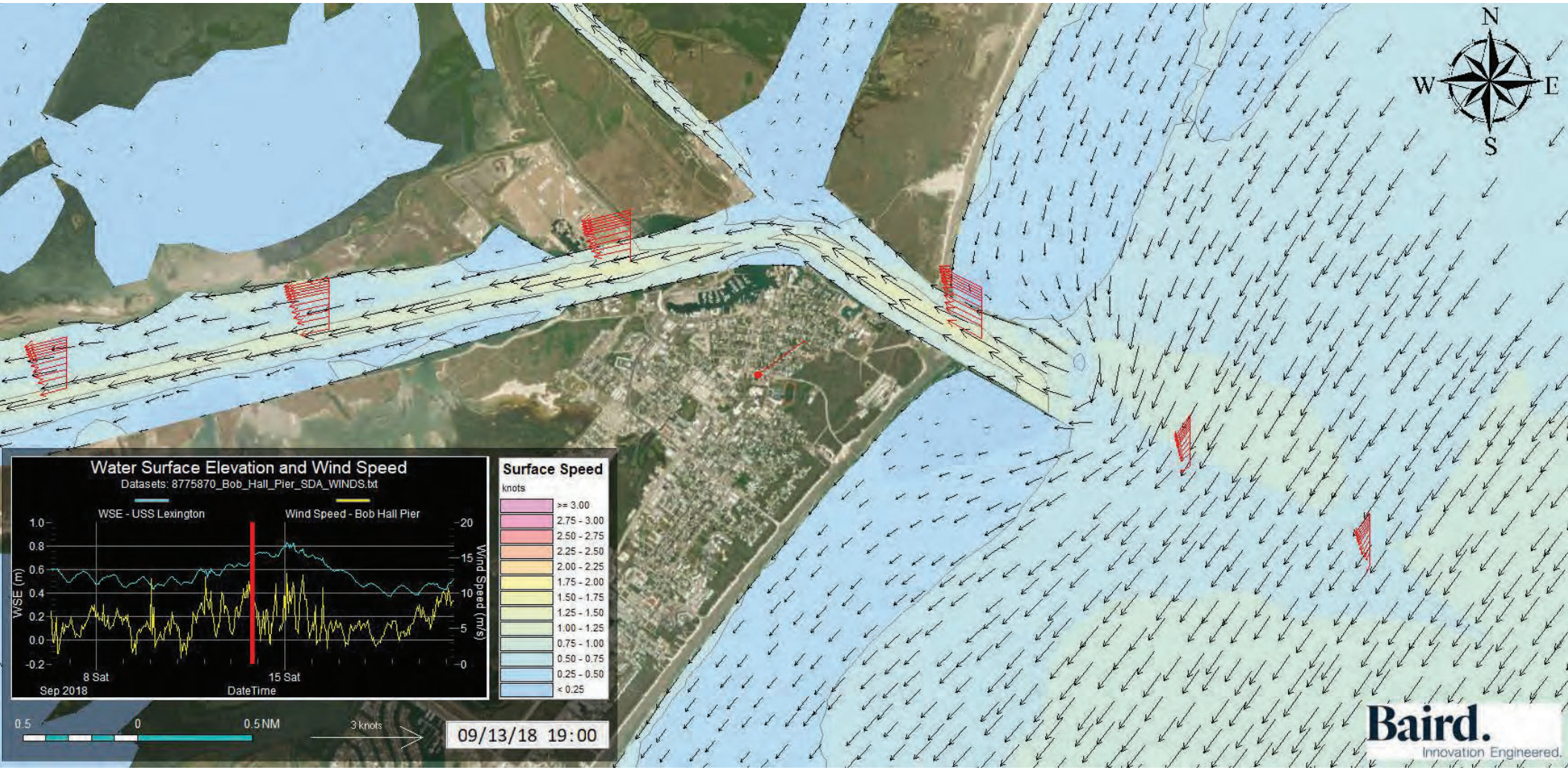
State: Texas
Date: April 2020

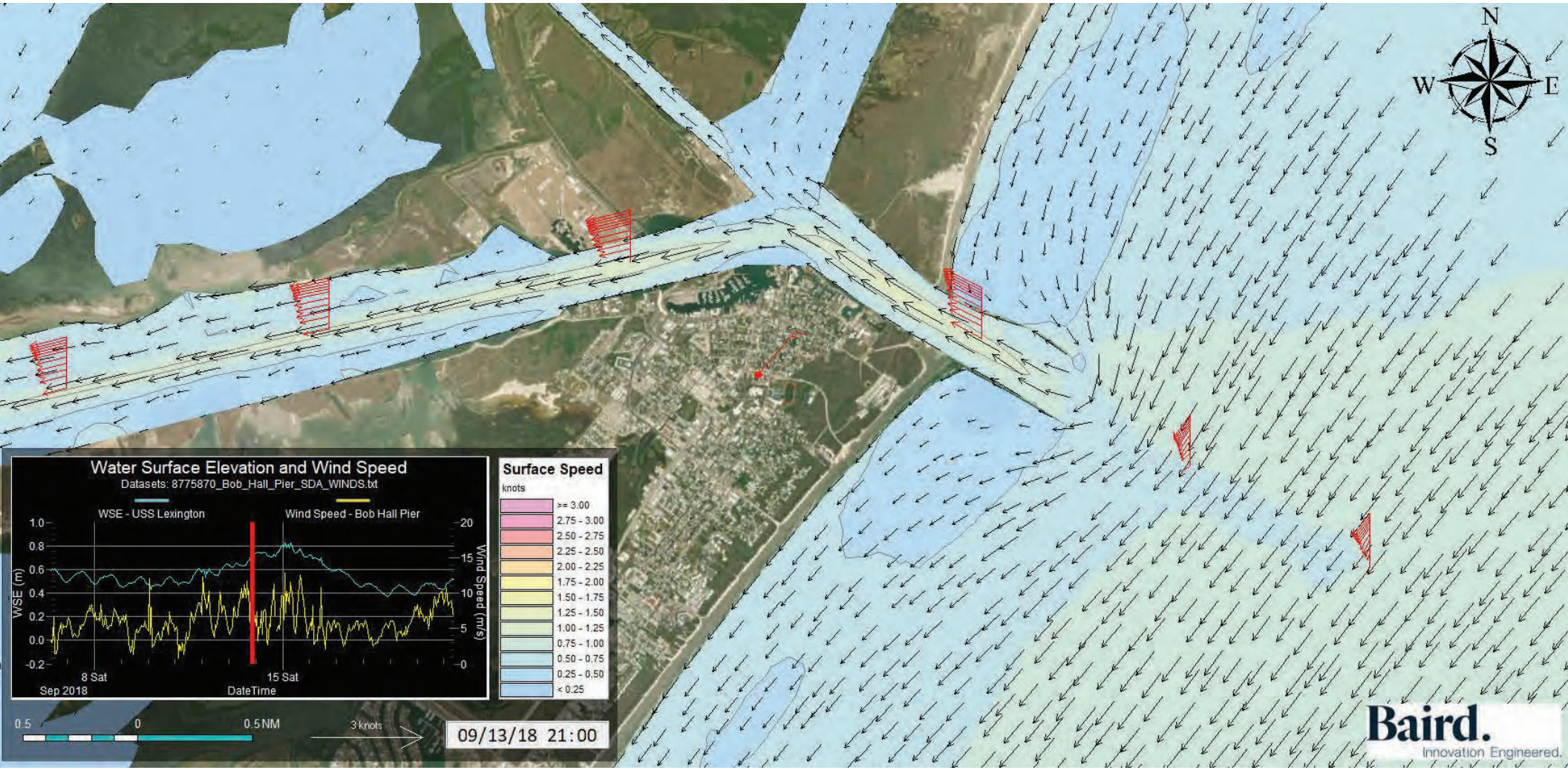
Appendix E: Hydrodynamic Modeling Information

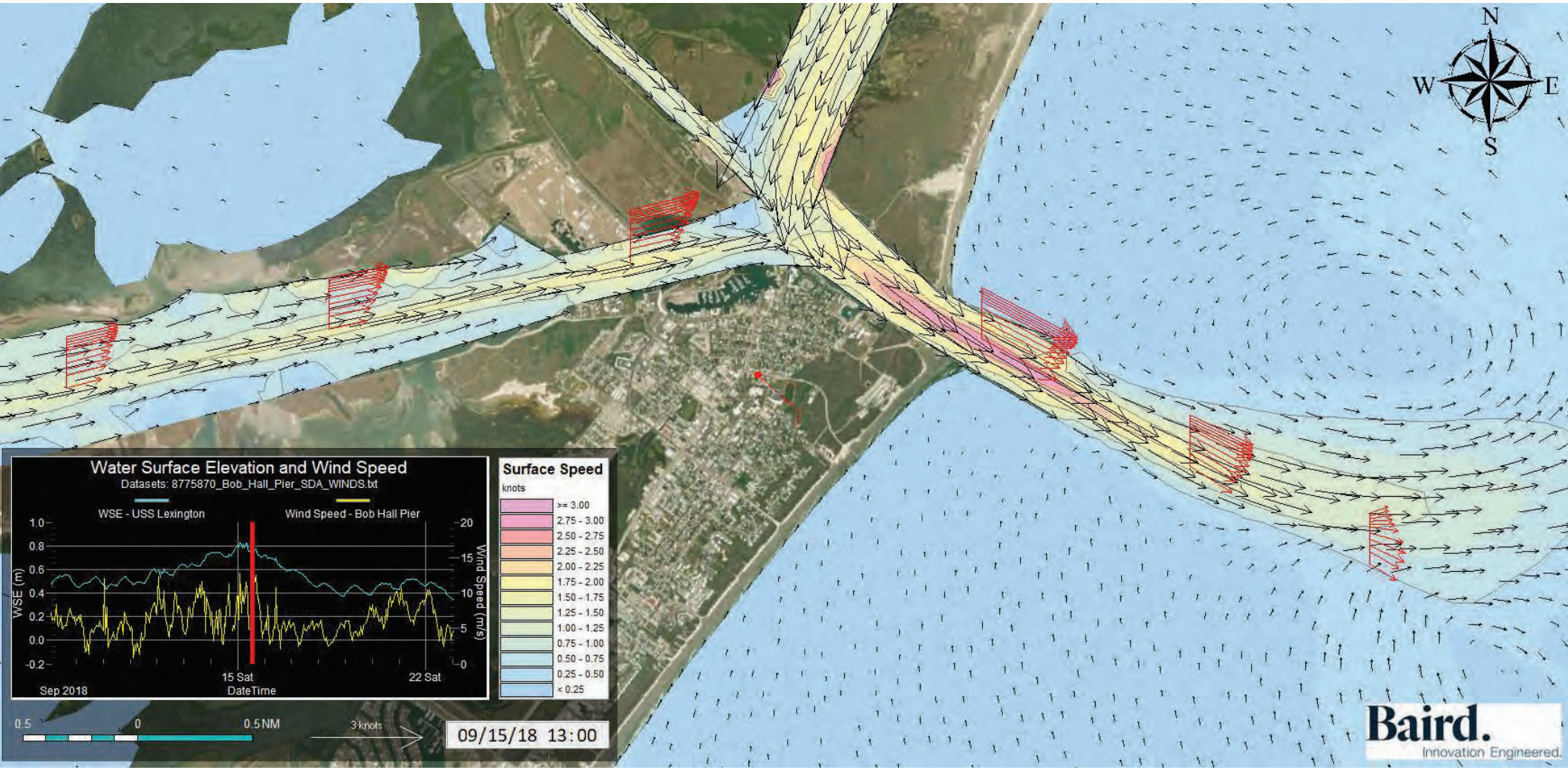
Please see Appendix E in Appendixes folder.

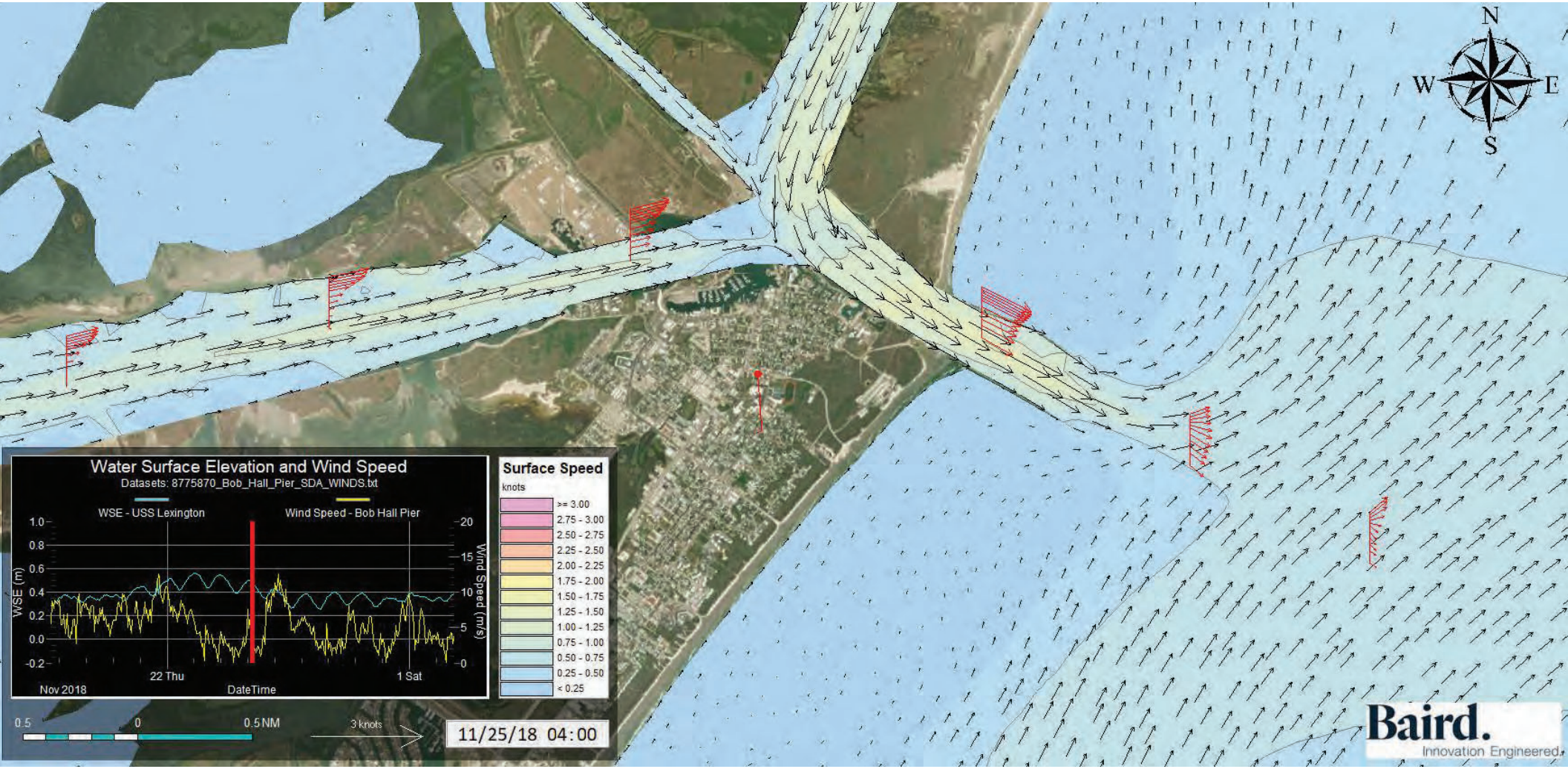

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
1 Sat
8 Sat
Sep 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 04:00
Baird.
Innovation Engineered.

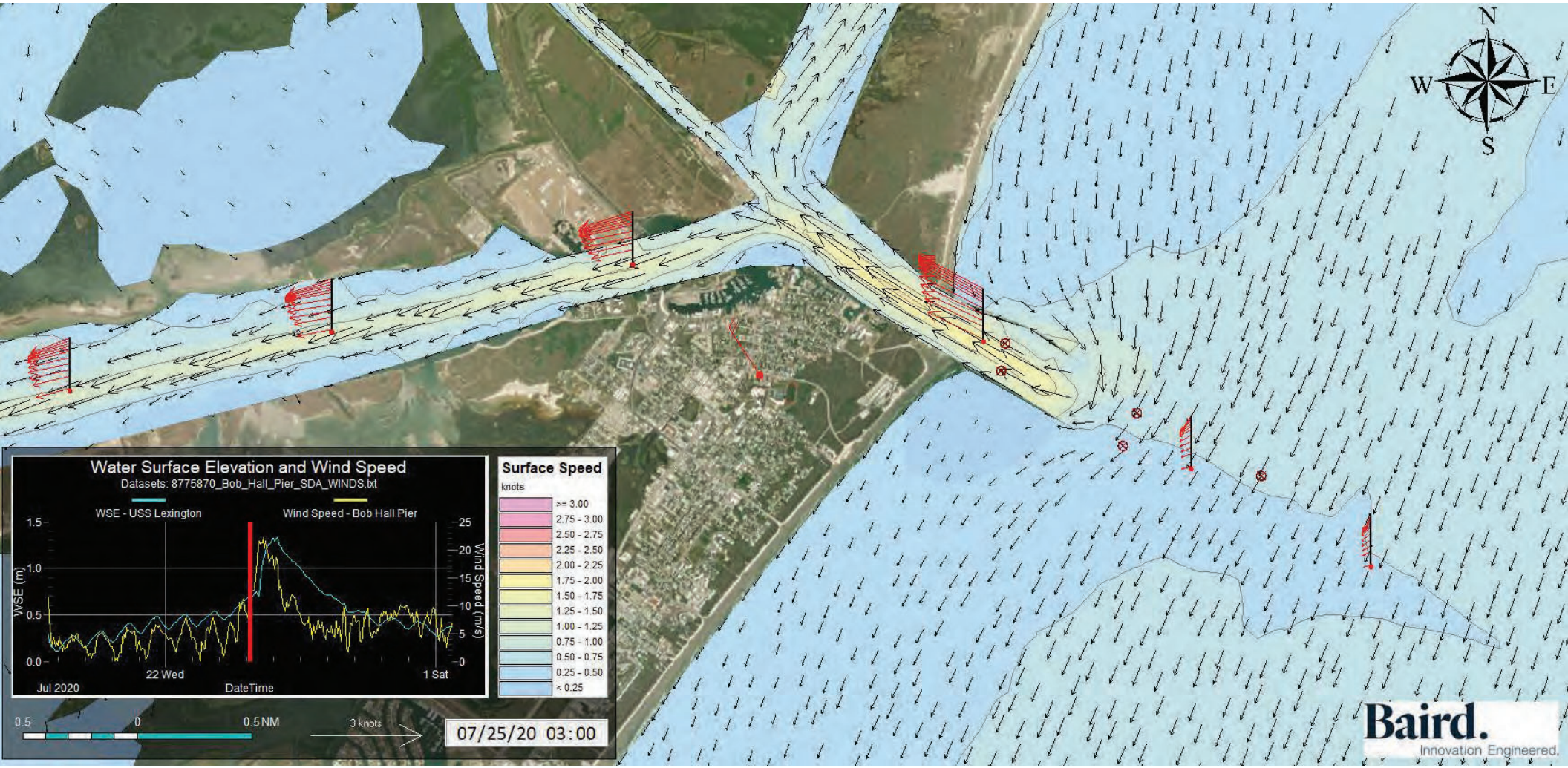

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
1 Sat
8 Sat
Sep 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 16:00
Baird.
Innovation Engineered.

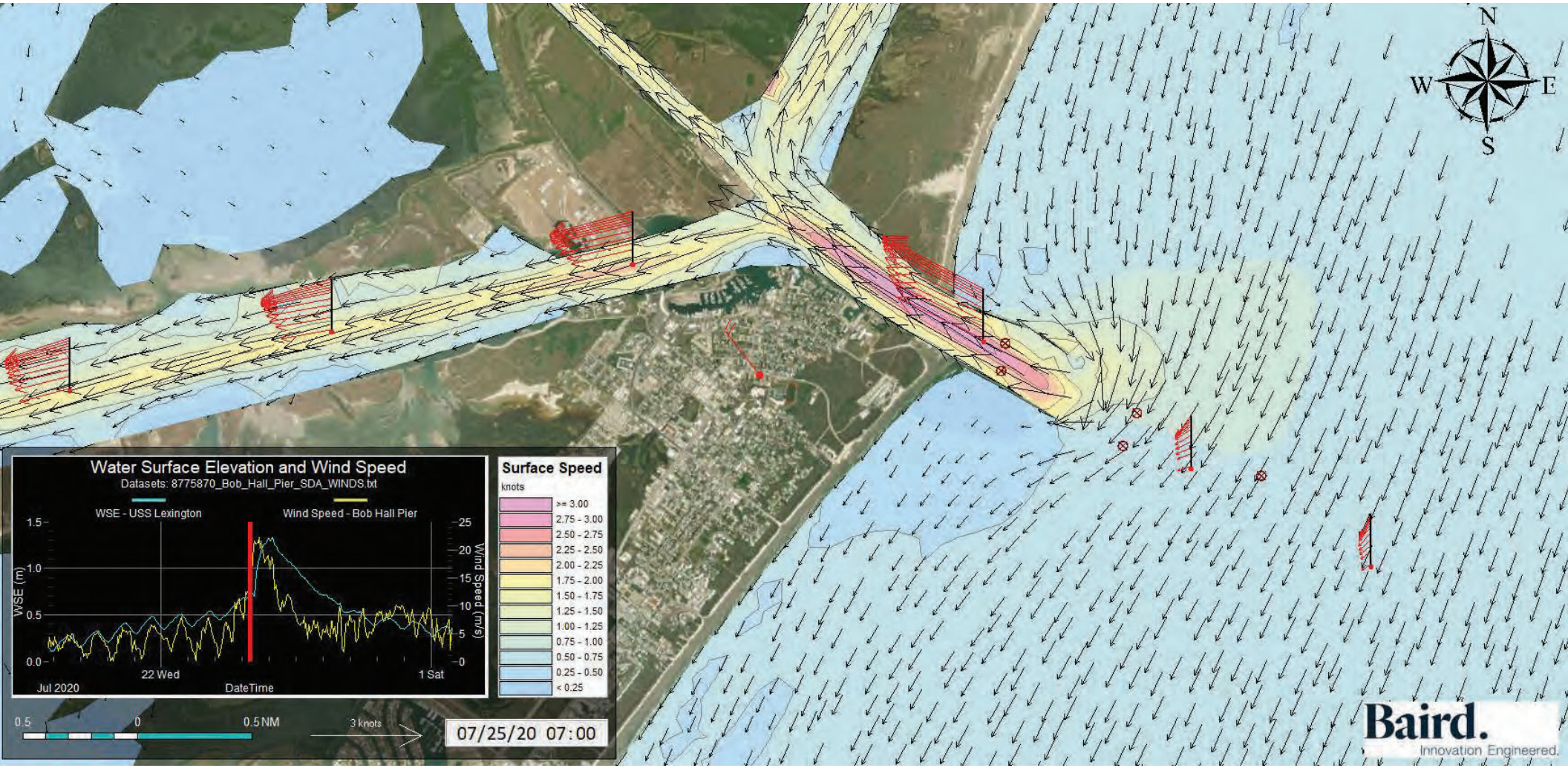

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 19:00
Baird.
Innovation Engineered.

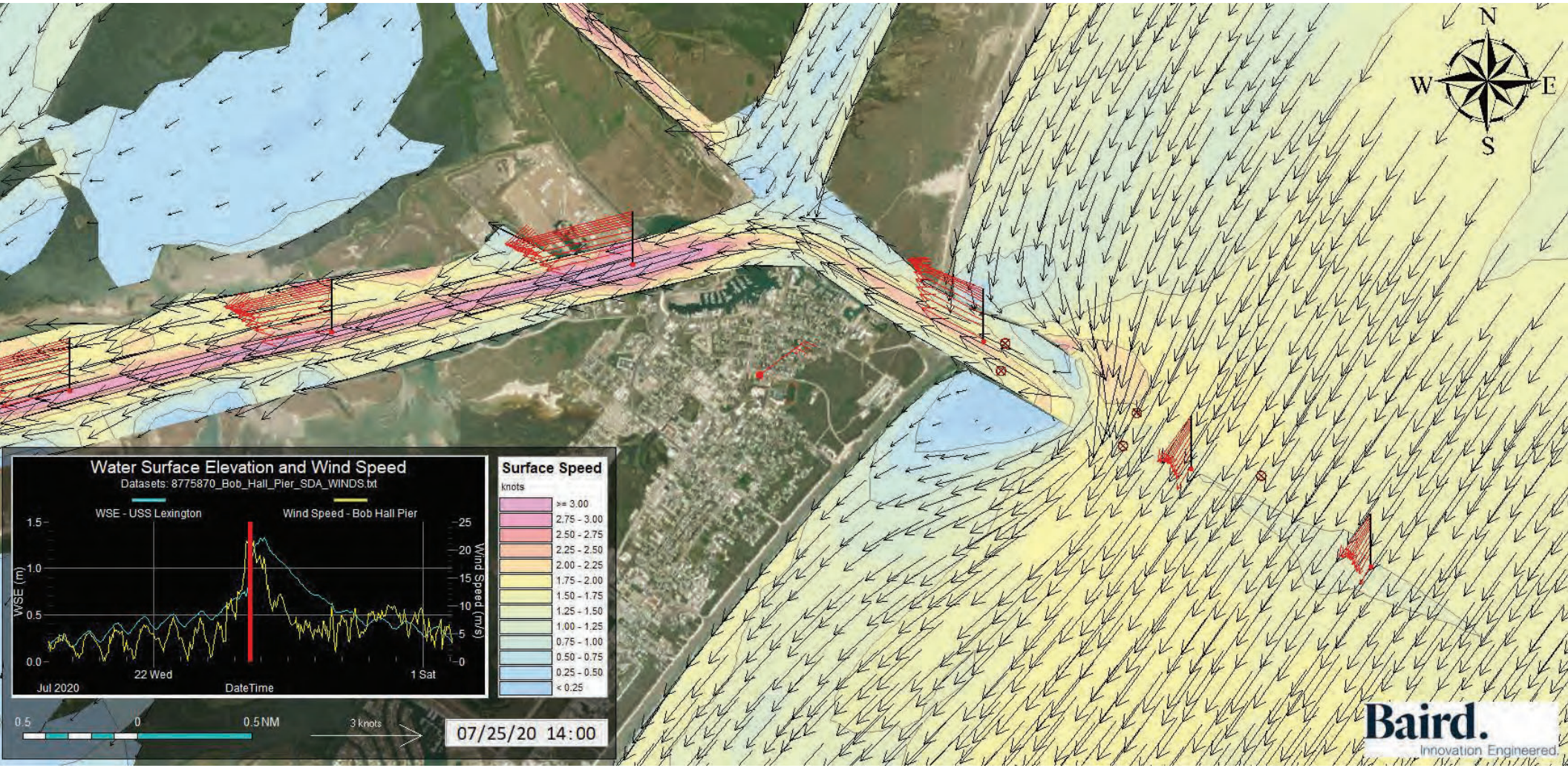

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 21:00
Baird.
Innovation Engineered.

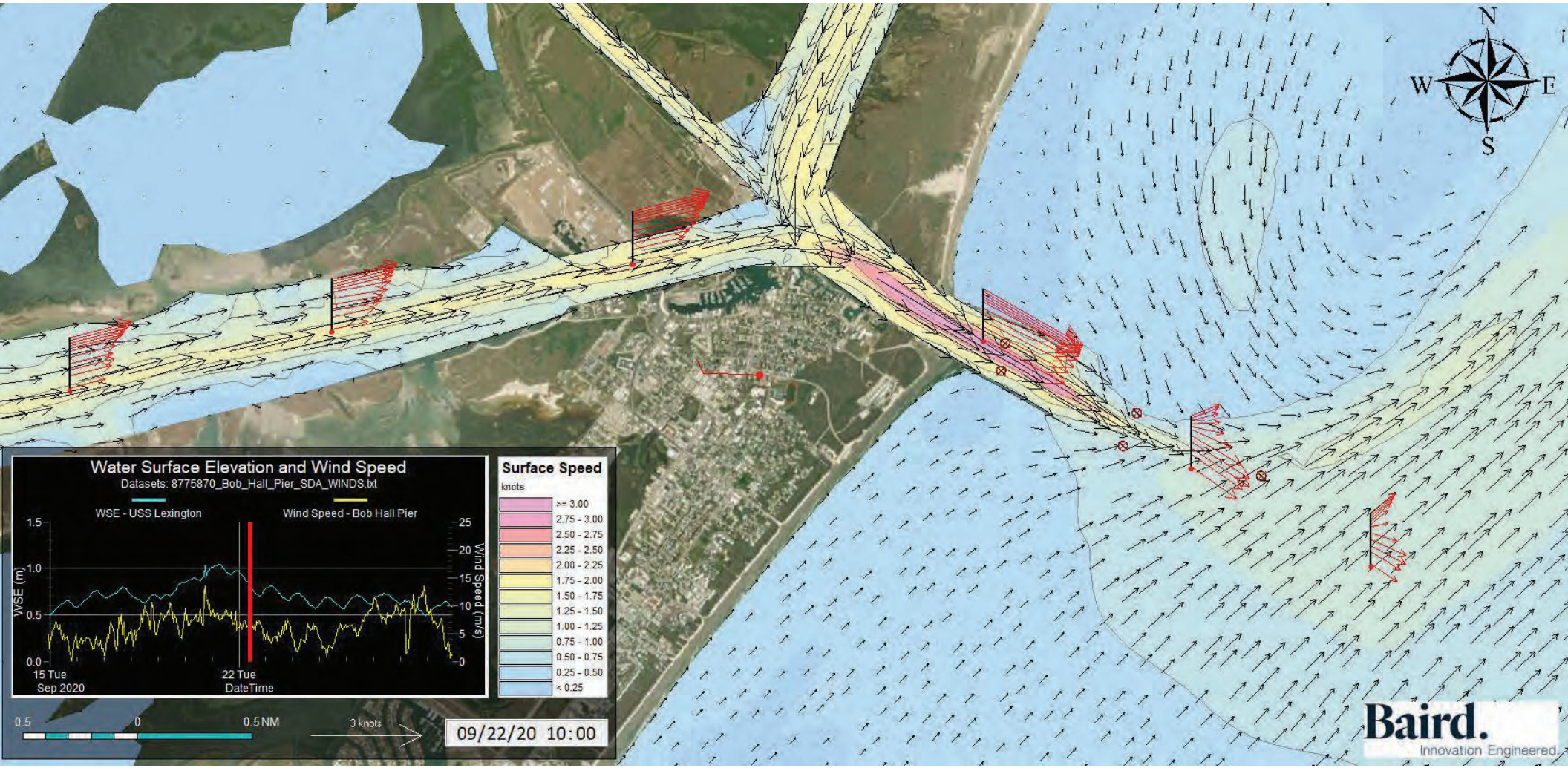

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
Sep 2018
15 Sat
22 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/15/18 13:00
Baird.
Innovation Engineered.

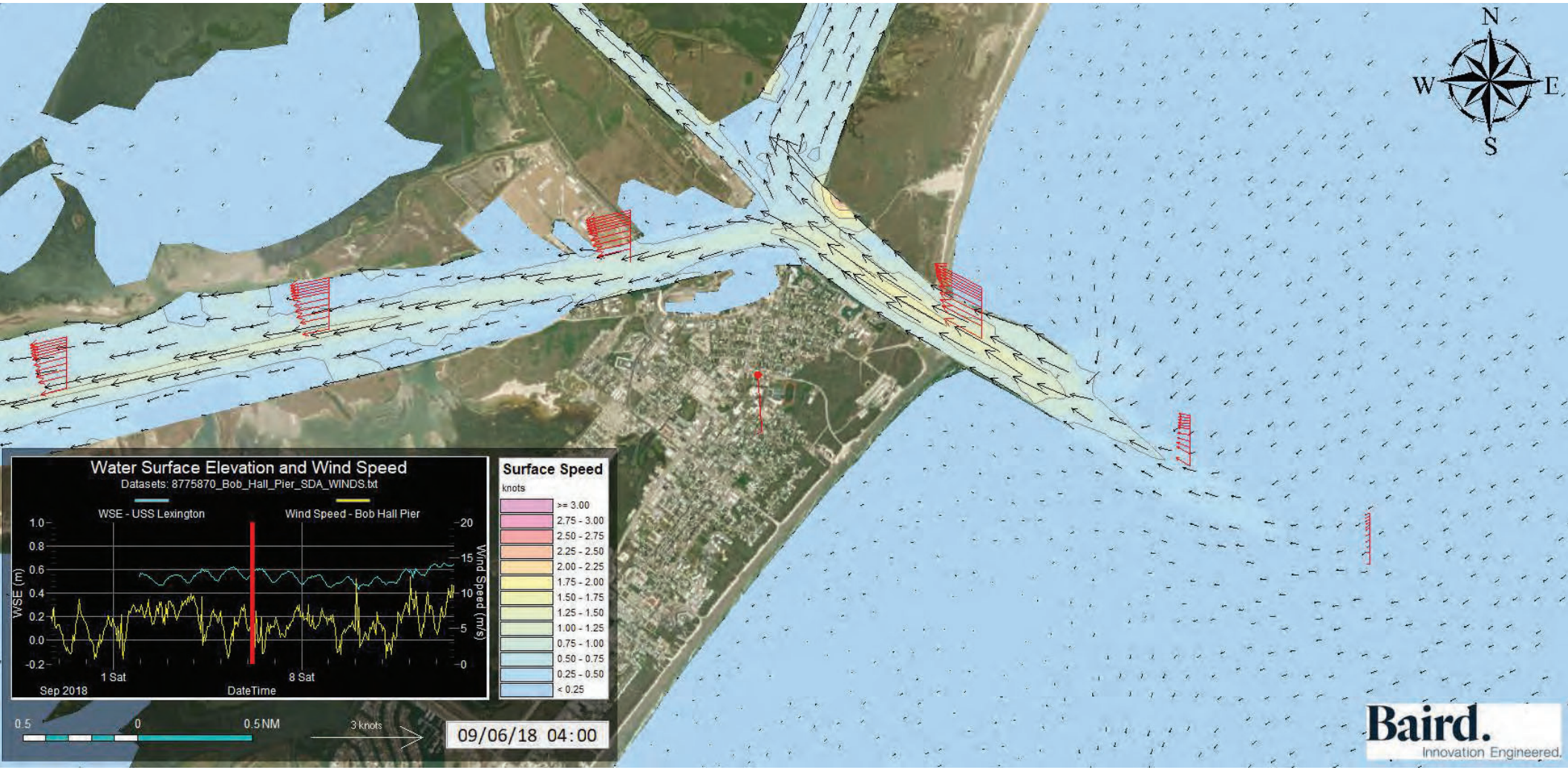

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
22 Thu
1 Sat
Nov 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
11/25/18 04:00
Baird.
Innovation Engineered.

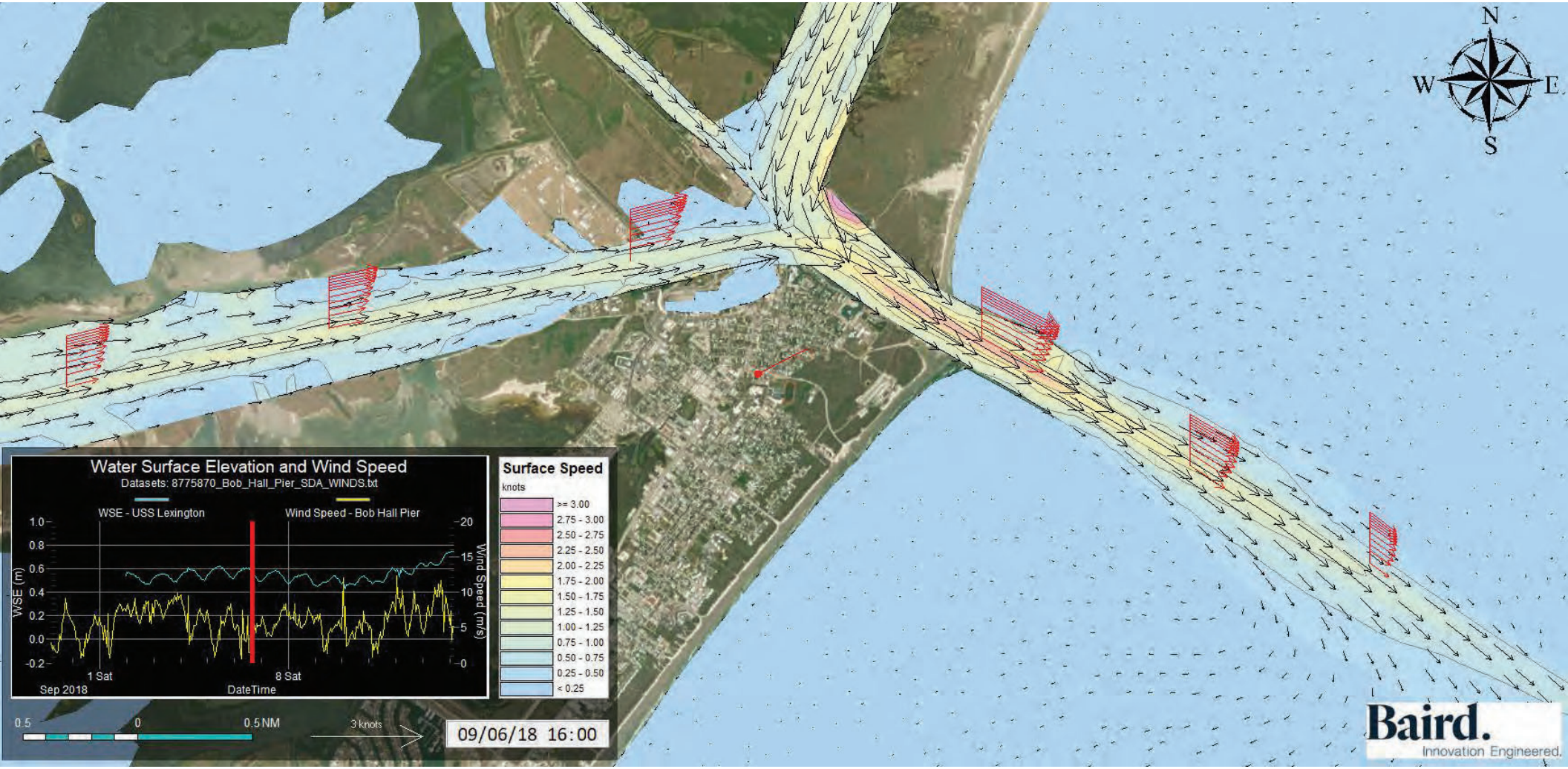

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
1 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 03:00
Baird.
Innovation Engineered.

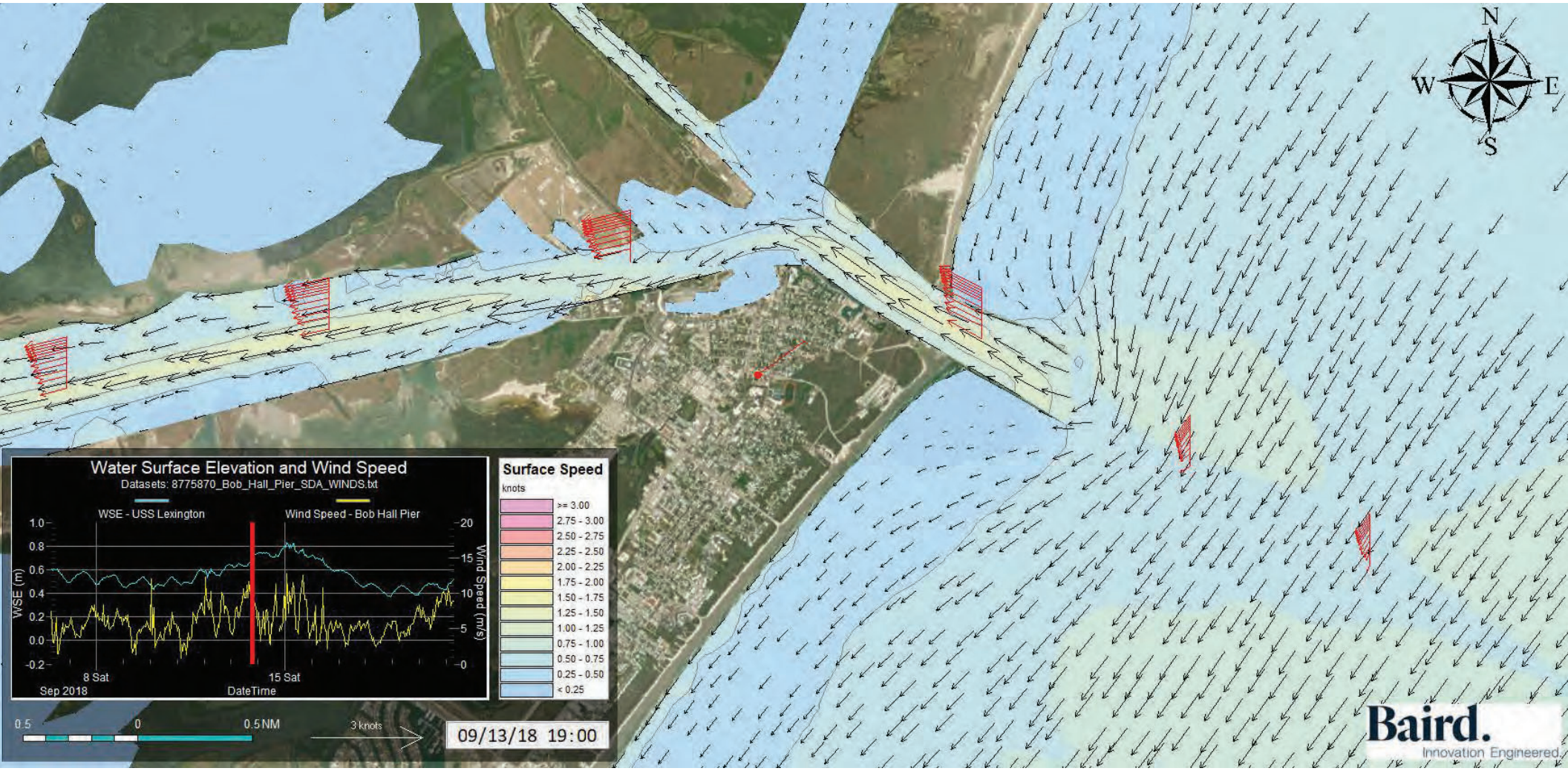

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
1 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 07:00
Baird.
Innovation Engineered.

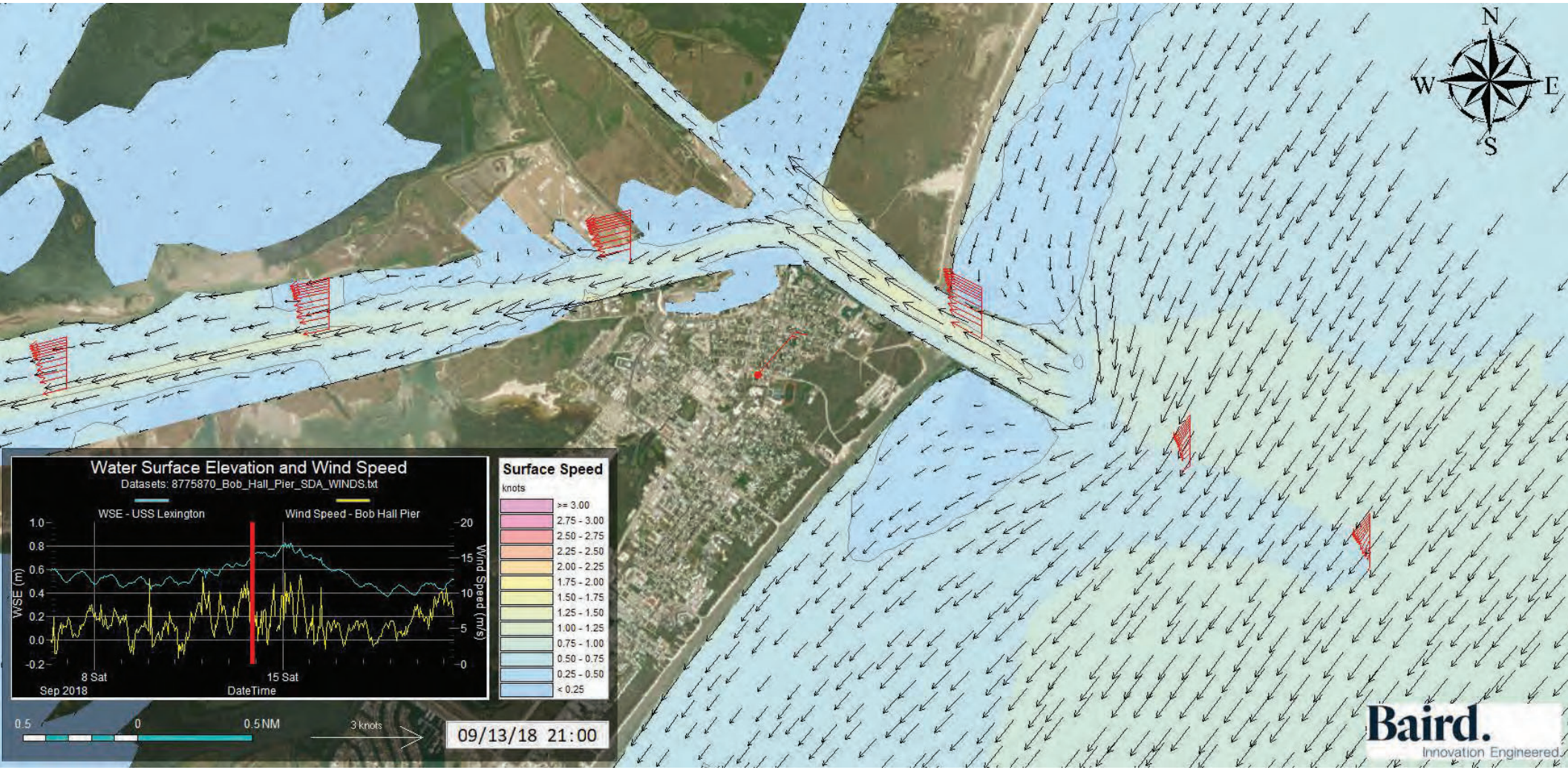

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
DateTime
1 Sat
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 14:00
Baird.
Innovation Engineered.

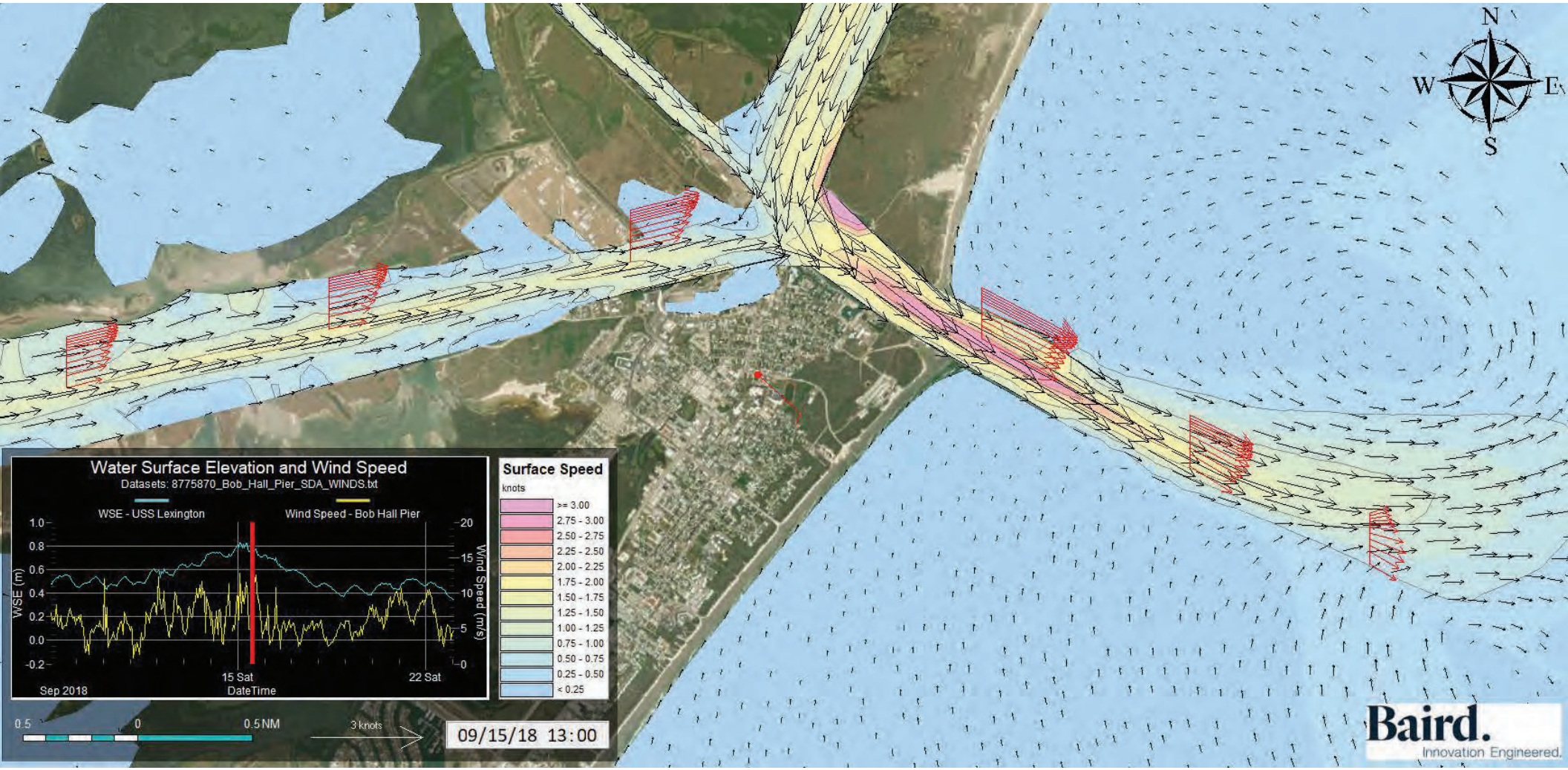

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
15 Tue
Sep 2020
22 Tue
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/22/20 10:00
Baird.
Innovation Engineered.

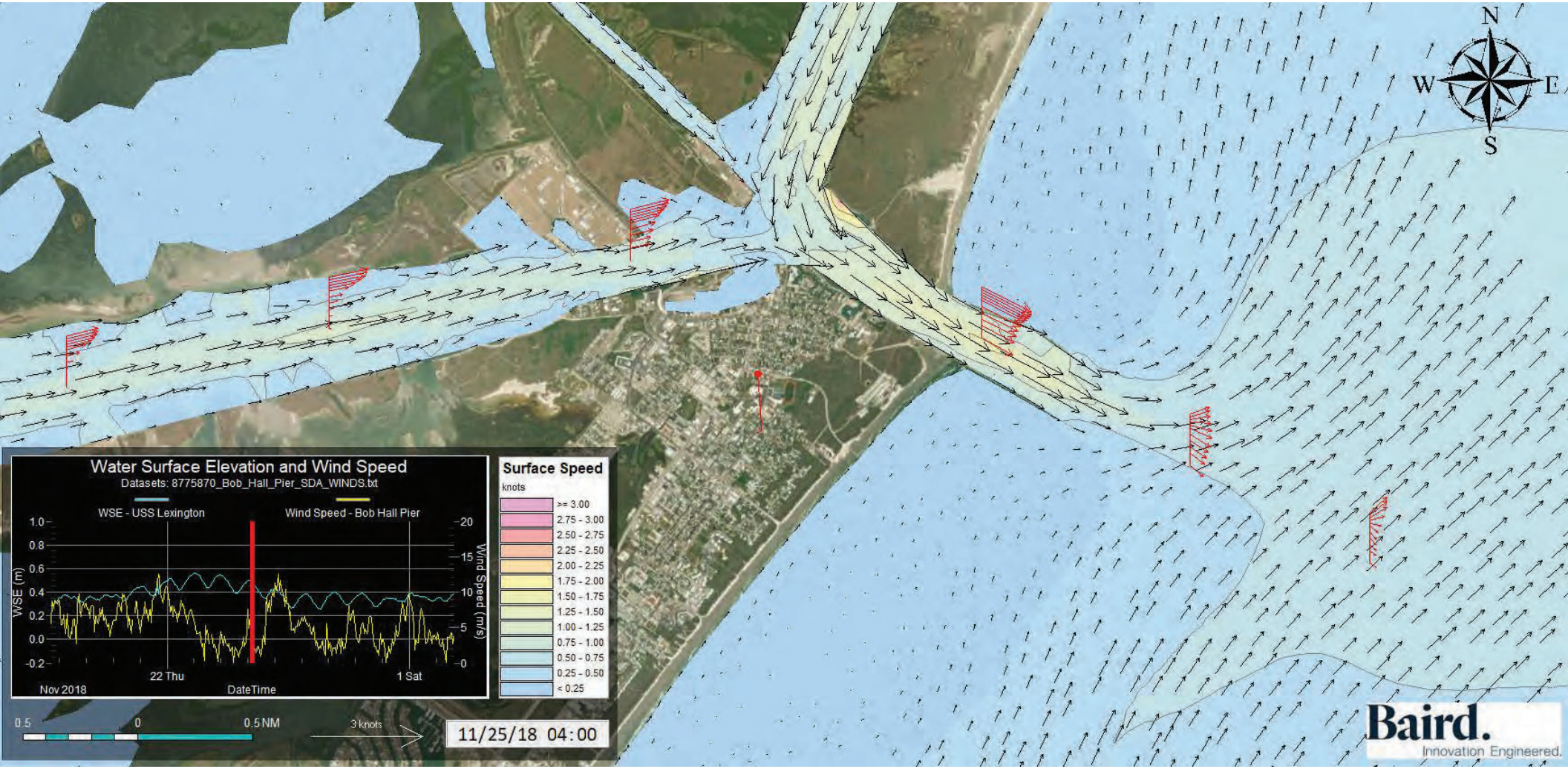

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
1 Sat
8 Sat
Sep 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 04:00
Baird.
Innovation Engineered.

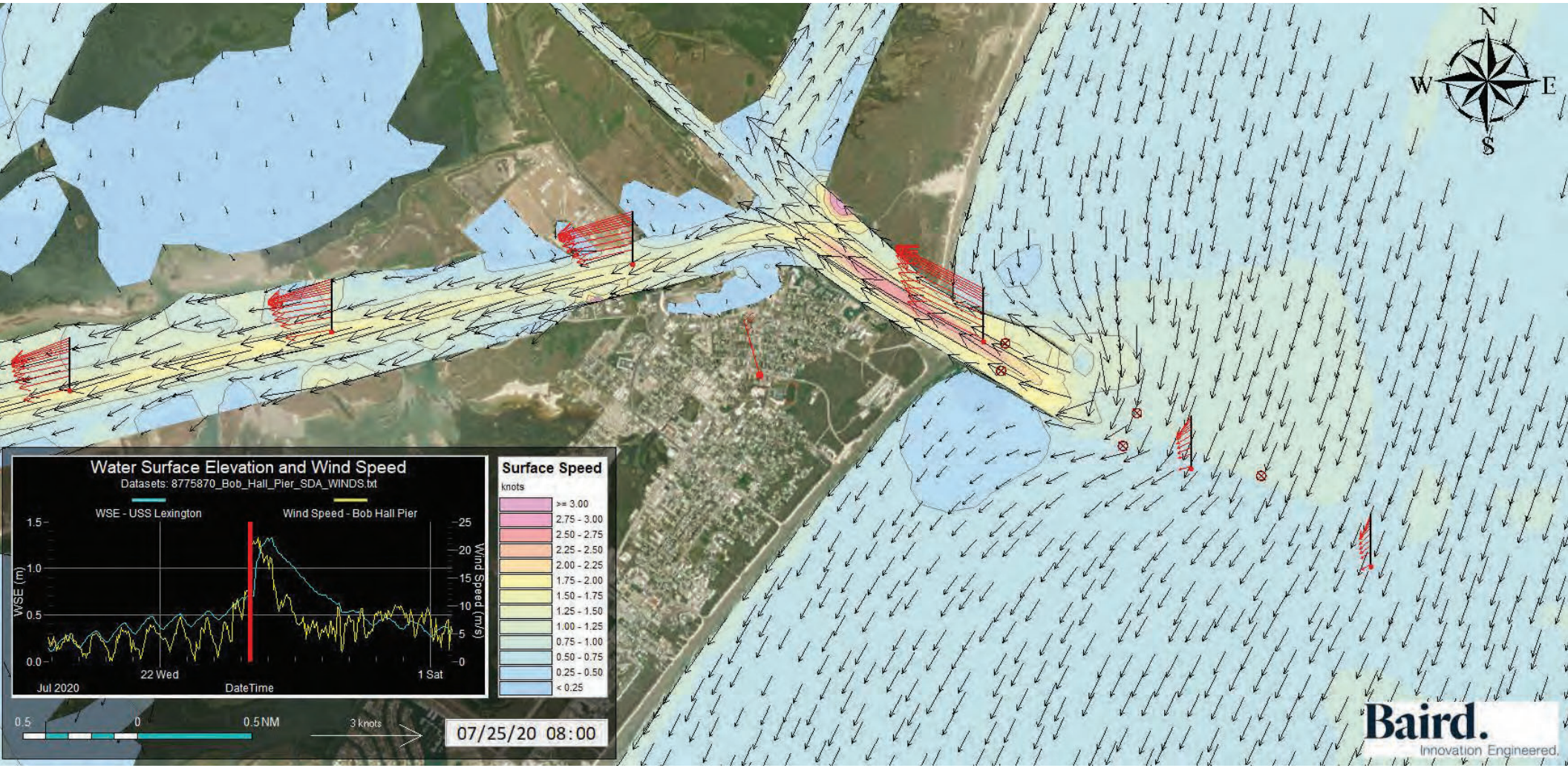

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
1 Sat
8 Sat
Sep 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 16:00
Baird.
Innovation Engineered.

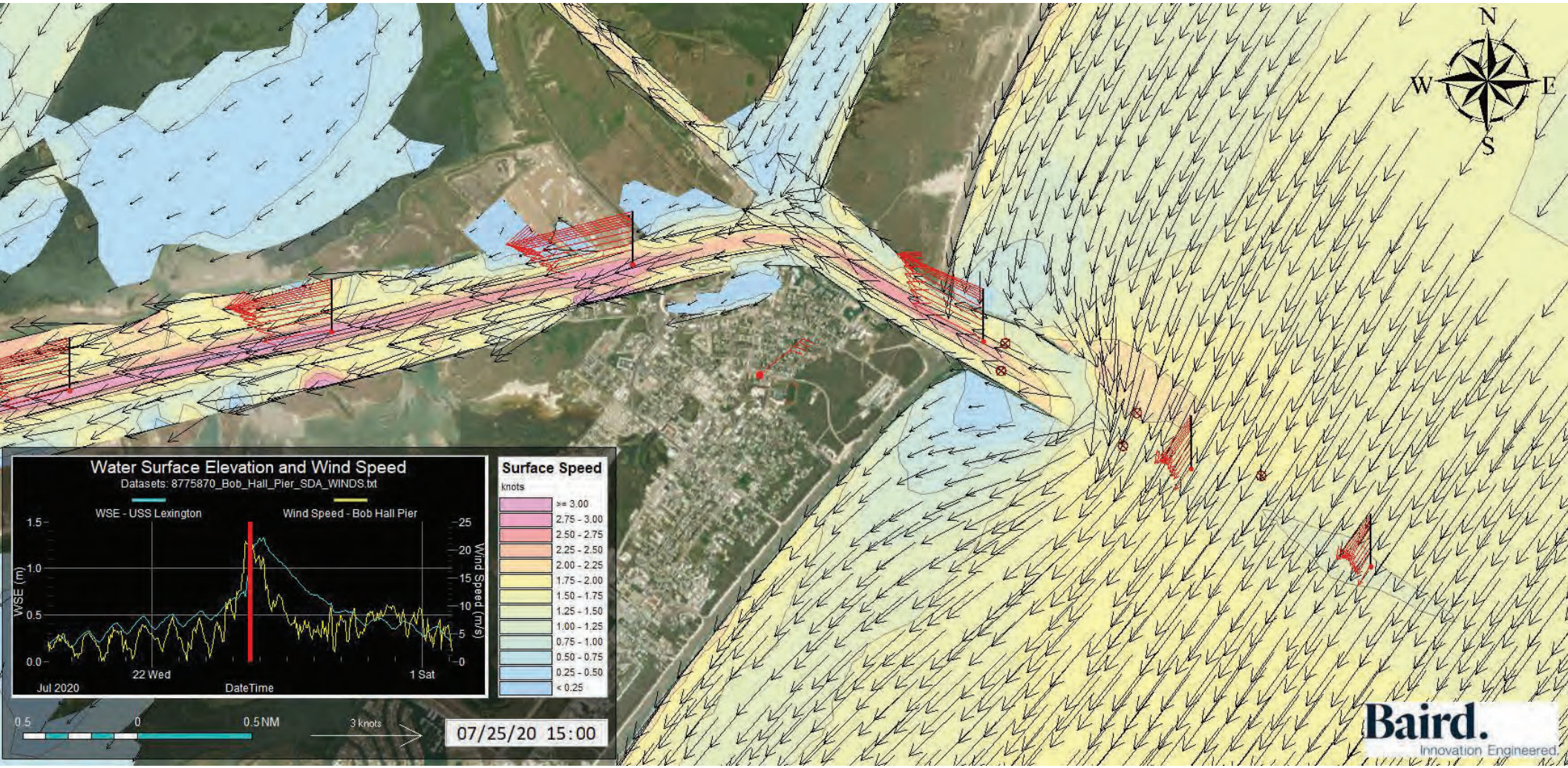

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 19:00
Baird.
Innovation Engineered.

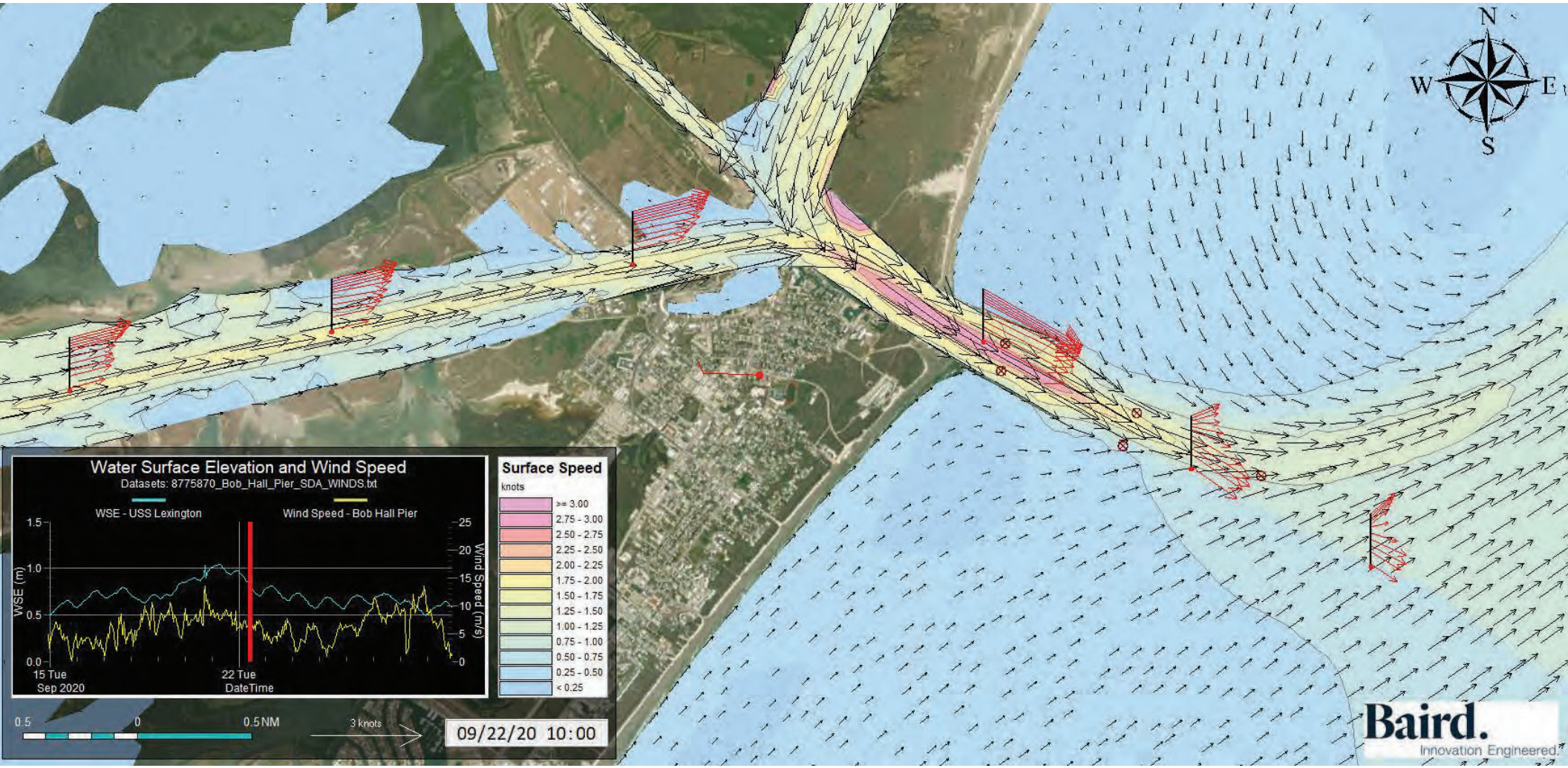

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 21:00
Baird.
Innovation Engineered.

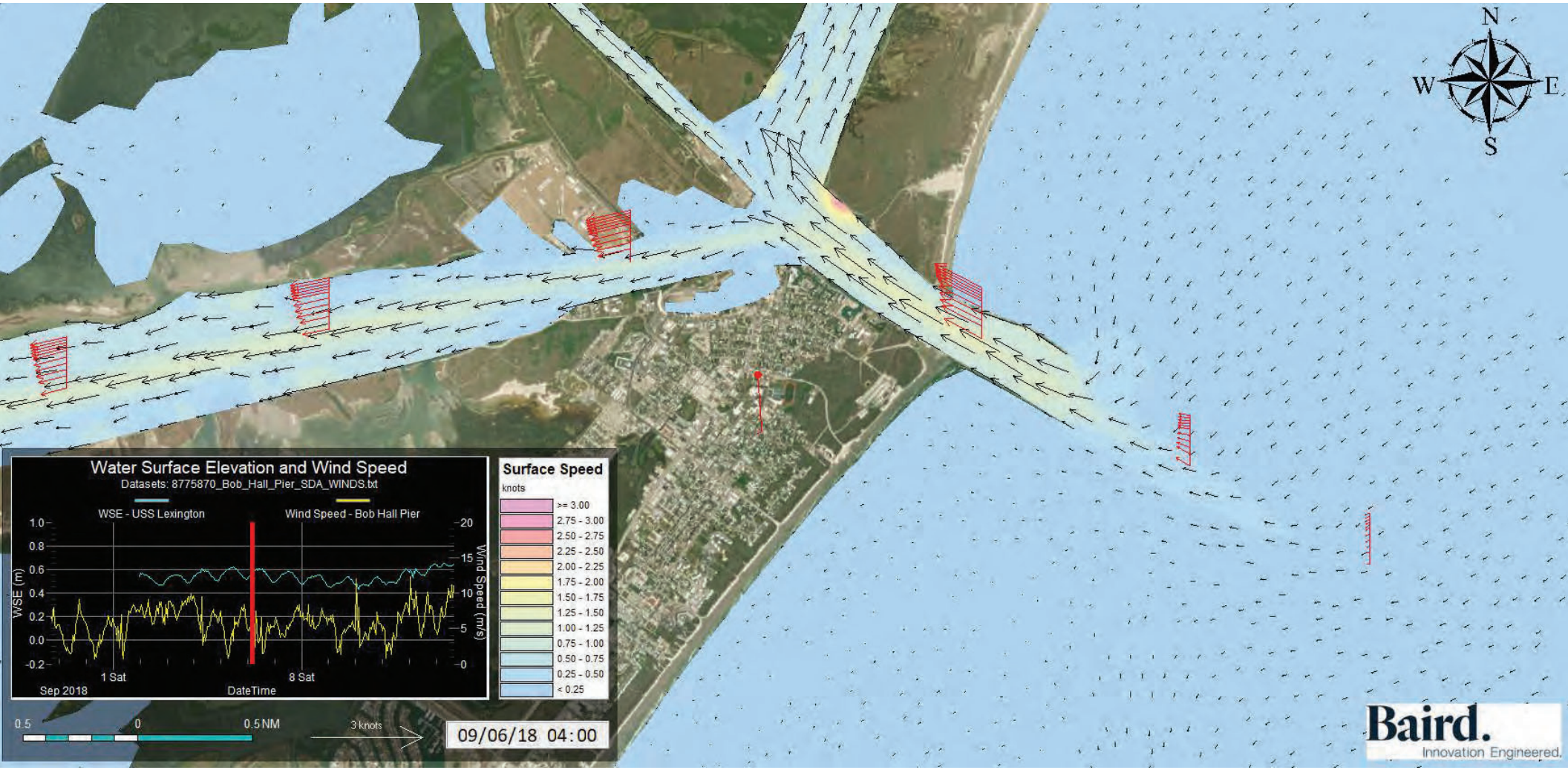

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
Sep 2018
15 Sat
22 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/15/18 13:00
Baird.
Innovation Engineered.

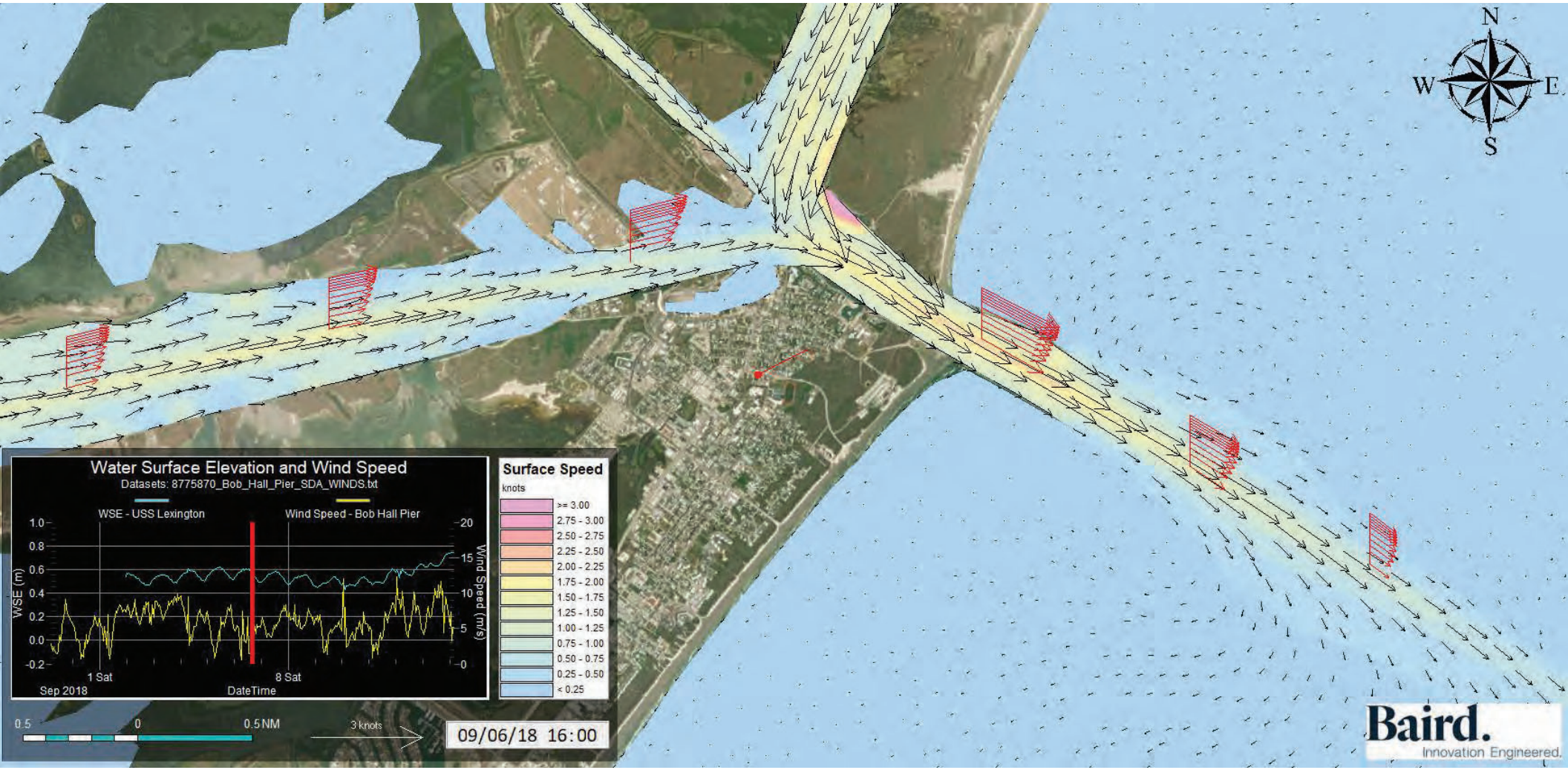

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
22 Thu
1 Sat
Nov 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
11/25/18 04:00
Baird.
Innovation Engineered.

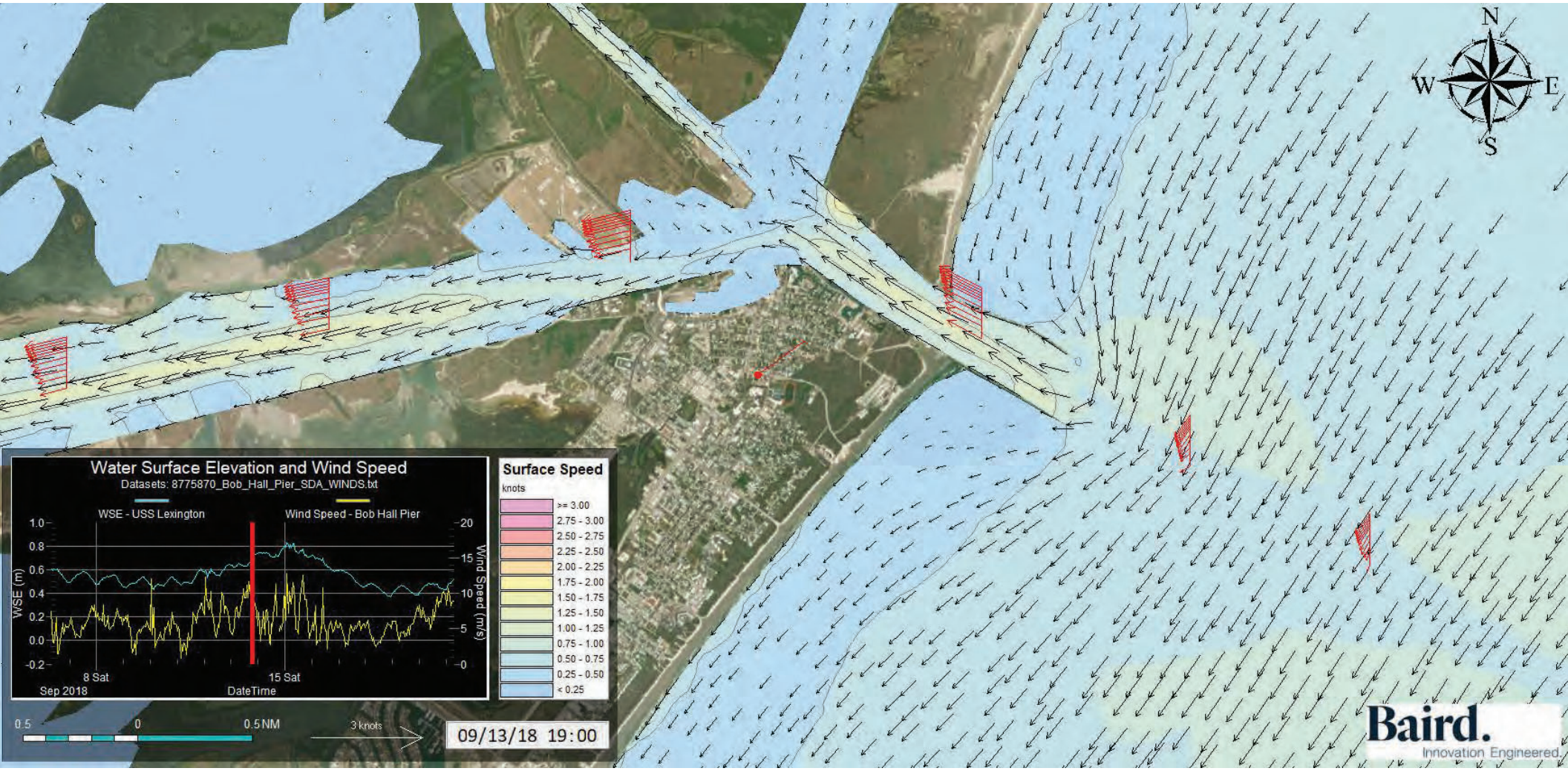

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
1 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 08:00
Baird.
Innovation Engineered.

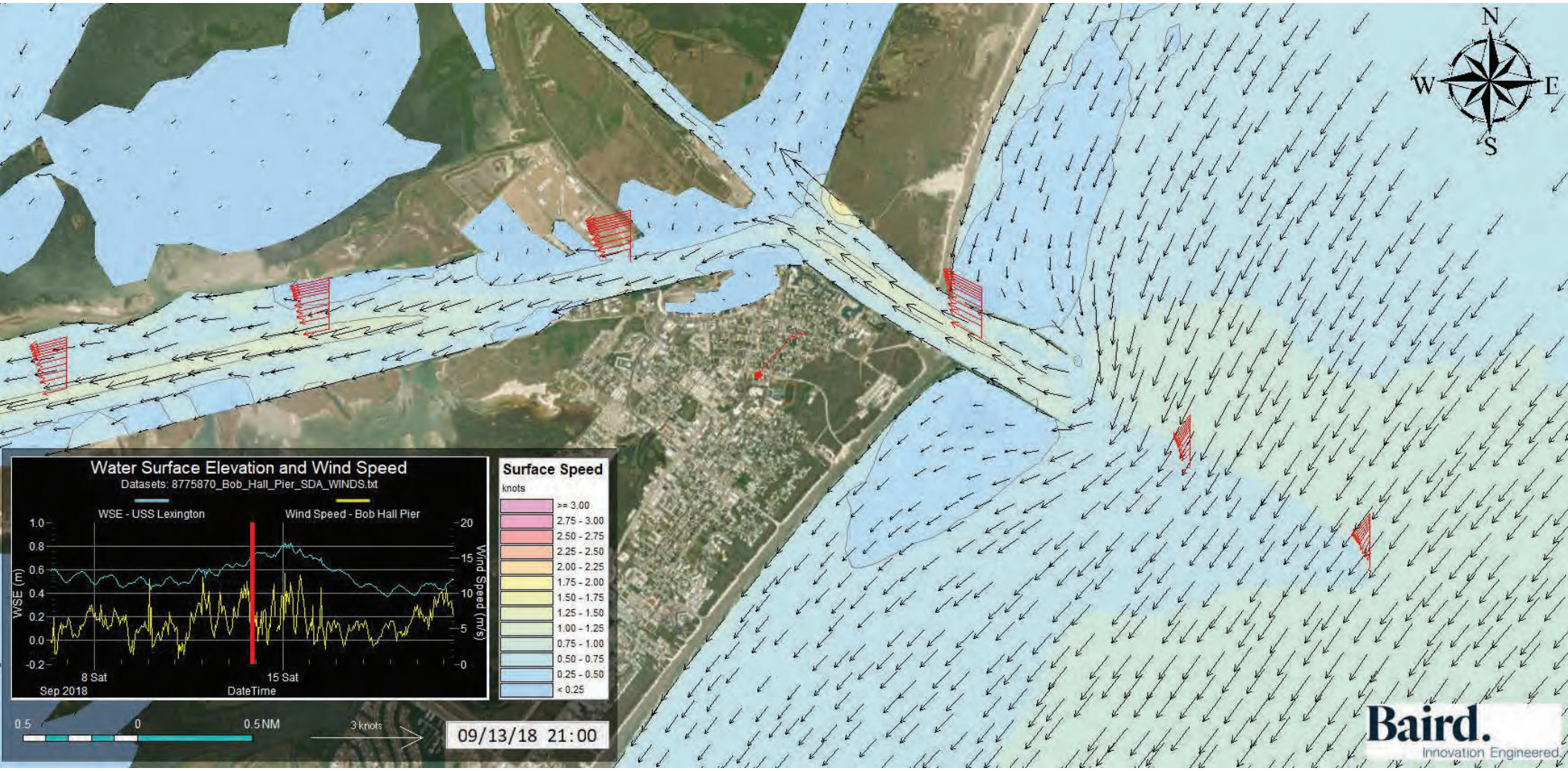

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
DateTime
1 Sat
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 15:00
Baird.
Innovation Engineered.

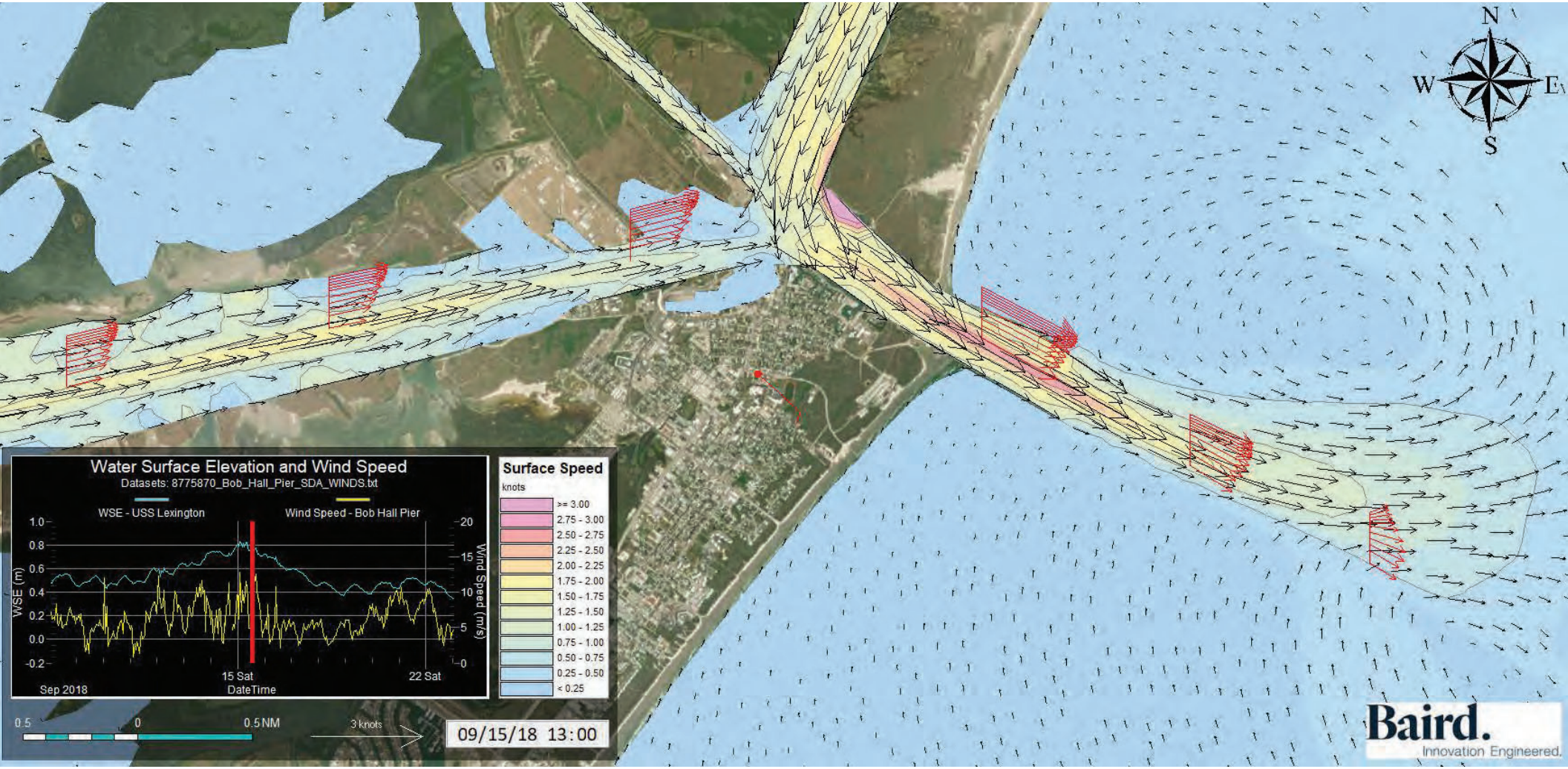

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
15 Tue
Sep 2020
22 Tue
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/22/20 10:00
Baird.
Innovation Engineered.

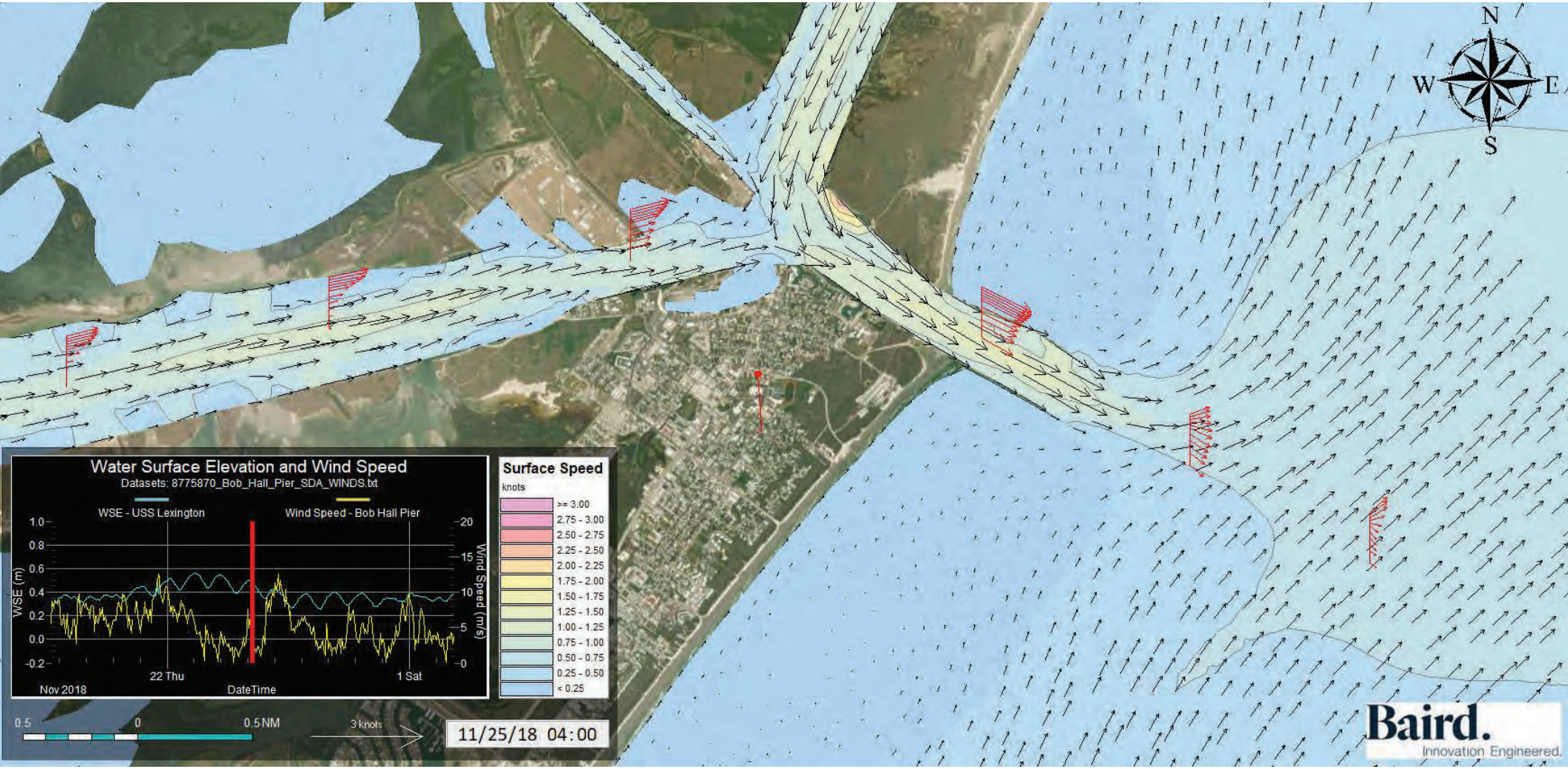

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
1 Sat
8 Sat
Sep 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 04:00
Baird.
Innovation Engineered.

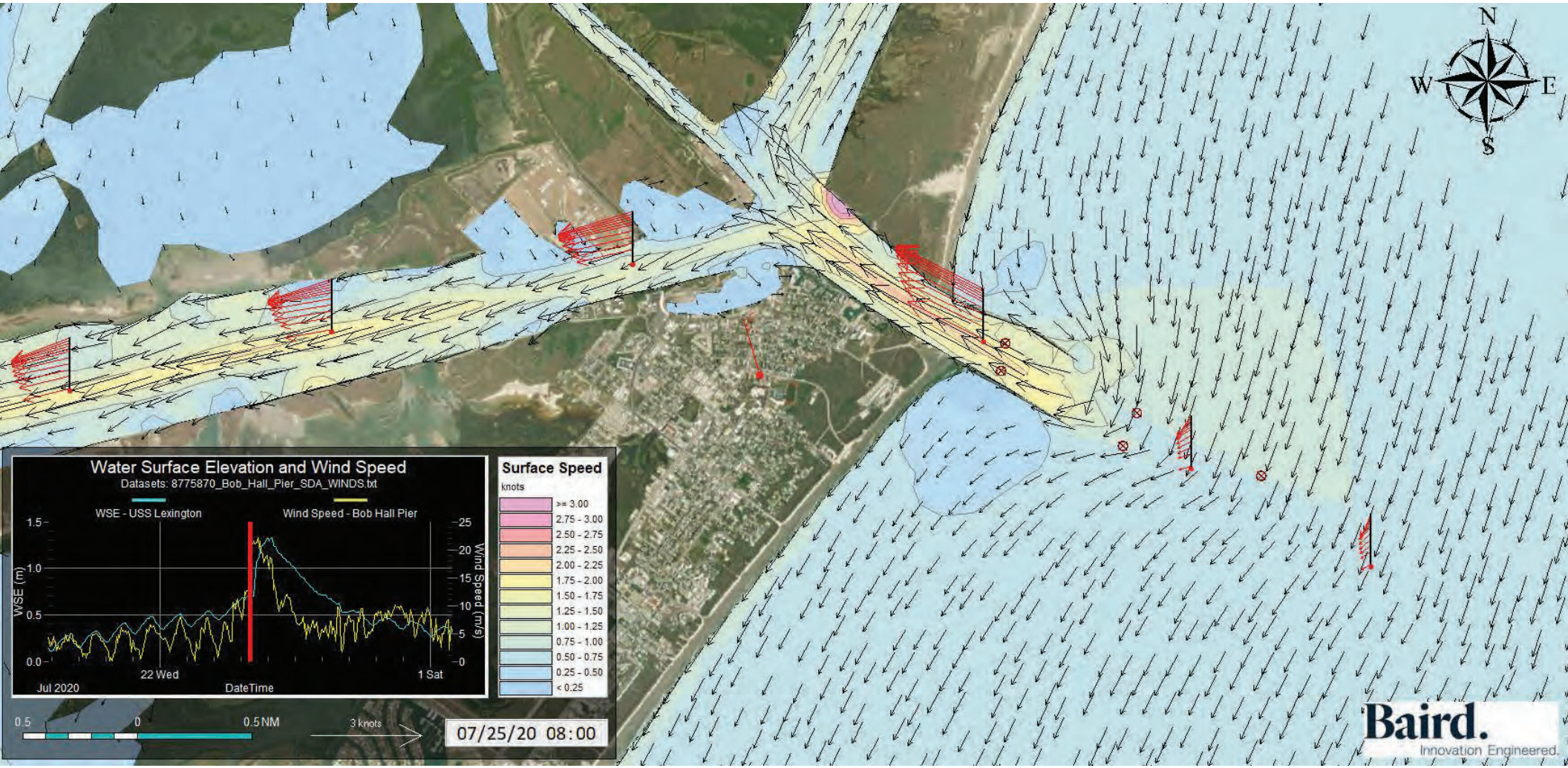

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
1 Sat
Sep 2018
8 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/06/18 16:00
Baird.
Innovation Engineered.

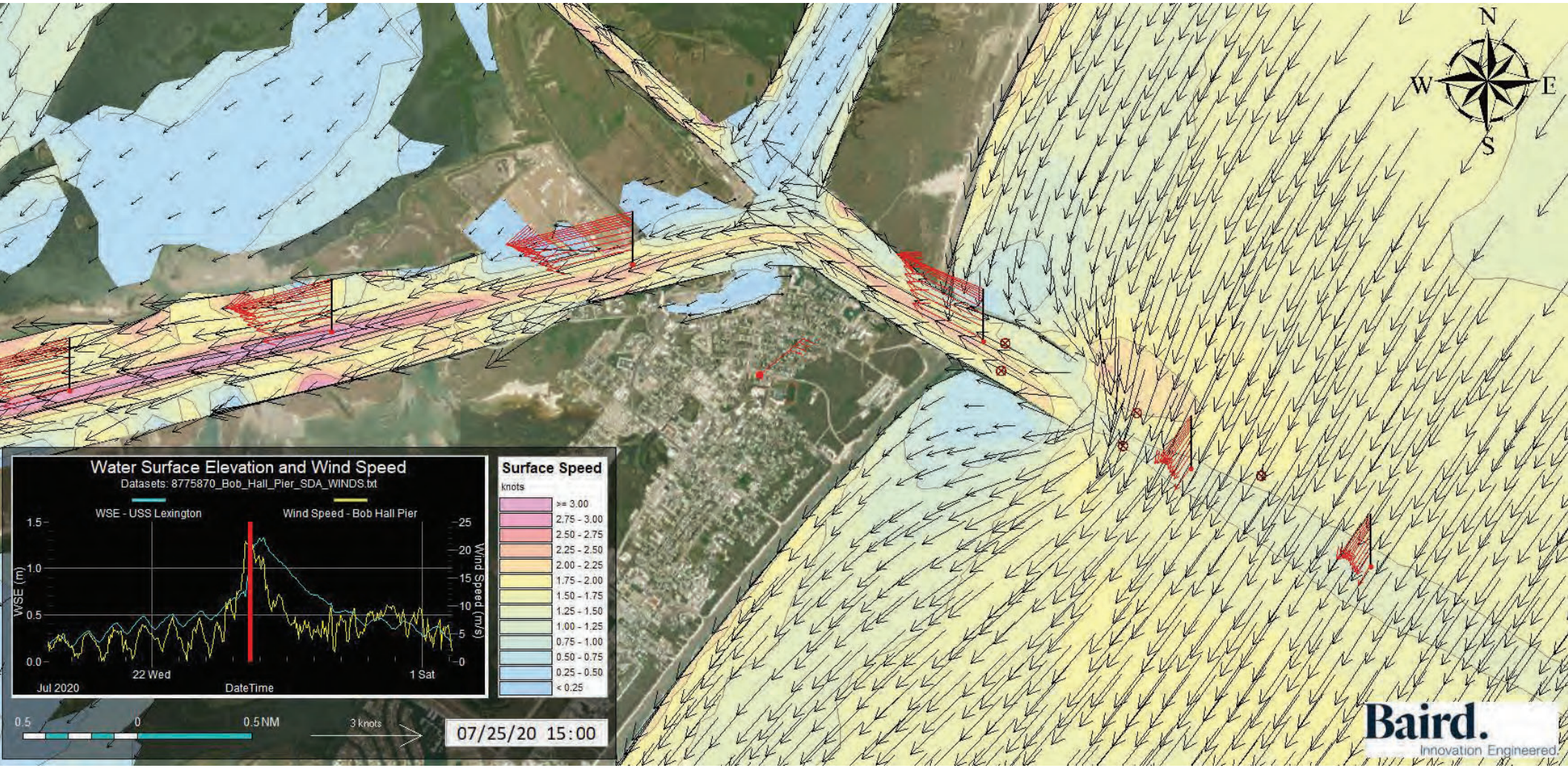

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 19:00
Baird.
Innovation Engineered.

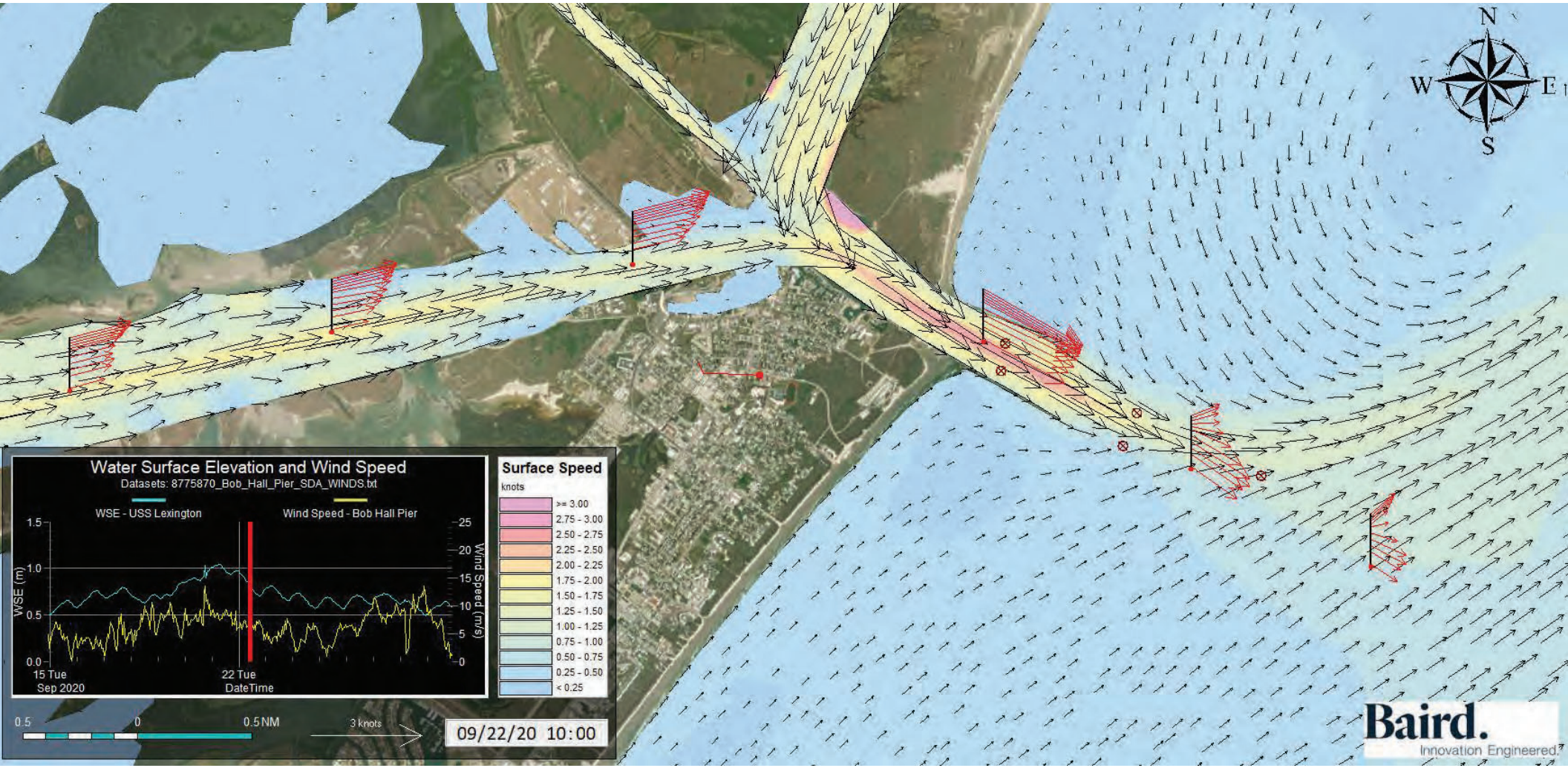

N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
20
15
10
5
0
8 Sat
Sep 2018
15 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/13/18 21:00
Baird.
Innovation Engineered.


N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
Sep 2018
15 Sat
22 Sat
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/15/18 13:00
Baird.
Innovation Engineered.


N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
WSE (m)
20
15
10
5
0
Wind Speed (m/s)
22 Thu
1 Sat
Nov 2018
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
11/25/18 04:00
Baird.
Innovation Engineered.


N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
Jul 2020
22 Wed
DateTime
1 Sat
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 08:00
Baird.
Innovation Engineered.


N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
22 Wed
1 Sat
Jul 2020
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
07/25/20 15:00
Baird.
Innovation Engineered.


N
W
E
S
Water Surface Elevation and Wind Speed
Datasets: 8775870_Bob_Hall_Pier_SDA_WINDS.txt
WSE - USS Lexington
Wind Speed - Bob Hall Pier
WSE (m)
Wind Speed (m/s)
1.5
1.0
0.5
0.0
25
20
15
10
5
0
15 Tue
Sep 2020
22 Tue
DateTime
Surface Speed
knots
>= 3.00
2.75 - 3.00
2.50 - 2.75
2.25 - 2.50
2.00 - 2.25
1.75 - 2.00
1.50 - 1.75
1.25 - 1.50
1.00 - 1.25
0.75 - 1.00
0.50 - 0.75
0.25 - 0.50
< 0.25
0.5
0
0.5 NM
3 knots
09/22/20 10:00
Baird.
Innovation Engineered.

Appendix F: Pilot Cards

Please see Appendix F in Appendixes folder.



Description of Ship Model

TUG60V1

Tug
ART 120-35W
Loaded Departure

Version 1

© 2022 Kongsberg Digital
All rights reserved
No part of this work covered by the copyright hereon may be reproduced or otherwise copied without prior written permission of Kongsberg Digital

Table of Contents

General Description 6
Ship Data 7
Blind Zone 9
Speed 10
Statistics 11
Acceleration 14
Acceleration from Slow to Half 17
Crash Stop 20
Deceleration from Half to Slow 23
Coasting Stop 26
Time for effective changes in telegraph settings in stopping conditions 29
Turning Circle Starboard, Deep Water 30
Turning Circle Starboard, Shallow Water 33
Turning Circle Port, Deep Water 36
Accelerated Turning 39
Coasting Circle 42
Course Change Manoeuvre 45
Zigzag 10°–10° 48
Zigzag 10°–10° Slow Speed 52
Zigzag 20°–20° 56
Pull Out 60
Spiral Test 63
Wind Forces 66
Williamson Turn 67
Wind Effect—Stopped 71
Wind Effect—Under Way 74
Free Oscillations 77

Model Identification

This is a 36.25m LOA (from fender to fender), 120 MT bollard pull, 2,560x3 kW ROTOR tugboat model. Note that Robert Allan Ltd (RAL) classified the Length Overall based on the steel hull, which is 34.95m.

The principle dimensions of this model are:

LOA (m)	36.25	Beam Molded (m)	15.39
Beam Waterline (m)	14.55	Draft Modelled (m)	4.08
Draft Extreme (m)	7.06	Displacement (mt)	1,172

Revision History

Ver 1 WH
Jan 5, 2022

Model Sources

Sources for Modeling

- Drawings
- 221-024 10010R2 Lines Plan
- 221-024 30000R3 General Arrangement
- 221-024 41500R2 Towing Arrangement
- 221-024 52500R3 Shafting Arrangement
- Drives
- AZT_Reg_P+_SM010_0625_0885_Free Running Ahead Test
- Combinator Data Free Running Aft & Fwd & Trawling-Pull
- Trial Prediction Aft thruster 22.10.2021
- Trial Prediction Aft thruster graph 22.10.2021 with combinator
- Trial Prediction Fwd thrusters 22.10.2021 with combinator
- Trial Prediction Fwd thrusters 22.10.2021
- 5262352-A-000 drawing
- Engine
- 3516E 2525 bkW at 1800 rpm Performance
- Performance
- 221-024 R1 AA Aft Winch Escort Report – Sealed
- 221-024 R1 CFD Analysis of Bollard Pull - Sealed
- 221-024 R1 Fwd Winch Escort Report – Sealed
- 221-024 R1 Self-Propelled Powering Analysis – Sealed
- 221-024-R1-10-1-ZigZag-12knots
- Stability
- 221-024-HYDRO_CC_0-TRIM
- 221-024-PRELIM-ESCORT-PLACARD
- 221-024-STAB-ESCORT_ABS
- 221-024-STAB-Upright
- 221-024-WINDAGE

References

- ROTOR TUG Memo August 17, 2012, Re: Pilot transfer with tugs
- ROTOR TUG Memo October 1, 2012, Re: The ART of tugnology: the ultimate balance between safe ship assist and safe excorting duties
- ROTOR TUG Memo May 6, 2015, Re: Comparison RT80-32, ART80-32
- Kooren, T., Quadvlieg, F. and Aalbers, A., “The ROTOR Tug”, ITS 2000.

General Description

Power Plant

TUG60V1 Tug ART 120-35W is powered by 3 diesel engines rating 2560 kW at 1800 rpm.

Propulsors

TUG60V1 is propelled by 3 controllable pitch propellers azimuthing at 12 deg/s. Directions of propulsor revolution are [right, left, right].

Speed

Top speed of TUG60V1 at 100% throttle setting and calm conditions is 14.8 kn ahead and 13.7 kn astern.

Rudders

This ship has no auxilliary rudders.

Thrusters

This ship has no auxilliary thrusters.

Stopping Ability

Stopping performance can be judged from crash stop manoeuvre. Crash stop distance of TUG60V1 is 52 m which makes 1.6 ship lengths. Such crash stop performance is good and satisfies IMO's requirements as described in IMO Resolution MCS.137(76) Standards for Ship Manoeuverability.

Turning Ability

The turning ability may be judged from turning circles. Turning cirlce test performed at 100% throttle setting and 35 deg starboard steering order results in advance 118 m or 3.6 ship's length and tactical diameter 90 m or 2.7 ship's length. Turning ability of TUG60V1 is fair and satisfies IMO's requirements.

Manoeuvring Ability

Zigzag test performed at 80% throttle setting show first overshoot angle 24.0 deg in the 10-10° test and 38.4 deg in the 20-20° test. Zigzag test results indicate that manouevring ability of TUG60V1 is poor and does not satisfy IMO's Resolution MCS.137(76).

Steering Ability

Steering ability of TUG60V1 is good. The ship is course stable.

Ship Data

Identification

Model name	TUG60V1
Ship database file name	TUG60v1.sdb
Type of ship	Tug
Loading condition	Loaded Departure
Ship's name	ART 120-35W

General Data

IMO#	2345678
Year Built	2021
Builder	STAR
Call Sign	ART12035W
MMSI	987654321
Bulbous Bow	No
Gross Tonnage, RT	
Net Tonnage, RT	
Deadweight, t	281
Displacement, t	1172
Length between perpendiculars, m	32.8
Length overall, m	36.25
Beam moulded, m	14.6
Draught fore, m	4.1
Draught aft, m	4.1
Block coefficient	0.587
Radius of inertia, multiples of L_{pp}	0.23
Lateral windage area, m²	191.8
Speed ahead, kn	14.8
Speed astern, kn	13.7
Minimum speed to maintain course with engine stopped, kn	
Transverse metacentric height, m	3.1

Engines

Number of engines	3
Type of engine	Diesel
Total shaft power, kW	7679
Revolutions, rpm	1800.0
Stall Revolutions, rpm	1800.0

Propellers

Number of propellers	3
Type of propulsion	Propeller
Max azimuting angle, deg	180.0
Max azimuting rate, deg/s	12.0
Revolutions, rpm	240.0
Direction of rotation	Clockwise/Counter-clockwise/Clockwise
Diameter, m	2.8
Pitch, P/D @ 0.7R	1.2
Total rudder area, % of $L_{pp}T_x$	

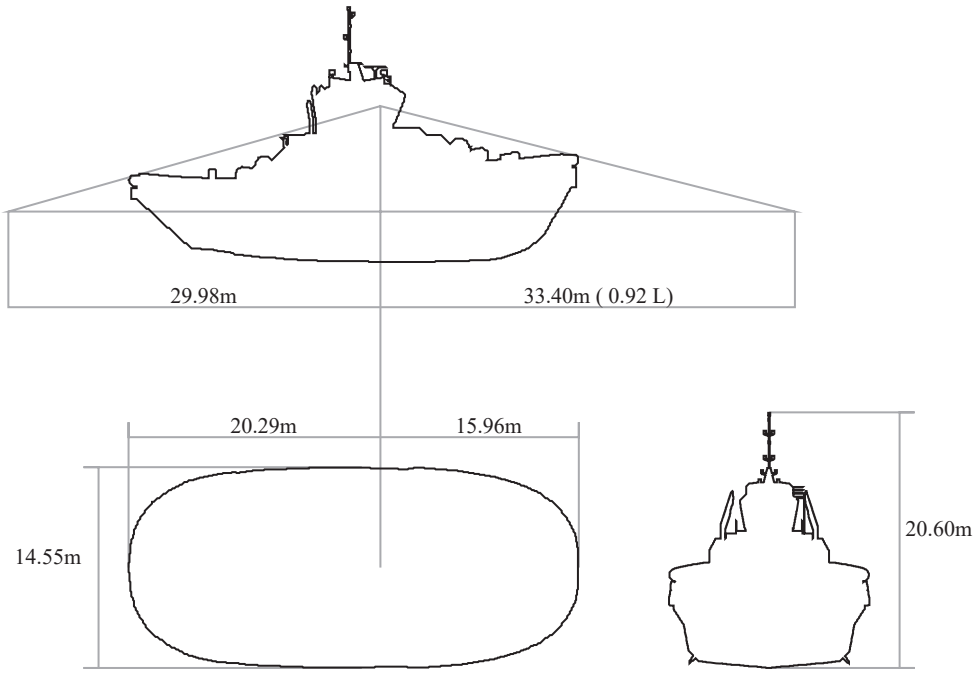
Radar Position

Longitudinal radar position, m	1.1
Lateral radar position, m	0.0
Vertical radar position, m	-11.6

Viewpoint Position

Longitudinal viewpoint position, m	1.5
Lateral viewpoint position, m	0.0
Vertical viewpoint position, m	8.5

Blind Zone



Speed

Throttle Setting		Propeller		Speed	
		revolutions	pitch	deep H/T = ∞	shallow H/T = 1.5
		rpm	P/D	kn	kn
Combinator Mode "Free Running Forward"					
Full sea speed	1	240.0	100.0%	14.8	12.1
Full Ahead	0.8	217.0	90.8%	12.5	11.3
Half Ahead	0.5	165.0	78.3%	9.0	8.7
Slow Ahead	0.25	147.5	44.6%	5.1	5.0
Dead Slow Ahead	0.125	144.0	25.6%	2.9	2.9
Stop	0	144.0	0.0%	0.0	0.0
Dead Slow Astern	-0.125	144.0	25.6%		
Slow Astern	-0.25	147.5	44.6%		
Half Astern	-0.5	165.0	78.3%		
Full Astern	-1	240.0	100.0%		
Combinator Mode "Trawl-Pull"					
Full sea speed	1	240.0	100.0%	14.8	12.1
Full Ahead	0.8	240.0	77.5%	12.5	11.3
Half Ahead	0.5	240.0	49.2%	8.9	8.7
Slow Ahead	0.25	240.0	27.9%	5.4	5.3
Dead Slow Ahead	0.125	240.0	17.9%	3.5	3.5
Stop	0	240.0	0.0%	0.0	0.0
Dead Slow Astern	-0.125	240.0	17.9%		
Slow Astern	-0.25	240.0	27.9%		
Half Astern	-0.5	240.0	49.2%		
Full Astern	-1	240.0	100.0%		

Table 1. Propeller revolutions and pitch and ship speed as function of machinery telegraph setting. Deep and shallow water.

Statistics

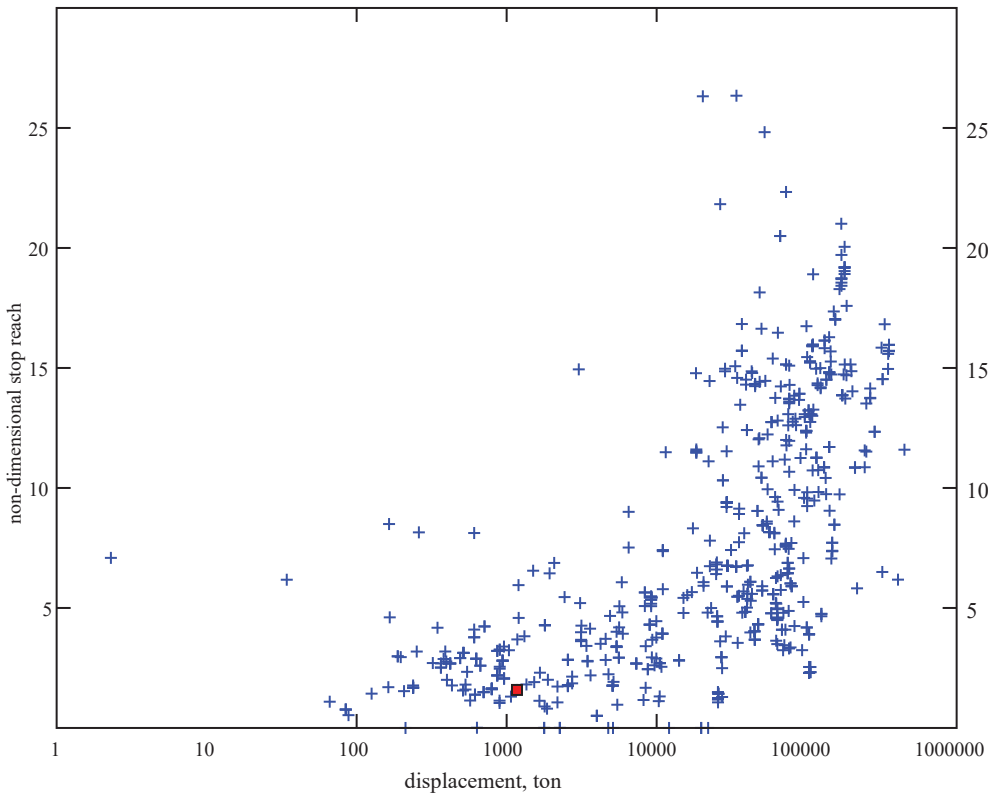


Fig. 1. Stop reach of the ship compared with other ship models.

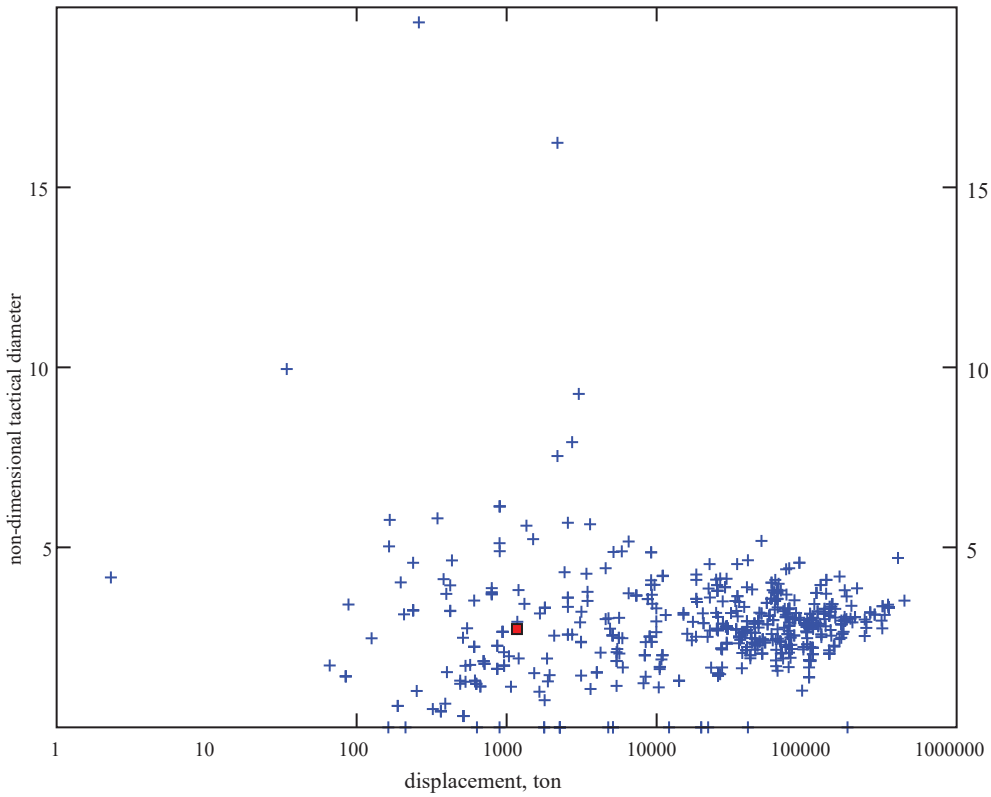


Fig. 2. Tactical diameter of the ship compared with other ship models.

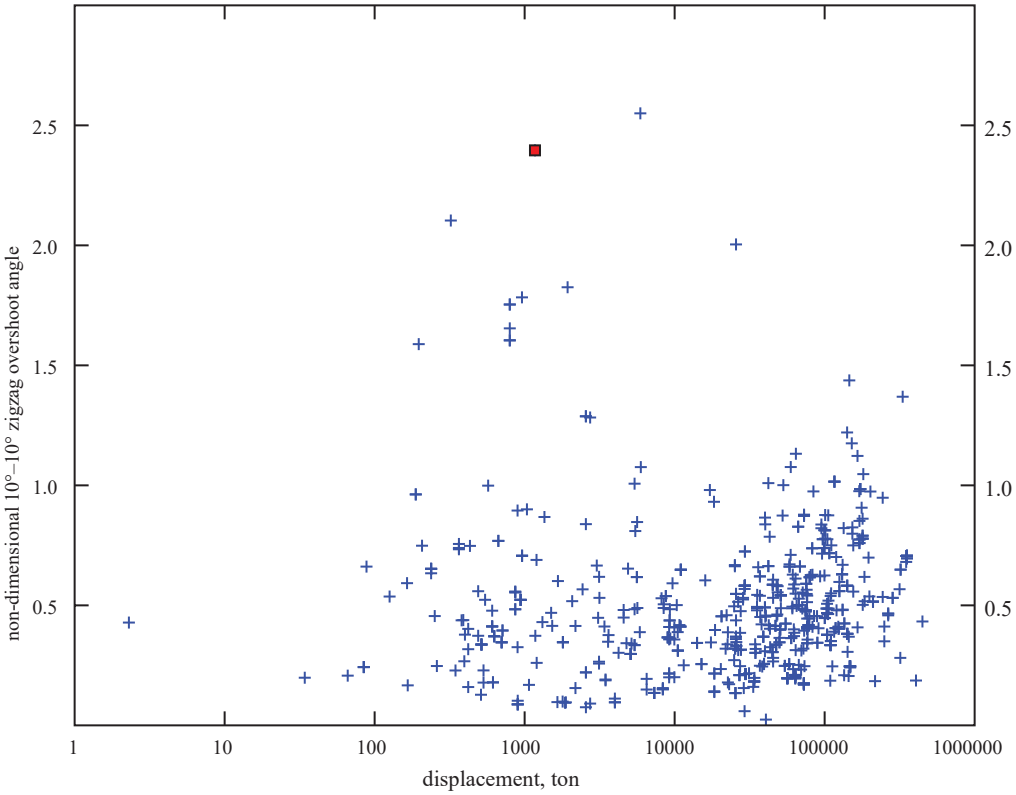


Fig. 3. Zig-zag overshoot angle of the ship compared with other ship models.

Acceleration

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 0.0
to, % 100.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	144.0	0	0.0	0.0
00:01:00	239.7	1.2	14.1	345.8
00:02:00	239.5	1.2	14.0	776.5
00:03:00	237.8	1.2	13.8	1207.3
00:04:00	239.5	1.2	14.1	1637.9
00:05:00	239.6	1.2	14.0	2068.2
00:06:00	239.7	1.2	13.9	2498.7
00:07:00	239.7	1.2	13.9	2929.5
00:08:00	239.7	1.2	14.1	3359.9
00:09:00	239.5	1.2	13.9	3790.2
00:10:00	237.7	1.2	13.8	4221.0
00:11:00	239.6	1.2	14.1	4651.6
00:12:00	239.6	1.2	14.0	5081.8
00:13:00	239.7	1.2	13.8	5512.4
00:14:00	239.8	1.2	13.9	5943.2
00:15:00	239.7	1.2	14.1	6373.5
00:16:00	239.4	1.2	13.9	6803.9
00:17:00	237.4	1.2	12.8	7235.8

Table 2. Acceleration.

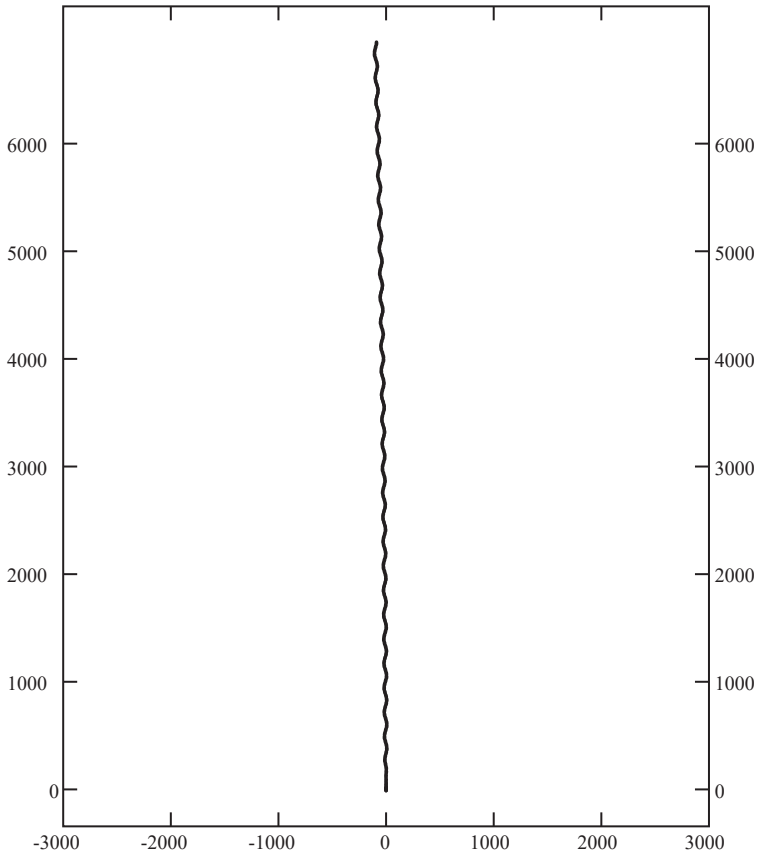


Fig. 4. Acceleration. Ship position plot.

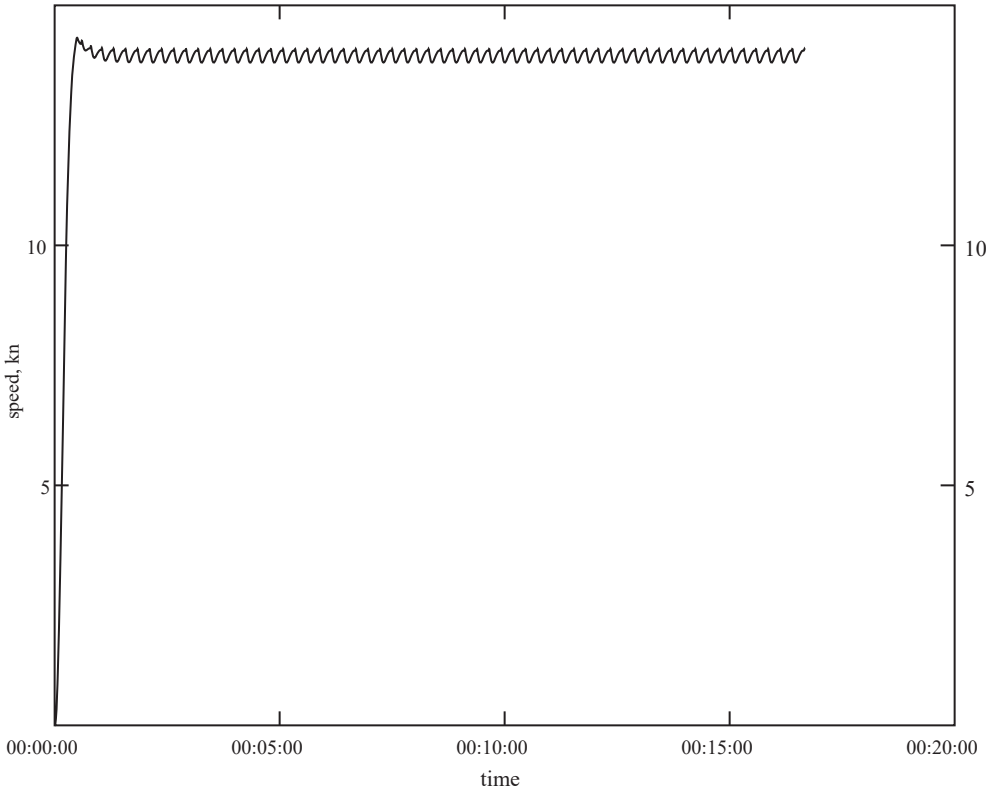


Fig. 5. Acceleration. Speed plot.

Acceleration from Slow to Half

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 25.0
to, % 50.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	147.5	0.535	5.1	0.0
00:01:00	164.7	0.94	8.6	253.4
00:02:00	164.7	0.94	8.5	517.0
00:03:00	164.8	0.94	8.5	780.4
00:04:00	164.7	0.94	8.5	1043.5
00:05:00	164.7	0.94	8.5	1306.1
00:06:00	165.3	0.94	8.5	1568.8
00:07:00	164.8	0.94	8.5	1831.8
00:08:00	164.7	0.94	8.5	2094.8
00:09:00	165.4	0.94	8.6	2357.5
00:10:00	164.7	0.94	8.5	2620.2
00:11:00	165.3	0.94	8.5	2883.1
00:12:00	164.7	0.94	8.5	3146.0
00:13:00	164.7	0.94	8.5	3409.0
00:14:00	165.3	0.94	8.6	3671.7
00:15:00	164.7	0.94	8.5	3934.6
00:16:00	165.3	0.94	8.5	4197.4
00:17:00	168.1	0.94	8.6	4459.6

Table 3. Acceleration from Slow to Half.

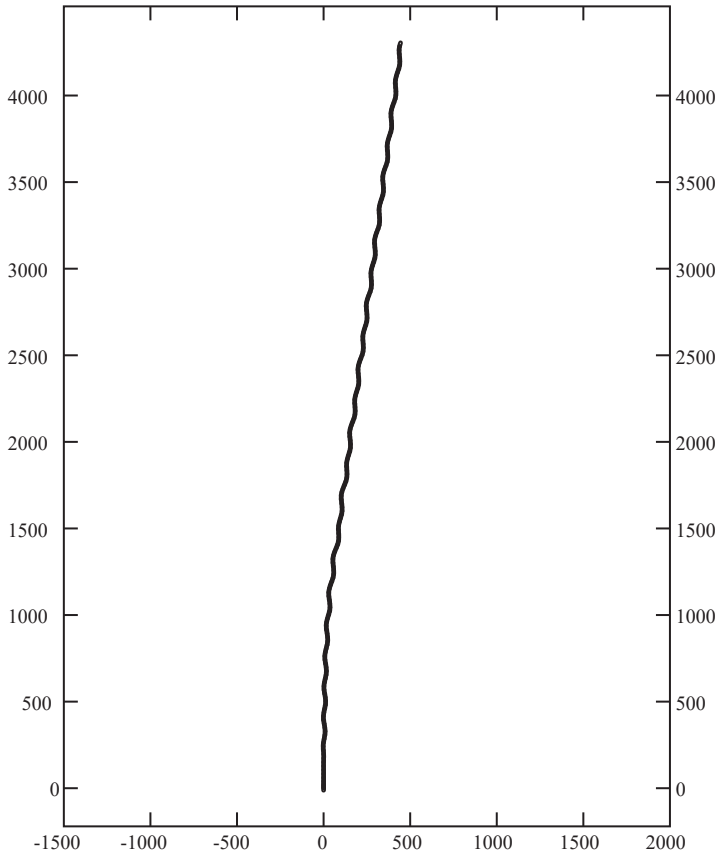


Fig. 6. Acceleration from Slow to Half. Ship position plot.

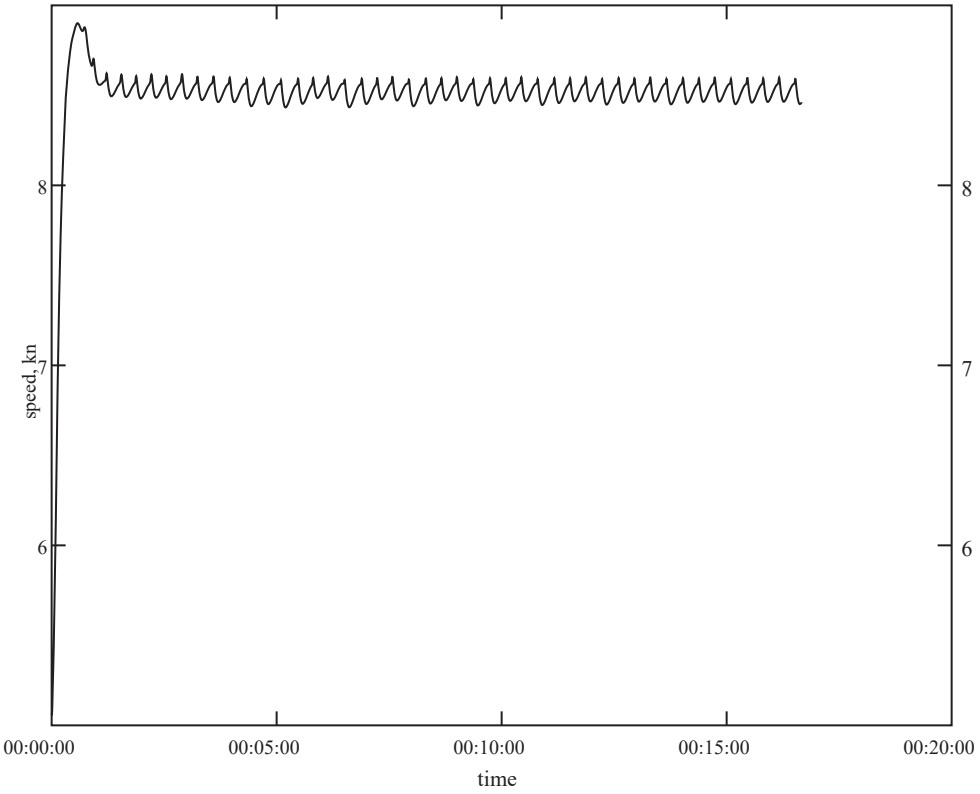


Fig. 7. Acceleration from Slow to Half. Speed plot.

Crash Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % ..... -100.0
Rudder, deg 0.0

Performance

Stop time, s 00:00:11
Advance at stop time, m 52.0
Transfer at stop time, m 0.7
Heading at stop time, deg 63.6

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	240.0	1.2	14.8	0.0	0.0
00:00:01	239.9	1.2	14.8	5.7	0.0
00:00:02	239.6	1.2	14.7	11.4	0.2
00:00:02	238.7	1.2	14.4	17.0	0.9
00:00:03	233.7	1.2	13.8	22.5	2.3
00:00:04	224.9	1.2	12.8	27.6	4.7
00:00:04	215.8	1.2	11.4	32.3	8.3
00:00:05	208.1	1.2	9.8	36.4	12.9
00:00:06	202.2	1.2	8.3	39.9	18.3
00:00:07	199.1	1.2	6.8	42.8	24.2
00:00:08	198.3	1.2	5.6	45.1	30.5
00:00:08	198.7	1.2	4.6	47.1	37.1
00:00:09	199.0	1.2	3.7	48.7	43.8
00:00:10	199.0	1.2	3.0	50.0	50.5
00:00:10	198.8	1.2	2.5	51.1	57.1
00:00:11	198.6	1.2	2.1	52.0	63.7

Table 4. Crash stop test.

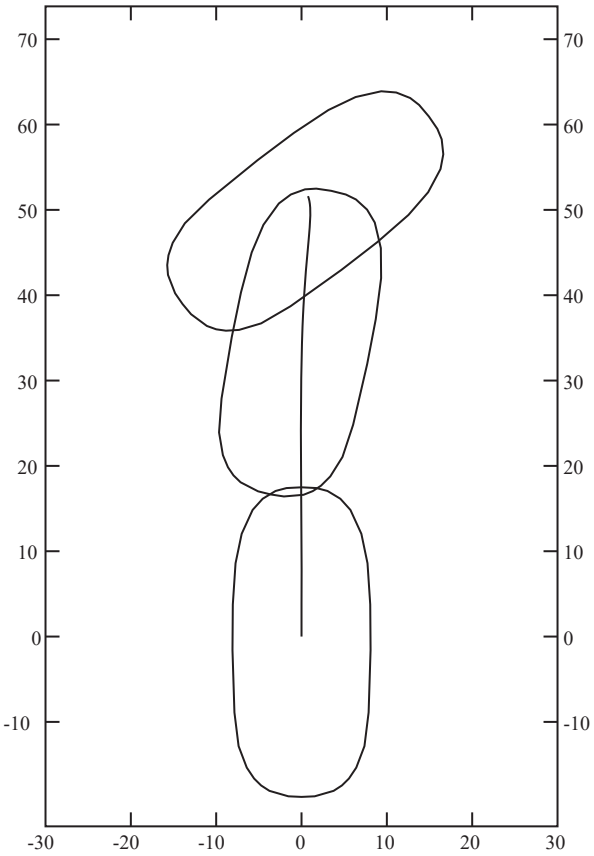


Fig. 8. Crash stop test. Ship position plot.

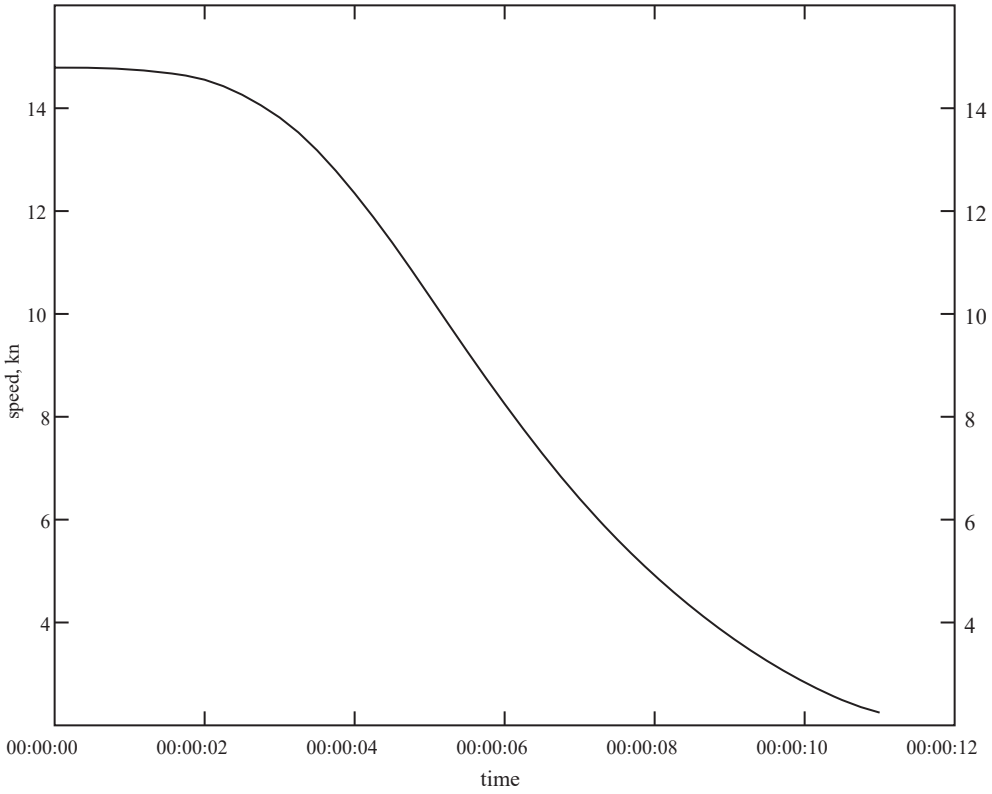


Fig. 9. Crash stop test. Speed plot.

Deceleration from Half to Slow

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 50.0
to, % 25.0
Rudder, deg 0.0

Performance

Stop time, s 00:00:51
Advance at stop time, m 158.1

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	165.0	0.94	9.0	0.0	0.0
00:00:02	150.8	0.787	8.8	9.1	0.0
00:00:04	148.8	0.635	8.3	17.9	0.0
00:00:06	147.8	0.535	7.8	26.2	0.0
00:00:08	147.0	0.535	7.3	34.0	0.0
00:00:10	147.0	0.535	6.9	41.3	0.0
00:00:12	147.1	0.535	6.6	48.2	0.0
00:00:14	147.1	0.535	6.3	54.8	0.0
00:00:16	147.1	0.535	6.1	61.2	0.0
00:00:18	147.2	0.535	5.9	67.4	0.0
00:00:20	147.2	0.535	5.8	73.5	0.0
00:00:22	147.2	0.535	5.7	79.3	0.0
00:00:24	147.2	0.535	5.6	85.1	0.0
00:00:26	147.2	0.535	5.5	90.8	0.0
00:00:28	147.2	0.535	5.4	96.4	0.0
00:00:30	147.2	0.535	5.3	101.9	0.0
00:00:32	147.2	0.535	5.3	107.4	0.0
00:00:34	147.2	0.535	5.2	112.8	0.0
00:00:36	147.2	0.535	5.2	118.2	0.0
00:00:38	147.2	0.535	5.2	123.5	0.0
00:00:40	147.2	0.535	5.2	128.8	0.0
00:00:42	147.3	0.535	5.1	134.1	0.0

00:00:44	147.3	0.535	5.1	139.4	0.0
00:00:46	147.3	0.535	5.1	144.7	0.0
00:00:48	147.3	0.535	5.1	149.9	0.0
00:00:50	147.3	0.535	5.1	155.1	0.0
00:00:52	147.3	0.535	5.1	160.4	0.0

Table 5. Deceleration from Half to Slow .

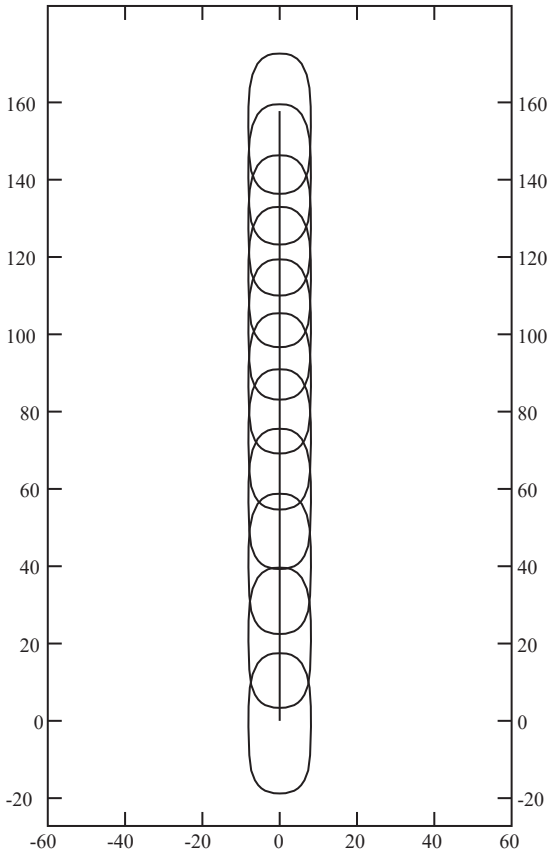


Fig. 10. Deceleration from Half to Slow . Ship position plot.

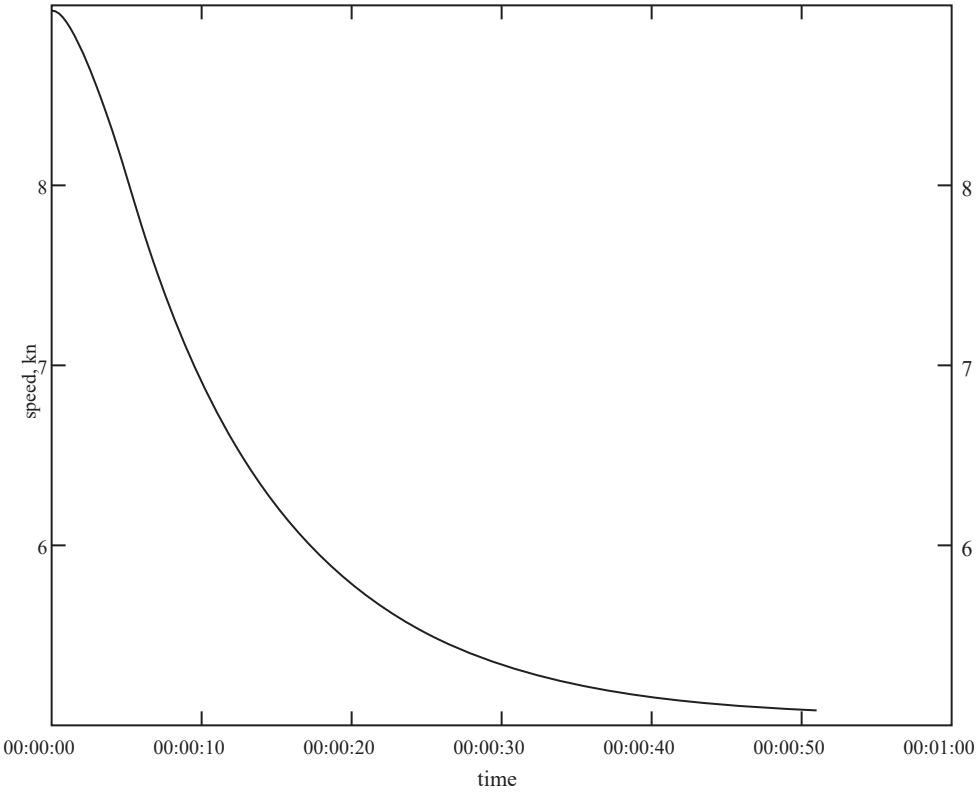


Fig. 11. Deceleration from Half to Slow . Speed plot.

Coasting Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder, deg 0.0

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	240.0	1.2	14.8	0.0	0.0
00:00:05	159.6	0.818	12.1	35.3	0.0
00:00:10	171.7	0.436	9.3	62.6	0.0
00:00:15	216.9	0.055	6.9	83.4	0.0
00:00:20	205.7	0	5.9	99.8	0.0
00:00:25	172.7	0	5.1	114.0	0.1
00:00:30	143.8	0	4.5	126.4	0.1
00:00:35	143.7	0	4.1	137.5	0.1
00:00:40	143.7	0	3.7	147.4	0.2
00:00:45	143.7	0	3.4	156.5	0.2
00:00:50	143.7	0	3.1	164.9	0.3

Table 6. Coasting stop test.

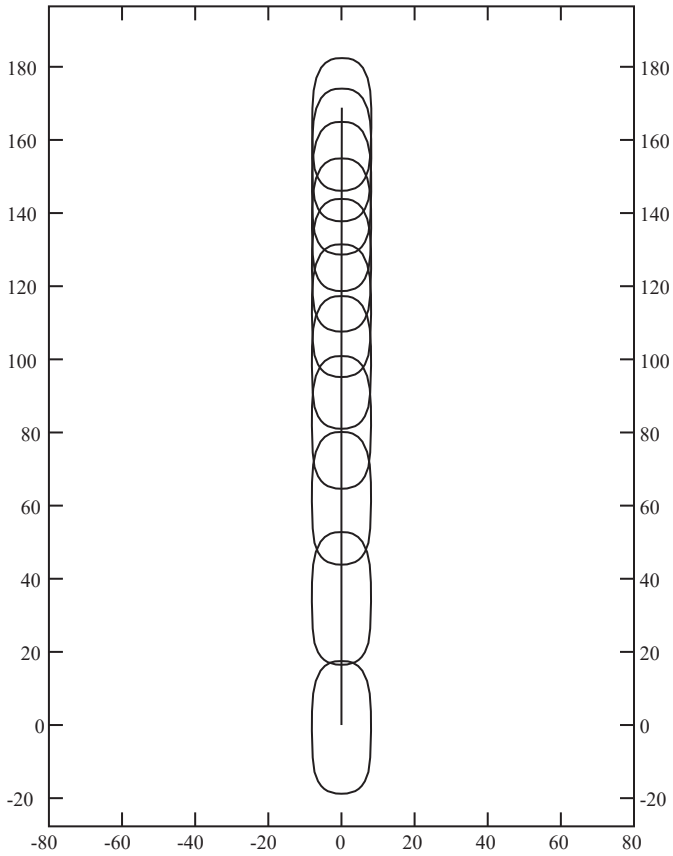


Fig. 12. Coasting stop test. Ship position plot.

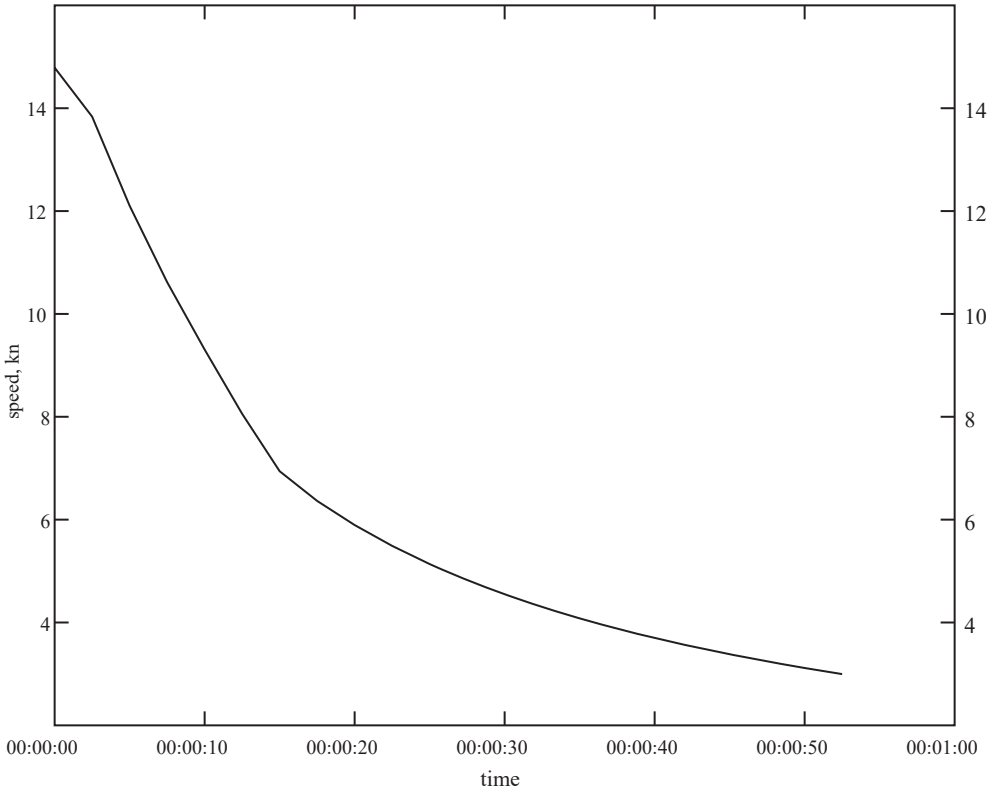


Fig. 13. Coasting stop test. Speed plot.

Time for effective changes in telegraph settings in stopping conditions

Initial Throttle	Initial Speed	Set Throttle	Reached Speed	Time
	kn		kn	s
Full Sea Speed	14.8	Full Astern	0.0	00:33:20
Full Ahead	12.5	Full Astern	0.0	00:33:20
Half Ahead	9.0	Full Astern	0.0	00:33:20
Slow Ahead	5.1	Full Astern	0.0	00:33:20
Full Sea Speed	14.8	Stop	3.0	00:00:53
Full Ahead	12.5	Stop	3.0	00:00:51
Half Ahead	9.0	Stop	3.0	00:00:45
Slow Ahead	5.1	Stop	3.0	00:00:27

Turning Circle Starboard, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting% 100.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:00:23
Advance, m 117.7
Transfer, m 22.1
Time 180°, s 00:00:40
Tactical diameter, m 89.6
Circulation diameter, m 100.6
Turn rate, deg/min 316.2
Speed loss, % 39.2

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	14.8	0.0	0	0
00:00:05	12.1	1.3	s86.9	s10.8
00:00:10	10.2	18.2	s290.7	s21.6
00:00:15	9.5	44.6	s328.0	s25.3
00:00:20	9.1	71.8	s323.0	s26.3
00:00:25	9.0	98.5	s318.7	s26.6
00:00:30	9.0	124.9	s317.0	s26.6
00:00:35	9.0	151.3	s316.4	s26.7
00:00:40	9.0	177.7	s316.2	s26.7
00:00:45	9.0	-156.0	s316.2	s26.7
00:00:50	9.0	-129.6	s316.2	s26.7
00:00:55	9.0	-103.3	s316.2	s26.7
00:01:00	9.0	-76.9	s316.2	s26.7
00:01:05	9.0	-50.6	s316.2	s26.7
00:01:10	9.0	-24.2	s316.2	s26.7
00:01:15	9.0	2.2	s316.2	s26.7

00:01:20	9.0	28.5	s316.2	s26.7

Table 7. Turning circle starboard, deep water.

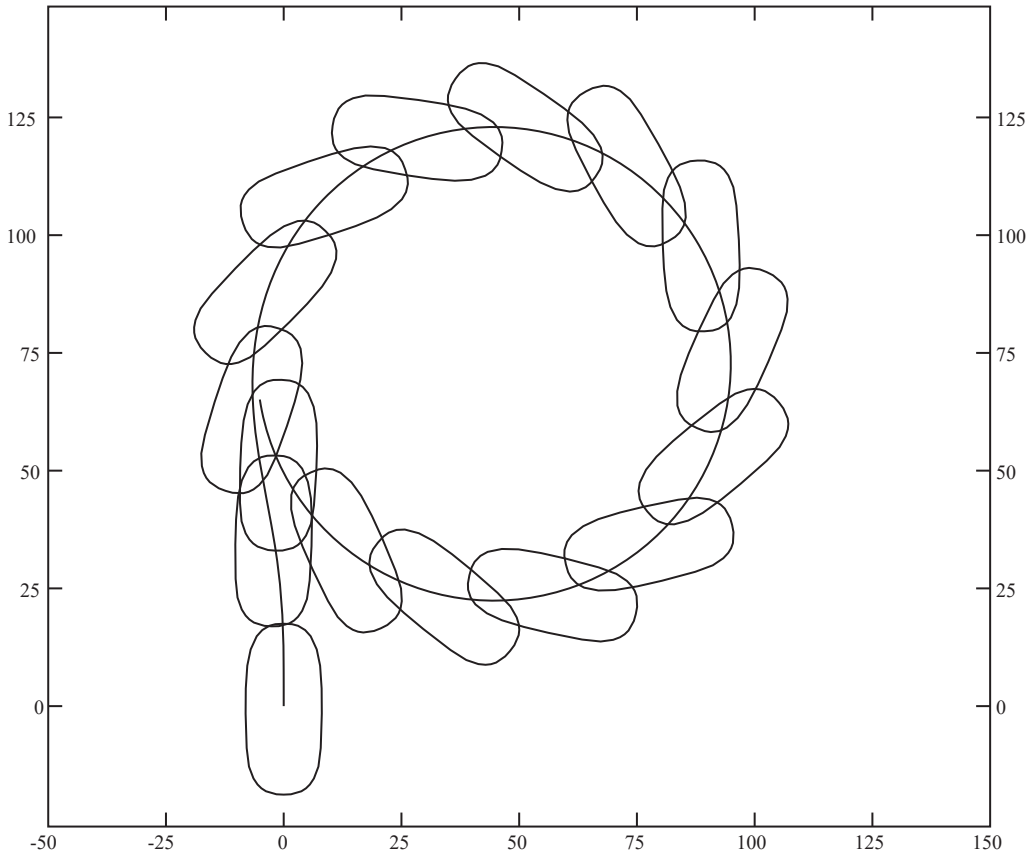


Fig. 14. Turning circle starboard, deep water. Ship position plot.

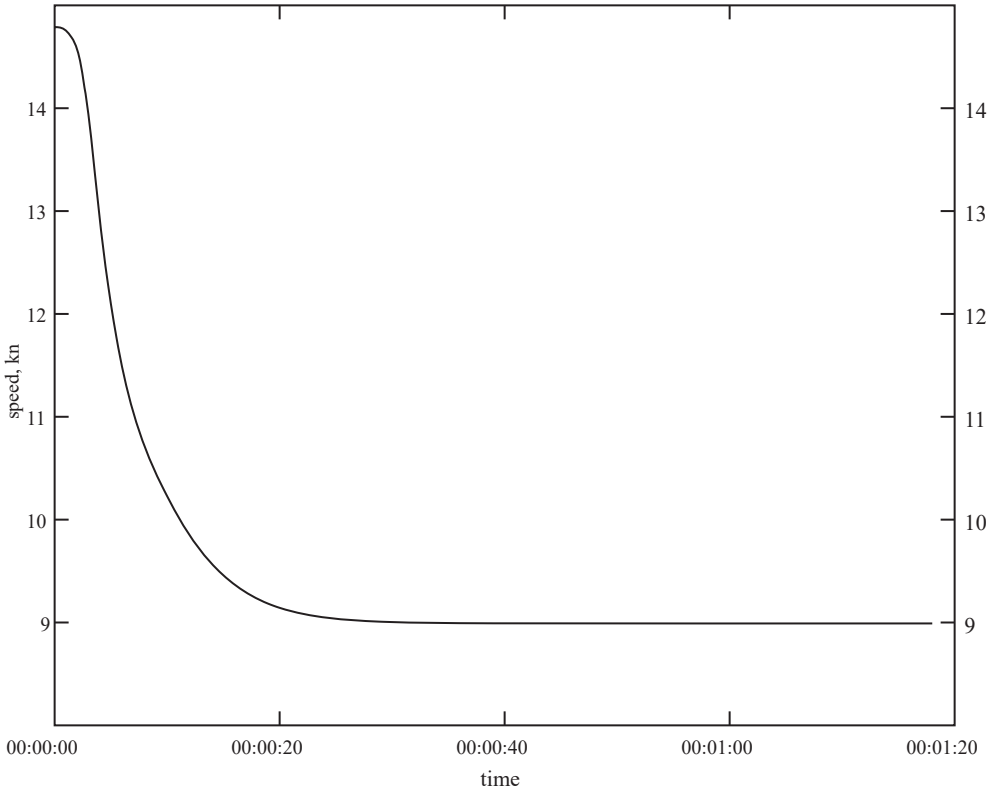


Fig. 15. Turning circle starboard, deep water. Speed plot.

Turning Circle Starboard, Shallow Water

Environment

Water depth, H/T 1.5
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 50.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:00:30
Advance, m 84.4
Transfer, m 27.5
Time 180°, s 00:00:52
Tactical diameter, m 76.9
Circulation diameter, m 78.2
Turn rate, deg/min 238.1
Speed loss, % 39.7

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	8.7	0.0	0	0
00:00:05	7.6	0.9	s52.4	s5.3
00:00:10	6.5	11.7	s196.8	s12.0
00:00:15	5.9	30.6	s241.2	s15.3
00:00:20	5.6	50.8	s242.3	s16.7
00:00:25	5.4	70.9	s240.4	s17.4
00:00:30	5.3	90.9	s239.2	s17.7
00:00:35	5.3	110.8	s238.6	s17.9
00:00:40	5.3	130.7	s238.4	s18.0
00:00:45	5.3	150.5	s238.2	s18.0
00:00:50	5.3	170.4	s238.1	s18.0
00:00:55	5.3	-169.8	s238.1	s18.0
00:01:00	5.3	-149.9	s238.1	s18.0
00:01:05	5.3	-130.1	s238.1	s18.0
00:01:10	5.3	-110.3	s238.1	s18.0
00:01:15	5.3	-90.4	s238.1	s18.0

00:01:20	5.3	-70.6	s238.1	s18.0
00:01:25	5.3	-50.7	s238.1	s18.0
00:01:30	5.3	-30.9	s238.1	s18.0
00:01:35	5.3	-11.1	s238.1	s18.0
00:01:40	5.3	8.8	s238.1	s18.0
00:01:45	5.3	28.6	s238.1	s18.0

Table 8. Turning circle starboard, shallow water.

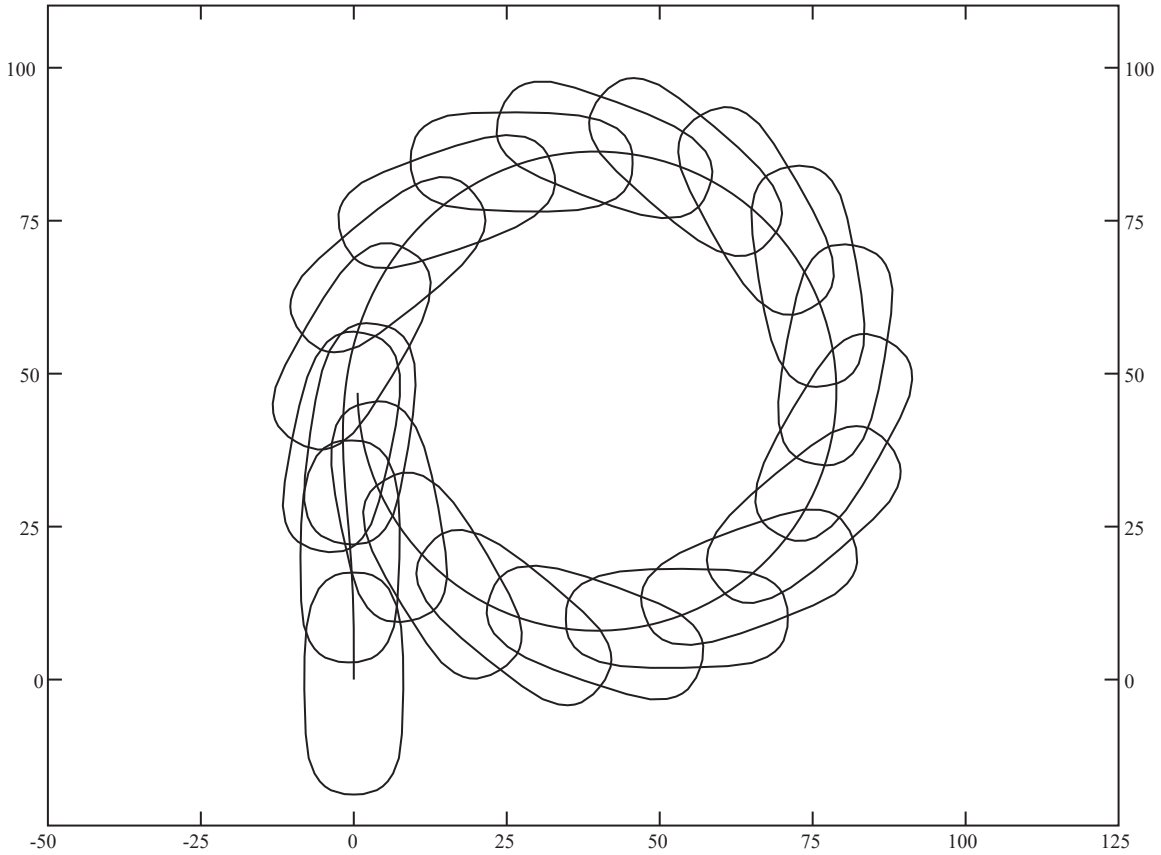


Fig. 16. Turning circle starboard, shallow water. Ship position plot.

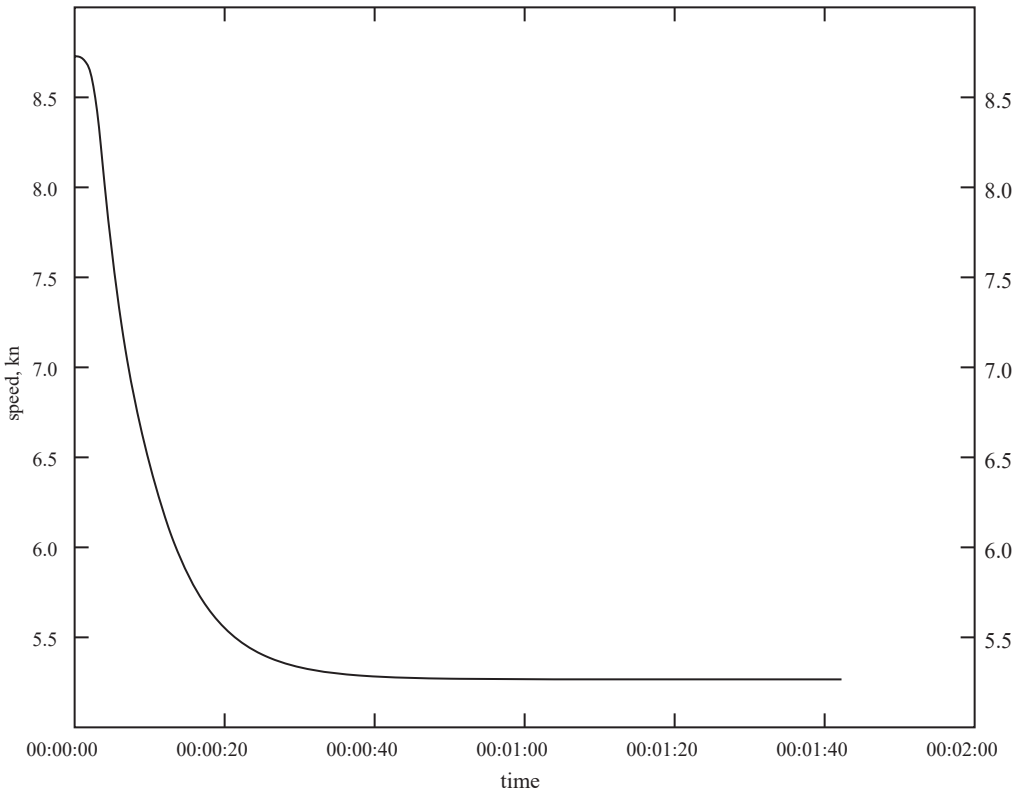


Fig. 17. Turning circle starboard, shallow water. Speed plot.

Turning Circle Port, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder command
from, deg 0.0
to, deg ..... -35.0

Performance

Time 90°, s 00:00:23
Advance, m 117.8
Transfer, m 22.2
Time 180°, s 00:00:40
Tactical diameter, m 89.6
Circulation diameter, m 100.7
Turn rate, deg/min ..... -315.9
Speed loss, % 39.2

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	14.8	0.0	0	0
00:00:05	12.1	-1.3	p86.2	p10.7
00:00:10	10.2	-18.1	p289.7	p21.6
00:00:15	9.5	-44.4	p327.5	p25.3
00:00:20	9.1	-71.6	p322.7	p26.3
00:00:25	9.0	-98.3	p318.4	p26.6
00:00:30	9.0	-124.7	p316.7	p26.6
00:00:35	9.0	-151.1	p316.1	p26.7
00:00:40	9.0	-177.4	p315.9	p26.7
00:00:45	9.0	156.2	p315.9	p26.7
00:00:50	9.0	129.9	p315.9	p26.7
00:00:55	9.0	103.6	p315.9	p26.7
00:01:00	9.0	77.3	p315.9	p26.7
00:01:05	9.0	50.9	p315.9	p26.7
00:01:10	9.0	24.6	p315.9	p26.7
00:01:15	9.0	-1.7	p315.9	p26.7

00:01:20	9.0	-28.0	p315.9	p26.7

Table 9. Turning circle port, deep water.

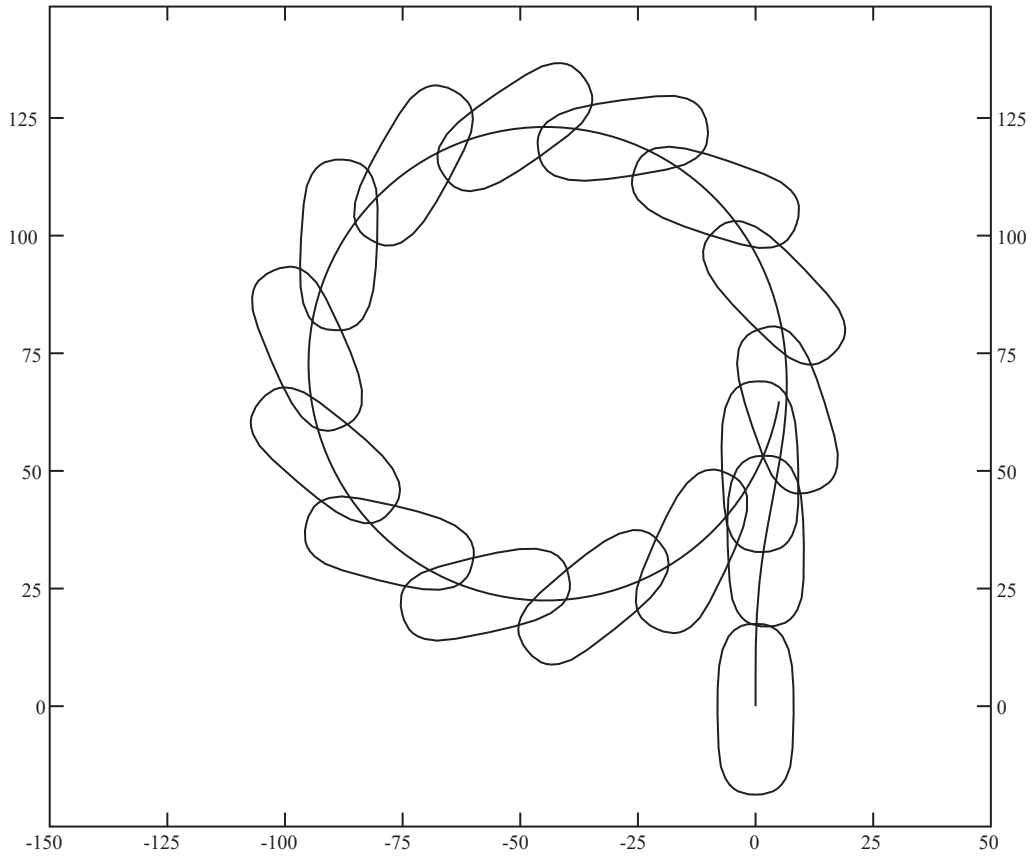


Fig. 18. Turning circle port, deep water. Ship position plot.

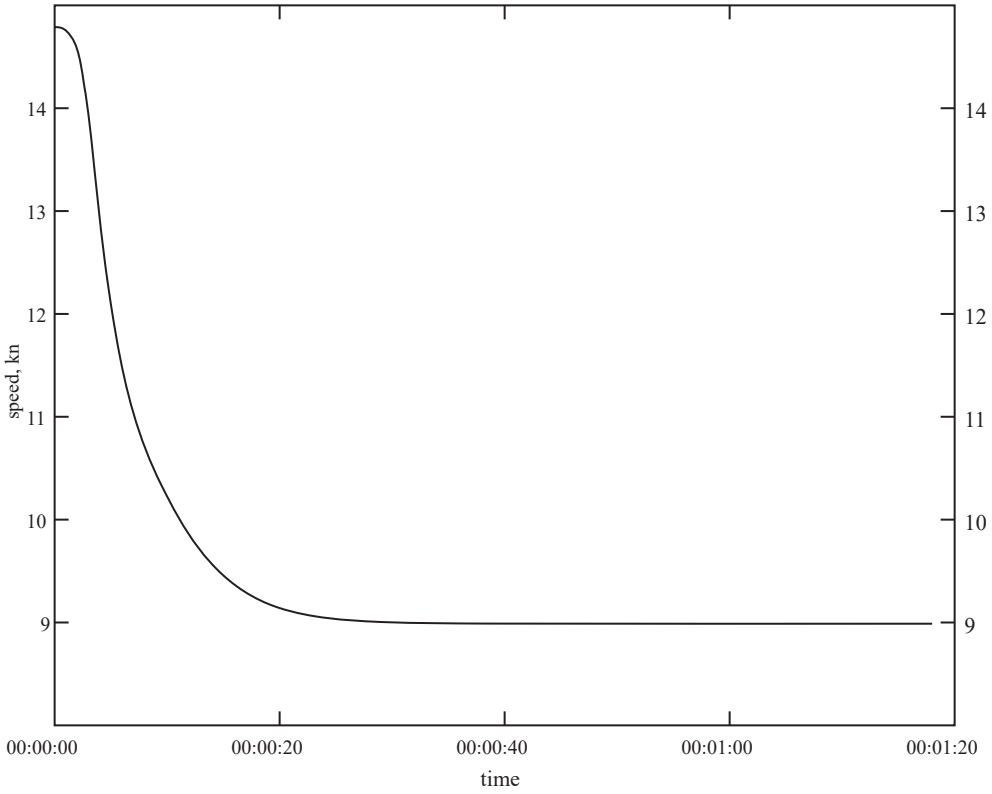


Fig. 19. Turning circle port, deep water. Speed plot.

Accelerated Turning

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
- from, % 0.0
- to, % 50.0

Rudder command
- from, deg 0.0
- to, deg 35.0

Performance

Time 90°, ... 00:00:46
Advance, m 94.0
Transfer, m 11.2
Time 180° 00:01:13
Tactical diameter, m 82.8
Circulation diameter, m 106.5
Turn rate, deg/min 201.9

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	0.0	0.0	0	0
00:00:10	2.7	-2.9	p22.7	s32.2
00:00:20	5.6	6.0	s139.6	s27.0
00:00:30	6.1	35.4	s195.6	s26.7
00:00:40	6.1	68.7	s201.5	s26.8
00:00:50	6.1	102.3	s201.9	s26.8
00:01:00	6.1	136.0	s201.9	s26.8
00:01:10	6.1	169.6	s201.9	s26.8
00:01:20	6.1	-156.7	s201.9	s26.8
00:01:30	6.1	-123.1	s201.9	s26.8
00:01:40	6.1	-89.4	s201.9	s26.8
00:01:50	6.1	-55.8	s201.9	s26.8
00:02:00	6.1	-22.1	s201.9	s26.8
00:02:10	6.1	11.5	s201.9	s26.8
00:02:20	6.1	45.2	s201.9	s26.8

Table 10. Accelerated turning.

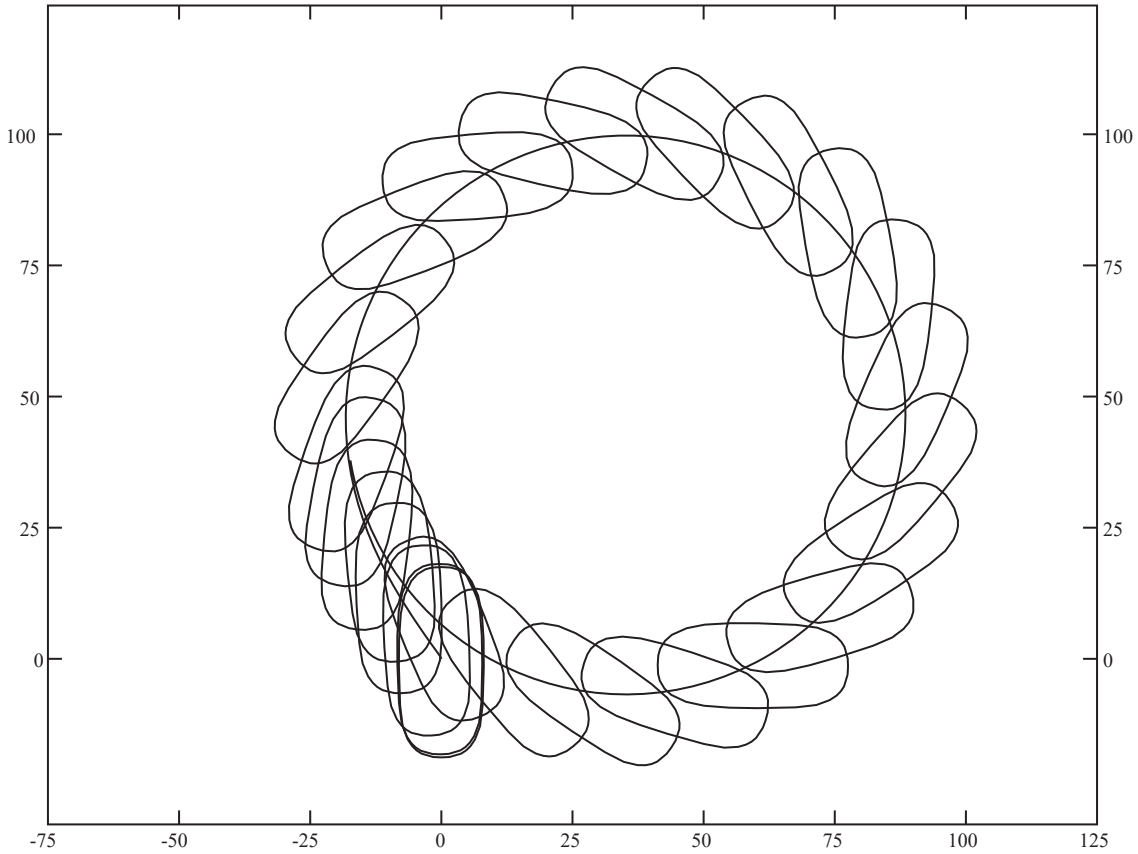


Fig. 20. Accelerated turning. Ship position plot.

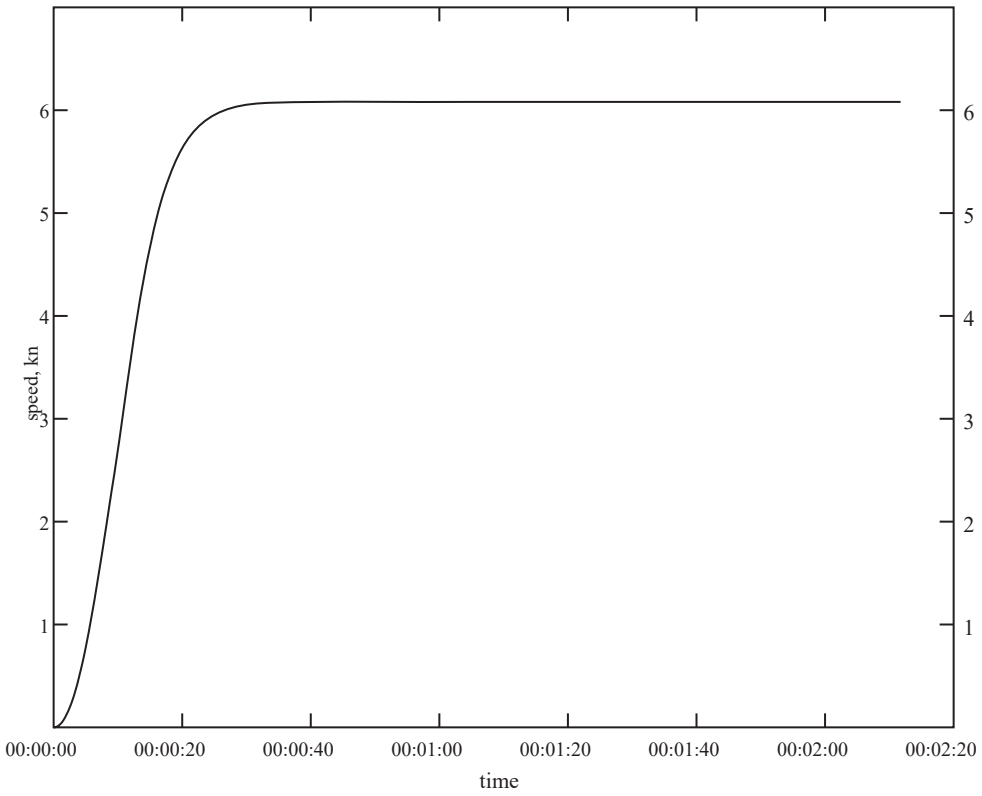


Fig. 21. Accelerated turning. Speed plot.

Coasting Circle

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder command
from, deg 0.0
to, deg 35.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	14.8	0.0	0	0
00:01:00	1.5	86.0	s57.5	s12.5
00:02:00	0.7	127.2	s29.8	s15.6
00:03:00	0.2	150.6	s18.4	s45.4
00:04:00	0.1	165.3	s11.5	s107.6
00:05:00	0.1	174.7	s7.6	s133.7
00:06:00	0.1	-178.9	s5.5	s135.4
00:07:00	0.0	-174.1	s4.3	s134.7
00:08:00	0.0	-170.2	s3.5	s134.1
00:09:00	0.0	-166.9	s3.0	s133.7
00:10:00	0.0	-164.1	s2.7	s133.5
00:11:00	0.0	-161.5	s2.4	s133.6
00:12:00	0.0	-159.3	s2.2	s133.9
00:13:00	0.0	-157.2	s2.0	s134.1
00:14:00	0.0	-155.3	s1.8	s134.3
00:15:00	0.0	-153.5	s1.7	s134.3
00:16:00	0.0	-151.9	s1.6	s134.3
00:17:00	0.0	-150.4	s1.5	s134.2

Table 11. Coasting Circle.

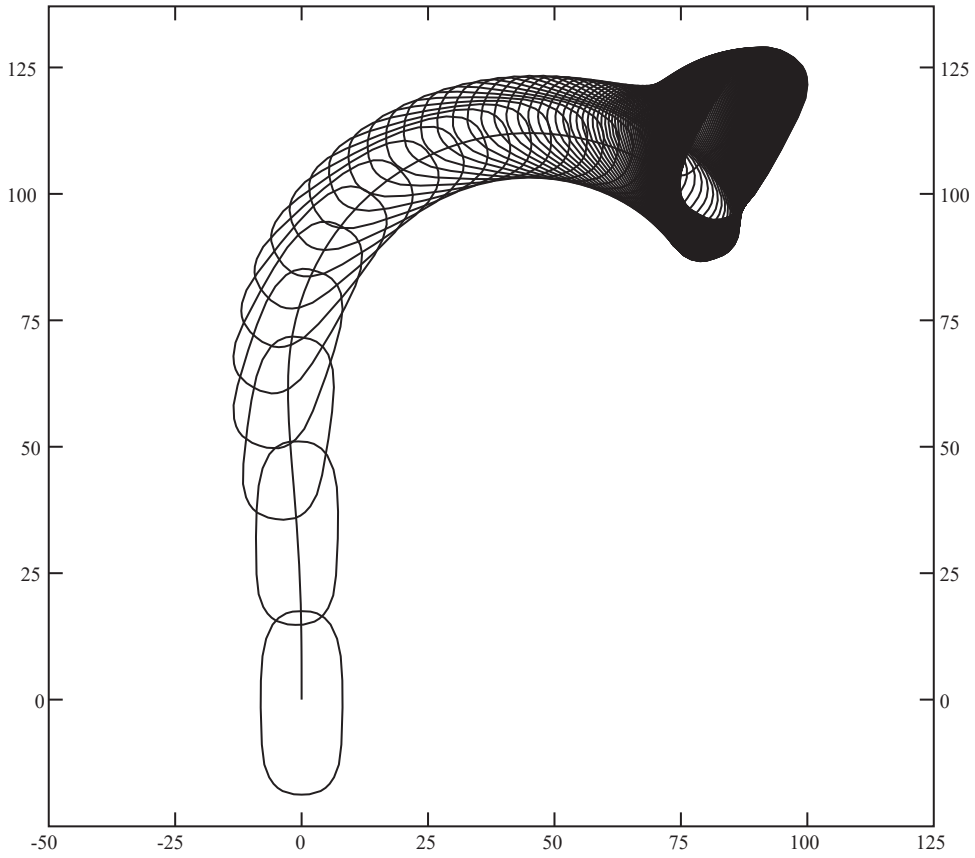


Fig. 22. Coasting Circle. Ship position plot.

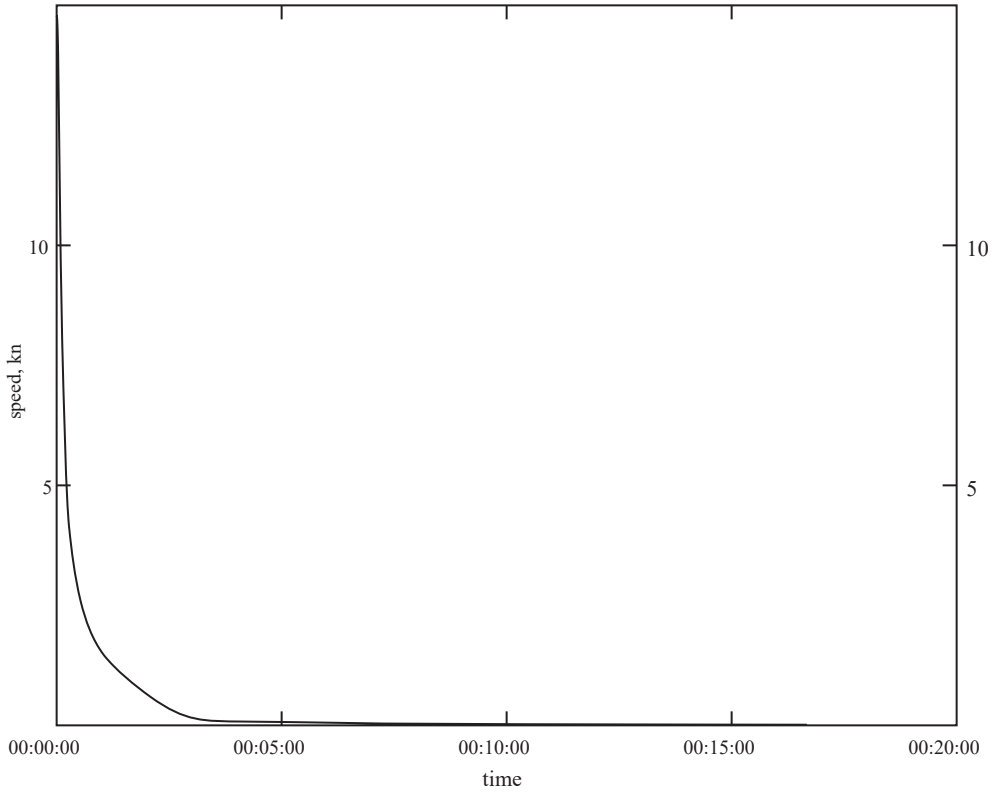


Fig. 23. Coasting Circle. Speed plot

Course Change Manoeuvre

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

Track reach, ship lengths 2.1

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.5	0
00:00:01	s3.4	0.0	12.5	p1.0
00:00:02	s9.5	0.0	12.5	p3.5
00:00:02	s10.0	-0.1	12.4	p0.4
00:00:03	s10.0	0.0	12.3	s7.9
00:00:04	s10.0	0.1	12.3	s18.7
00:00:04	s10.0	0.5	12.2	s30.8
00:00:05	s10.0	0.9	12.2	s43.9
00:00:06	s10.0	1.6	12.2	s57.8
00:00:07	s10.0	2.4	12.2	s72.0
00:00:08	s10.0	3.4	12.1	s86.0
00:00:08	s10.0	4.5	12.1	s99.5
00:00:09	s10.0	5.8	12.1	s112.3
00:00:10	s10.0	7.3	12.1	s124.6
00:00:10	s10.0	9.0	12.1	s136.4

Table 12. Course Change Manoeuvre.

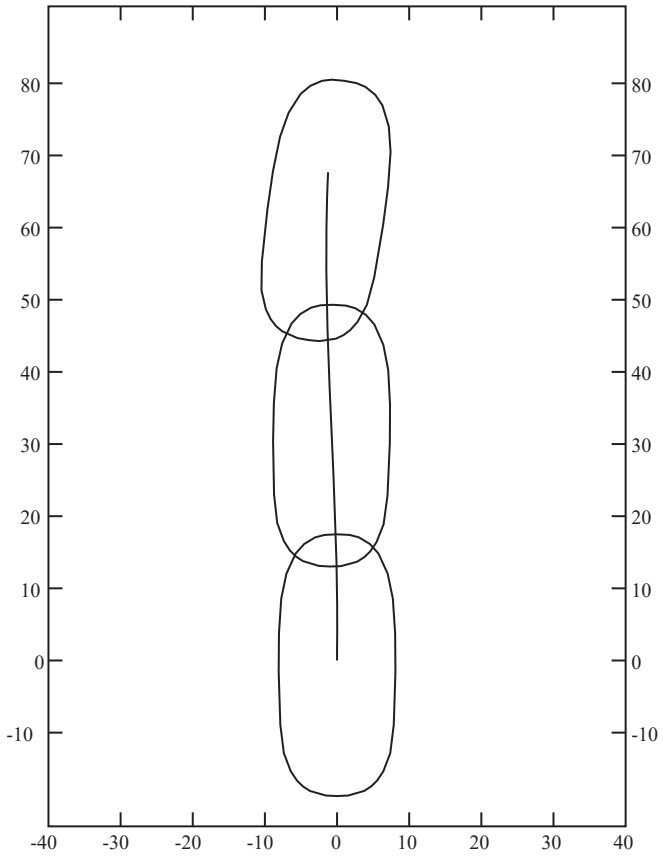


Fig. 24. Course Change Manoeuvre. Ship position plot.

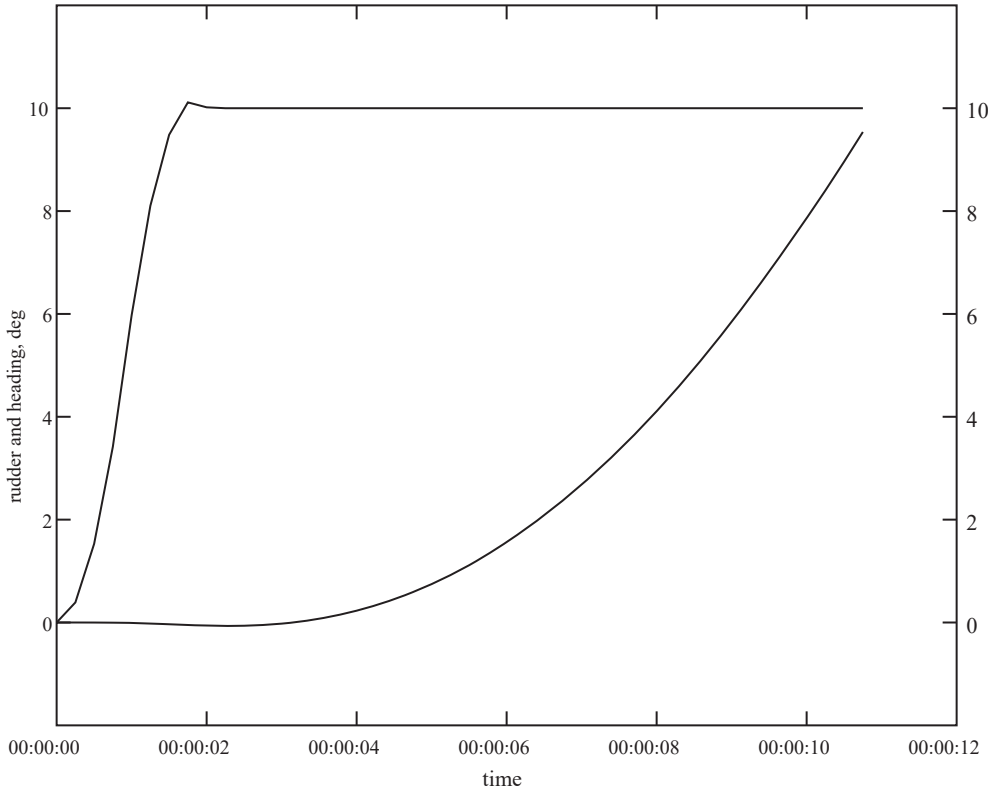


Fig. 25. Course Change Manoeuvre. Rudder and heading plot.

Zigzag 10°–10°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 24.0
Second overshoot angle, deg 39.1

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.5	0
00:00:05	s10.0	0.7	12.2	s39.5
00:00:10	s10.0	7.9	12.1	s128.6
00:00:15	p10.0	21.5	11.8	s171.0
00:00:20	p10.0	31.8	11.8	s71.3
00:00:25	p10.0	33.6	12.0	p28.0
00:00:30	p10.0	27.3	12.0	p120.6
00:00:35	p10.0	14.0	11.9	p194.6
00:00:40	p10.0	-4.4	11.7	p241.2
00:00:45	s10.0	-25.6	11.4	p250.8
00:00:50	s10.0	-41.9	11.5	p135.7
00:00:55	s10.0	-48.7	11.8	p31.0
00:01:00	s10.0	-49.3	12.0	s69.8

Table 13. Zigzag 10°–10°.

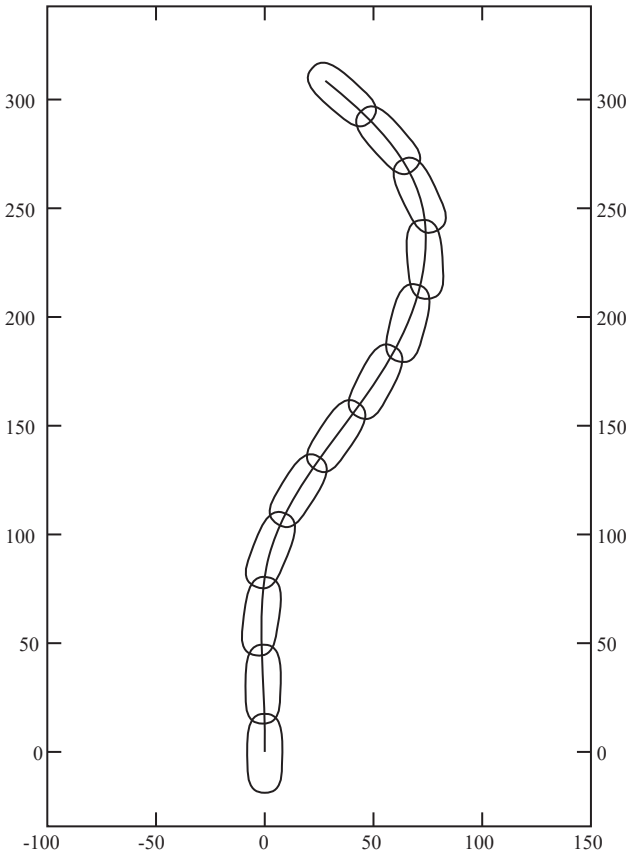


Fig. 26. Zigzag 10°–10°. Ship position plot.

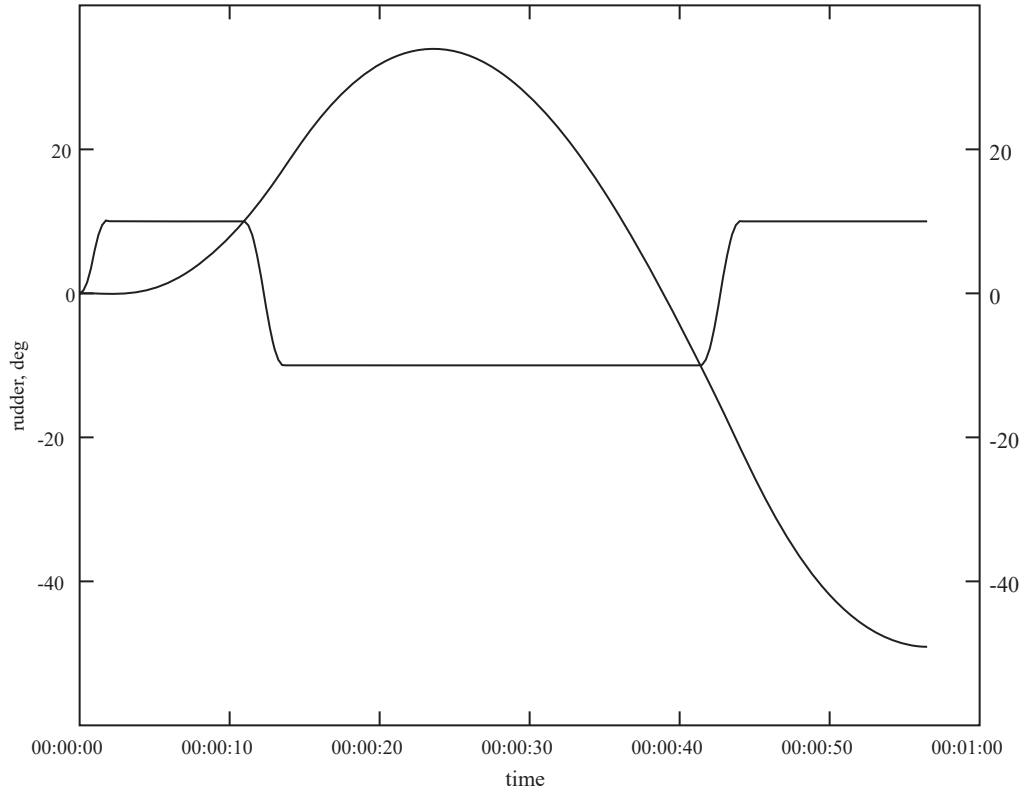


Fig. 27. Zigzag test 10°–10°. Rudder and heading plot.

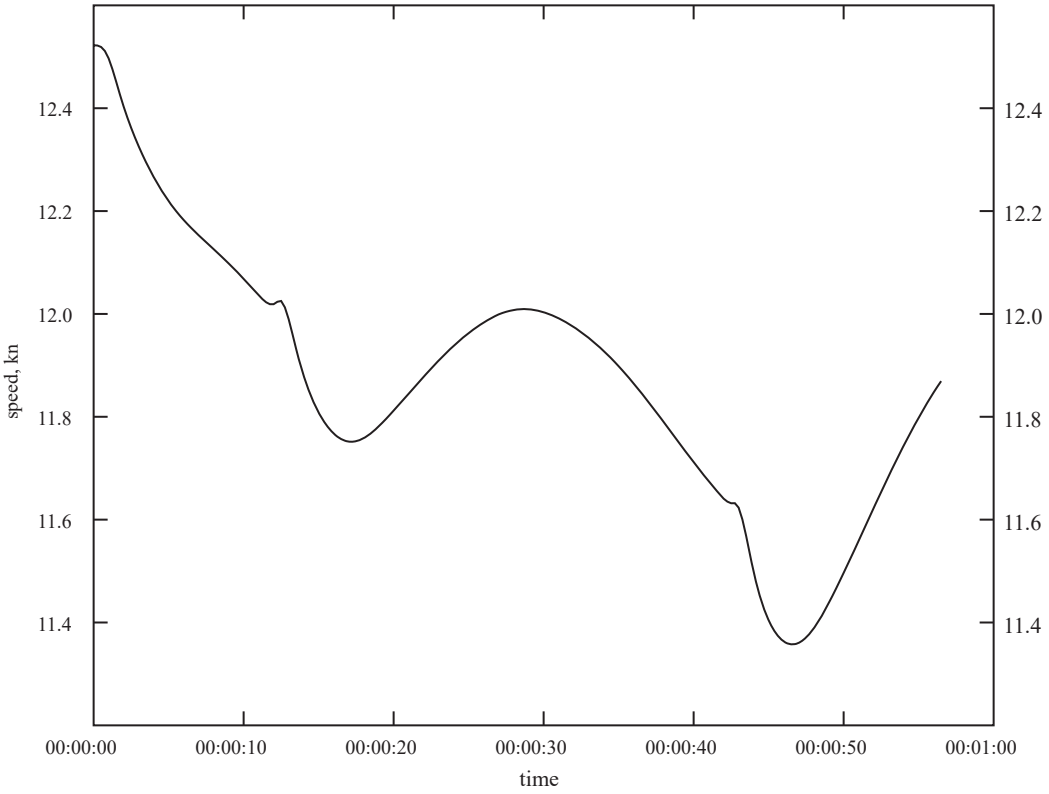


Fig. 28. Zigzag test 10°–10°. Speed plot.

Zigzag 10°–10° Slow Speed

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 24.6
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 15.2
Second overshoot angle, deg 22.5

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	5.0	0
00:00:05	s10.0	-0.1	4.9	s1.4
00:00:10	s10.0	0.7	4.9	s17.2
00:00:15	s10.0	2.8	4.8	s33.9
00:00:20	s10.0	6.3	4.8	s48.5
00:00:25	s5.7	10.8	4.8	s61.3
00:00:30	p10.0	16.5	4.7	s67.4
00:00:35	p10.0	21.3	4.7	s46.2
00:00:40	p10.0	24.2	4.7	s23.3
00:00:45	p10.0	25.2	4.7	s2.0
00:00:50	p10.0	24.5	4.8	p17.9
00:00:55	p10.0	22.3	4.8	p35.4
00:01:00	p10.0	18.7	4.8	p50.2
00:01:05	p10.0	14.0	4.8	p62.7
00:01:10	p10.0	8.3	4.8	p72.8
00:01:15	p10.0	1.9	4.8	p80.7
00:01:20	p10.0	-5.0	4.7	p86.1
00:01:25	s3.3	-12.4	4.7	p91.9
00:01:30	s10.0	-20.1	4.6	p86.6
00:01:35	s10.0	-26.3	4.6	p60.8
00:01:40	s10.0	-30.3	4.6	p35.0
00:01:45	s10.0	-32.2	4.7	p12.6

00:01:50	s10.0	-32.6	4.7	s8.4

Table 14. Zigzag 10°–10° Slow Speed.

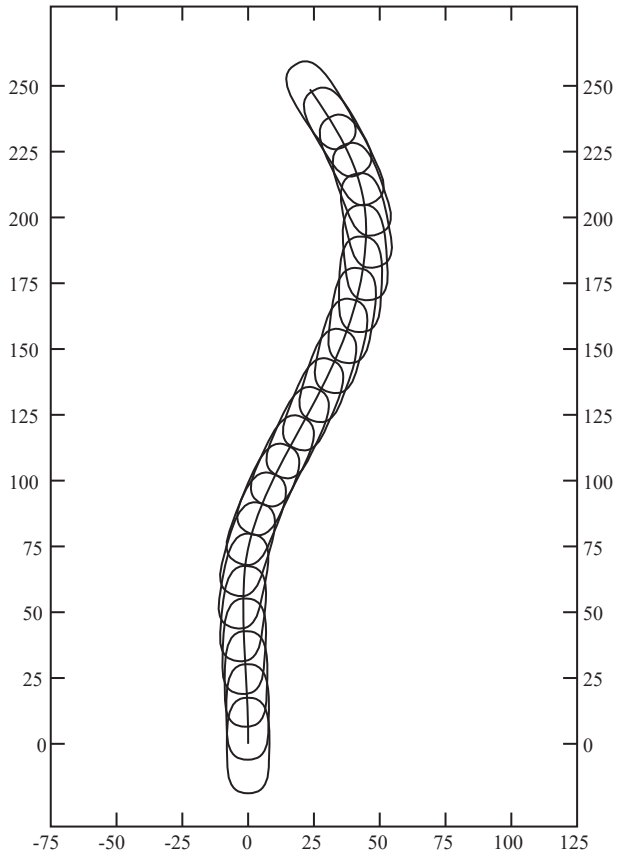


Fig. 29. Zigzag 10°–10° Slow Speed. Ship position plot.

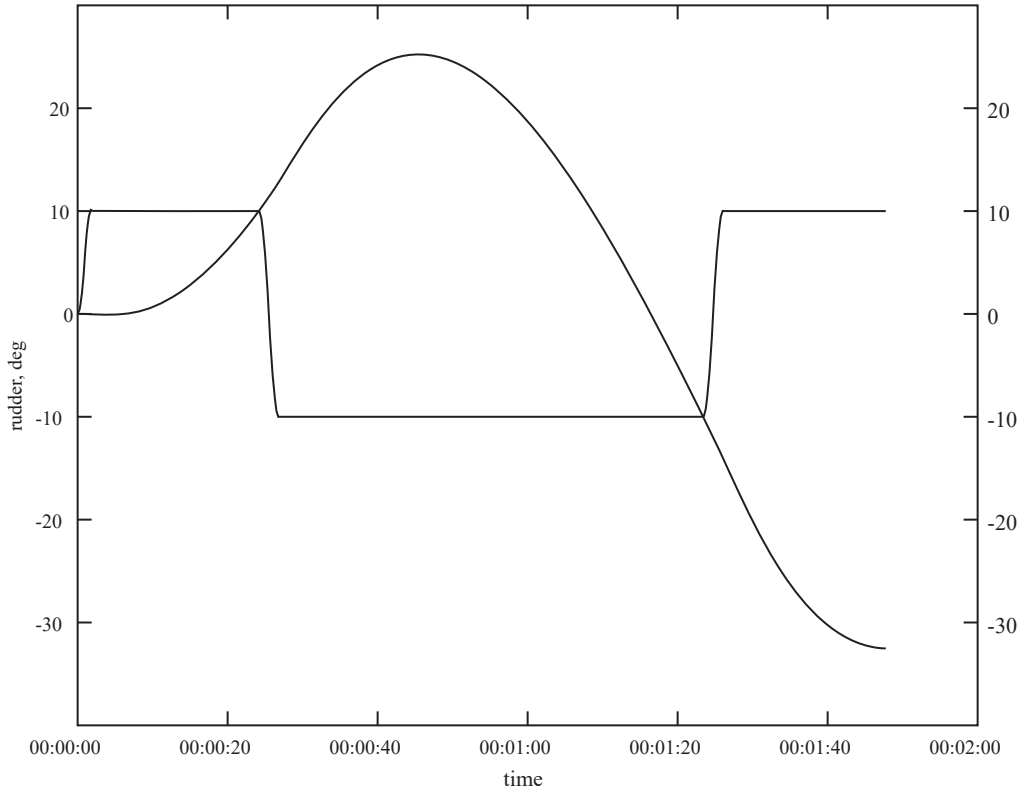


Fig. 30. Zigzag test 10°–10° Slow Speed. Rudder and heading plot.

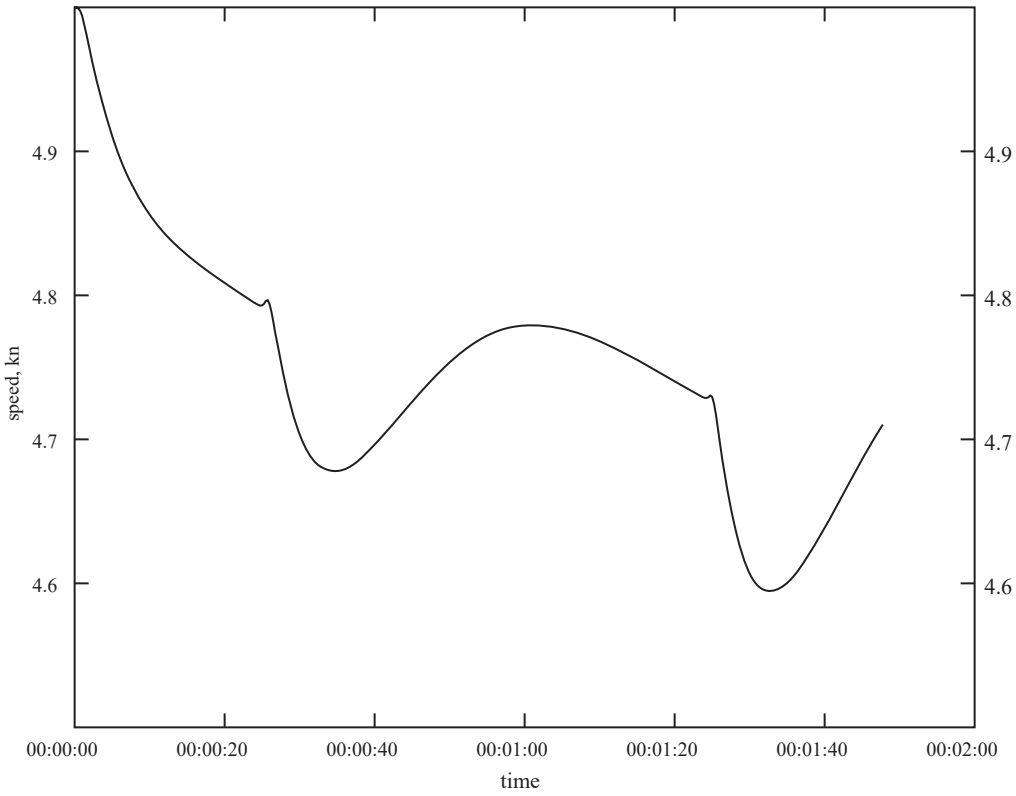


Fig. 31. Zigzag test 10°–10° Slow Speed. Speed plot.

Zigzag 20°–20°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 20.0
Committed heading, deg 20.0

Performance

First overshoot angle, deg 38.4
Second overshoot angle, deg 41.7

time	rudder	heading	speed	turn rate
s	deg	kn	deg	deg/min
00:00:00	0	0.0	12.5	0
00:00:05	s20.0	0.9	11.7	s58.1
00:00:10	s20.0	12.2	11.2	s204.4
00:00:15	p9.1	33.3	11.0	s293.9
00:00:20	p20.0	53.5	10.3	s155.2
00:00:25	p20.0	58.0	10.7	p41.9
00:00:30	p20.0	47.6	10.9	p196.5
00:00:35	p20.0	27.2	10.7	p278.9
00:00:40	p20.0	2.9	10.5	p298.0
00:00:45	p19.0	-22.0	10.4	p300.7
00:00:50	s20.0	-47.1	10.1	p259.5
00:00:55	s20.0	-60.9	10.3	p62.6
00:01:00	s20.0	-62.3	10.9	s128.7

Table 15. Zigzag 20°–20°.

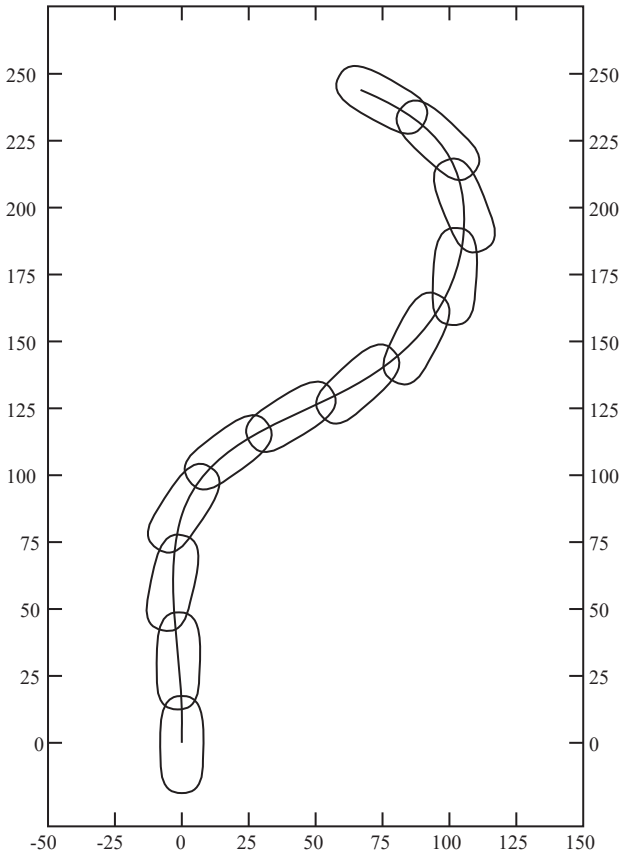


Fig. 32. Zigzag 20°–20°. Ship position plot.

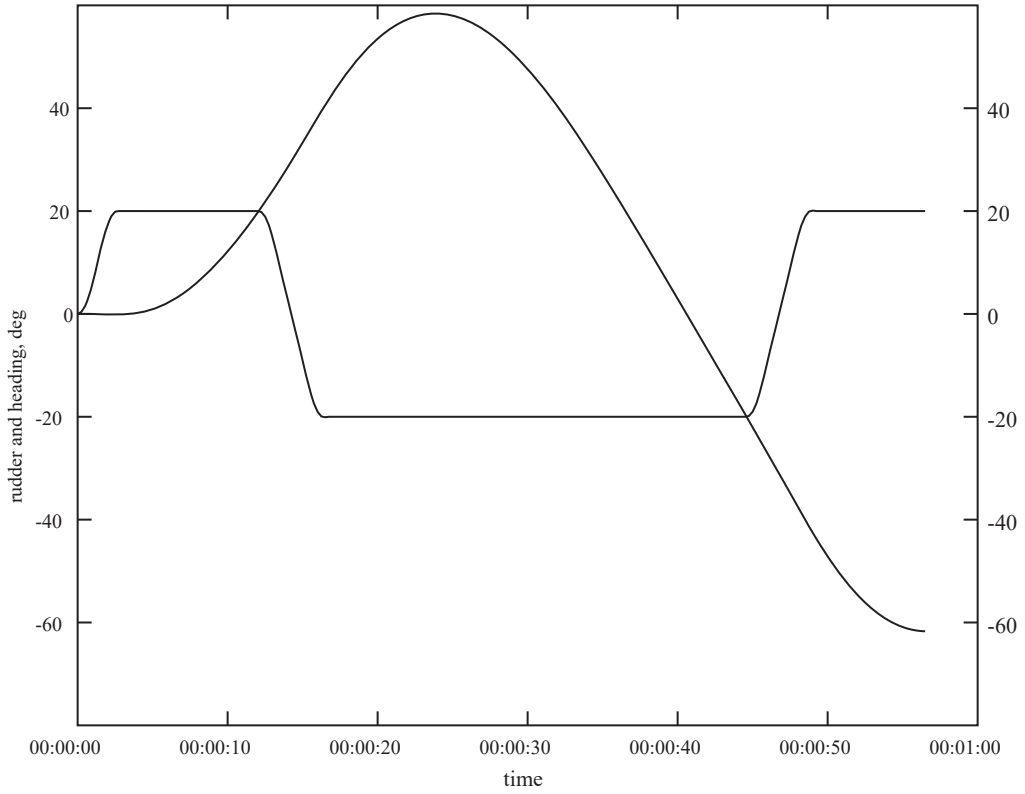


Fig. 33. Zigzag test 20°–20°. Rudder and heading plot.

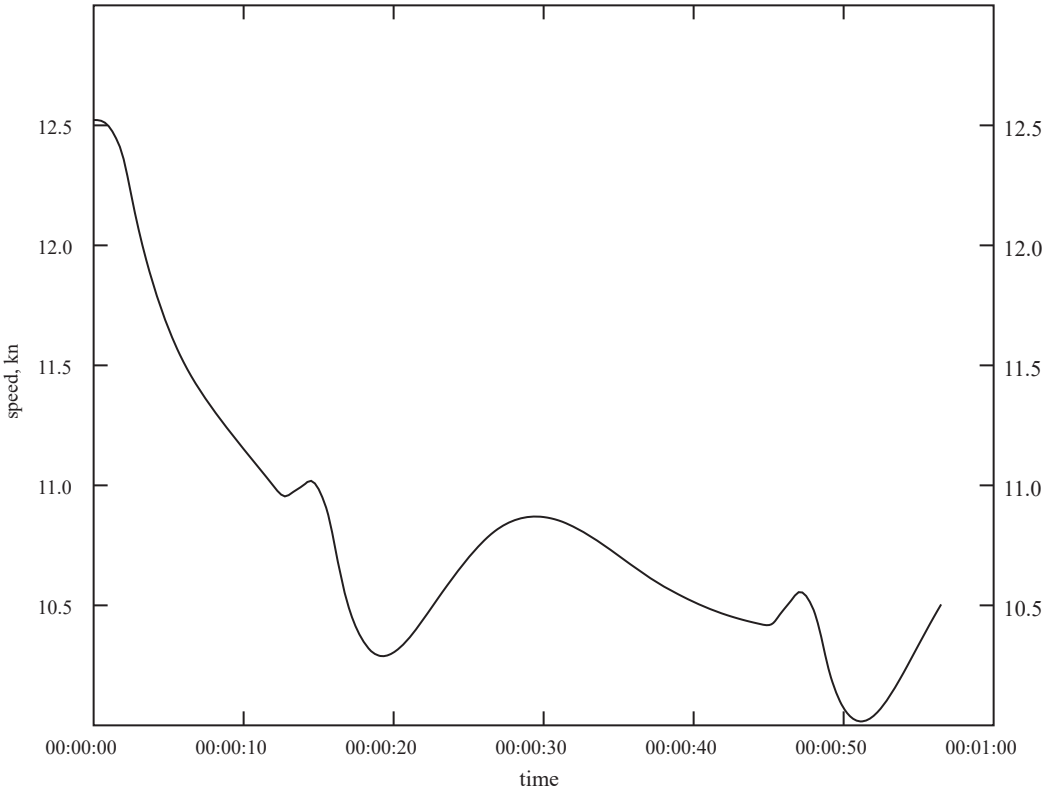


Fig. 34. Zigzag test 20°–20°. Speed plot.

Pull Out

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0

Rudder

From, deg 0.0
To, deg 10.0
And then to, deg 0.0

time	rudder	heading	turn rate
s	deg	deg	deg/min
00:00:00	0	0.0	0
00:00:20	0	46.1	s194.1
00:00:40	0	101.0	s143.4
00:01:00	0	145.3	s124.6
00:01:20	0	-174.9	s115.6
00:01:40	0	-137.2	s110.8
00:02:00	0	-100.7	s108.2
00:02:20	0	-64.9	s106.8
00:02:40	0	-29.4	s106.0
00:03:00	0	5.8	s105.5
00:03:20	0	41.0	s105.3
00:03:40	0	76.0	s105.1
00:04:00	0	111.1	s105.0
00:04:20	0	146.1	s105.0
00:04:40	0	-178.9	s105.0
00:05:00	0	-143.9	s104.9
00:00:00	0	0.0	0
00:00:20	0	-46.1	p194.6
00:00:40	0	-101.2	p144.1
00:01:00	0	-145.7	p125.3
00:01:20	0	174.2	p116.2
00:01:40	0	136.4	p111.4
00:02:00	0	99.7	p108.8

00:02:20	0	63.7	p107.3
00:02:40	0	28.1	p106.5
00:03:00	0	-7.4	p106.0
00:03:20	0	-42.7	p105.8
00:03:40	0	-77.9	p105.6
00:04:00	0	-113.1	p105.5
00:04:20	0	-148.3	p105.5
00:04:40	0	176.6	p105.4
00:05:00	0	141.4	p105.4

Table 16. Pull Out.

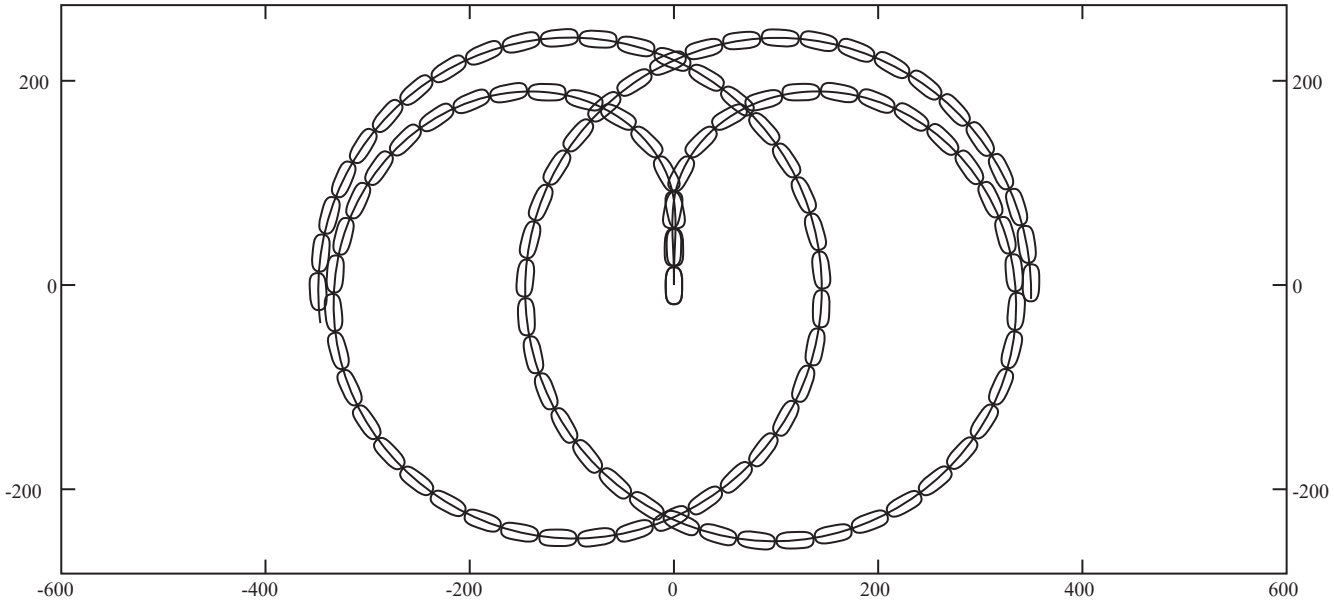


Fig. 35. Pull Out. Ship position plot.

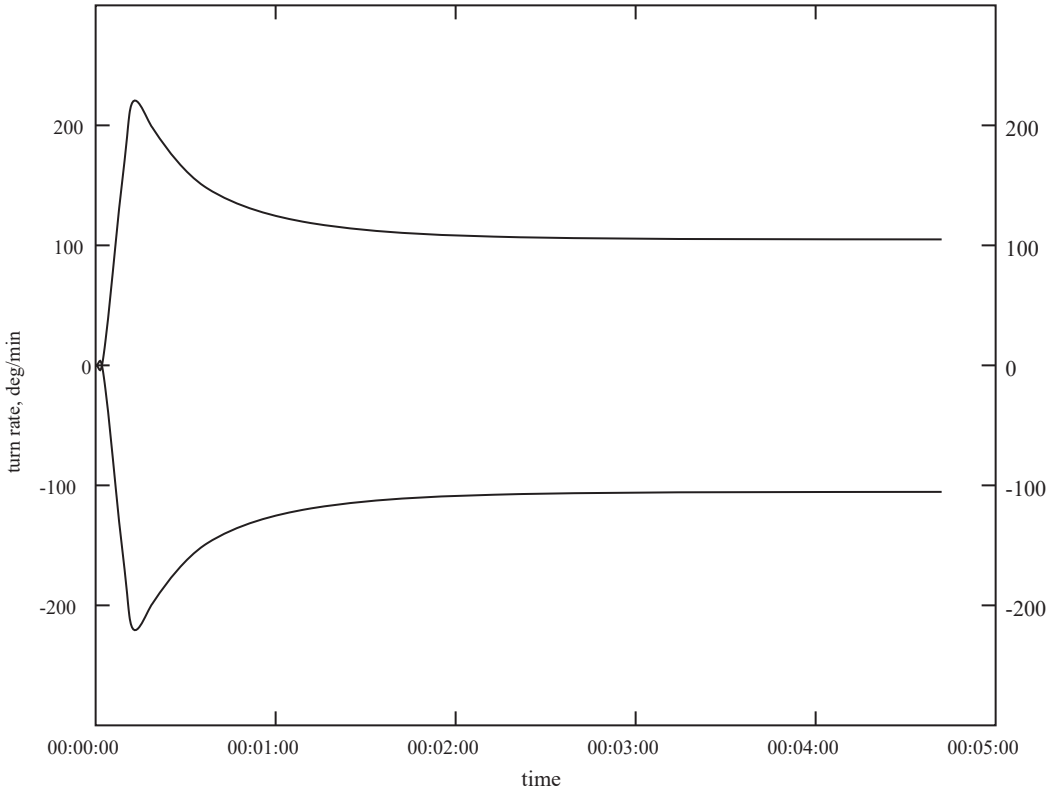


Fig. 36. Pull Out plot.

Environment

Environment

Water depth, H/T	∞
Wind speed, m/s	0.0
Water current speed, kn	0.0

Controls

Machinery telegraph setting%	80.0
Rudder, deg	s35.0, s30.0, s25.0, s20.0, s15.0, s10.0, s5.0, s4.0, s3.0, s2.0
	s1.0, s0.0, p1.0, p5.0, p10.0, p15.0, p20.0, p25.0, p30.0, p35.0
	p30.0, p25.0, p20.0, p15.0, p10.0, p5.0, p4.0, p3.0, p2.0, p1.0
	p0.0, s1.0, s5.0, s10.0, s15.0, s20.0, s25.0, s30.0, s35.0

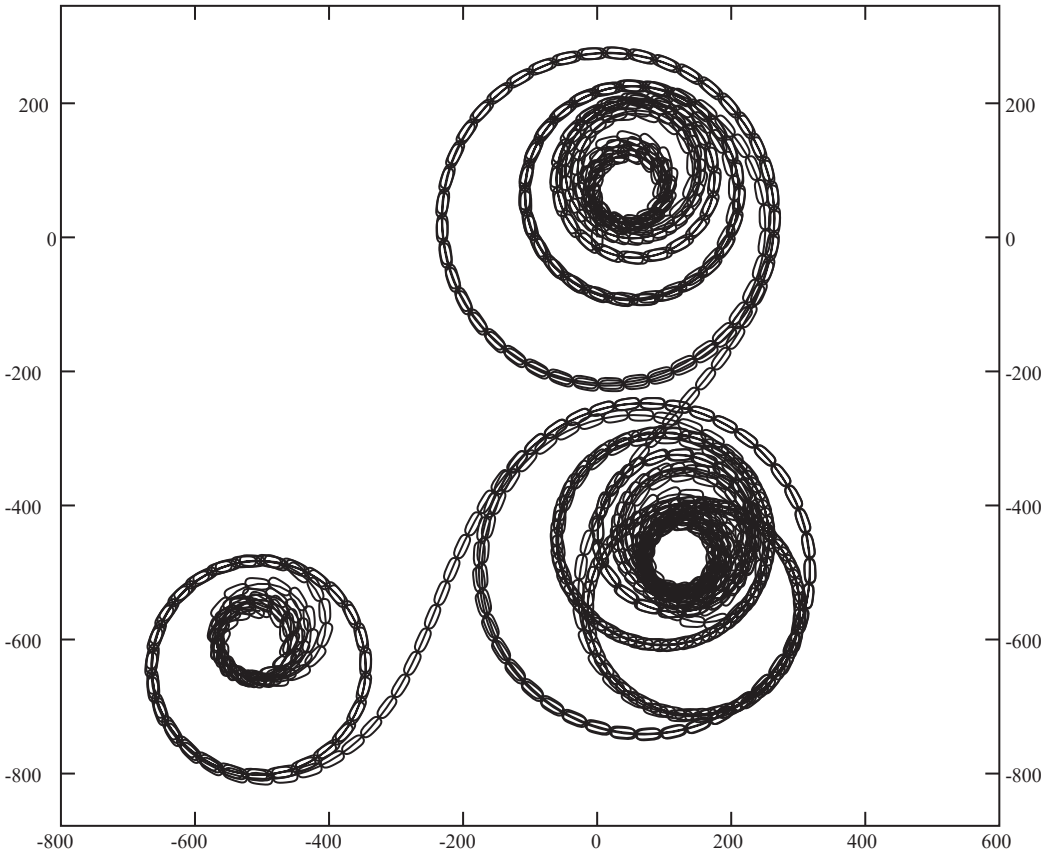


Fig. 37. Spiral test. Ship position plot.

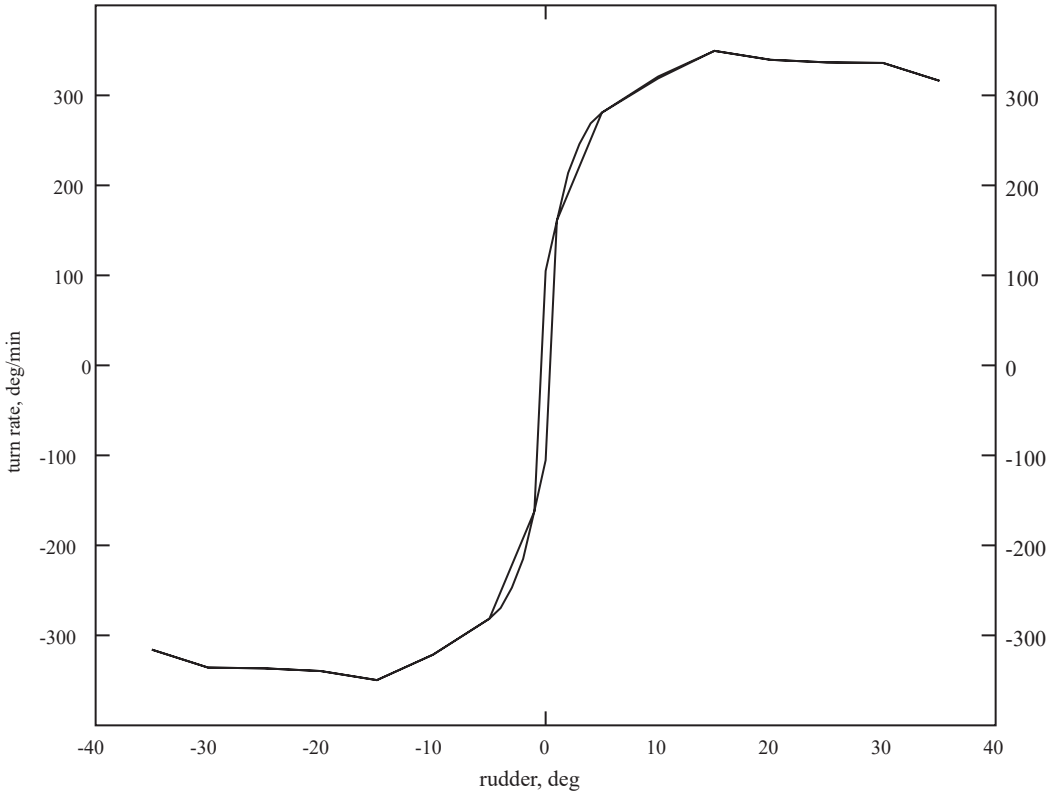


Fig. 38. Spiral test. Equilibrium turn rate plot

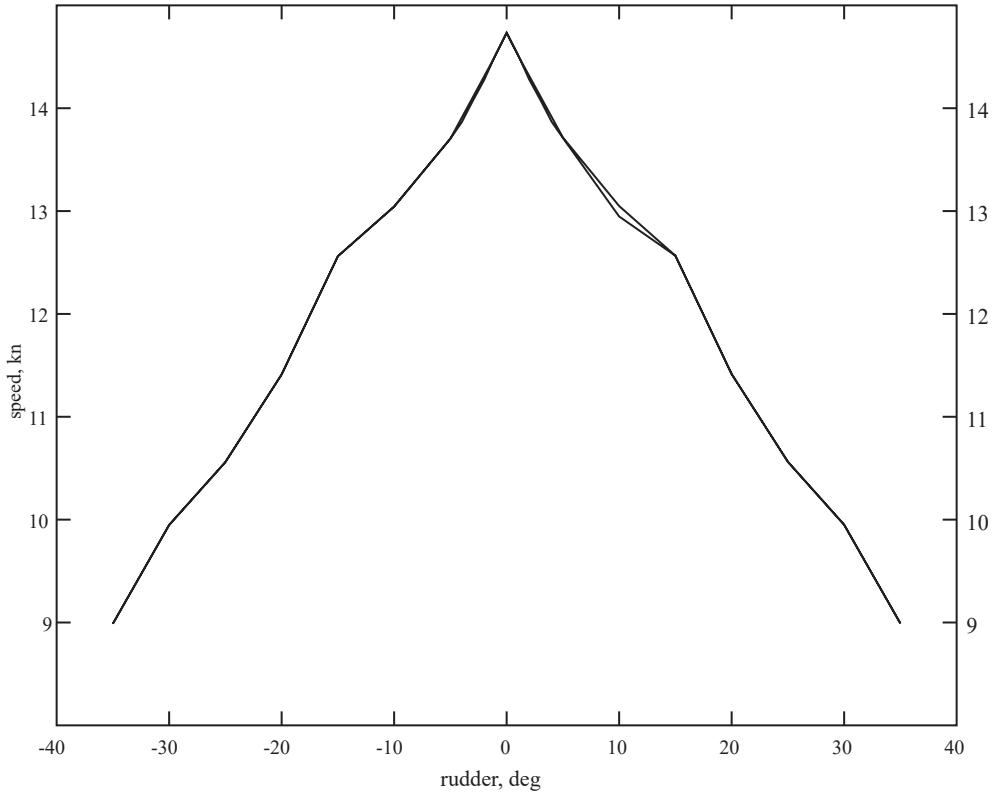
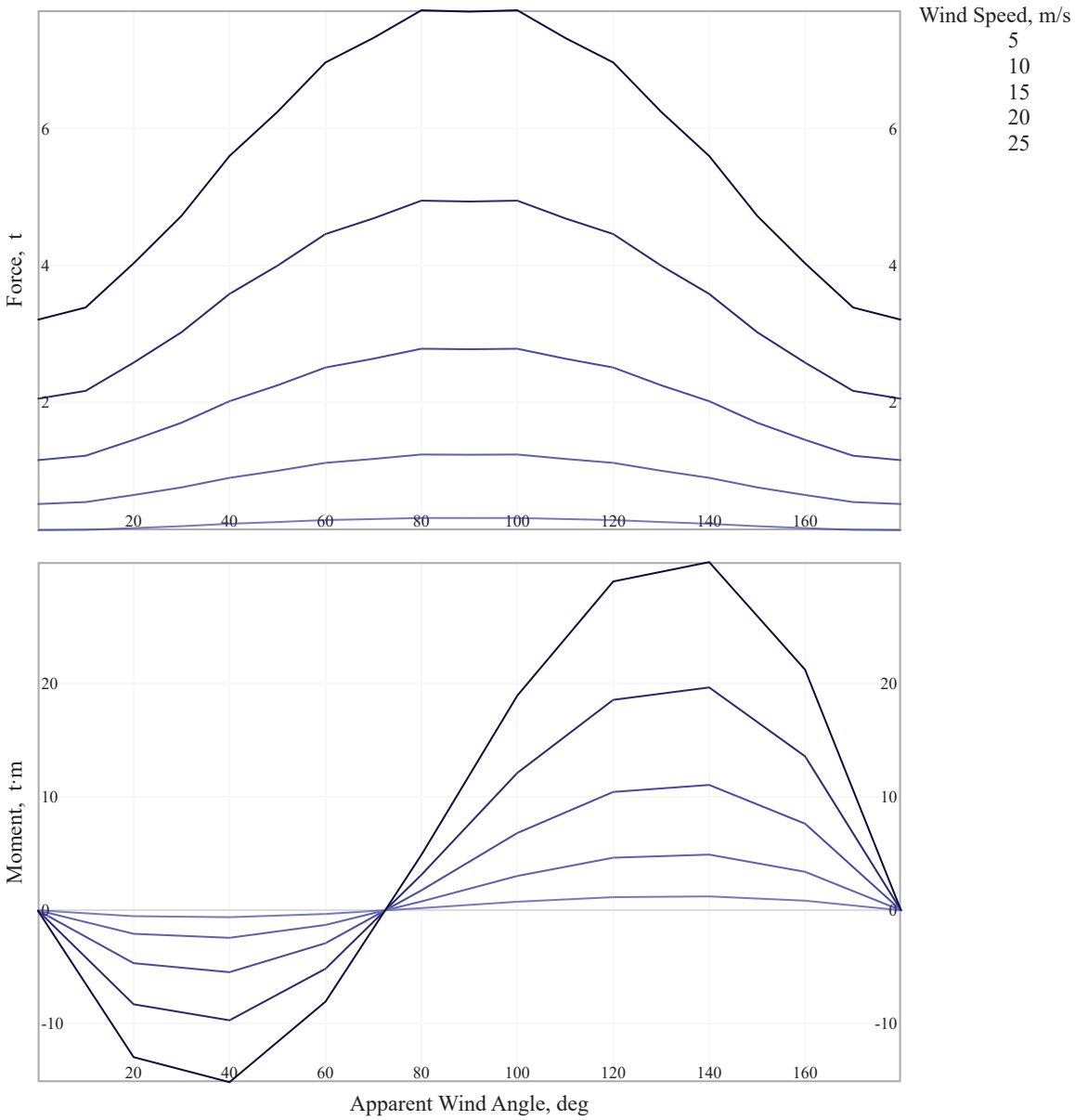


Fig. 39. Spiral test. Equilibrium speed plot

Wind Forces


Wind Speed, m/s
5
10
15
20
25
Force, t
6
4
2
20
40
60
80
100
120
140
160
Moment, t·m
20
10
0
-10
Apparent Wind Angle, deg

Williamson Turn

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Rudder, deg 45.0
Committed heading, deg 10.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	14.8	0.0	0	0
00:00:05	11.3	1.2	s81.4	s12.6
00:00:10	9.1	17.2	s278.3	s26.4
00:00:15	9.5	43.8	s313.5	s8.6
00:00:20	7.6	60.9	s60.0	p16.5
00:00:25	8.1	54.7	p184.3	p29.1
00:00:30	8.1	34.4	p276.4	p33.5
00:00:35	8.0	10.7	p286.9	p34.8
00:00:40	7.9	-13.2	p286.2	p35.2
00:00:45	7.9	-37.1	p285.6	p35.3
00:00:50	7.9	-60.9	p285.4	p35.3
00:00:55	7.9	-84.7	p285.3	p35.3
00:01:00	7.9	-108.5	p285.3	p35.3
00:01:05	8.5	-132.9	p317.1	p25.8
00:01:10	9.9	-158.3	p256.5	p7.0
00:01:15	11.8	-174.3	p127.3	p1.5
00:01:20	13.0	-179.8	p6.1	s2.3
00:01:25	13.7	-175.3	s80.0	s0.6
00:01:30	13.9	-173.0	p36.5	p3.3
00:01:35	14.0	178.6	p162.1	p4.2
00:01:40	13.8	166.5	p81.7	s0.4

Table 20. Williamson Turn.

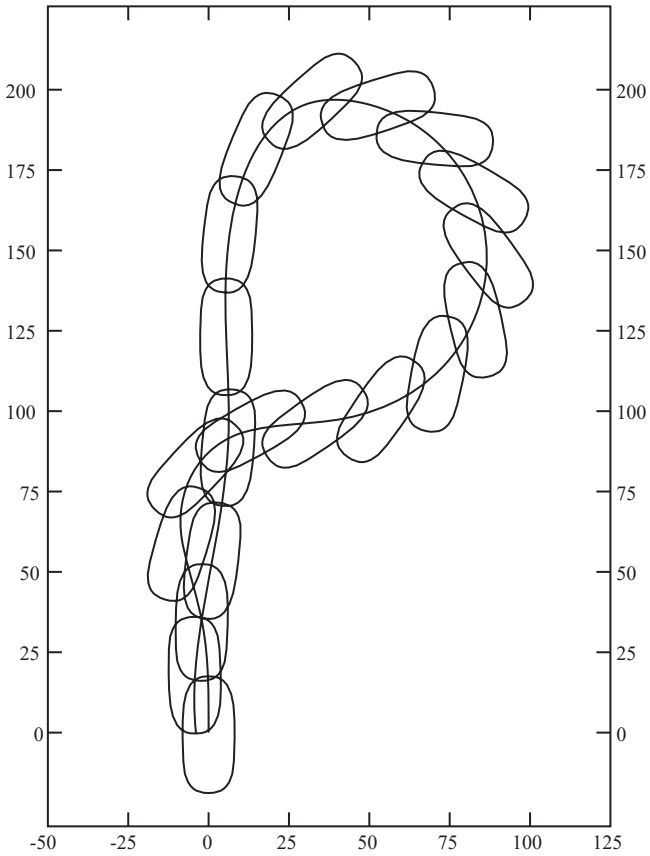


Fig. 44. Williamson Turn. Ship position plot.

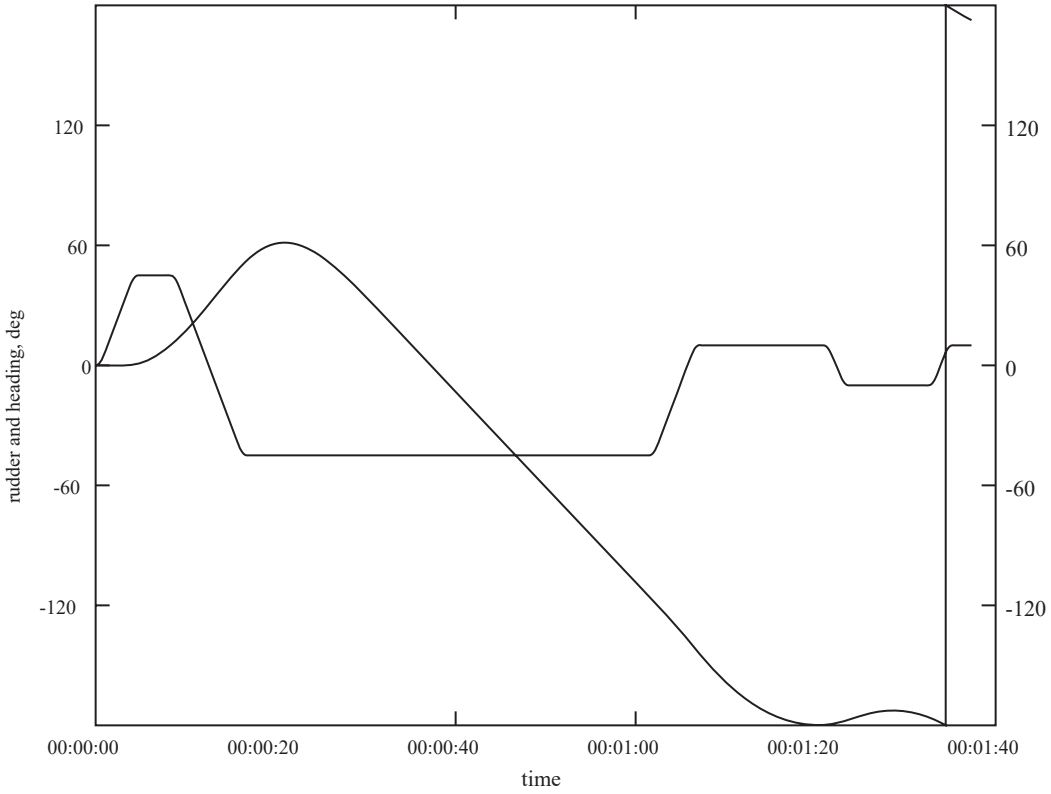


Fig. 45. Williamson Turn. Rudder and heading plot.

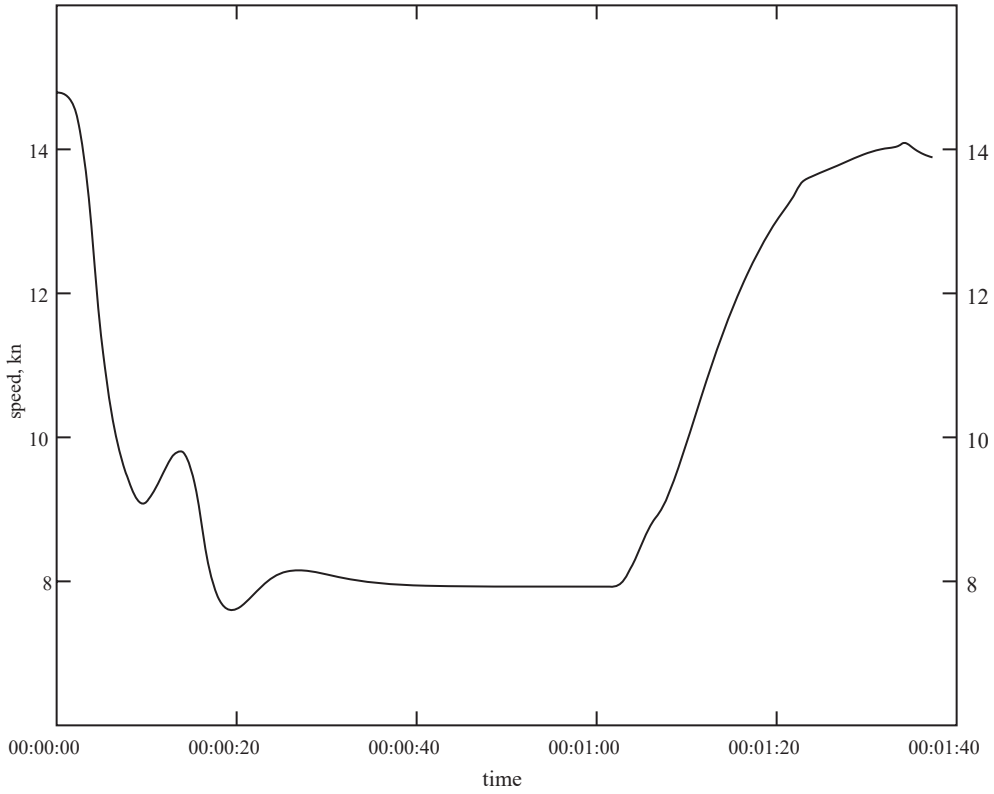


Fig. 46. Williamson Turn. Speed plot.

Wind Effect—Stopped

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	0.0	0.0	s180.0
00:00:20	0.9	-8.1	s86.0
00:00:40	1.3	-17.1	s79.2
00:01:00	1.4	-13.3	s80.9
00:01:20	1.4	-5.5	s86.6
00:01:40	1.4	-5.2	s87.6
00:02:00	1.4	-10.0	s83.2
00:02:20	1.4	-10.3	s82.1
00:02:40	1.4	-6.8	s84.5
00:03:00	1.4	-6.0	s85.6
00:03:20	1.4	-8.0	s84.0
00:03:40	1.4	-8.7	s83.0
00:04:00	1.4	-7.3	s84.0
00:04:20	1.4	-6.7	s84.7
00:04:40	1.4	-7.5	s84.1
00:05:00	1.4	-8.0	s83.5

Table 21. Wind effect—stopped.

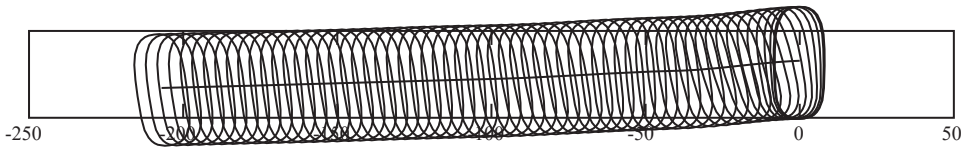


Fig. 47. Wind effect—stopped. Ship position plot.

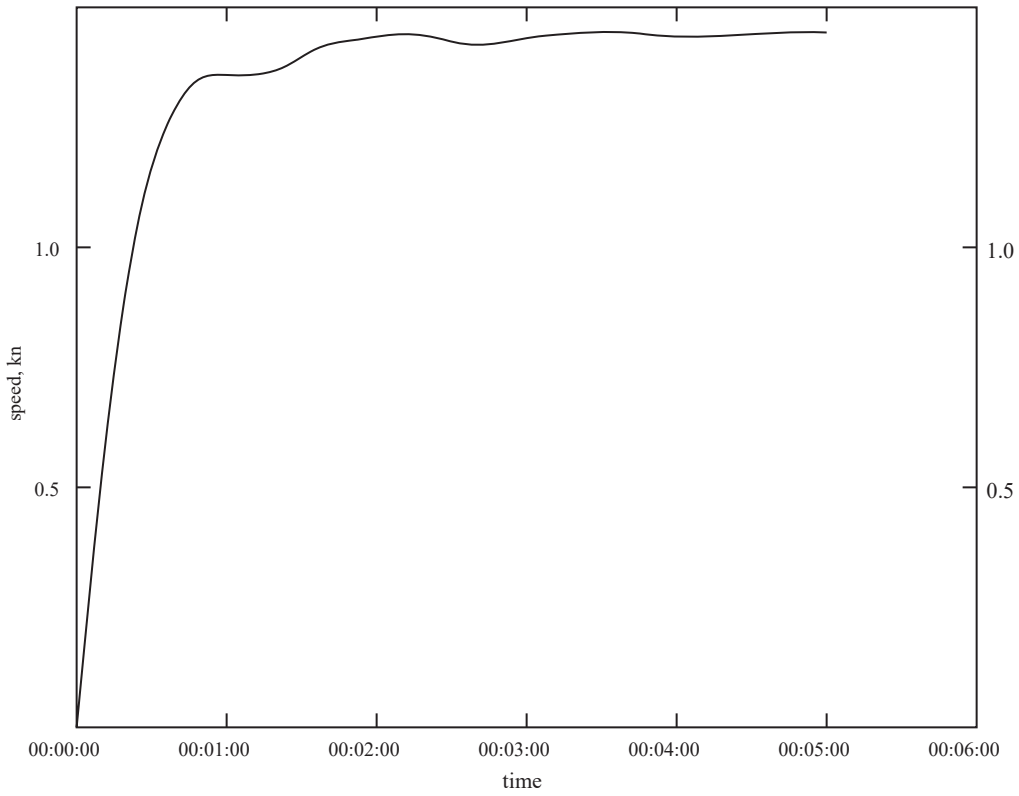


Fig. 48. Wind effect—stopped. Speed plot.

Wind Effect—Under Way

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	14.8	0.0	0
00:00:20	14.8	8.7	s2.2
00:00:40	14.6	38.2	s3.4
00:01:00	14.5	74.9	s3.3
00:01:20	14.5	113.3	s2.9
00:01:40	14.6	151.7	s2.3
00:02:00	14.7	179.0	s1.1
00:02:20	14.8	-173.0	p0.7
00:02:40	14.7	170.0	p2.8
00:03:00	14.6	134.6	p3.7
00:03:20	14.5	95.3	p3.4
00:03:40	14.5	54.8	p2.9
00:04:00	14.7	17.6	p2.1
00:04:20	14.8	-5.2	p0.7
00:04:40	14.8	-6.4	s1.3
00:05:00	14.7	17.5	s3.3

Table 22. Wind effect—under way.

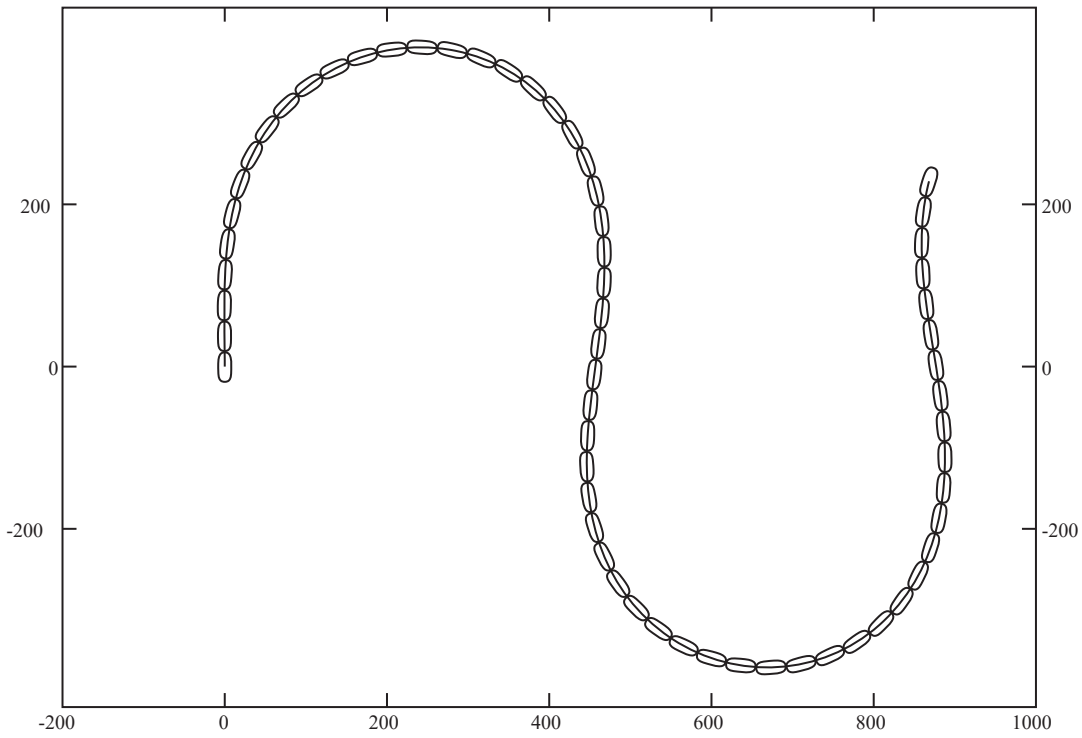


Fig. 49. Wind effect—under way. Ship position plot.

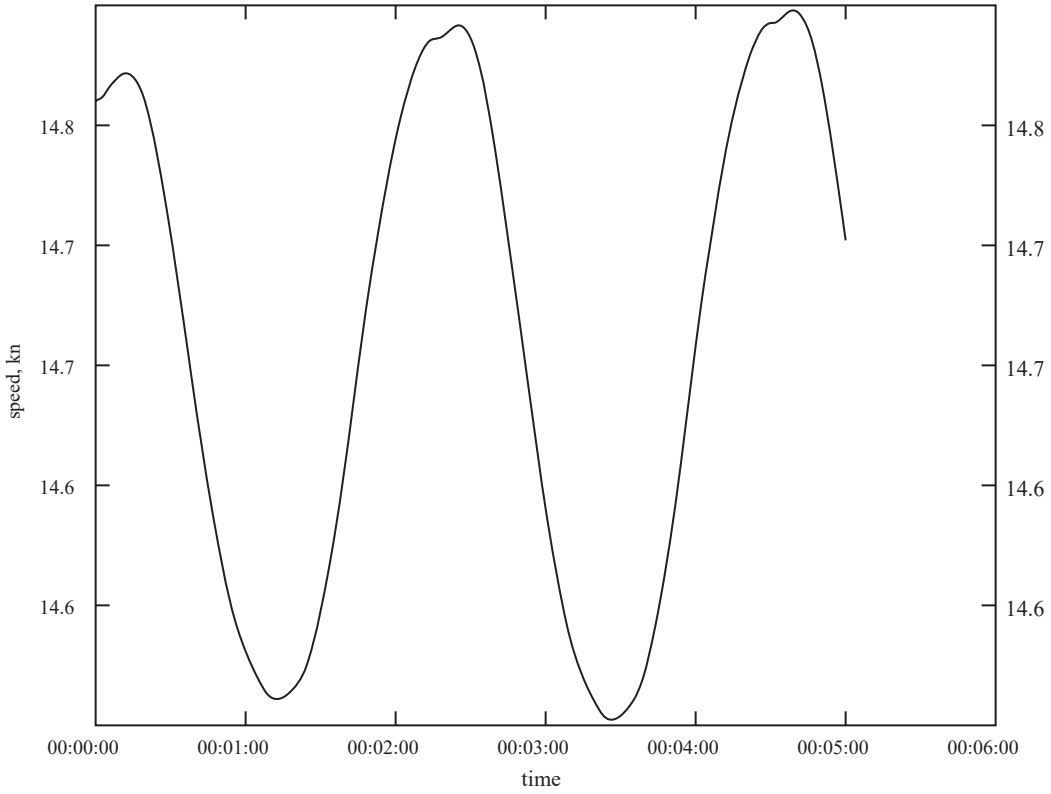


Fig. 50. Wind effect—under way. Speed plot.

Free Oscillations

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0
Wave height, m 0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

Initial Inclination

Roll, deg 10.0
Pitch, deg 5.0
Heave, m 0

time	roll	pitch	heave
s	deg	deg	m
00:00:00	10.0	5.0	0.0
00:00:05	1.0	0.9	0.0
00:00:10	-0.4	0.2	0.0
00:00:15	-0.3	0.0	0.0
00:00:20	0.2	0.0	0.0
00:00:25	0.0	0.0	0.0
00:00:30	-0.1	0.0	0.0
00:00:35	-0.1	0.0	0.0
00:00:40	-0.1	0.0	0.0
00:00:45	-0.1	0.0	0.0
00:00:50	-0.1	0.0	0.0
00:00:55	-0.1	0.0	0.0
00:01:00	-0.1	0.0	0.0
00:01:05	-0.1	0.0	0.0
00:01:10	-0.1	0.0	0.0
00:01:15	-0.1	0.0	0.0
00:01:20	-0.1	0.0	0.0
00:01:25	-0.1	0.0	0.0
00:01:30	-0.1	0.0	0.0
00:01:35	-0.1	0.0	0.0
00:01:40	-0.1	0.0	0.0

Table 23. Free Oscillations.

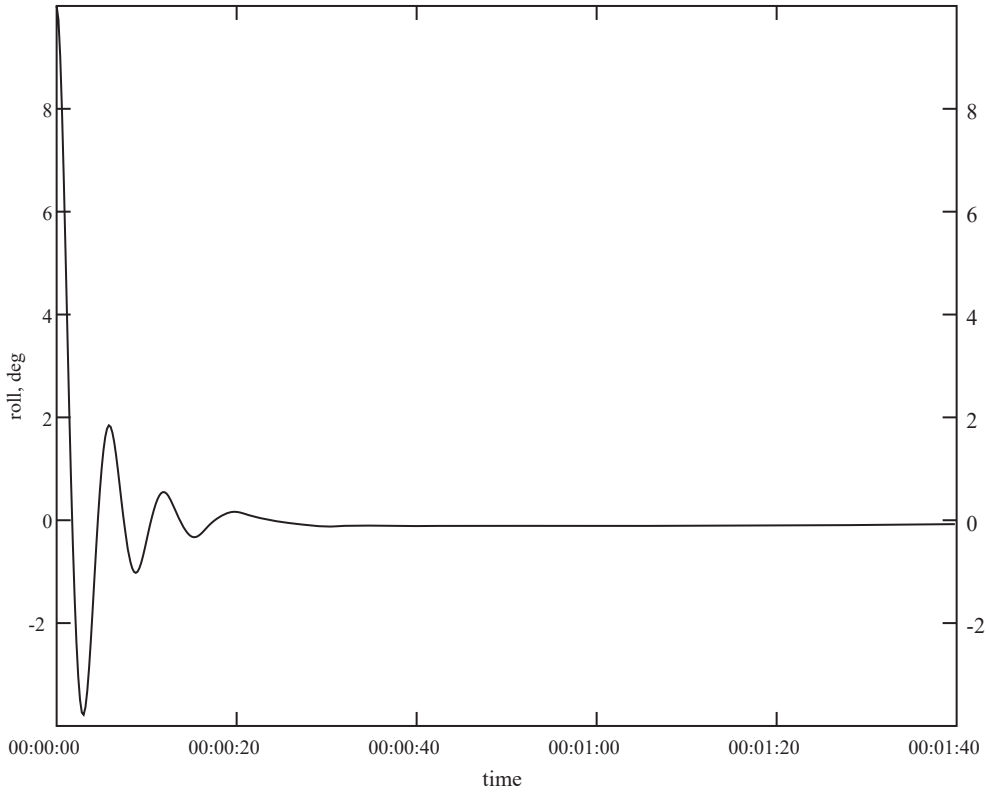


Fig. 51. Free Oscillations. Roll plot.

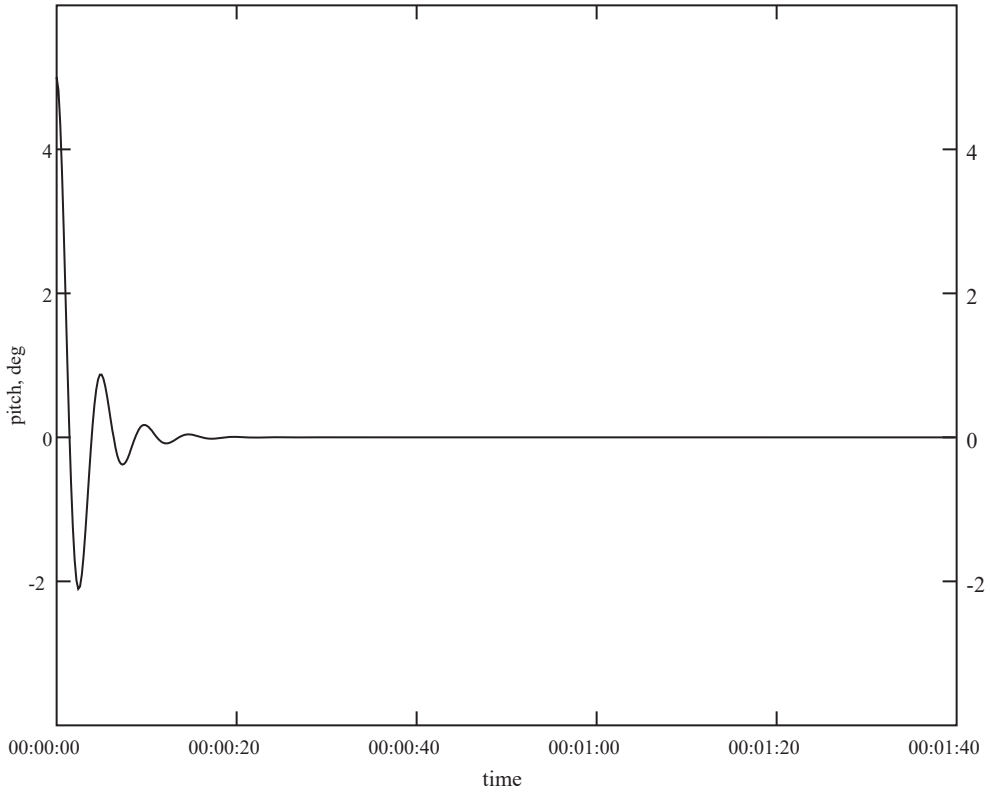


Fig. 52. Free Oscillations. Pitch plot.

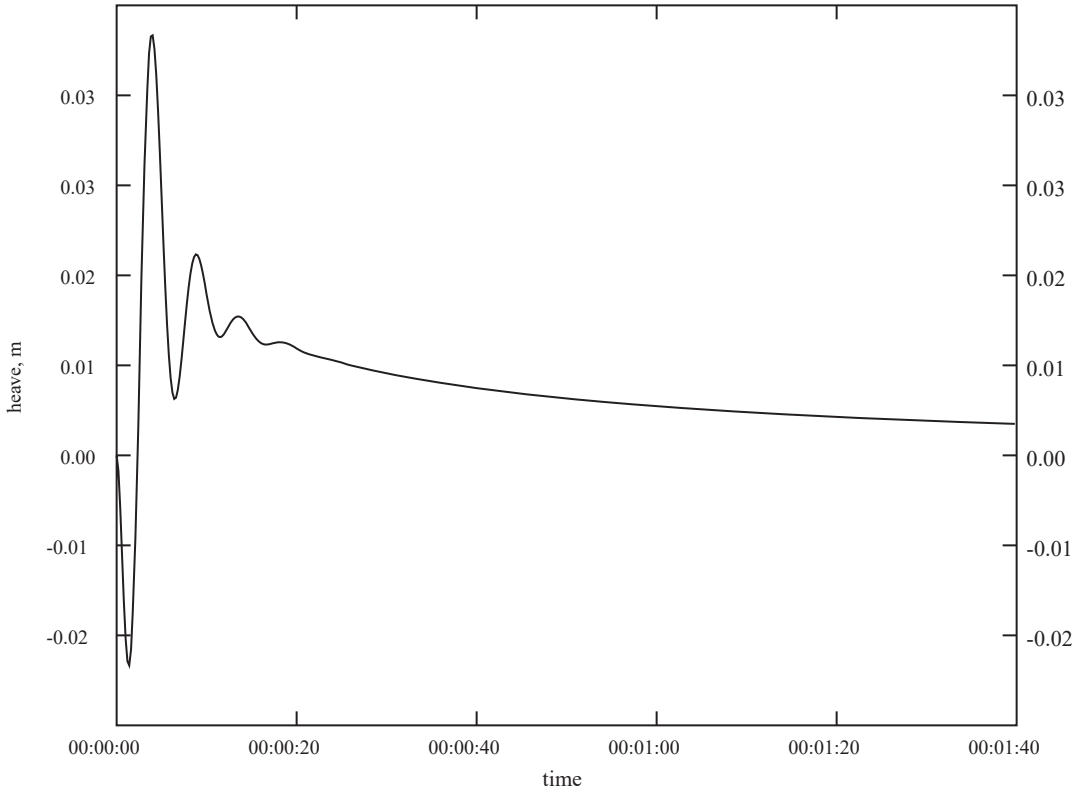


Fig. 53. Free Oscillations. Heave plot.

PILOT CARD

TUG60V1
Version 1

Ship's name ART 120-35W

Call Sign ART12035W **Deadweight** 281 tonnes **Year built** 2021

Draught aft 4.08 m / 13 ft 5 in **Forward** 4.08 m / 13 ft 5 in **Displacement** 1172 tonnes

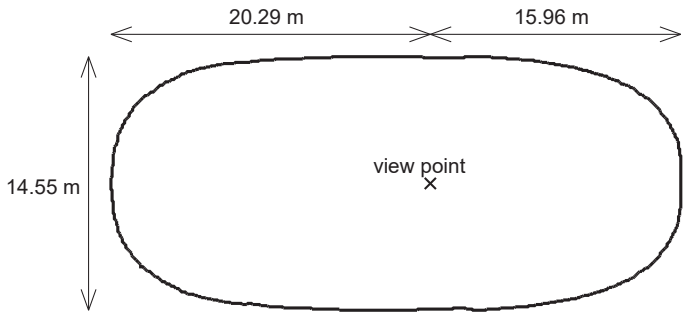
SHIP'S PARTICULARS

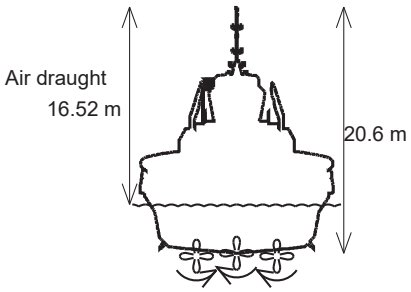
Length overall 36.25 m **Anchor chain:** **Port** _____ shackles **Starboard** _____ shackles

Breadth 14.55 m

Bulbous bow No

(1 shackle = 27.432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 7679 kW (10441 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Loaded Departure
Full sea speed	**1**	240.0	100.0%	N/A	14.8
Full Ahead	**0.8**	217.0	90.8%	N/A	12.5
Half Ahead	**0.5**	165.0	78.3%	N/A	9.0
Slow Ahead	**0.25**	147.5	44.6%	N/A	5.1
Dead Slow Ahead	**0.125**	144.0	25.6%	N/A	2.9
Stop	**0**	144.0	0.0%	N/A	0.0
Dead Slow Astern	**-0.125**	144.0	25.6%		
Slow Astern	**-0.25**	147.5	44.6%		
Half Astern	**-0.5**	165.0	78.3%		

STEERING PARTICULARS

Type of rudder Propeller **Maximum angle** 180 °

Hard-over to hard-over 30 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors ☐

Whistle ☐

Radar ☐ 3 cm ☐ 10 cm

ARPA ☐

Speed log ☐ **Doppler:** Yes / No

Water speed ☐

Ground speed ☐

Dual-axis ☐

Engine telegraphs ☐

Steering gear ☐

Number of power units operating ☐

Indicators: ☐

Rudder ☐

Rpm/pitch ☐

Rate of turn ☐

Compass system ☐

Constant gyro error ± ____ °

VHF ☐

Elec. pos. fix. system ☐

Type ____

OTHER INFORMATION:

WHEELHOUSE POSTER

TUG60V1
Version 1

Ship's name ART 120-35W **Call Sign** ART12035W **Gross tonnage** _____ **Net tonnage** _____

Max. Displacement 1172 tonnes, and **Deadweight** 281 tonnes, and **Block coefficient** 0.587 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Loaded Departure
Trial / Estimated	Trial / Estimated
N/A m forward	4.08 m forward
N/A m aft	4.08 m aft

STEERING PARTICULARS

Type of rudder(s) Propeller

Maximum rudder angle 180 °

Time hard-over to hard-over

with one power unit 60 s

with two power units 30 s

Min. speed to maintain course propeller stopped _____ knots

Rudder angle for neutral effect 0 °

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving min / shackle
Port		
Starboard		
(1 shackle = 27.432 m = 15 fathoms)		

PROPULSION PARTICULARS

Type of engine Diesel , 7679 kW (10441 hp) **Type of propulsion** Propelle

Engine order		RPM	Pitch	Speed (knots)	
				Loaded	Loaded Departure
Full sea speed	1	240.0	100.0%	N/A	14.8
Full Ahead	0.8	217.0	90.8%	N/A	12.5
Half Ahead	0.5	165.0	78.3%	N/A	9.0
Slow Ahead	0.25	147.5	44.6%	N/A	5.1
Dead Slow Ahead	0.125	144.0	25.6%	N/A	2.9
Stop	0	144.0	0.0%	N/A	0.0
Dead Slow Astern	-0.125	144.0	25.6%		
Slow Astern	-0.25	147.5	44.6%		
Half Astern	-0.5	165.0	78.3%		
Full Astern	-1	240.0	100.0%		

Critical revolutions _____ rpm

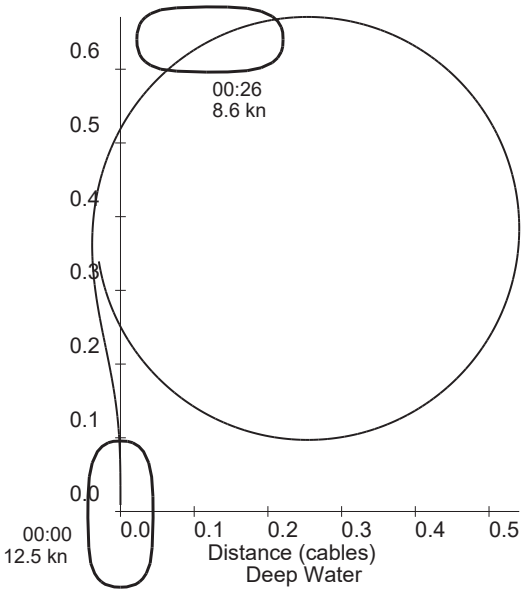
THRUSTER EFFECT at trial conditions

Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	N/A	N/A	N/A	N/A	N/A
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

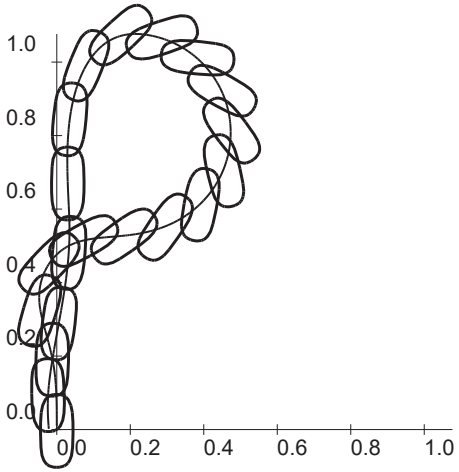
DRAUGHT INCREASE (LOADED DEPARTURE)

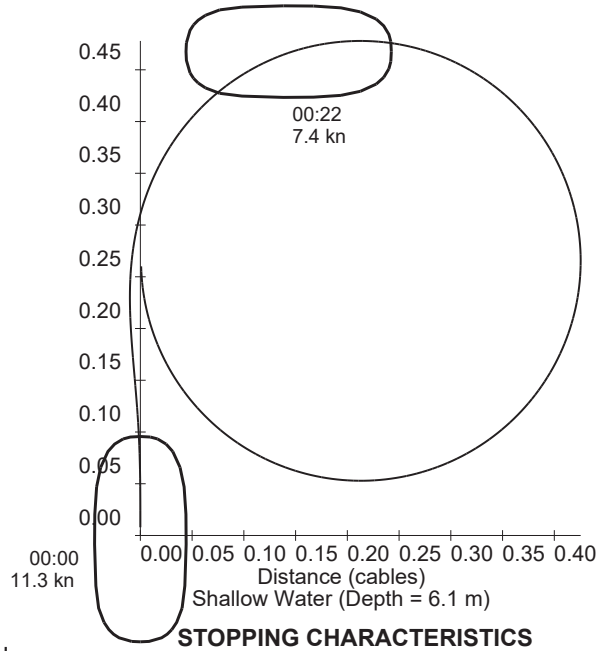
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
4.1	5.1	0.13
	8.9	0.40
	13.4	0.01
2.0	5.0	0.14
	8.7	0.40

TURNING CIRCLES AT MAX. RUDDER ANGLE (180 °)

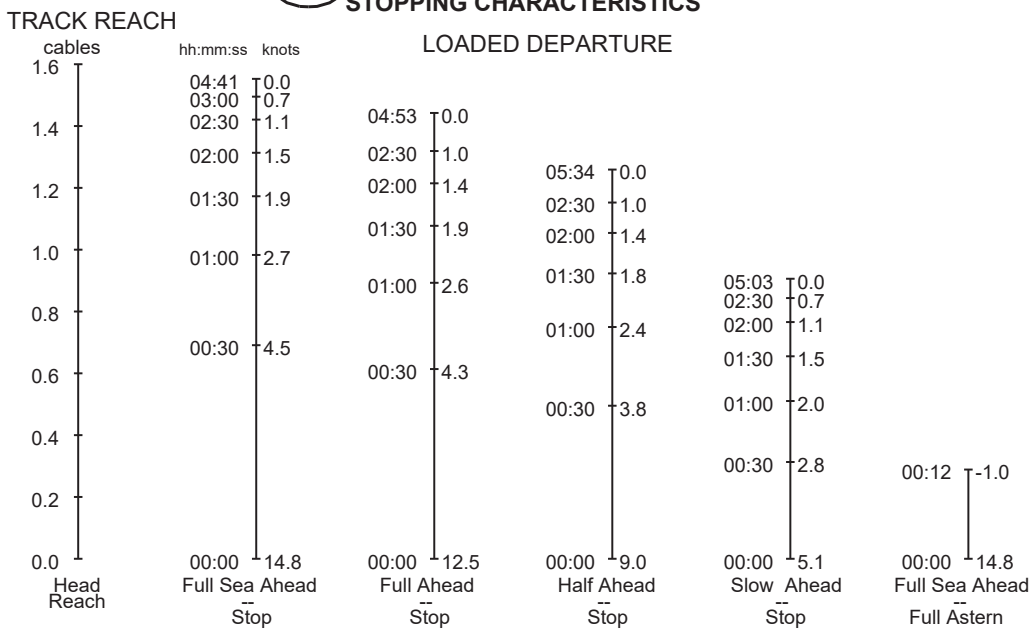


WILLIAMSON TURN



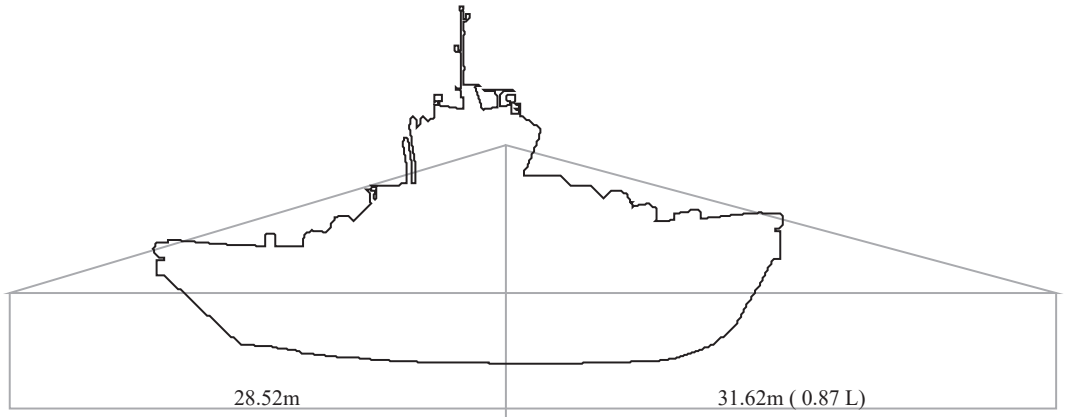


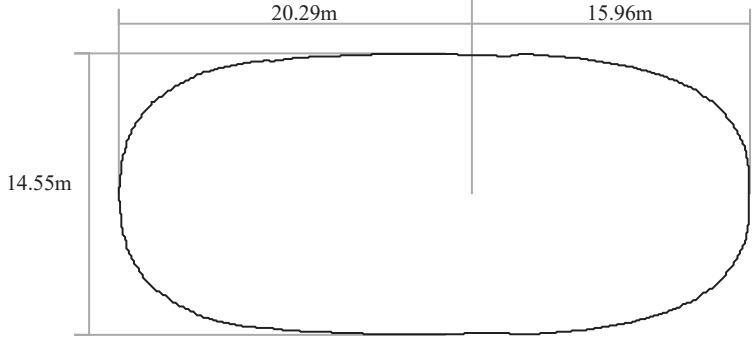
STOPPING CHARACTERISTICS

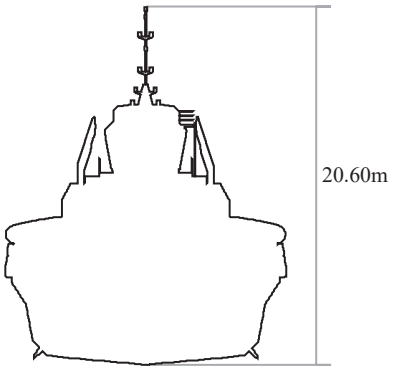


PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE







Description of Ship Model

VLCC18L

Oil carrier
Elizabeth I. Angelicoussi
Loaded

Version 6

© 2018 Kongsberg Maritime
All rights reserved
No part of this work covered by the copyright hereon may be reproduced or otherwise copied without prior written permission of Kongsberg Maritime

Table of Contents

General Description 6
Ship Data 7
Blind Zone 9
Speed 10
Statistics 11
Acceleration 14
Acceleration from Slow to Half 17
Crash Stop 20
Deceleration from Half to Slow 23
Coasting Stop 26
Time for effective changes in telegraph settings in stopping conditions 29
Turning Circle Starboard, Deep Water 30
Turning Circle Starboard, Shallow Water 33
Turning Circle Port, Deep Water 36
Accelerated Turning 39
Coasting Circle 42
Course Change Manoeuvre 45
Zigzag 10°–10° 48
Zigzag 10°–10° Slow Speed 52
Zigzag 20°–20° 56
Pull Out 60
Spiral Test 63
Wind Forces 66
Williamson Turn 67
Wind Effect—Stopped 71
Wind Effect—Under Way 74
Free Oscillations 77

Model Identification

The model VLCC18L represents 153,911 GT 306,230 DWT VLCC M/T *Elizabeth I. Angelicoussi* in loaded condition. *Elizabeth I. Angelicoussi* was built by Daewoo Shipbuilding & Marine Engineering Co. Ltd., Koje, Republic of Korea in 2004.

Revision History

22.01.2008 BS
Version 1

09.02.2008 VZ
Version 2
Corrected:
General: Water plane fineness coefficient, relative vertical radius of inertia.
Propellers: Pitch ratio, momentum of inertia, revolution table, longitudinal force coefficient.
Engines: momentum of inertia, Start Air torque coefficient.
Rudders: lateral force coefficient.
Bollards. Mooring Lines. Winches: Number, Power, Max speed
Hydrodynamics: vertical force, roll and pitch moments coefficients, longitudinal force coefficient, longitudinal force coefficient correction, lateral force coefficient, vertical moment coefficient, Virtual Masses.
Aerodynamics.

07.05.2008 AM
Version 3
Corrected:
Propellers: momentum of inertia.
Engines: momentum of inertia.

02.07.2008 befr
Version 4
Consolidation done

17.07.2008 BEFR
Version 5
Bollards changed from 14 to 12

14.08.2008 SZ
Version 6
Ship identify data improved.
Autopilot adjusted.

03.09.2008 AM
Version 7
Corrected: Longular forse coefficient, Longular forse coefficient correction, Virtual Masses K44

Model Sources

The model VLCC18L is developed using source documents provided by Daewoo Shipbuilding & Marine Engineering Co., LTD, Project *Kristen 306,000 TDW Crude Oil Tanker*, Proj. no.5194.

- Kongsberg's Doc. no.: SU-0676-A10/12-May-2006 *Model Data Request Form (Form)* with general information pages filled out.

Note however that manoeuvre data has incomplete.

- The Acceleration data is not provided.
- Speeds in Combinator Table provided only for Ahead.

To complement manoeuvre data, respective manoeuvre data from a number of prototype ships have been used.

2.*General Arrangement,* Drawing no. DA101Z029 dated 2004.03.16 provided by DSME Dep't Integrated Design Team.

3.Photos of the ship in different loading conditions and environments.

General Description

Power Plant

VLCC18L Oil carrier Elizabeth I. Angelicoussi is powered by 1 diesel engine rating 29431 kW at 76 rpm.

Propulsors

VLCC18L is propelled by 1 fixed pitch propeller. Direction of propulsor revolution is right.

Speed

Top speed of VLCC18L at 100% throttle setting and calm conditions is 16.8 kn ahead and 8.4 kn astern.

Rudders

This ship is steered with 1 rudder with maximum angle 35 deg. The rudder uses 25.0 s from full port to full starboard.

Thrusters

This ship has no auxilliary thrusters.

Stopping Ability

Stopping performance can be judged from crash stop manoeuvre. Crash stop distance of VLCC18L is 5136 m which makes 16.0 ship lengths. Such crash stop performance is poor and does not satisfy IMO's requirements as described in IMO Resolution MCS.137(76) Standards for Ship Manoeuverability.

Turning Ability

The turning ability may be judged from turning circles. Thurning cirlce test performed at 100% throttle setting and 35 deg starboard steering order results in advance 1116 m or 3.5 ship's length and tactical diameter 999 m or 3.1 ship's length. Turning ability of VLCC18L is fair and satisfies IMO's requirements.

Manoeuvring Ability

Zigzag test performed at 80% throttle setting show first overshoot angle 9.9 deg in the 10-10° test and 14.5 deg in the 20-20° test. Zigzag test results indicate that manouevring ability of VLCC18L is fair and satisfies IMO's Resolution MCS.137(76).

Steering Ability

Steering ability of VLCC18L is poor. The ship is course unstable.

Ship Data

Identification

Model name	VLCC18L
Ship database file name	VLCC18L.sdb
Type of ship	Oil carrier
Loading condition	Loaded
Ship's name	Elizabeth I. Angelicoussi

General Data

IMO#	9257149
Year Built	2004
Builder	Daewoo Shipbuilding & Marine Engineering
Call Sign	SZHJ
MMSI	240165000
Bulbous Bow	Yes
Gross Tonnage, RT	
Net Tonnage, RT	
Deadweight, t	306200
Displacement, t	349000
Length between perpendiculars, m	320
Length overall, m	332
Beam moulded, m	58
Draught fore, m	22.5
Draught aft, m	22.5
Block coefficient	0.816
Radius of inertia, multiples of L_{pp}	0.19
Lateral windage area, m²	3324
Speed ahead, kn	16.8
Speed astern, kn	8.4
Minimum speed to maintain course with engine stopped, kn	
Transverse metacentric height, m	6.8

Engines

Number of engines	1
Type of engine	Diesel
Total shaft power, kW	29431
Revolutions, rpm	76.0
Stall Revolutions, rpm	76.0

Propellers

Number of propellers	1
Type of propulsion	Propeller
Max azimuting angle, deg	0.0
Max azimuting rate, deg/s	0.0
Revolutions, rpm	76.0
Direction of rotation	Clockwise
Diameter, m	9.9
Pitch, P/D @ 0.7R	0.752

Rudders

Number of rudders	1
Rudder type	Normal
Max rudder angle, deg	35.0
Max rudder rate, deg/s	2.8
Rudder area, m²	109.7
Total rudder area, % of $L_{pp}T_{\alpha}$	1.5

Bow Anchors

Number of bow anchors	2
Mass, t	17.3/17.0
Chain break load, t	1018.0

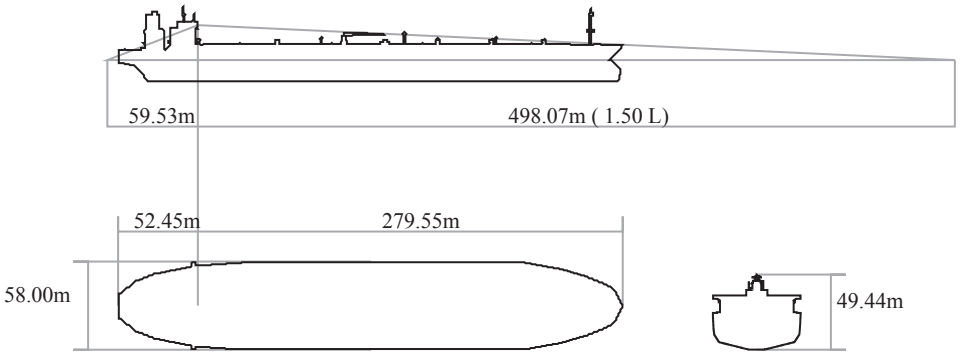
Radar Position

Longitudinal radar position, m	-123.5
Lateral radar position, m	0.0
Vertical radar position, m	-39.7

Viewpoint Position

Longitudinal viewpoint position, m	-114.0
Lateral viewpoint position, m	0.0
Vertical viewpoint position, m	23.0

Blind Zone



Speed

Throttle Setting		Propeller		Speed	
		revolutions	pitch	deep H/T = ∞	shallow H/T = 1.5
		rpm	P/D	kn	kn
Full sea speed	1	76.0	N/A	16.8	15.9
Full Ahead	0.8	57.0	N/A	12.7	12.3
Half Ahead	0.5	47.0	N/A	10.4	10.2
Slow Ahead	0.25	33.0	N/A	7.2	7.2
Dead Slow Ahead	0.125	28.0	N/A	6.1	6.1
Dead Slow Astern	-0.125	-28.0	N/A	-4.1	-4.0
Slow Astern	-0.25	-33.0	N/A	-4.8	-4.8
Half Astern	-0.5	-47.0	N/A	-6.9	-6.9
Full Astern	-1	-57.0	N/A	-8.4	-8.4

Table 1. Propeller revolutions and pitch and ship speed as function of machinery telegraph setting. Deep and shallow water.

Statistics

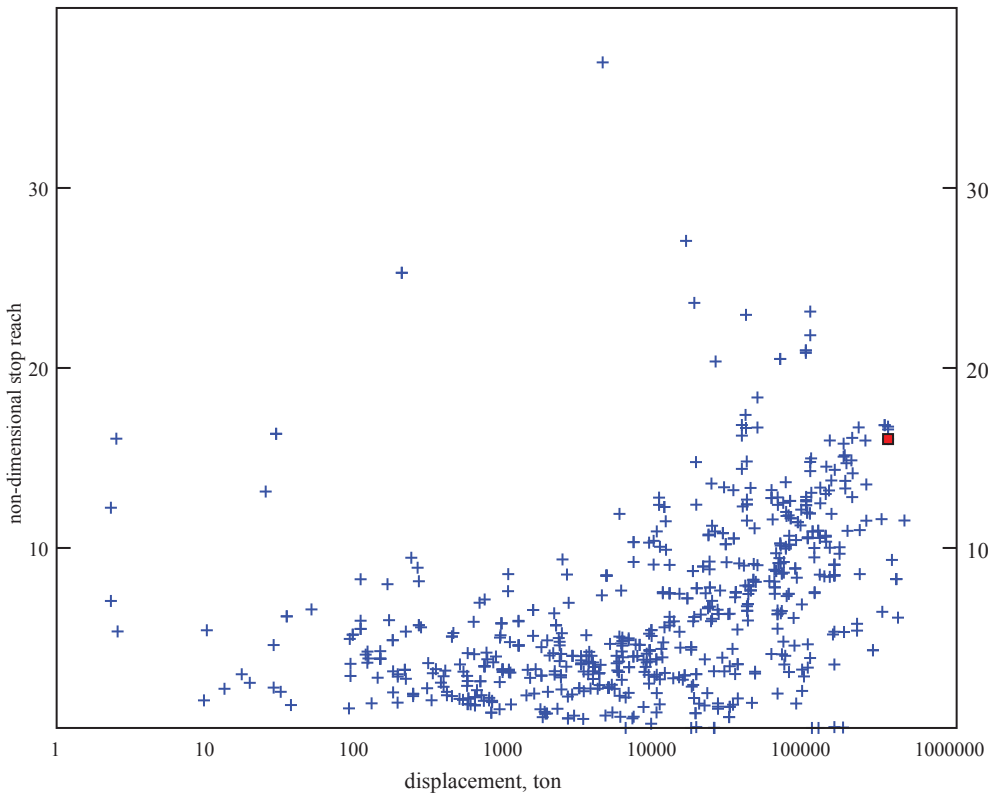


Fig. 1. Stop reach of the ship compared with other ship models.

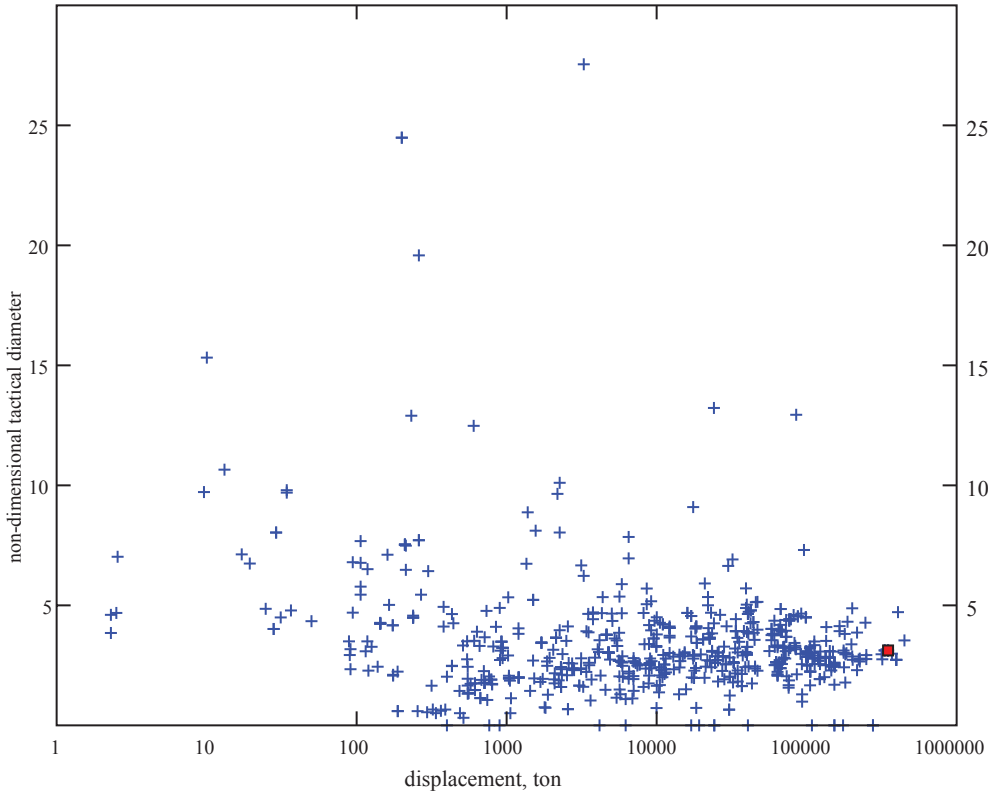


Fig. 2. Tactical diameter of the ship compared with other ship models.

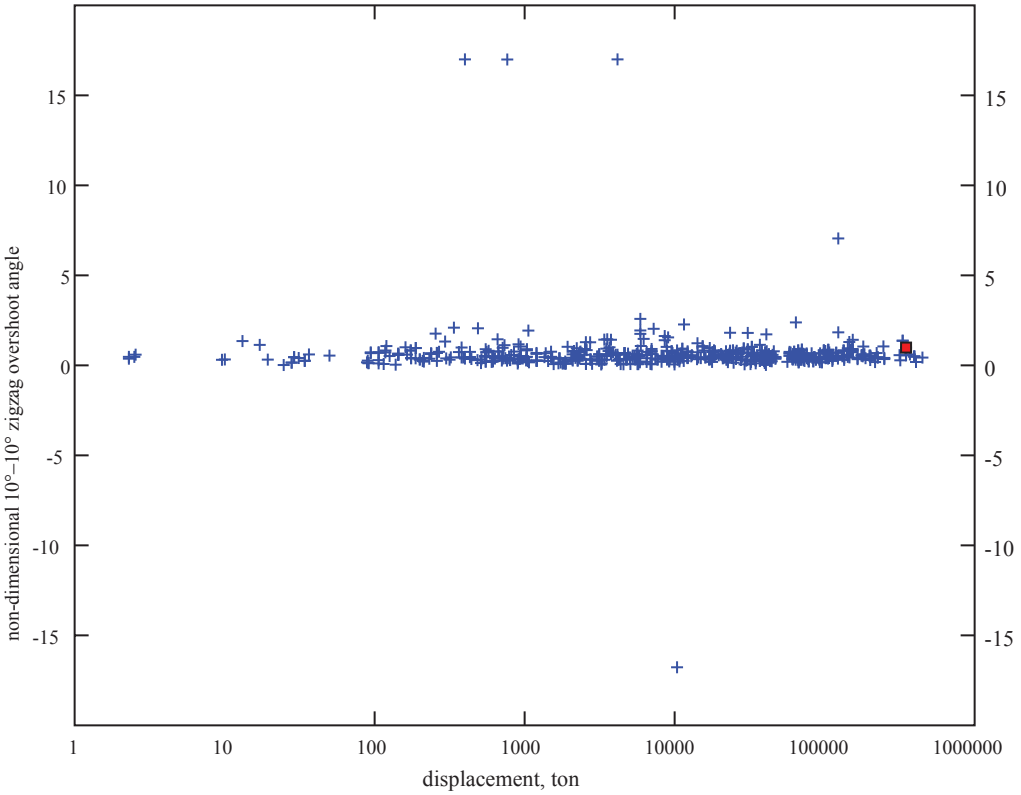


Fig. 3. Zig-zag overshoot angle of the ship compared with other ship models.

Acceleration

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 0.0
to, % 100.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	0.0	0.752	0.0	0.0
00:01:00	58.9	0.752	0.4	3.7
00:02:00	73.4	0.752	1.6	33.0
00:03:00	75.5	0.752	3.0	103.1
00:04:00	75.8	0.752	4.3	216.0
00:05:00	75.8	0.752	5.6	370.3
00:06:00	75.8	0.752	6.9	563.6
00:07:00	75.8	0.752	8.0	793.2
00:08:00	75.8	0.752	9.0	1055.9
00:09:00	75.7	0.752	9.9	1348.6
00:10:00	75.7	0.752	10.8	1668.1
00:11:00	75.8	0.752	11.5	2011.5
00:12:00	75.8	0.752	12.1	2376.4
00:13:00	75.8	0.752	12.7	2760.6
00:14:00	75.9	0.752	13.3	3162.3
00:15:00	75.9	0.752	13.7	3579.3
00:16:00	75.9	0.752	14.2	4010.1
00:17:00	76.0	0.752	14.5	4451.6

Table 2. Acceleration.

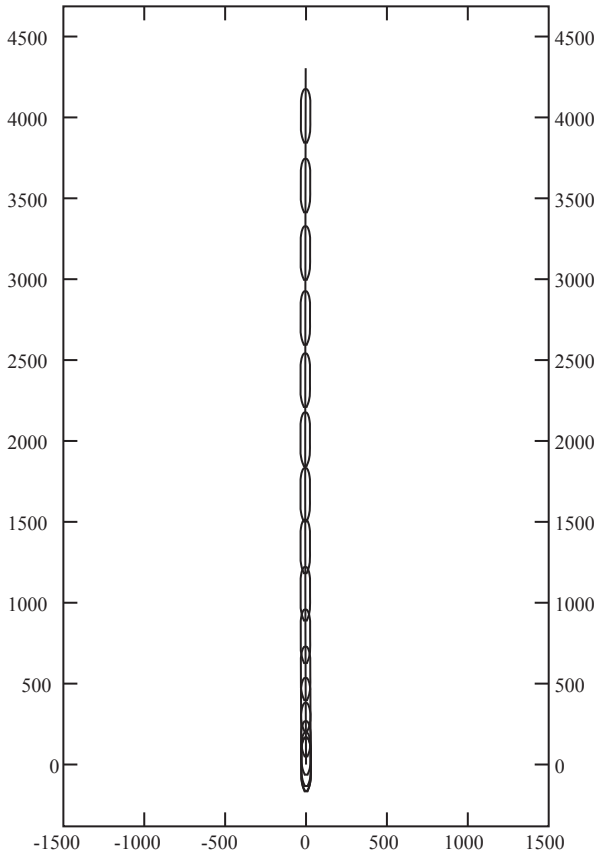


Fig. 4. Acceleration. Ship position plot.

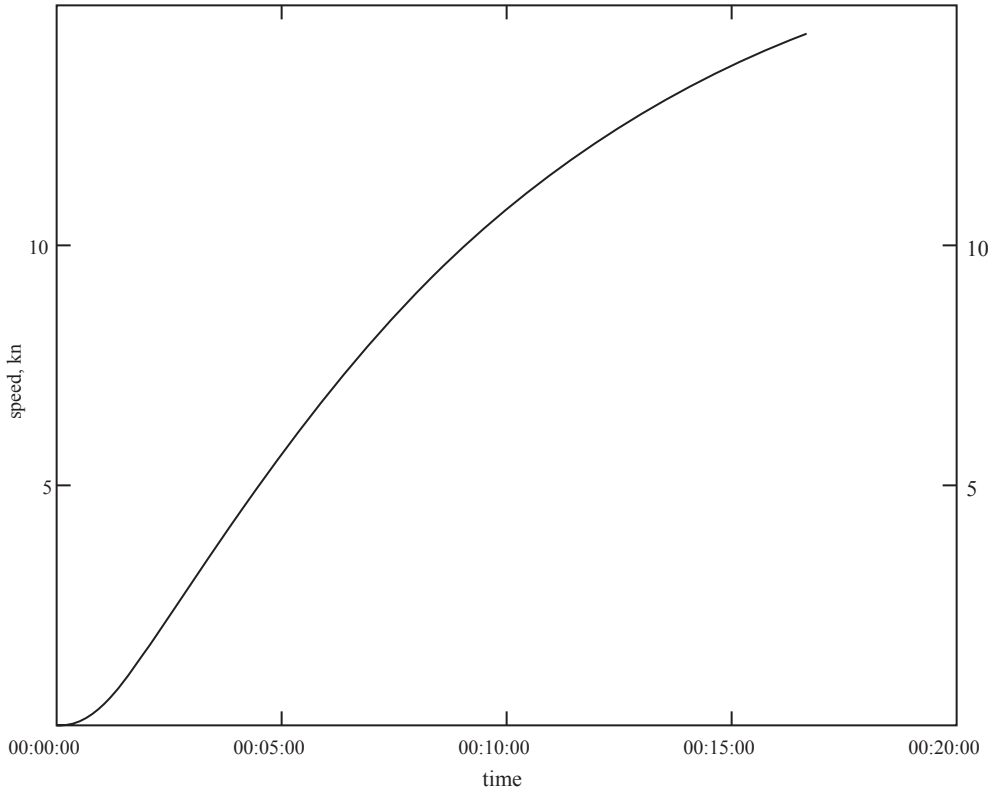


Fig. 5. Acceleration. Speed plot.

Acceleration from Slow to Half

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 25.0
to, % 50.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	33.0	0.752	7.2	0.0
00:01:00	46.9	0.752	7.4	225.6
00:02:00	47.0	0.752	7.7	458.5
00:03:00	47.0	0.752	7.9	698.3
00:04:00	47.1	0.752	8.1	944.6
00:05:00	47.1	0.752	8.3	1196.9
00:06:00	47.1	0.752	8.4	1454.8
00:07:00	47.1	0.752	8.6	1717.9
00:08:00	47.1	0.752	8.8	1985.7
00:09:00	47.1	0.752	8.9	2258.0
00:10:00	47.1	0.752	9.0	2534.4
00:11:00	47.1	0.752	9.1	2814.6
00:12:00	47.1	0.752	9.2	3098.3
00:13:00	47.1	0.752	9.3	3385.1
00:14:00	47.1	0.752	9.4	3674.9
00:15:00	47.1	0.752	9.5	3967.4
00:16:00	47.1	0.752	9.6	4262.4
00:17:00	47.1	0.752	9.7	4559.9

Table 3. Acceleration from Slow to Half.

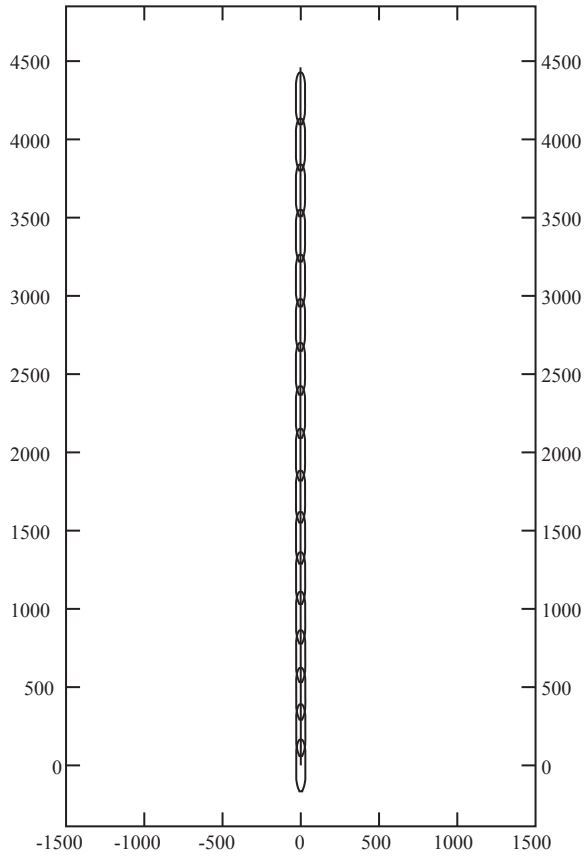


Fig. 6. Acceleration from Slow to Half. Ship position plot.

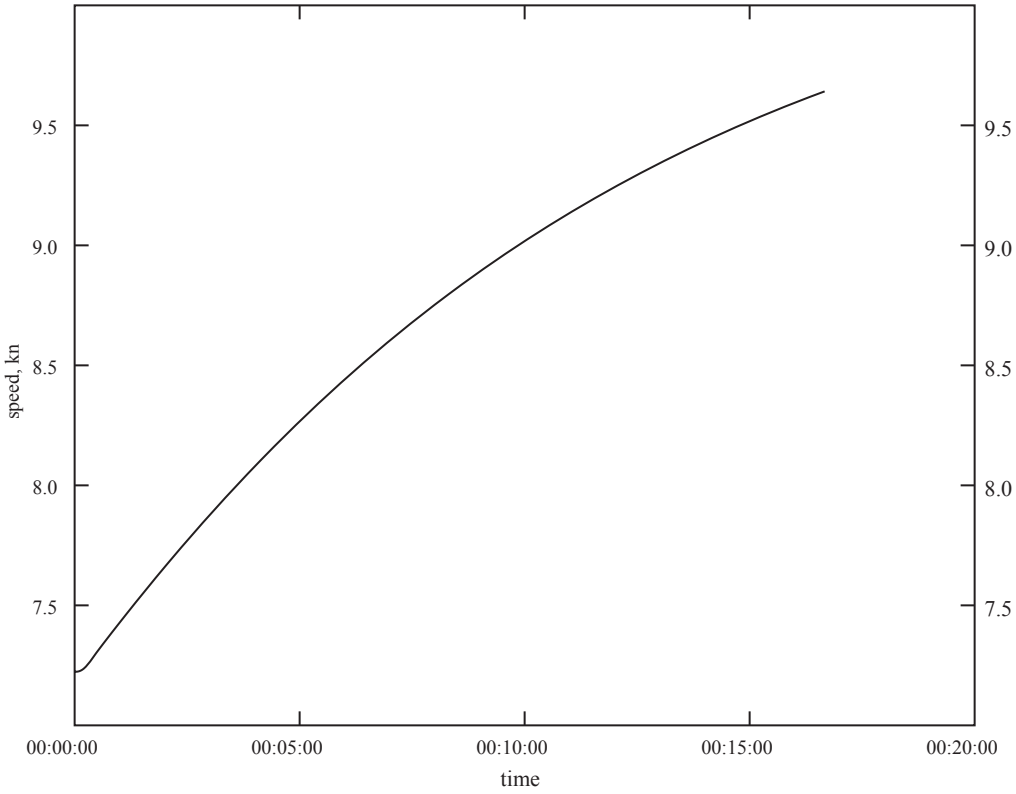


Fig. 7. Acceleration from Slow to Half. Speed plot.

Crash Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % ..... -100.0
Rudder, deg 0.0

Performance

Stop time, s 00:16:40
Advance at stop time, m 5135.6
Transfer at stop time, m 1055.9
Heading at stop time, deg 113.4

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	16.8	0.0	0.0
00:01:00	37.9	0.752	16.2	512.2	0.0
00:02:00	27.7	0.752	15.4	1001.2	0.2
00:03:00	23.6	0.752	14.7	1466.1	0.6
00:04:00	21.1	0.752	14.0	1908.1	1.3
00:05:00	-27.5	0.752	13.2	2328.3	2.7
00:06:00	-41.8	0.752	12.4	2724.9	5.3
00:07:00	-51.6	0.752	11.6	3095.7	9.7
00:08:00	-53.8	0.752	10.6	3438.4	16.3
00:09:00	-54.5	0.752	9.7	3751.6	24.9
00:10:00	-54.8	0.752	8.7	4034.3	34.7
00:11:00	-55.1	0.752	7.6	4285.7	45.3
00:12:00	-55.3	0.752	6.6	4505.5	56.8
00:13:00	-55.4	0.752	5.6	4694.2	69.0
00:14:00	-55.5	0.752	4.6	4852.5	82.0
00:15:00	-55.6	0.752	3.7	4981.1	95.3
00:16:00	-56.0	0.752	2.9	5082.1	106.8
00:17:00	-56.3	0.752	2.1	5160.0	116.5

Table 4. Crash stop test.

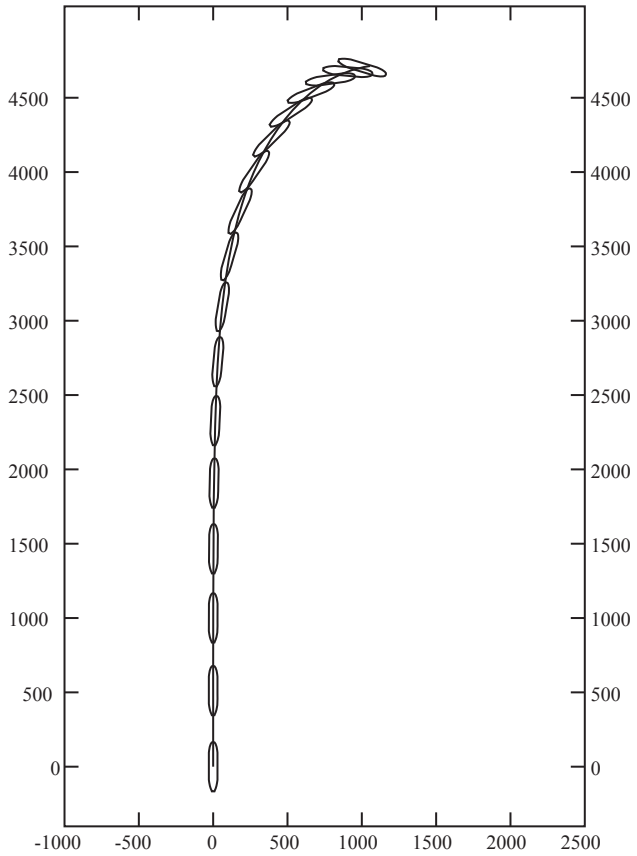


Fig. 8. Crash stop test. Ship position plot.

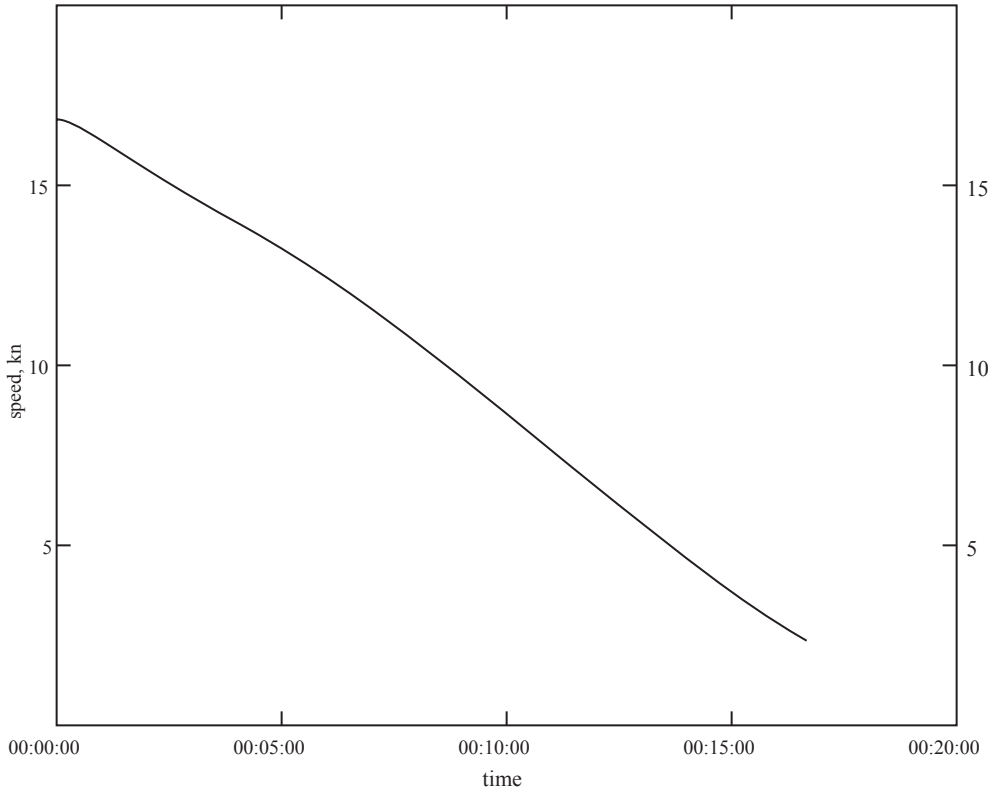


Fig. 9. Crash stop test. Speed plot.

Deceleration from Half to Slow

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 50.0
to, % 25.0
Rudder, deg 0.0

Performance

Stop time, s 00:16:40
Advance at stop time, m 4683.3

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	47.0	0.752	10.4	0.0	0.0
00:01:00	33.1	0.752	10.2	319.6	0.0
00:02:00	32.9	0.752	10.0	632.6	0.0
00:03:00	32.9	0.752	9.8	939.4	0.1
00:04:00	32.9	0.752	9.7	1240.3	0.1
00:05:00	32.9	0.752	9.5	1535.8	0.2
00:06:00	32.9	0.752	9.3	1826.4	0.4
00:07:00	32.9	0.752	9.2	2112.3	0.7
00:08:00	32.9	0.752	9.1	2394.0	1.1
00:09:00	32.9	0.752	8.9	2671.6	1.7
00:10:00	32.9	0.752	8.8	2945.4	2.6
00:11:00	32.9	0.752	8.7	3215.7	3.8
00:12:00	32.9	0.752	8.6	3482.6	5.4
00:13:00	32.9	0.752	8.5	3746.2	7.7
00:14:00	32.9	0.752	8.4	4006.5	10.7
00:15:00	32.9	0.752	8.3	4263.4	14.5
00:16:00	32.9	0.752	8.1	4516.7	19.3
00:17:00	32.9	0.752	8.0	4766.3	24.9

Table 5. Deceleration from Half to Slow .

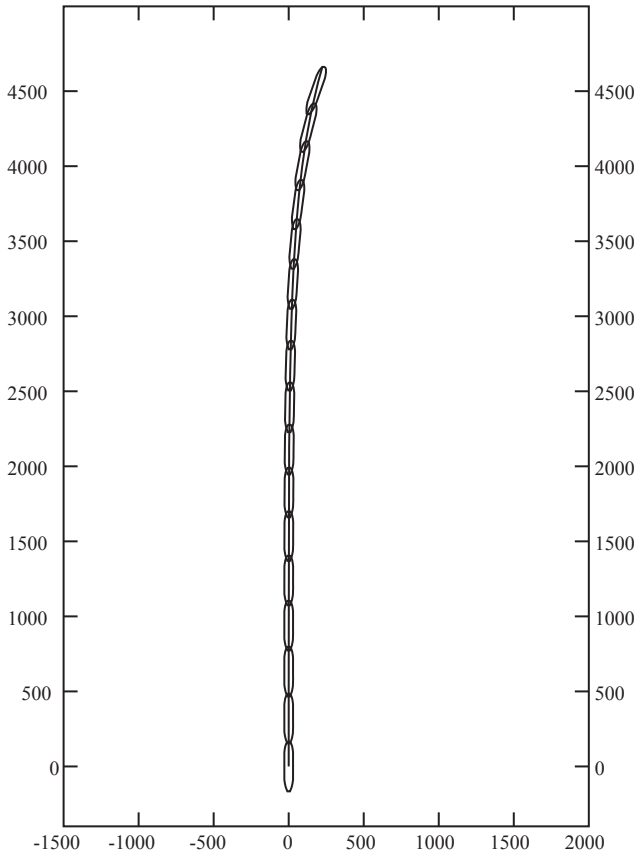


Fig. 10. Deceleration from Half to Slow . Ship position plot.

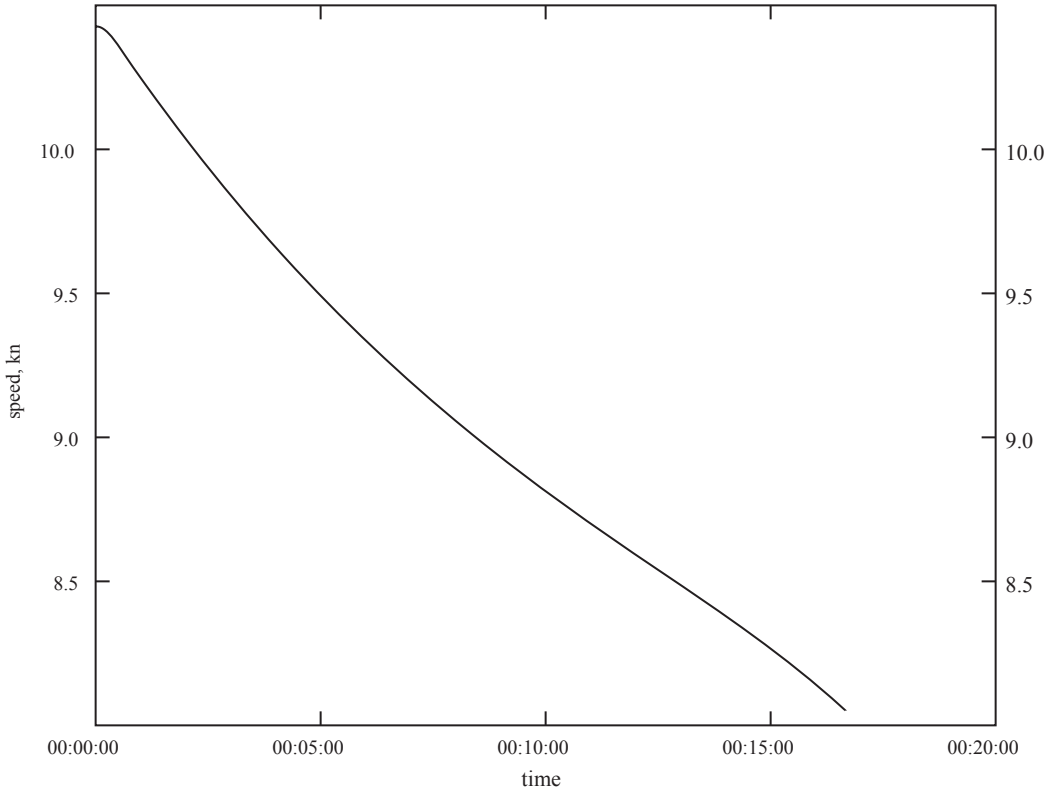


Fig. 11. Deceleration from Half to Slow . Speed plot.

Coasting Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder, deg 0.0

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	16.8	0.0	0.0
00:01:00	37.9	0.752	16.2	512.2	0.0
00:02:00	27.7	0.752	15.4	1001.2	0.2
00:03:00	23.6	0.752	14.7	1466.1	0.6
00:04:00	21.2	0.752	14.0	1908.1	1.3
00:05:00	19.4	0.752	13.3	2329.2	2.7
00:06:00	17.8	0.752	12.7	2730.5	5.6
00:07:00	16.2	0.752	12.1	3113.1	10.8
00:08:00	14.6	0.752	11.4	3476.5	19.0
00:09:00	12.8	0.752	10.7	3819.1	29.7
00:10:00	10.9	0.752	9.9	4138.2	41.9
00:11:00	8.7	0.752	9.1	4431.8	55.3
00:12:00	6.0	0.752	8.2	4699.2	69.2
00:13:00	1.1	0.752	7.5	4941.4	83.5
00:14:00	0.3	0.752	6.7	5159.6	98.1
00:15:00	0.2	0.752	6.0	5355.1	113.0
00:16:00	0.2	0.752	5.3	5529.4	128.0
00:17:00	0.2	0.752	4.7	5685.3	142.4

Table 6. Coasting stop test.

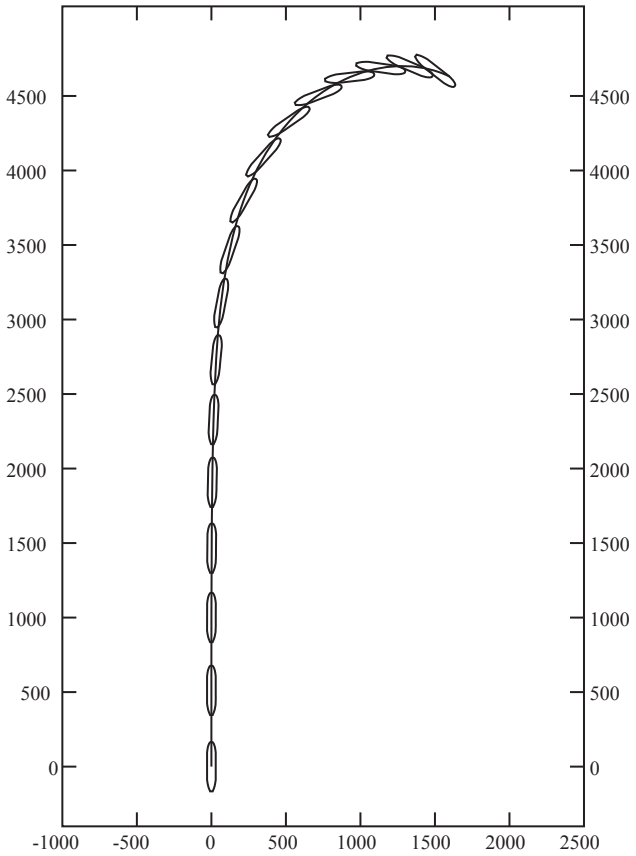


Fig. 12. Coasting stop test. Ship position plot.

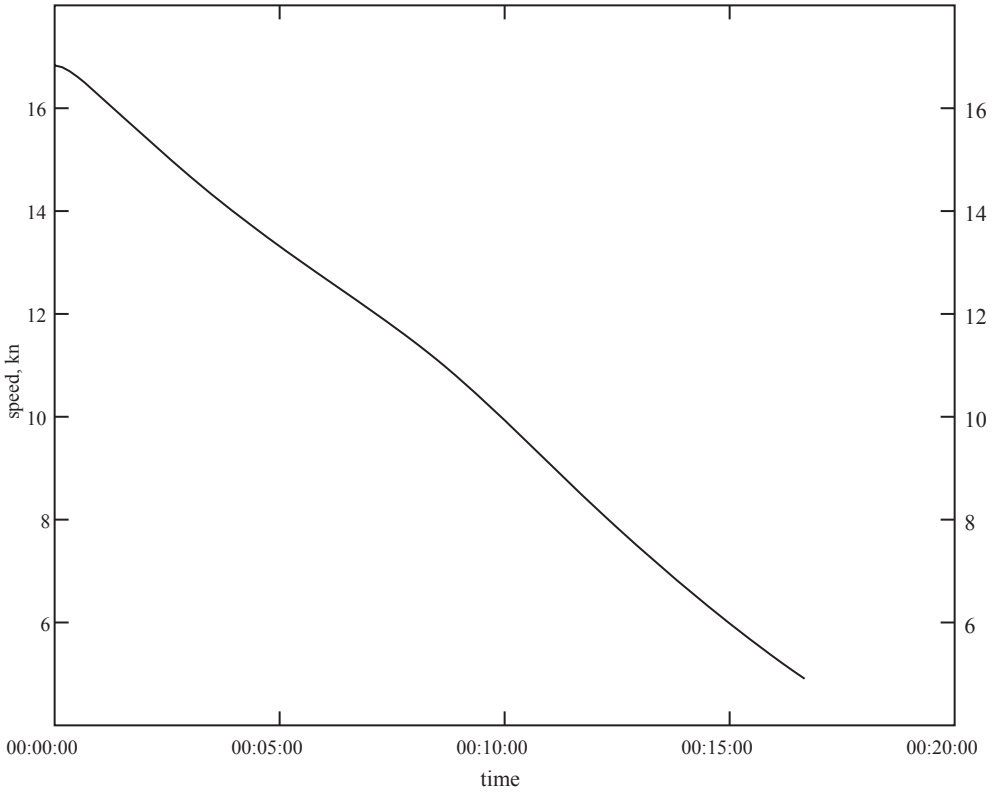


Fig. 13. Coasting stop test. Speed plot.

Time for effective changes in telegraph settings in stopping conditions

Initial Throttle	Initial Speed	Set Throttle	Reached Speed	Time
	kn		kn	s
Full Sea Speed	16.8	Full Astern	0.0	00:22:36
Full Ahead	12.7	Full Astern	0.0	00:18:35
Half Ahead	10.4	Full Astern	0.0	00:16:05
Slow Ahead	7.2	Full Astern	0.0	00:12:13
Full Sea Speed	16.8	Stop	3.4	00:33:20
Full Ahead	12.7	Stop	3.4	00:33:20
Half Ahead	10.4	Stop	3.4	00:33:20
Slow Ahead	7.2	Stop	3.4	00:33:20

Turning Circle Starboard, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting% 100.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:02:40
Advance, m 1115.6
Transfer, m 376.4
Time 180°, s 00:05:22
Tactical diameter, m 998.8
Circulation diameter, m 801.6
Turn rate, deg/min 25.6
Speed loss, % 65.6

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	16.8	0.0	0	0
00:00:45	16.7	10.0	s24.4	s6.7
00:01:30	15.6	35.5	s45.1	s16.1
00:02:15	12.8	72.0	s46.0	s23.0
00:03:00	10.5	103.4	s38.3	s24.9
00:03:45	8.9	130.2	s33.6	s25.4
00:04:30	7.9	154.3	s30.8	s25.5
00:05:15	7.2	176.7	s29.0	s25.6
00:06:00	6.7	-162.0	s27.9	s25.6
00:06:45	6.4	-141.4	s27.1	s25.5
00:07:30	6.2	-121.3	s26.6	s25.5
00:08:15	6.1	-101.5	s26.2	s25.4
00:09:00	6.0	-81.9	s26.0	s25.3
00:09:45	5.9	-62.5	s25.8	s25.3
00:10:30	5.9	-43.2	s25.7	s25.3
00:11:15	5.8	-23.9	s25.6	s25.2

00:12:00	5.8	-4.7	s25.6	s25.2
00:12:45	5.8	14.5	s25.6	s25.2
00:13:30	5.8	33.7	s25.5	s25.2

Table 7. Turning circle starboard, deep water.

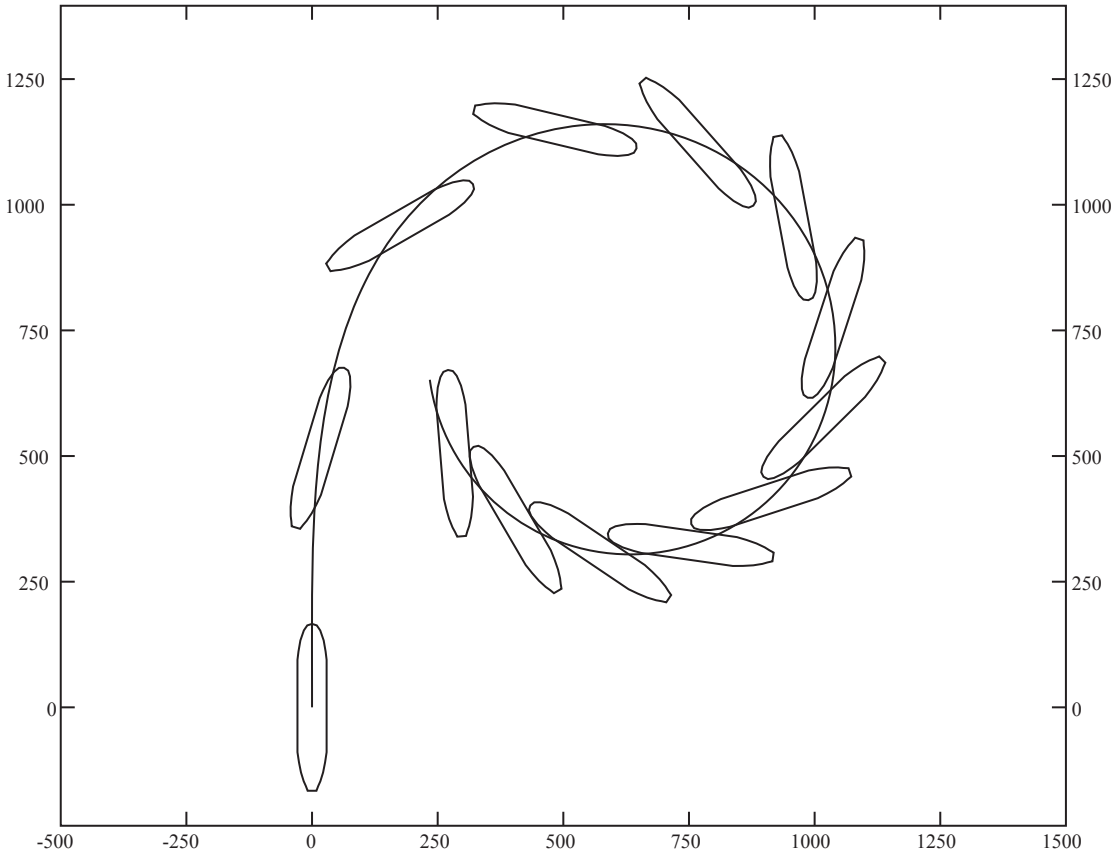


Fig. 14. Turning circle starboard, deep water. Ship position plot.

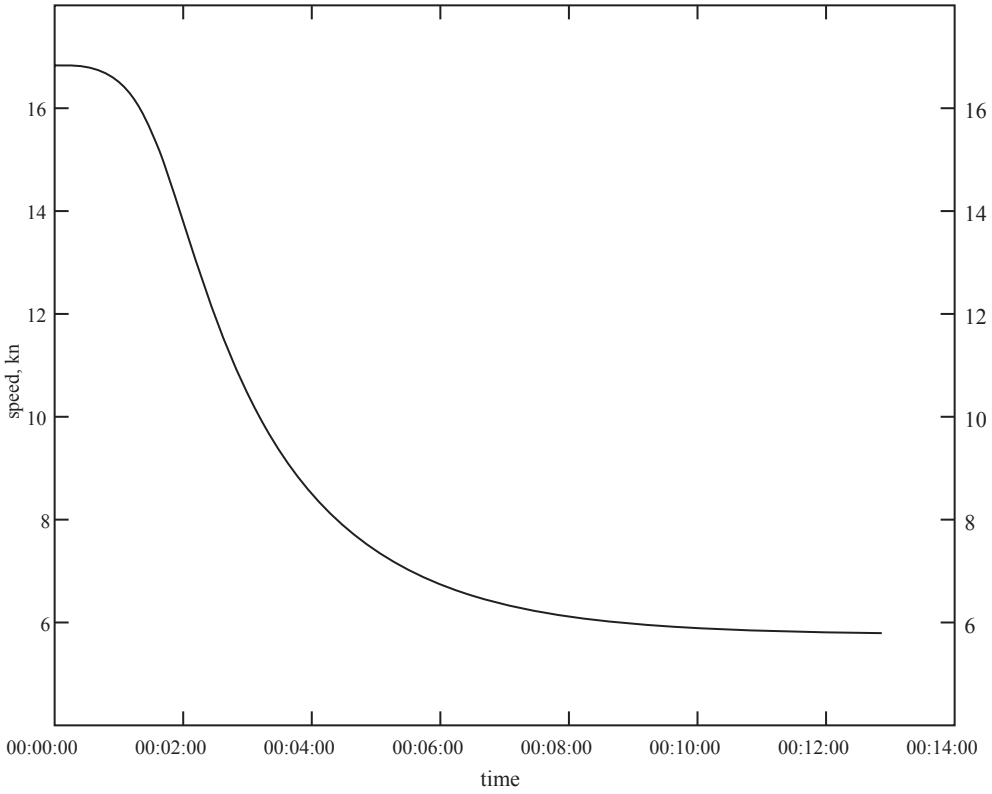


Fig. 15. Turning circle starboard, deep water. Speed plot.

Turning Circle Starboard, Shallow Water

Environment

Water depth, H/T 1.5
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 50.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:04:38
Advance, m 1135.2
Transfer, m 525.1
Time 180°, s 00:08:18
Tactical diameter, m 1139.9
Circulation diameter, m 894.7
Turn rate, deg/min 19.8
Speed loss, % 50.9

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	10.2	0.0	0	0
00:01:00	10.2	6.3	s11.8	s3.1
00:02:00	9.9	22.4	s20.2	s7.5
00:03:00	9.3	46.0	s26.1	s10.8
00:04:00	8.5	72.8	s27.1	s12.3
00:05:00	7.8	99.6	s26.2	s12.9
00:06:00	7.2	125.2	s25.0	s13.2
00:07:00	6.7	149.7	s23.9	s13.3
00:08:00	6.4	173.1	s23.0	s13.4
00:09:00	6.0	-164.3	s22.3	s13.5
00:10:00	5.8	-142.3	s21.7	s13.5
00:11:00	5.6	-120.9	s21.2	s13.6
00:12:00	5.4	-99.9	s20.8	s13.6
00:13:00	5.3	-79.2	s20.5	s13.6
00:14:00	5.2	-58.8	s20.3	s13.6
00:15:00	5.1	-38.7	s20.1	s13.6

00:16:00	5.0	-18.7	s19.9	s13.7
00:17:00	5.0	1.1	s19.7	s13.7

Table 8. Turning circle starboard, shallow water.

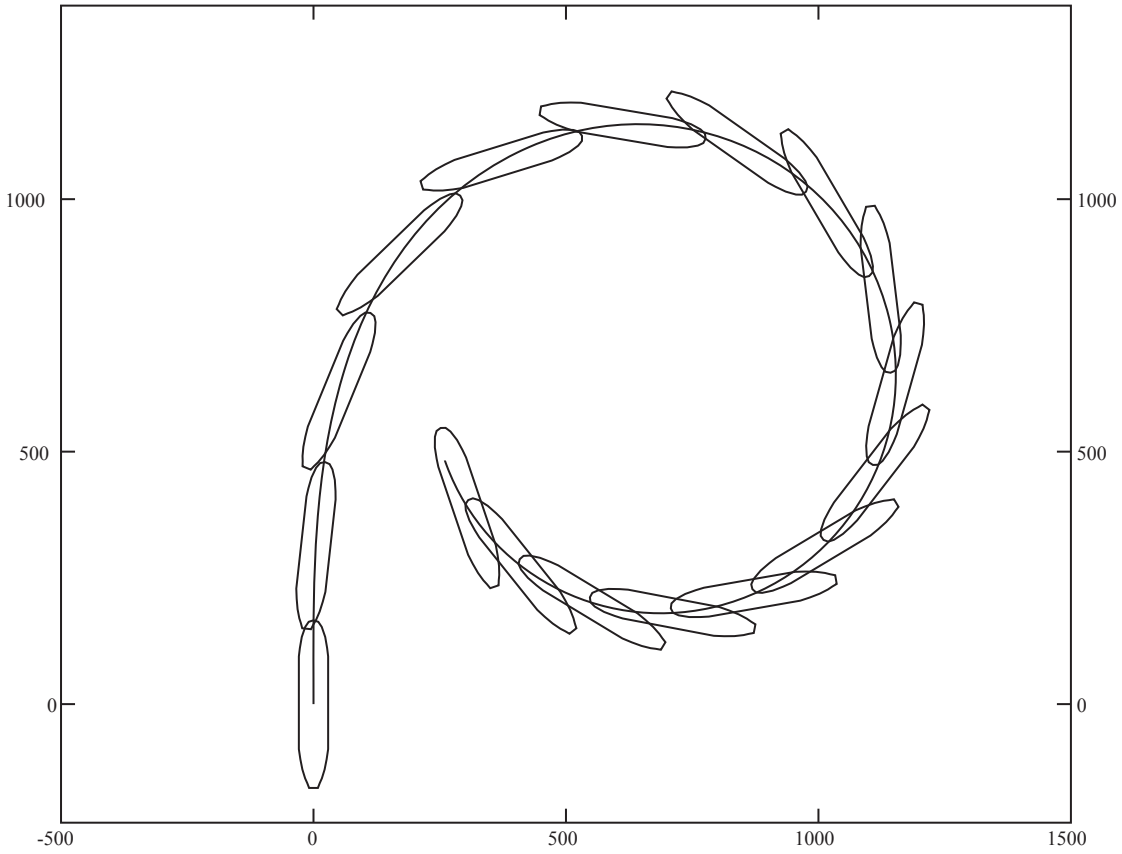


Fig. 16. Turning circle starboard, shallow water. Ship position plot.

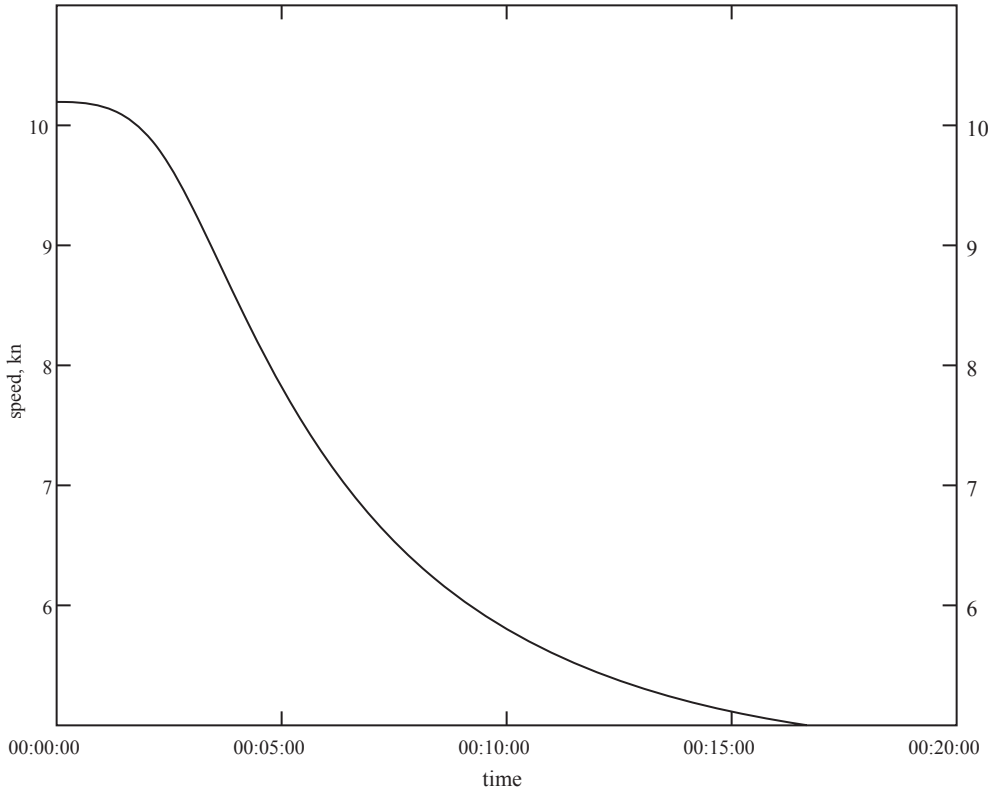


Fig. 17. Turning circle starboard, shallow water. Speed plot.

Turning Circle Port, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder command
from, deg 0.0
to, deg ..... -35.0

Performance

Time 90°, s 00:02:28
Advance, m 1023.9
Transfer, m 343.0
Time 180°, s 00:05:05
Tactical diameter, m 937.4
Circulation diameter, m 686.5
Turn rate, deg/min ..... -27.3
Speed loss, % 68.5

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	16.8	0.0	0	0
00:00:45	16.7	-11.4	p28.8	p7.7
00:01:30	15.0	-43.6	p53.7	p19.3
00:02:15	11.9	-80.8	p44.7	p24.6
00:03:00	9.7	-111.4	p37.6	p25.9
00:03:45	8.3	-138.0	p33.5	p26.4
00:04:30	7.4	-162.1	p31.0	p26.6
00:05:15	6.7	175.3	p29.5	p26.7
00:06:00	6.3	153.5	p28.6	p26.8
00:06:45	6.0	132.3	p28.2	p27.0
00:07:30	5.8	111.2	p27.9	p27.2
00:08:15	5.7	90.3	p27.8	p27.4
00:09:00	5.6	69.6	p27.6	p27.5
00:09:45	5.5	48.9	p27.5	p27.6
00:10:30	5.4	28.3	p27.4	p27.7
00:11:15	5.3	7.7	p27.4	p27.8

00:12:00	5.3	-12.8	p27.3	p27.9
00:12:45	5.3	-33.2	p27.3	p27.9

Table 9. Turning circle port, deep water.

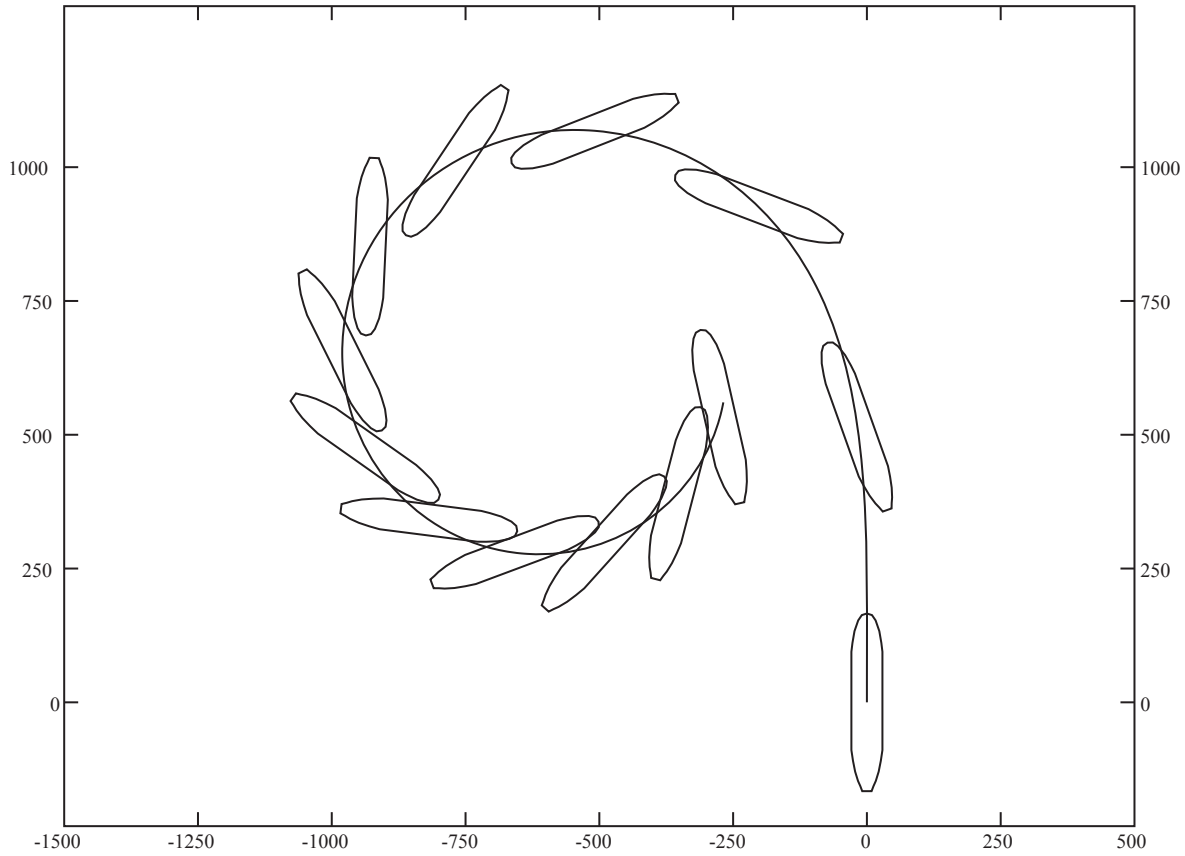


Fig. 18. Turning circle port, deep water. Ship position plot.

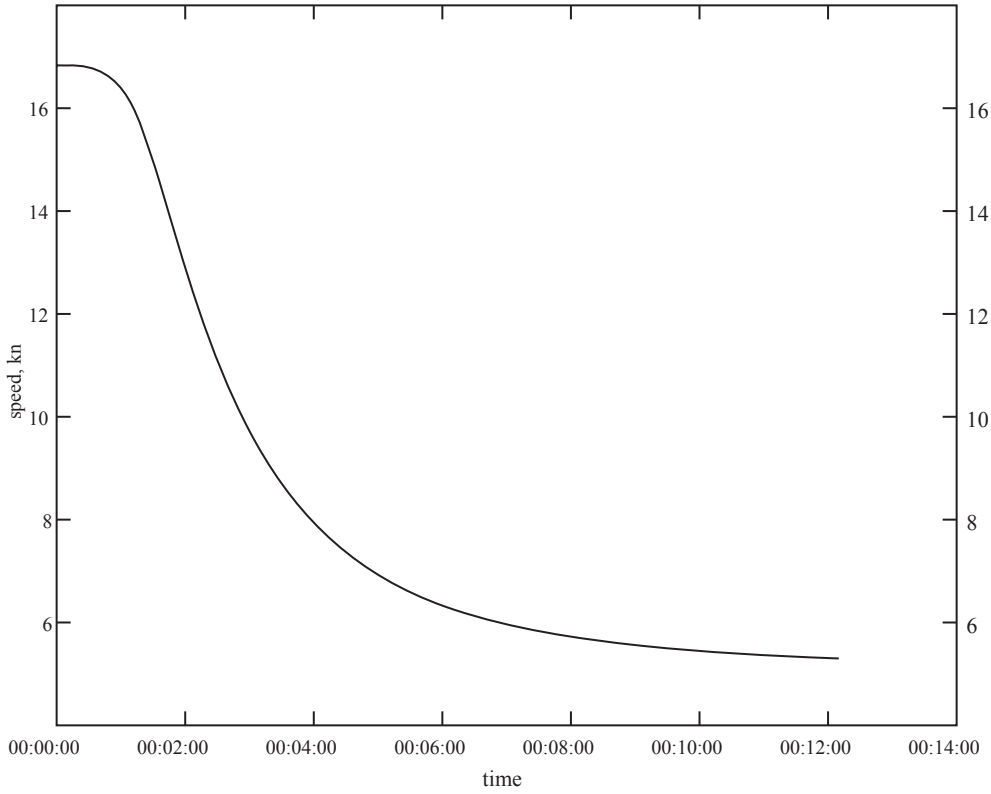


Fig. 19. Turning circle port, deep water. Speed plot.

Accelerated Turning

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
- from, % 0.0
- to, % 50.0

Rudder command
- from, deg 0.0
- to, deg 35.0

Performance

Time 90°, ... 00:06:55
Advance, m 253.6
Transfer, m 146.4
Time 180° 00:12:40
Tactical diameter, m 609.4
Circulation diameter, m 775.6
Turn rate, deg/min 16.1

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	0.0	0.0	0	0
00:01:00	0.4	2.5	s7.4	s19.2
00:02:00	0.9	14.0	s14.3	s20.8
00:03:00	1.4	29.3	s15.8	s22.9
00:04:00	1.8	45.1	s15.6	s24.2
00:05:00	2.2	60.5	s15.4	s25.0
00:06:00	2.5	75.9	s15.4	s25.6
00:07:00	2.7	91.3	s15.4	s25.9
00:08:00	2.9	106.7	s15.5	s26.1
00:09:00	3.0	122.3	s15.6	s26.1
00:10:00	3.1	137.9	s15.7	s26.0
00:11:00	3.2	153.6	s15.8	s25.9
00:12:00	3.3	169.4	s15.8	s25.8
00:13:00	3.4	-174.7	s15.9	s25.7
00:14:00	3.4	-158.8	s16.0	s25.7

00:15:00	3.5	-142.8	s16.0	s25.6
00:16:00	3.5	-126.8	s16.1	s25.5
00:17:00	3.5	-110.7	s16.1	s25.5

Table 10. Accelerated turning.

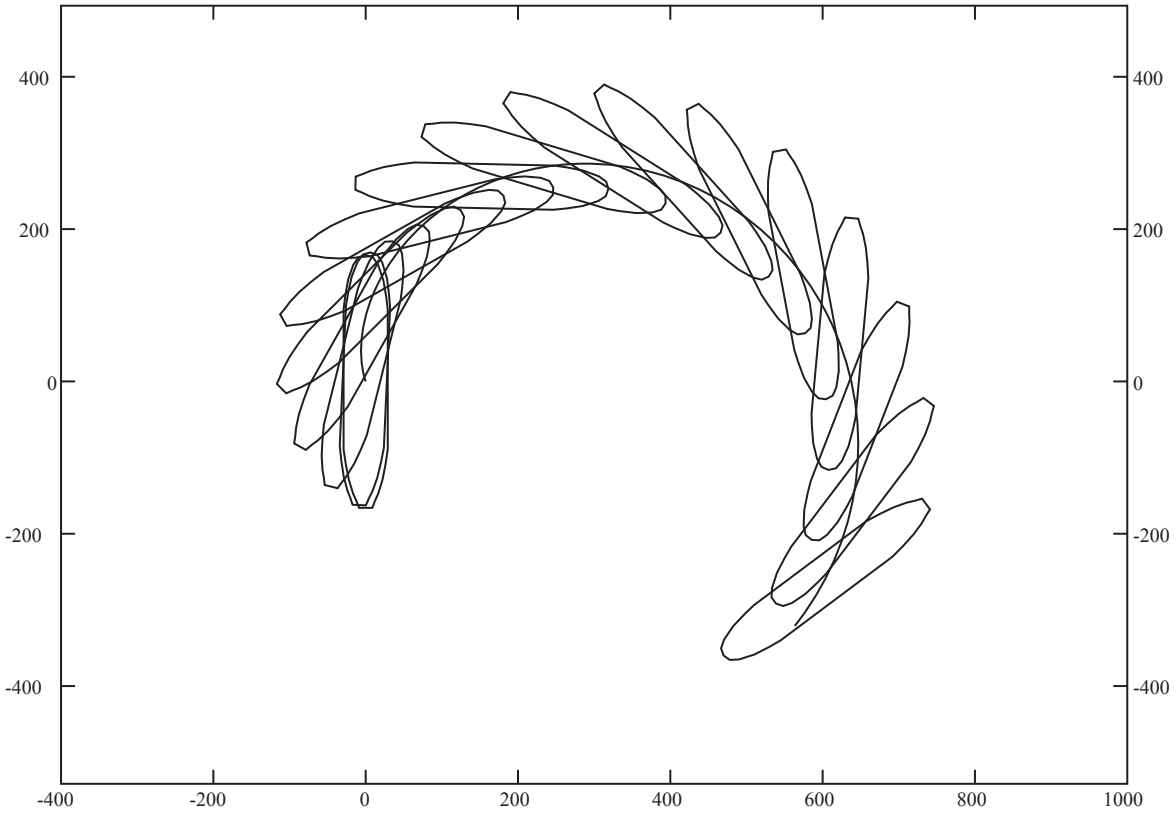


Fig. 20. Accelerated turning. Ship position plot.

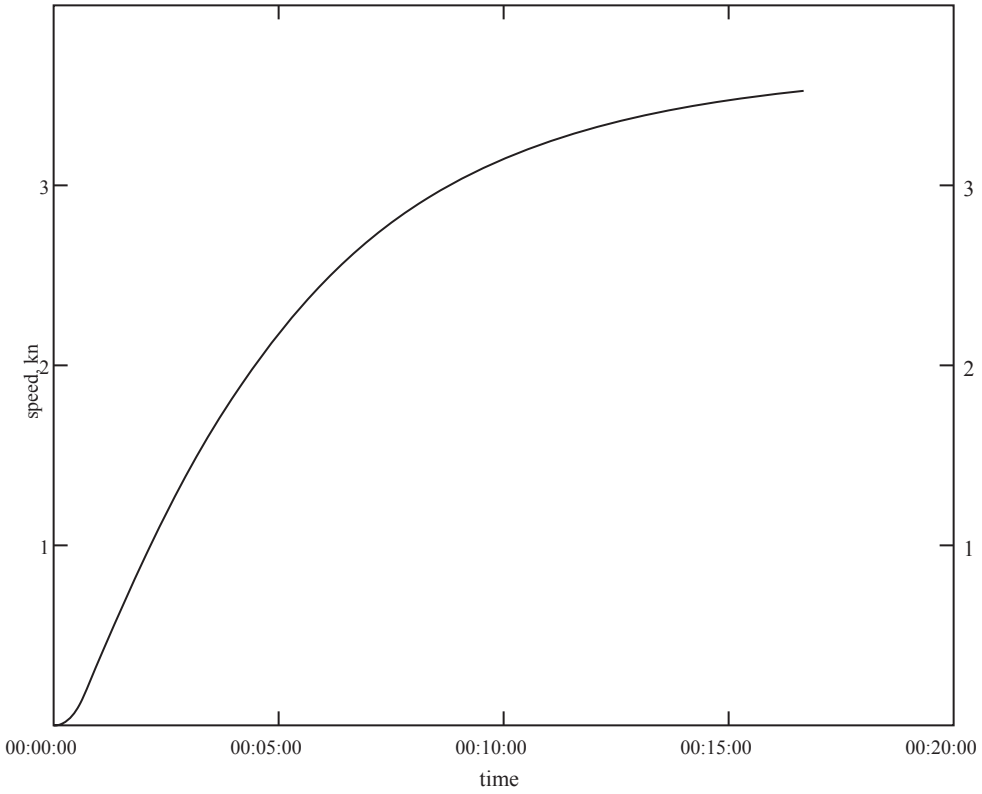


Fig. 21. Accelerated turning. Speed plot.

Coasting Circle

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder command
from, deg 0.0
to, deg 35.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	16.8	0.0	0	0
00:01:00	16.1	11.4	s18.2	s6.8
00:02:00	14.4	34.6	s28.4	s14.1
00:03:00	11.6	68.7	s38.5	s21.0
00:04:00	8.8	102.9	s29.7	s24.2
00:05:00	6.9	129.1	s23.2	s25.1
00:06:00	5.6	150.0	s18.9	s25.5
00:07:00	4.7	167.3	s15.9	s25.6
00:08:00	4.0	-178.0	s13.7	s25.7
00:09:00	3.5	-165.2	s12.0	s25.7
00:10:00	3.2	-153.8	s10.7	s25.8
00:11:00	2.8	-143.7	s9.6	s25.8
00:12:00	2.6	-134.5	s8.8	s25.8
00:13:00	2.4	-126.1	s8.0	s25.9
00:14:00	2.2	-118.4	s7.4	s25.9
00:15:00	2.0	-111.3	s6.9	s25.9
00:16:00	1.9	-104.6	s6.4	s25.9
00:17:00	1.8	-98.4	s6.0	s25.9

Table 11. Coasting Circle.

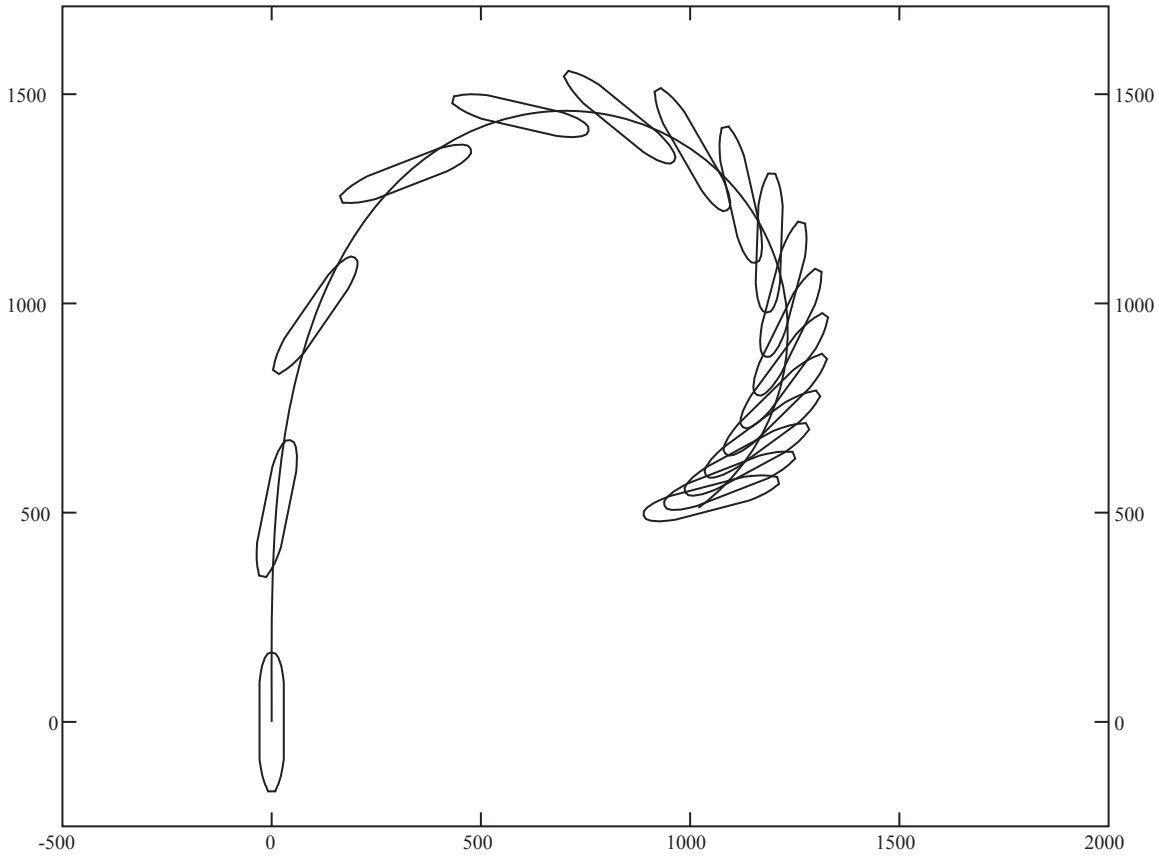


Fig. 22. Coasting Circle. Ship position plot.

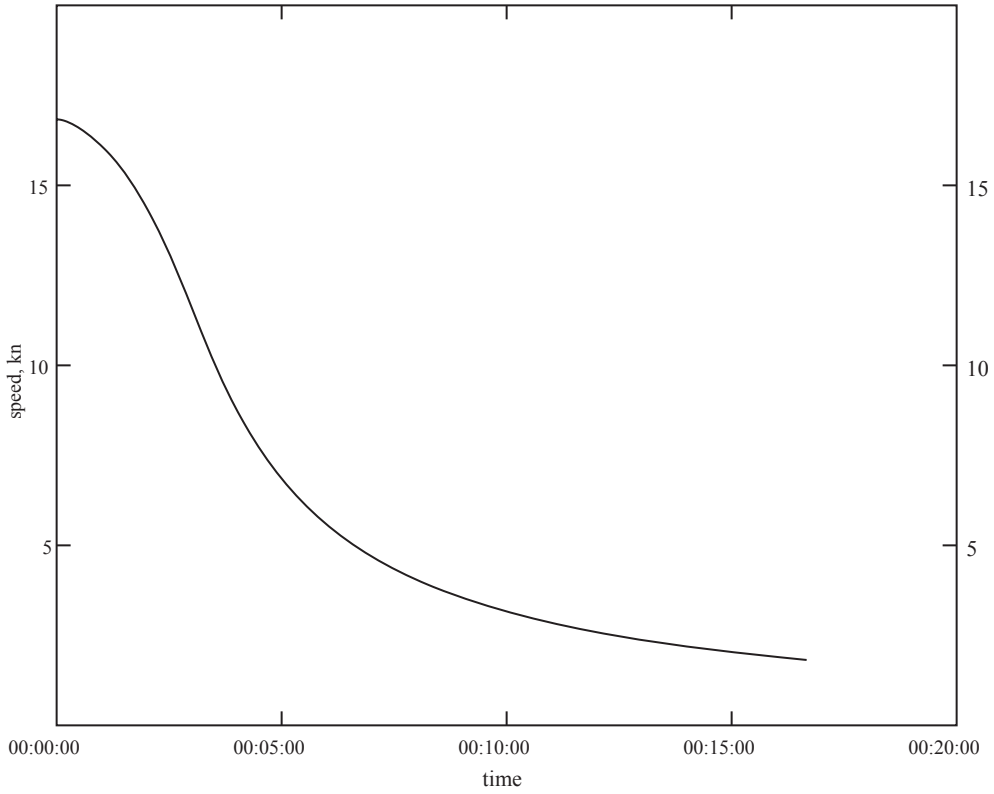


Fig. 23. Coasting Circle. Speed plot

Course Change Manoeuvre

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

Track reach, ship lengths 1.8

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.7	0
00:00:05	s9.1	0.0	12.7	s0.7
00:00:10	s10.0	0.1	12.7	s2.1
00:00:15	s10.0	0.4	12.7	s3.2
00:00:20	s10.0	0.7	12.7	s4.1
00:00:25	s10.0	1.0	12.7	s4.9
00:00:30	s10.0	1.5	12.7	s5.6
00:00:35	s10.0	2.0	12.7	s6.3
00:00:40	s10.0	2.5	12.7	s6.9
00:00:45	s10.0	3.1	12.7	s7.4
00:00:50	s10.0	3.8	12.7	s7.9
00:00:55	s10.0	4.4	12.7	s8.4
00:01:00	s10.0	5.2	12.7	s8.9
00:01:05	s10.0	5.9	12.7	s9.3
00:01:10	s10.0	6.7	12.7	s9.7
00:01:15	s10.0	7.5	12.7	s10.2
00:01:20	s10.0	8.4	12.7	s10.6
00:01:25	s10.0	9.3	12.6	s10.9
00:01:30	s10.0	10.2	12.6	s11.3

Table 12. Course Change Manoeuvre.

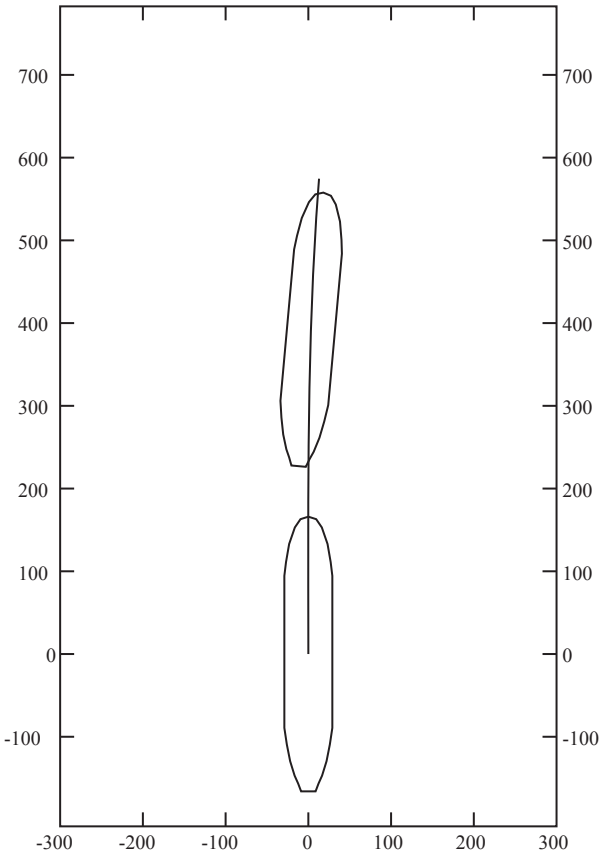


Fig. 24. Course Change Manoeuvre. Ship position plot.

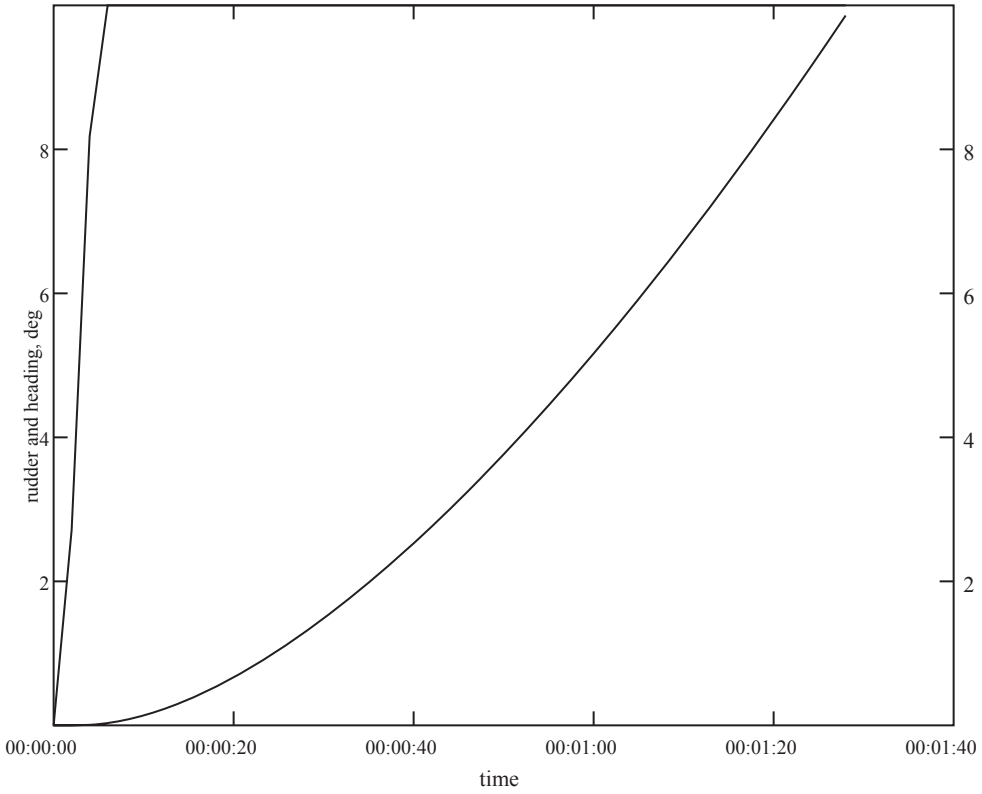


Fig. 25. Course Change Manoeuvre. Rudder and heading plot.

Zigzag 10°–10°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 9.9
Second overshoot angle, deg 31.6

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.7	0
00:00:45	s10.0	3.1	12.7	s7.4
00:01:30	s9.0	10.2	12.6	s11.3
00:02:15	p10.0	15.3	12.5	s4.5
00:03:00	p10.0	18.1	12.4	s3.0
00:03:45	p10.0	19.7	12.4	s1.1
00:04:30	p10.0	19.6	12.4	p1.5
00:05:15	p10.0	17.0	12.4	p5.7
00:06:00	p10.0	11.1	12.4	p10.0
00:06:45	p10.0	2.3	12.3	p13.3
00:07:30	p10.0	-8.8	12.0	p16.0
00:08:15	s10.0	-17.6	11.6	p8.3
00:09:00	s10.0	-23.3	11.5	p7.0
00:09:45	s10.0	-28.2	11.4	p6.3
00:10:30	s10.0	-32.6	11.3	p5.4
00:11:15	s10.0	-36.3	11.3	p4.4
00:12:00	s10.0	-39.2	11.3	p3.2
00:12:45	s10.0	-41.1	11.4	p1.7
00:13:30	s10.0	-41.6	11.4	s0.4

Table 13. Zigzag 10°–10°.

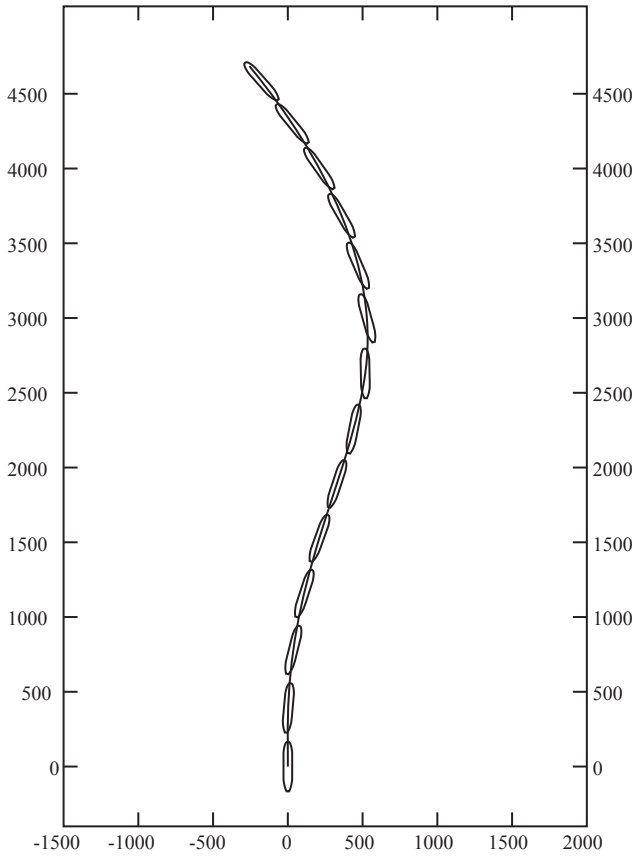


Fig. 26. Zigzag 10°–10°. Ship position plot.

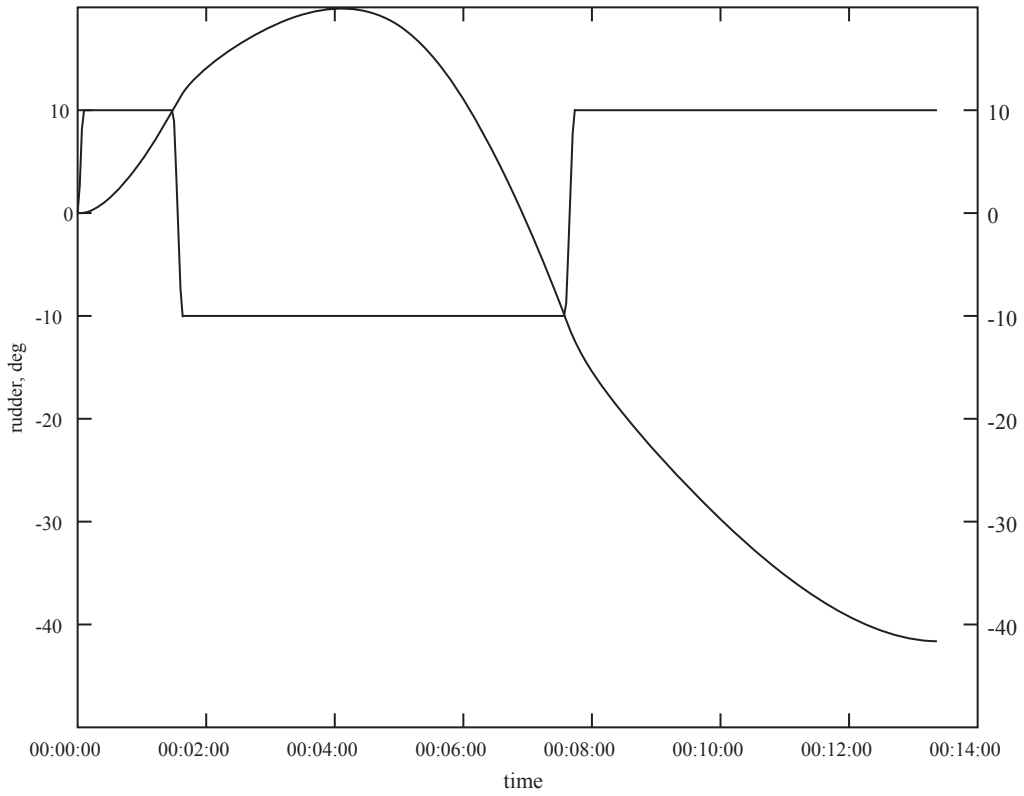


Fig. 27. Zigzag test 10°–10°. Rudder and heading plot.

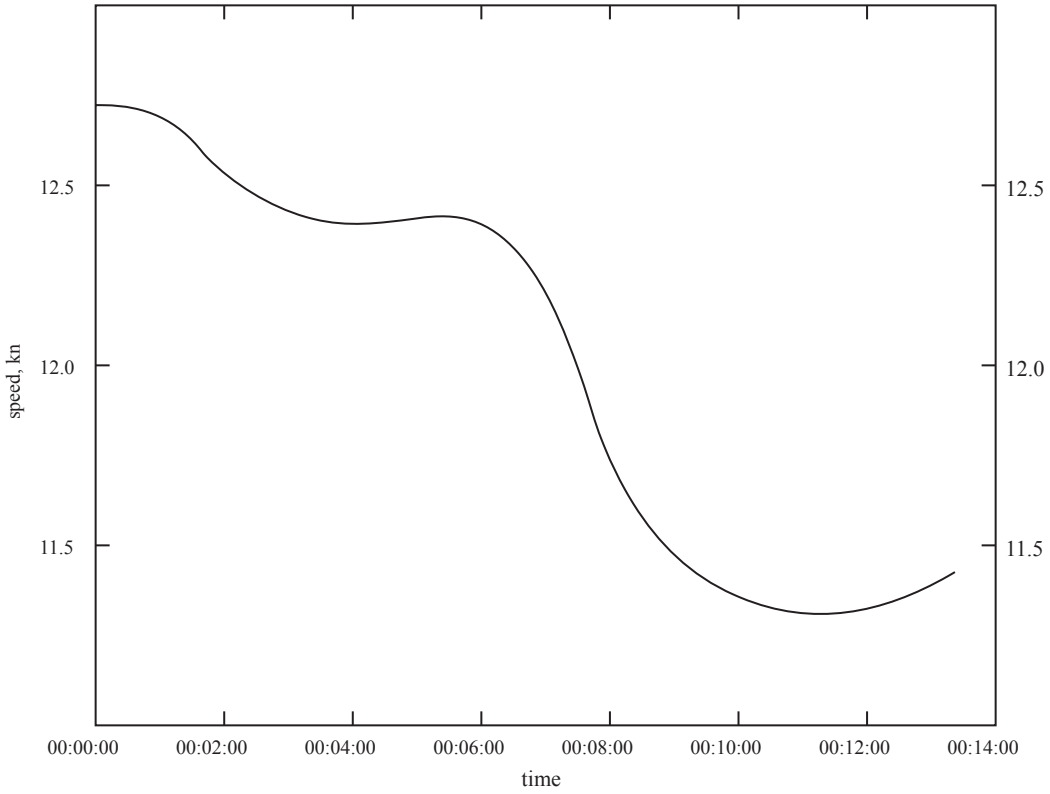


Fig. 28. Zigzag test 10°–10°. Speed plot.

Zigzag 10°–10° Slow Speed

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 12.5
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 7.6
Second overshoot angle, deg 27.5

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	6.1	0
00:02:00	s10.0	5.2	6.1	s4.3
00:04:00	p10.0	13.6	6.0	s2.3
00:06:00	p10.0	16.8	6.0	s1.0
00:08:00	p10.0	17.4	6.0	p0.5
00:10:00	p10.0	14.1	6.0	p3.1
00:12:00	p10.0	5.2	5.9	p5.6
00:14:00	p10.0	-7.9	5.8	p7.5
00:16:00	s10.0	-18.2	5.6	p3.6
00:18:00	s10.0	-24.8	5.5	p3.0
00:20:00	s10.0	-30.3	5.5	p2.5
00:22:00	s10.0	-34.5	5.5	p1.7
00:24:00	s10.0	-37.1	5.5	p0.7
00:26:00	s10.0	-37.5	5.5	s0.6

Table 14. Zigzag 10°–10° Slow Speed.

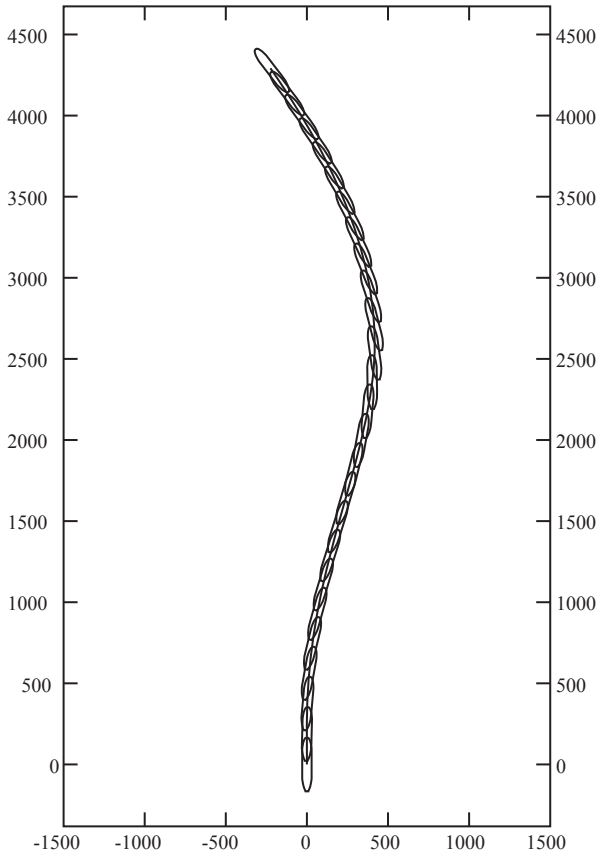


Fig. 29. Zigzag 10°–10° Slow Speed. Ship position plot.

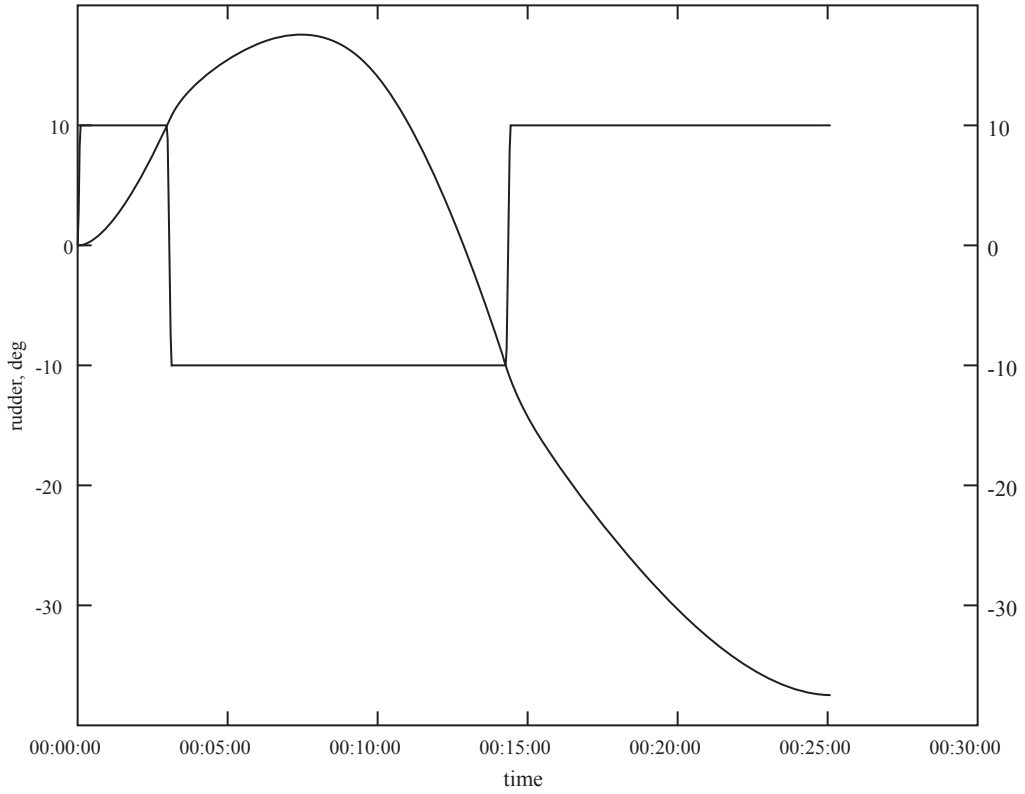


Fig. 30. Zigzag test 10°–10° Slow Speed. Rudder and heading plot.

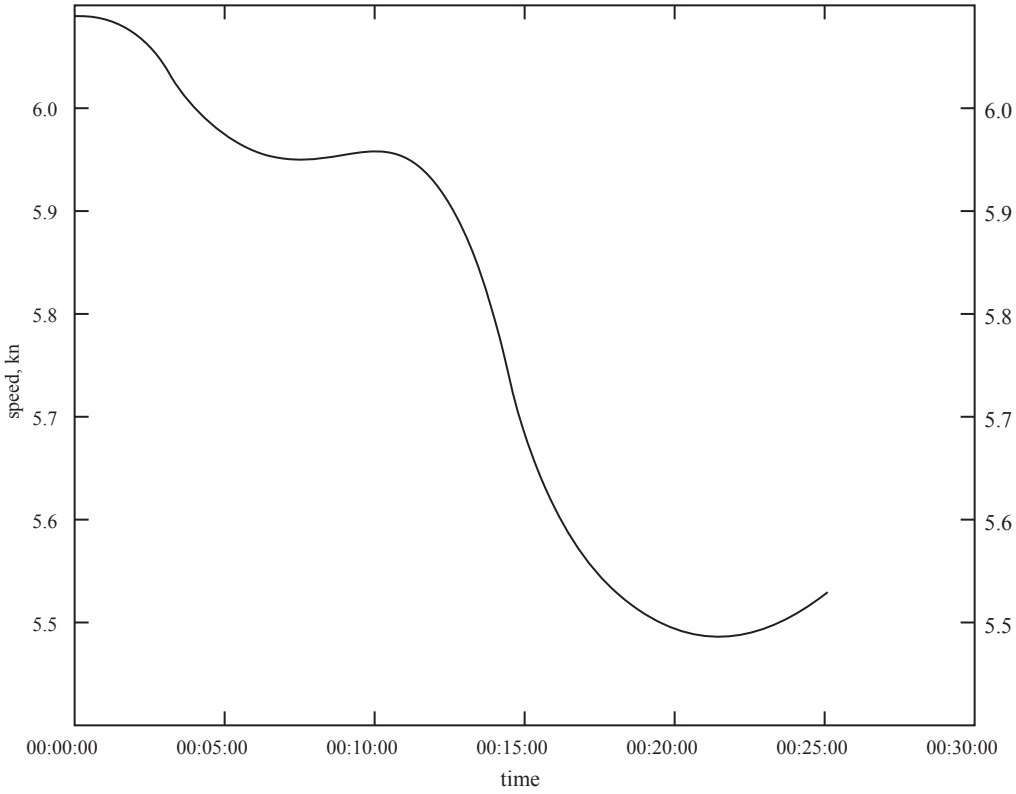


Fig. 31. Zigzag test 10°–10° Slow Speed. Speed plot.

Zigzag 20°–20°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 20.0
Committed heading, deg 20.0

Performance

First overshoot angle, deg 14.5
Second overshoot angle, deg 18.5

time	rudder	heading	speed	turn rate
s	deg	kn	deg	deg/min
00:00:00	0	0.0	12.7	0
00:00:45	s20.0	4.8	12.7	s11.3
00:01:30	s20.0	15.2	12.5	s16.6
00:02:15	p20.0	26.6	12.1	s8.3
00:03:00	p20.0	31.2	11.9	s4.8
00:03:45	p20.0	33.9	11.9	s2.2
00:04:30	p20.0	34.3	11.9	p1.5
00:05:15	p20.0	31.1	11.9	p7.6
00:06:00	p20.0	23.2	11.9	p13.2
00:06:45	p20.0	11.4	11.7	p18.3
00:07:30	p20.0	-4.0	11.2	p22.7
00:08:15	p6.7	-22.5	10.5	p25.3
00:09:00	s20.0	-32.6	9.9	p6.7
00:09:45	s20.0	-36.3	9.8	p3.6
00:10:30	s20.0	-38.2	9.9	p1.4
00:11:15	s20.0	-38.5	10.1	s1.6

Table 15. Zigzag 20°–20°.

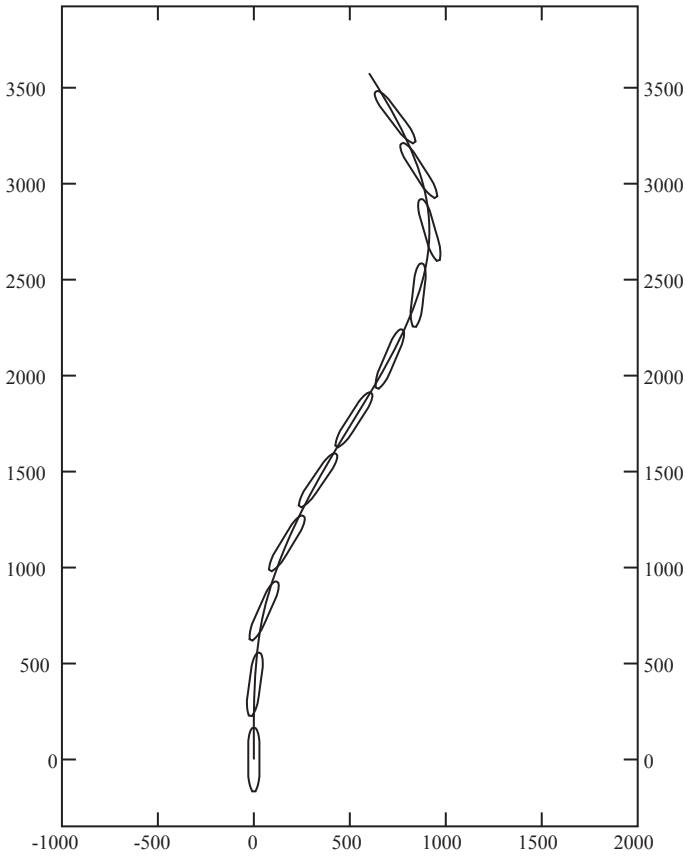


Fig. 32. Zigzag 20°–20°. Ship position plot.

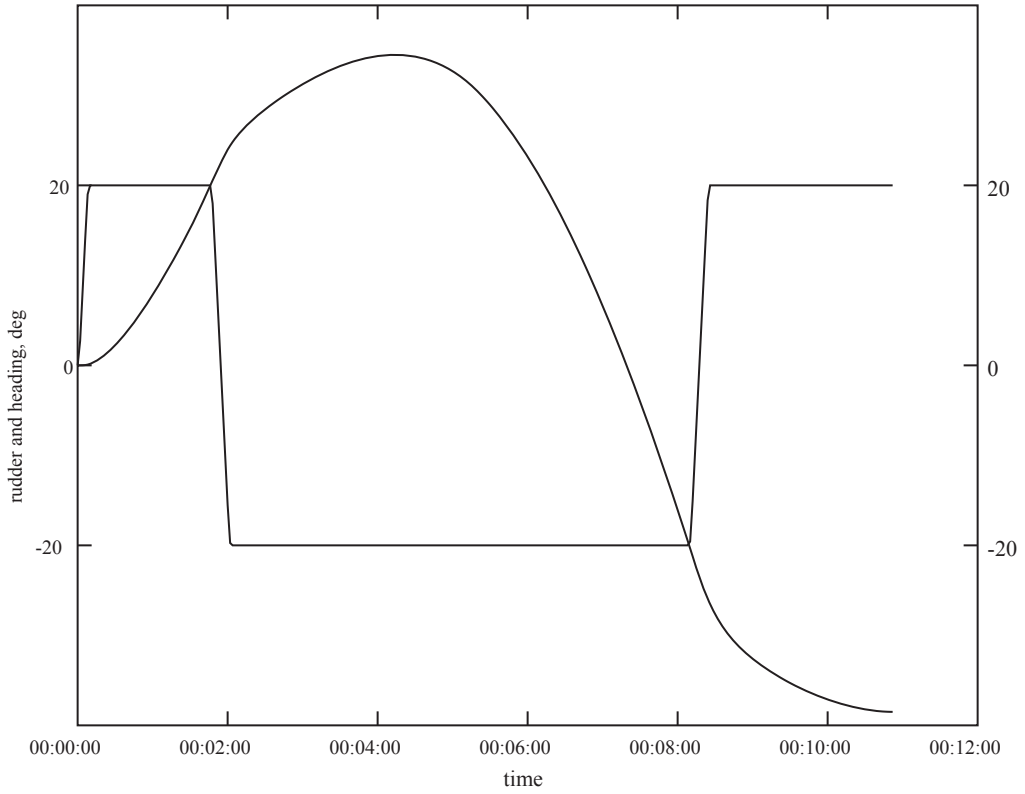


Fig. 33. Zigzag test 20°–20°. Rudder and heading plot.

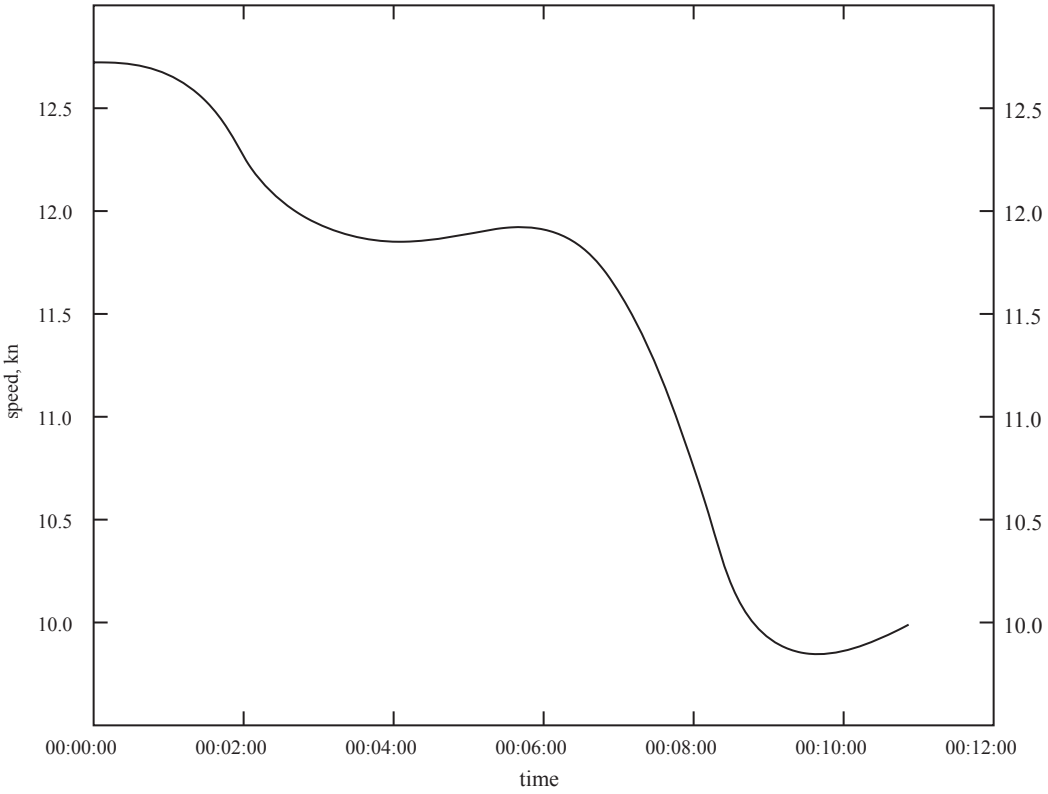


Fig. 34. Zigzag test 20°–20°. Speed plot.

Pull Out

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0

Rudder

From, deg 0.0
To, deg 10.0
And then to, deg 0.0

time	rudder	heading	turn rate
s	deg	deg	deg/min
00:00:00	0	0.0	0
00:00:05	s9.1	0.0	s1.2
00:00:10	s10.0	0.2	s3.5
00:00:15	s10.0	0.6	s5.3
00:00:20	s10.0	1.1	s6.7
00:00:25	s10.0	1.7	s7.9
00:00:30	s10.0	2.4	s9.0
00:00:35	s10.0	3.2	s10.0
00:00:40	s10.0	4.1	s10.9
00:00:45	s10.0	5.0	s11.7
00:00:50	s10.0	6.0	s12.5
00:00:55	s10.0	7.1	s13.2
00:01:00	s10.0	8.2	s13.9
00:01:05	s10.0	9.4	s14.6
00:01:10	s5.6	10.7	s15.0
00:01:15	0	11.8	s13.5
00:01:20	0	12.9	s12.6
00:01:25	0	14.0	s12.2
00:01:30	0	15.0	s12.2
00:00:00	0	0.0	0
00:00:05	p9.1	0.0	p1.4
00:00:10	p10.0	-0.3	p3.8
00:00:15	p10.0	-0.7	p5.7

00:00:20	p10.0	-1.2	p7.2
00:00:25	p10.0	-1.9	p8.5
00:00:30	p10.0	-2.6	p9.6
00:00:35	p10.0	-3.5	p10.6
00:00:40	p10.0	-4.4	p11.5
00:00:45	p10.0	-5.4	p12.4
00:00:50	p10.0	-6.4	p13.2
00:00:55	p10.0	-7.6	p13.9
00:01:00	p10.0	-8.8	p14.7
00:01:05	p9.6	-10.0	p15.4
00:01:10	p0.2	-11.3	p14.7
00:01:15	0	-12.4	p13.4
00:01:20	0	-13.5	p12.8
00:01:25	0	-14.6	p12.6

Table 16. Pull Out.

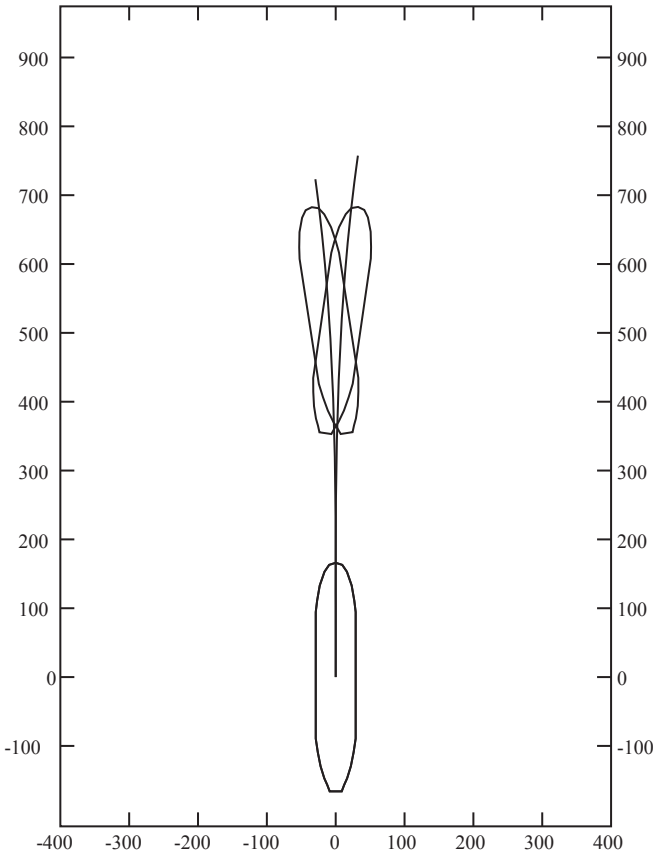


Fig. 35. Pull Out. Ship position plot.

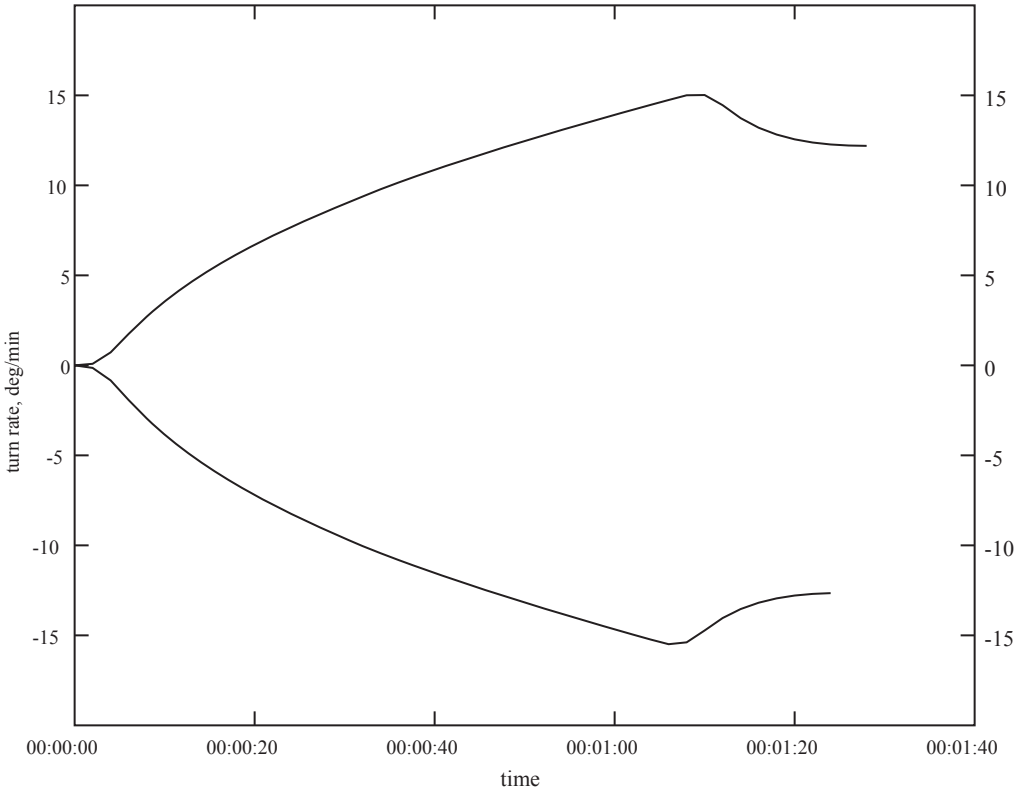


Fig. 36. Pull Out plot.

Environment

Environment

Water depth, H/T	∞
Wind speed, m/s	0.0
Water current speed, kn	0.0

Controls

Machinery telegraph setting%	80.0
Rudder, deg	s35.0, s30.0, s25.0, s20.0, s15.0, s10.0, s5.0, s4.0, s3.0, s2.0
	s1.0, s0.0, p1.0, p2.0, p3.0, p4.0, p5.0, p10.0, p15.0, p20.0
	p25.0, p30.0, p35.0, p30.0, p25.0, p20.0, p15.0, p10.0, p5.0, p4.0
	p3.0, p2.0, p1.0, p0.0, s1.0, s2.0, s3.0, s4.0, s5.0, s10.0
	s15.0, s20.0, s25.0, s30.0, s35.0

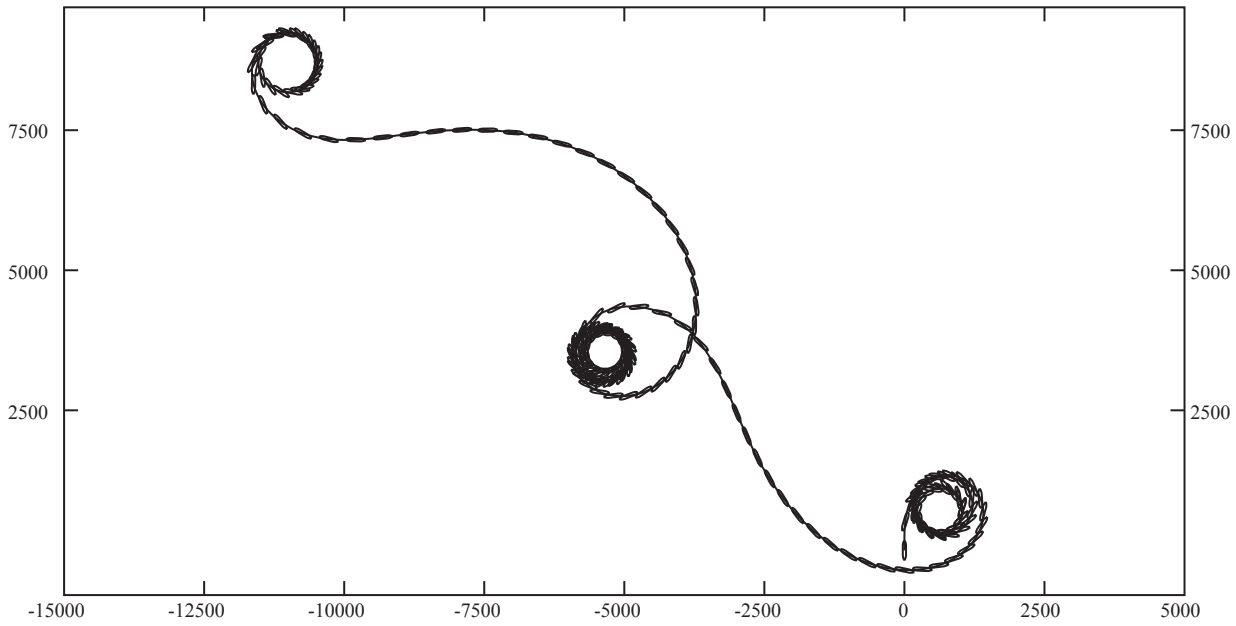


Fig. 37. Spiral test. Ship position plot.

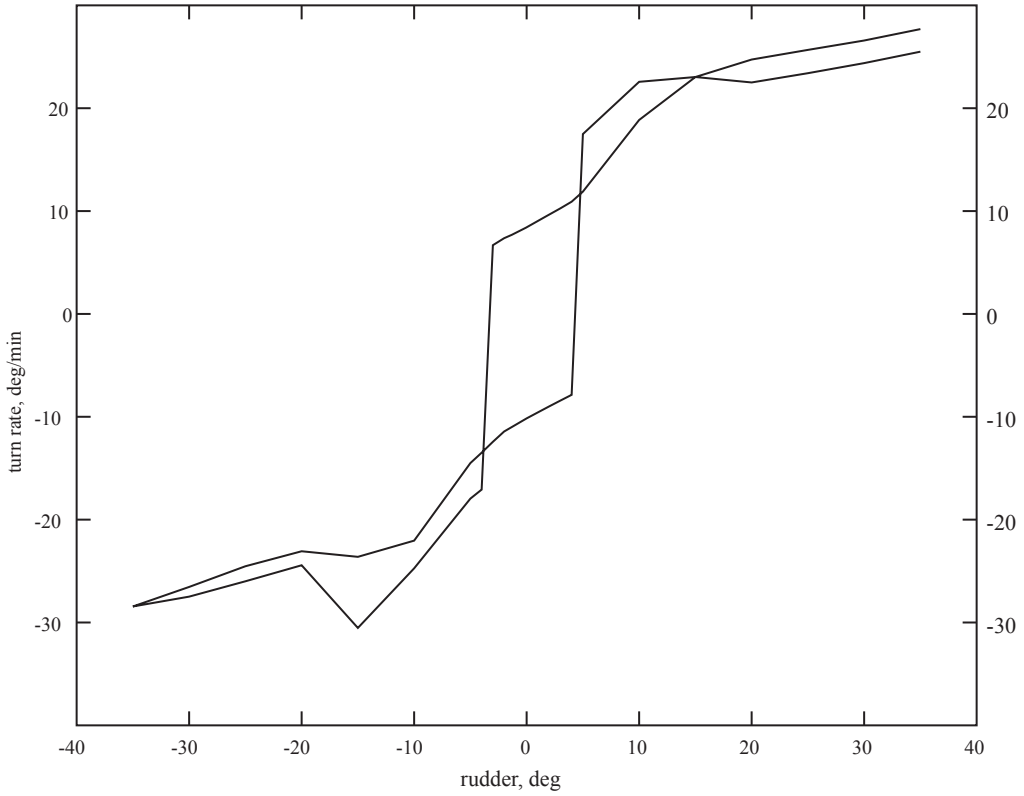


Fig. 38. Spiral test. Equilibrium turn rate plot

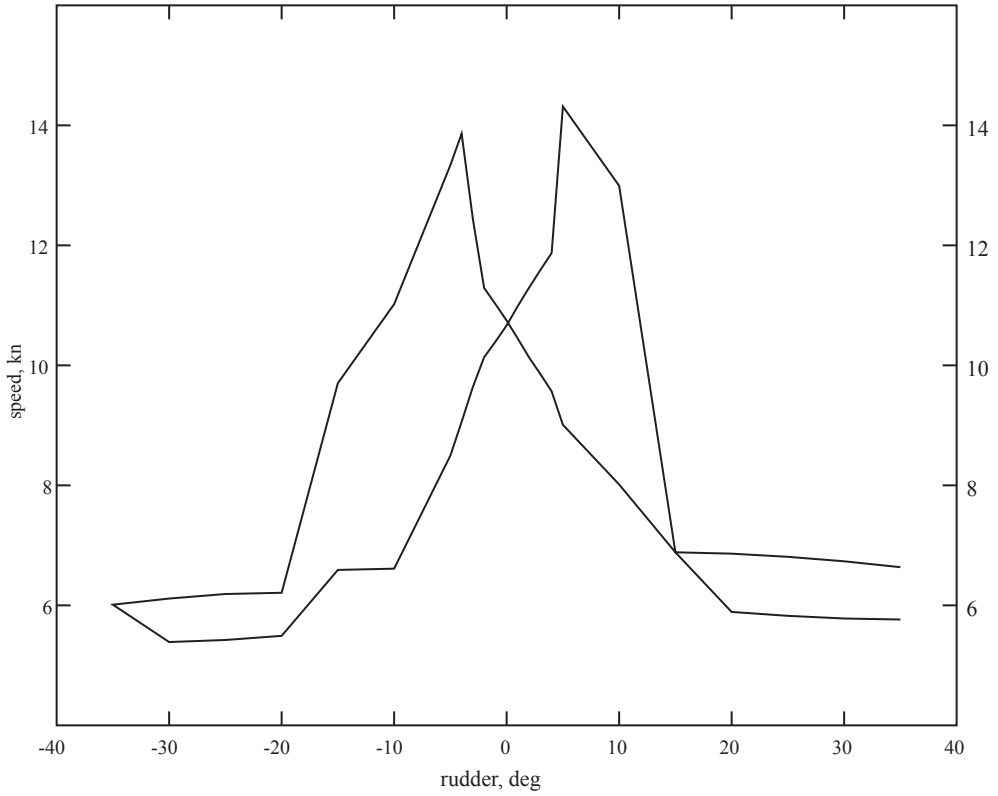
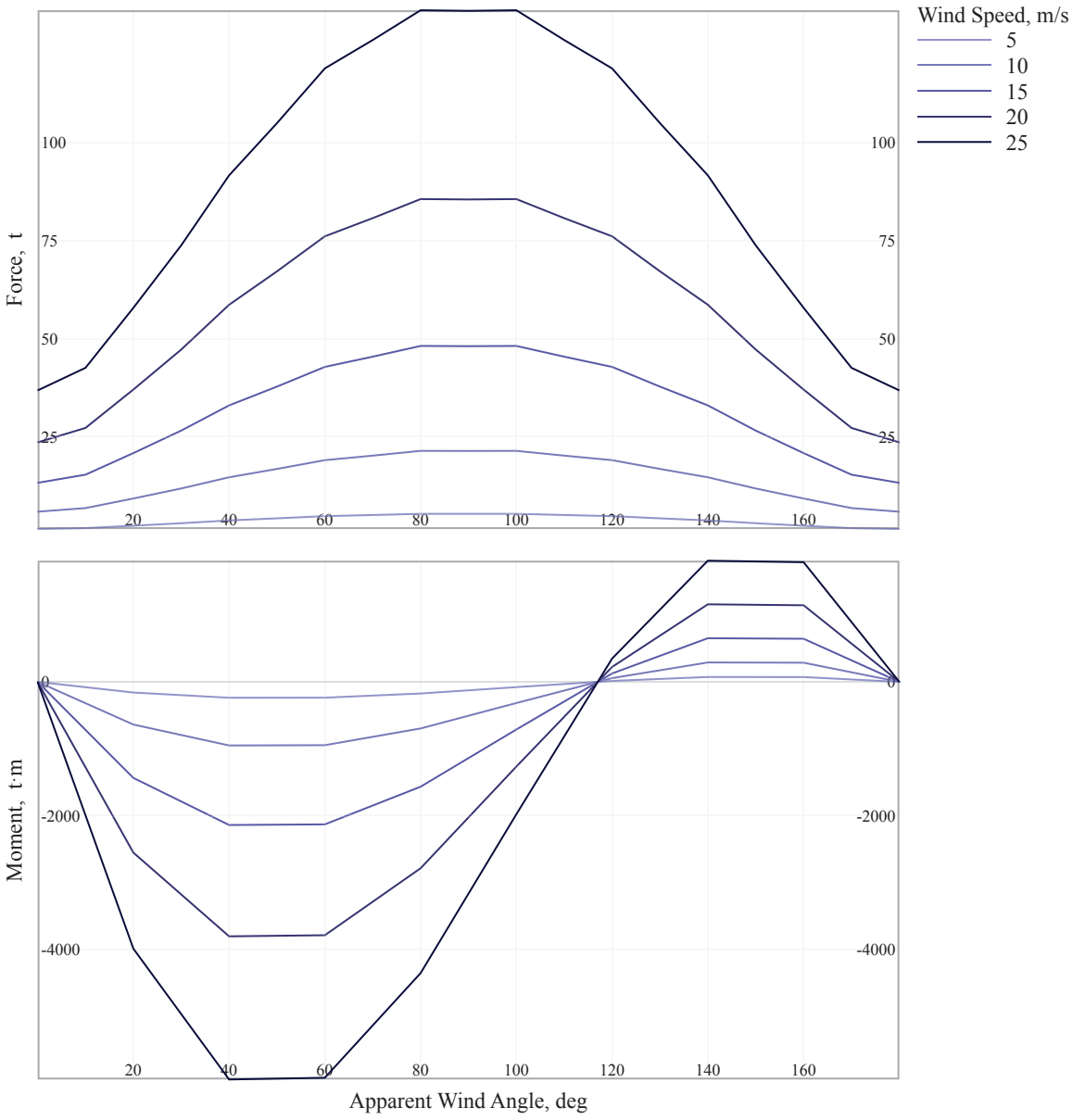


Fig. 39. Spiral test. Equilibrium speed plot

Wind Forces


Wind Speed, m/s
5
10
15
20
25
Force, t
100
75
50
25
20
40
60
80
100
120
140
160
Moment, t·m
0
-2000
-4000
Apparent Wind Angle, deg

Williamson Turn

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Rudder, deg 35.0
Committed heading, deg 25.4

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	16.8	0.0	0	0
00:01:00	16.5	16.8	s30.1	s10.0
00:02:00	14.9	42.9	s9.1	s12.3
00:03:00	14.7	46.8	p1.5	s5.8
00:04:00	14.9	35.3	p23.1	p4.9
00:05:00	13.4	-2.9	p49.3	p19.8
00:06:00	10.3	-47.3	p39.6	p25.2
00:07:00	8.3	-83.6	p33.6	p26.3
00:08:00	7.2	-115.4	p30.5	p26.6
00:09:00	6.5	-145.0	p28.8	p26.7
00:10:00	6.1	-169.5	p9.9	p22.5
00:11:00	6.7	-176.4	p4.7	p14.8
00:12:00	7.6	-179.6	p2.0	p9.1
00:13:00	8.6	179.2	p0.6	p5.4
00:14:00	9.5	179.1	s0.1	p2.9
00:15:00	10.4	179.2	s0.3	p1.3
00:16:00	11.1	179.5	s0.3	p0.5
00:17:00	11.8	179.7	s0.2	p0.1

Table 20. Williamson Turn.

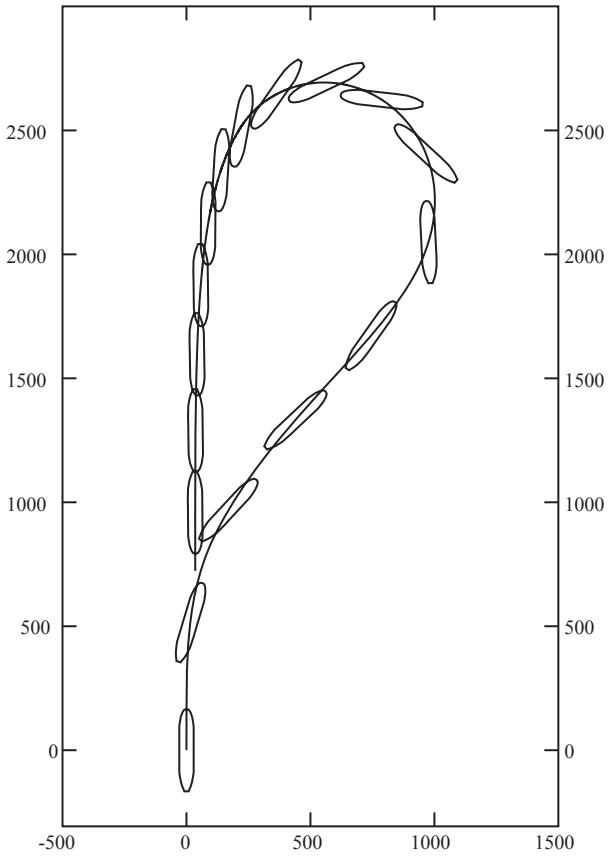


Fig. 44. Williamson Turn. Ship position plot.

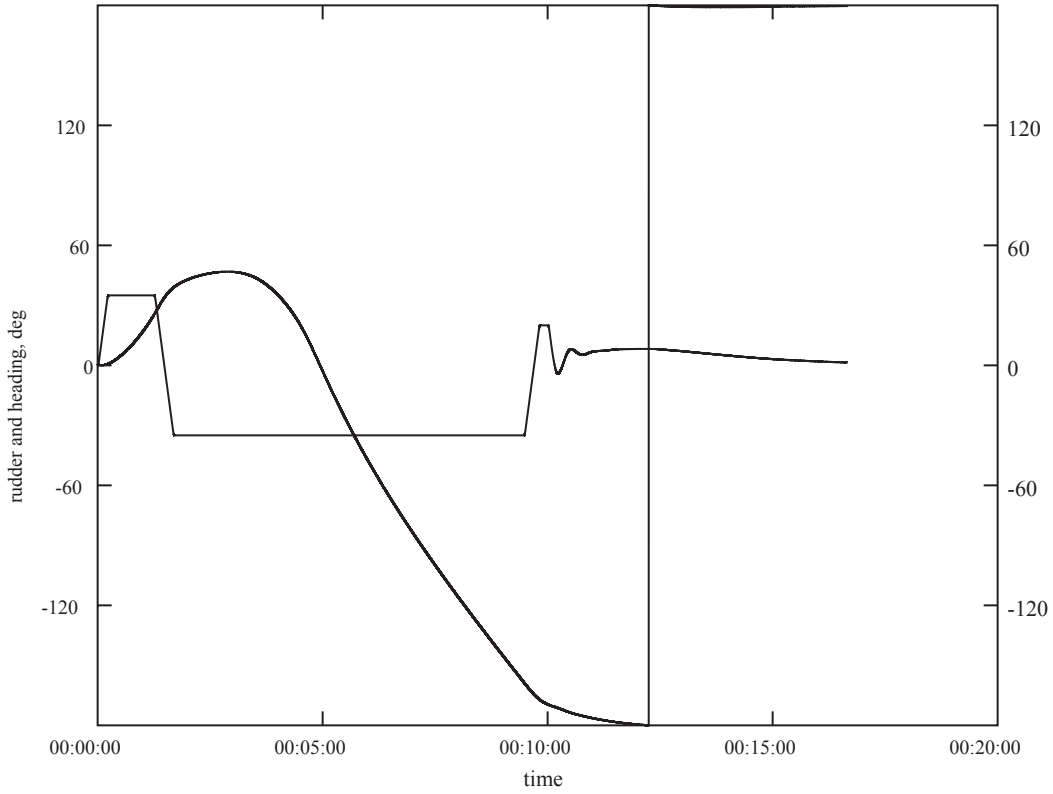


Fig. 45. Williamson Turn. Rudder and heading plot.

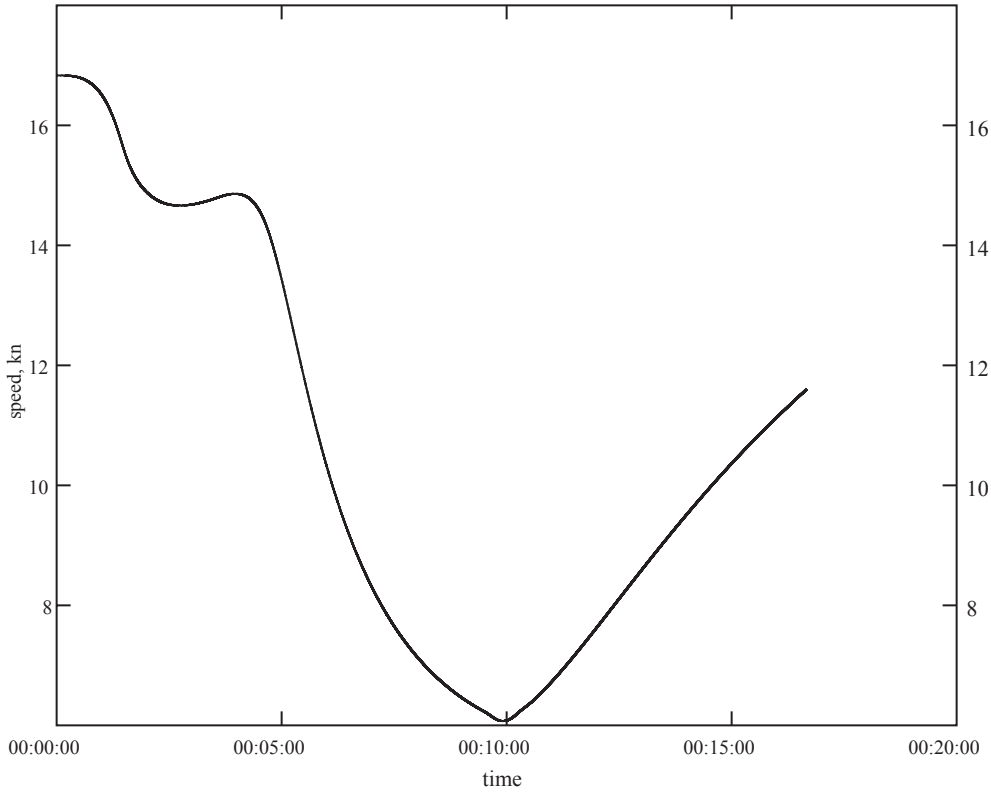


Fig. 46. Williamson Turn. Speed plot.

Wind Effect—Stopped

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	0.0	0.0	s180.0
00:00:20	0.1	0.1	s90.2
00:00:40	0.1	0.6	s90.5
00:01:00	0.2	1.2	s90.9
00:01:20	0.2	2.2	s91.6
00:01:40	0.3	3.2	s92.4
00:02:00	0.3	4.5	s93.4
00:02:20	0.4	5.8	s94.4
00:02:40	0.4	7.2	s95.5
00:03:00	0.5	8.5	s96.6
00:03:20	0.5	9.9	s97.8
00:03:40	0.5	11.1	s98.9
00:04:00	0.6	12.3	s99.9
00:04:20	0.6	13.4	s100.9
00:04:40	0.6	14.4	s101.9
00:05:00	0.6	15.3	s102.7

Table 21. Wind effect—stopped.

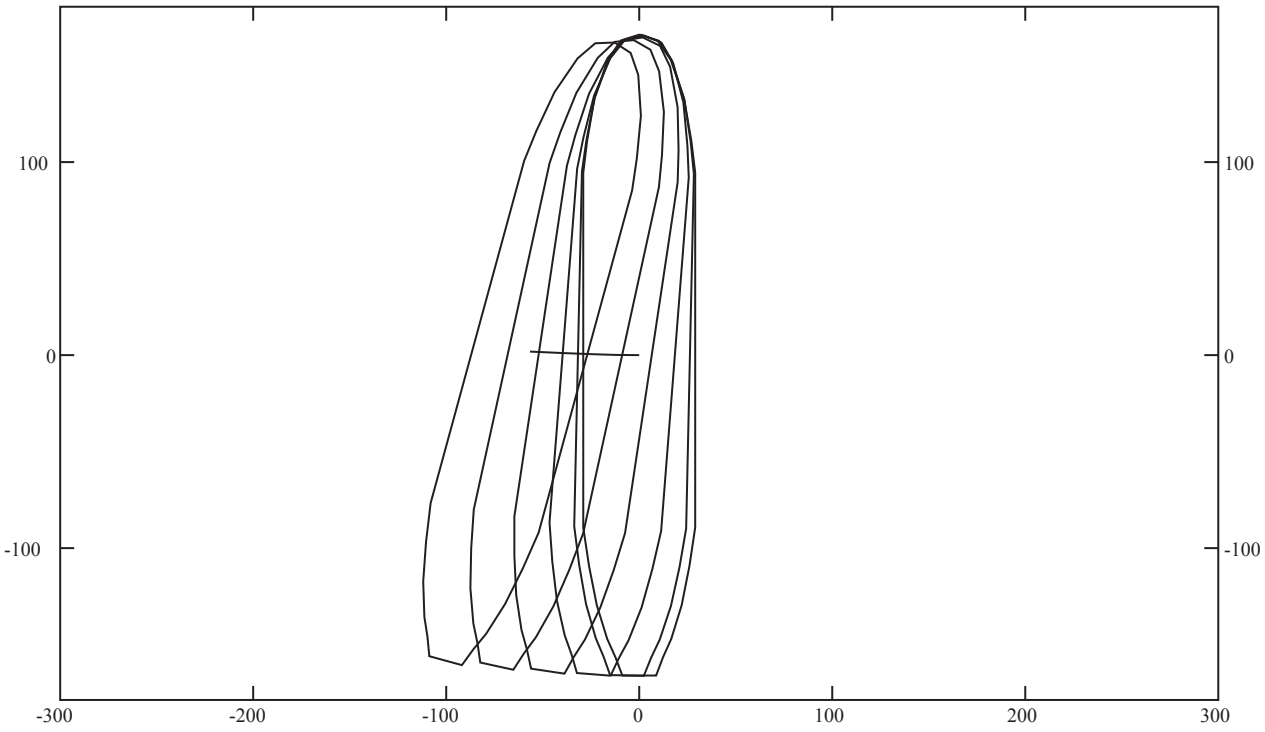


Fig. 47. Wind effect—stopped. Ship position plot.

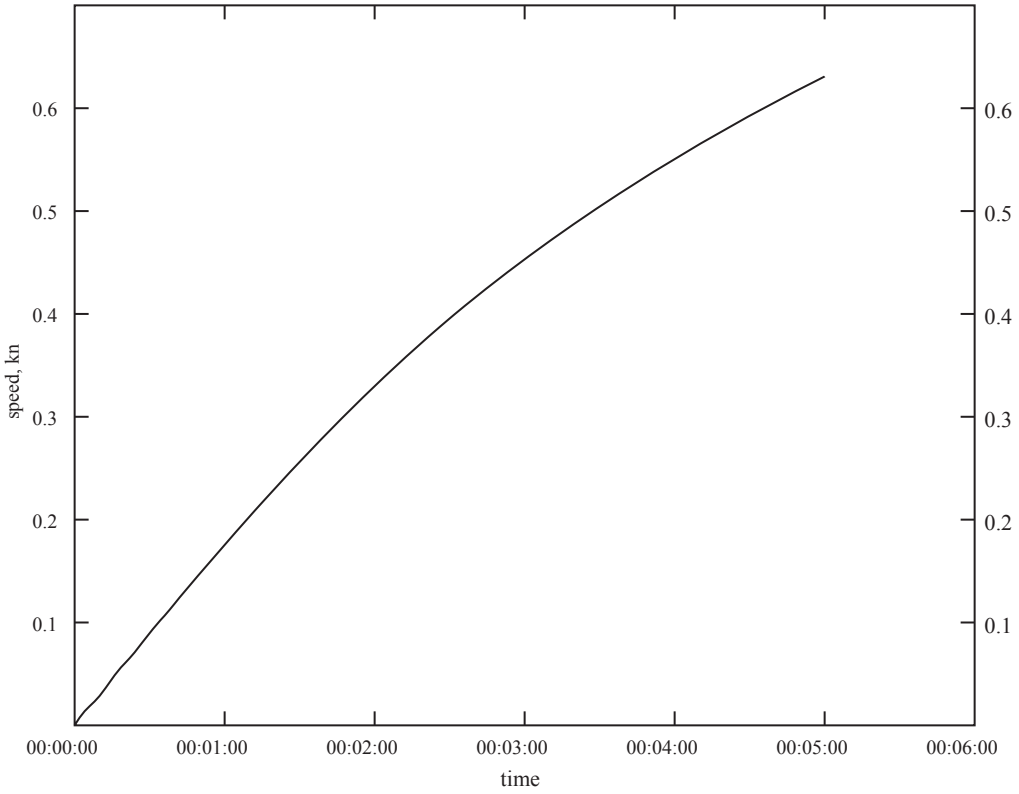


Fig. 48. Wind effect—stopped. Speed plot.

Wind Effect—Under Way

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	16.7	0.0	0
00:00:20	16.7	0.0	s0.2
00:00:40	16.7	0.1	s0.4
00:01:00	16.7	0.4	s0.7
00:01:20	16.7	1.0	s1.0
00:01:40	16.7	1.7	s1.4
00:02:00	16.7	2.8	s1.9
00:02:20	16.7	4.1	s2.4
00:02:40	16.6	5.9	s3.1
00:03:00	16.6	8.1	s3.8
00:03:20	16.5	10.8	s4.6
00:03:40	16.5	13.9	s5.5
00:04:00	16.4	17.4	s6.5
00:04:20	16.3	21.3	s7.4
00:04:40	16.1	25.6	s8.4
00:05:00	15.9	30.0	s9.1

Table 22. Wind effect—under way.

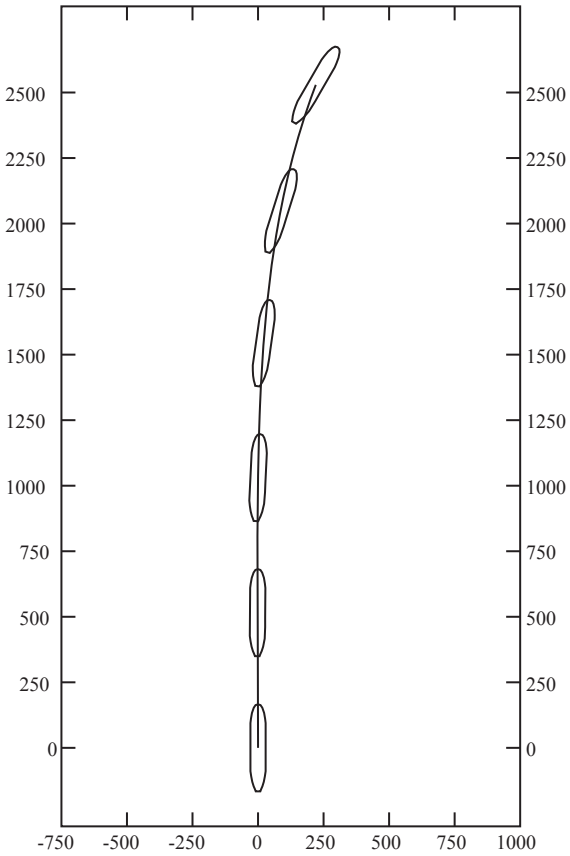


Fig. 49. Wind effect—under way. Ship position plot.

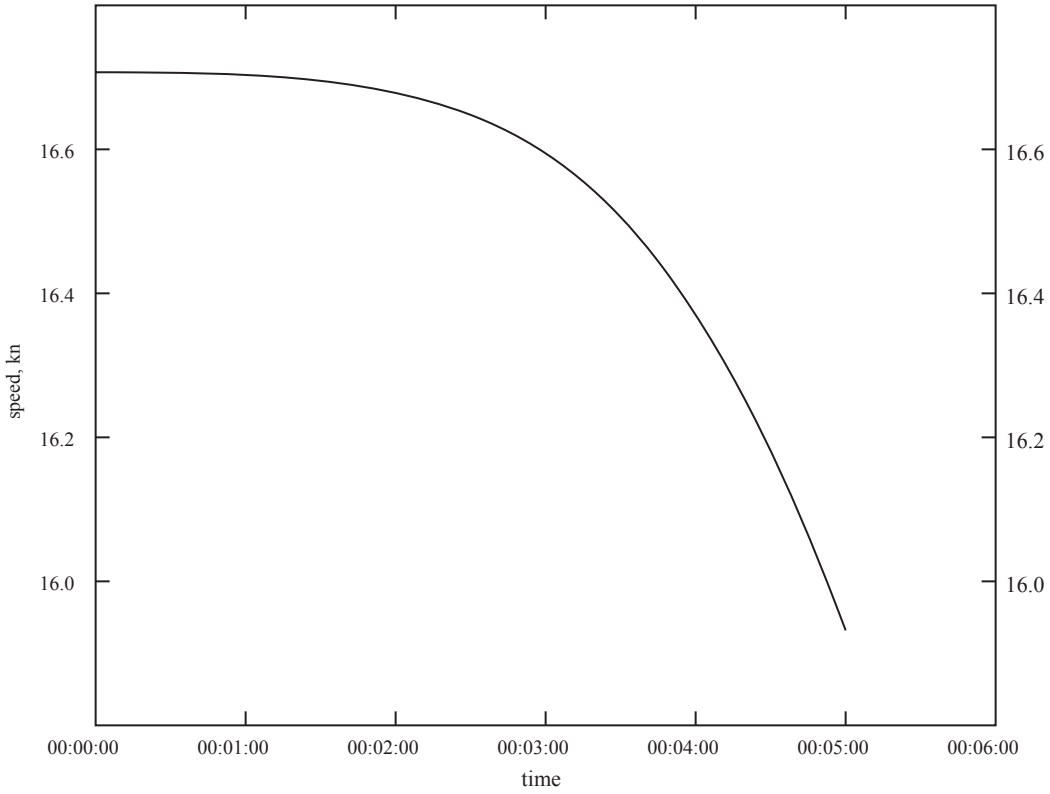


Fig. 50. Wind effect—under way. Speed plot.

Free Oscillations

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0
Wave height, m 0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

Initial Inclination

Roll, deg 10.0
Pitch, deg 5.0
Heave, m 0

time	roll	pitch	heave
s	deg	deg	m
00:00:00	10.0	5.0	0.0
00:00:05	-3.8	-1.1	-0.1
00:00:10	-2.0	0.1	0.2
00:00:15	3.9	0.0	0.0
00:00:20	-2.6	0.0	0.0
00:00:25	0.3	0.0	0.0
00:00:30	1.2	0.0	0.0
00:00:35	-1.4	0.0	0.0
00:00:40	0.6	0.0	0.0
00:00:45	0.2	0.0	0.0
00:00:50	-0.5	0.0	0.0
00:00:55	0.4	0.0	0.0
00:01:00	-0.1	0.0	0.0
00:01:05	-0.2	0.0	0.0
00:01:10	0.2	0.0	0.0
00:01:15	-0.1	0.0	0.0
00:01:20	0.0	0.0	0.0
00:01:25	0.1	0.0	0.0
00:01:30	-0.1	0.0	0.0
00:01:35	0.0	0.0	0.0
00:01:40	0.0	0.0	0.0

Table 23. Free Oscillations.

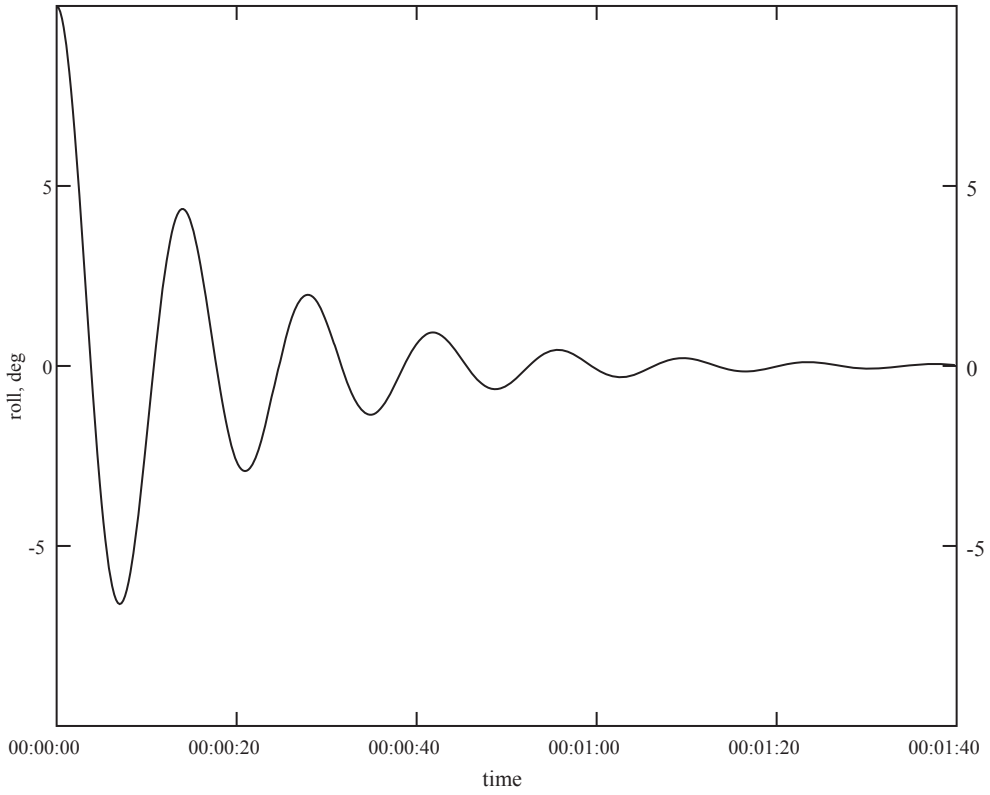


Fig. 51. Free Oscillations. Roll plot.

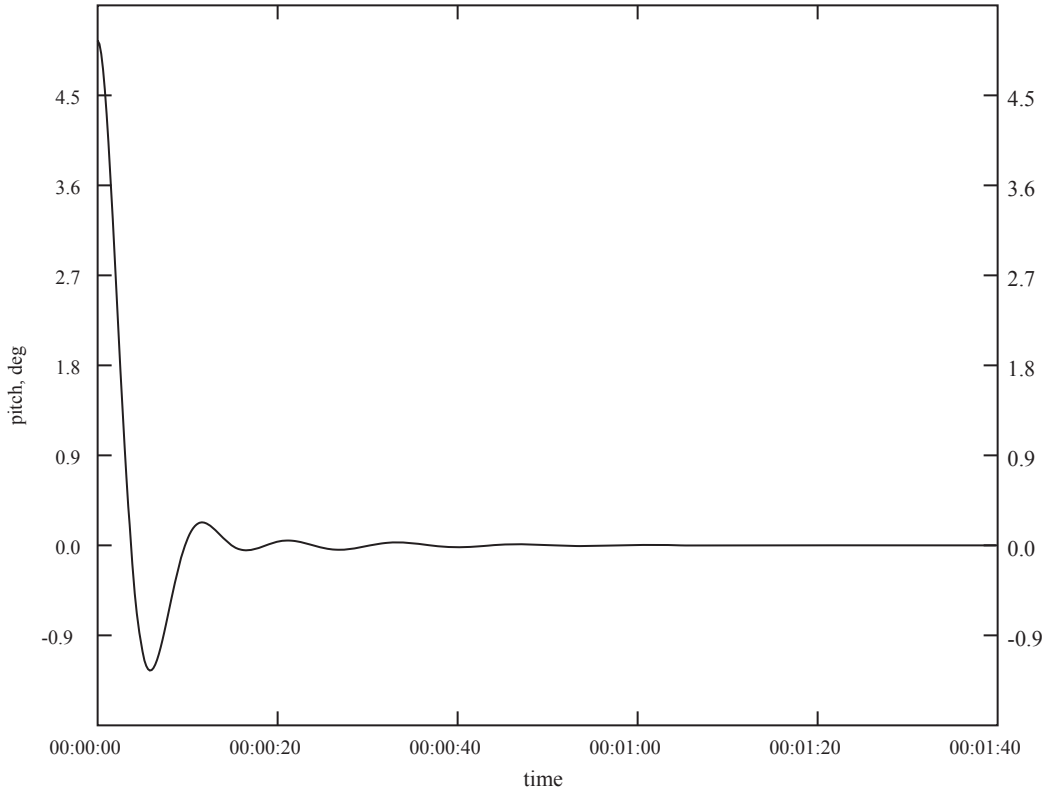


Fig. 52. Free Oscillations. Pitch plot.

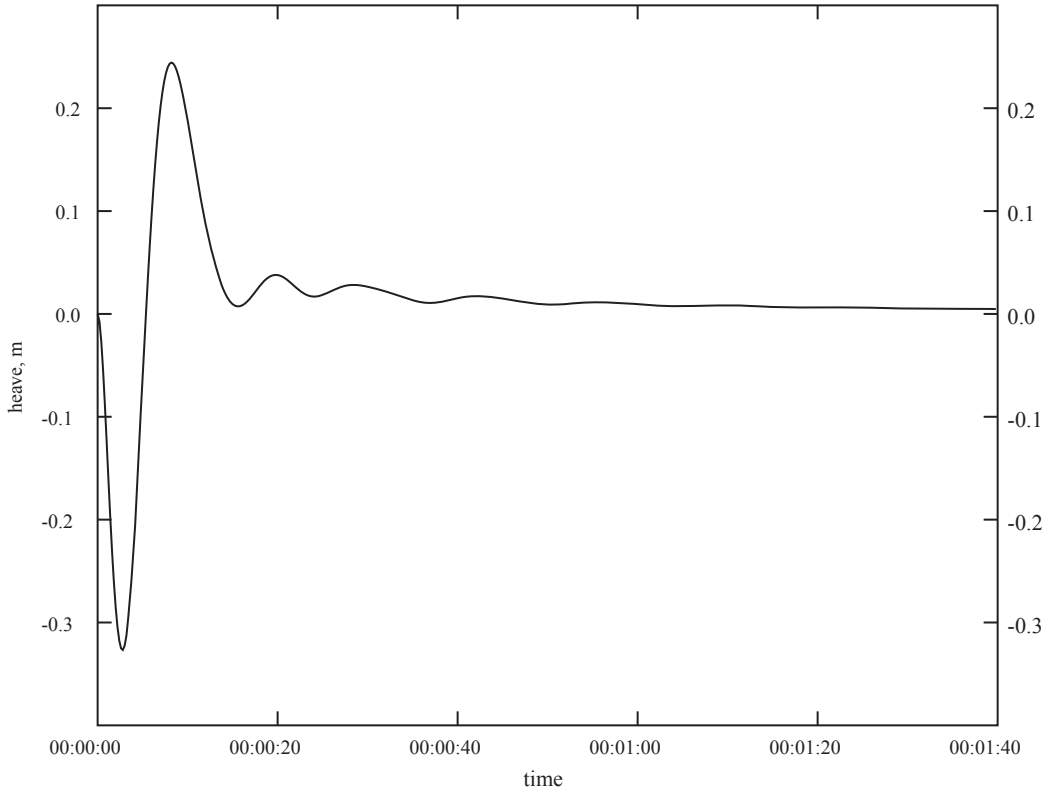


Fig. 53. Free Oscillations. Heave plot.

PILOT CARD

VLCC18L
Version 6

Ship's name Elizabeth I. Angelicoussi

Call Sign SZHJ **Deadweight** 306200 tonnes **Year built** 2004

Draught aft 22.49 m / 73 ft 9 in **Forward** 22.49 m / 73 ft 9 in **Displacement** 349000 tonnes

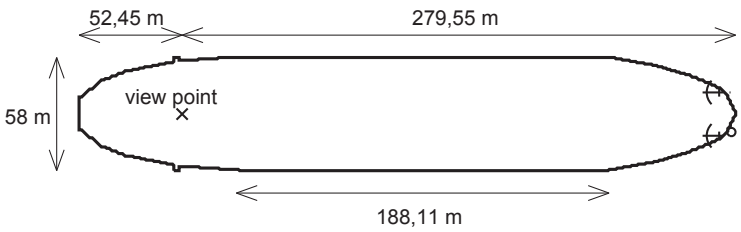
SHIP'S PARTICULARS

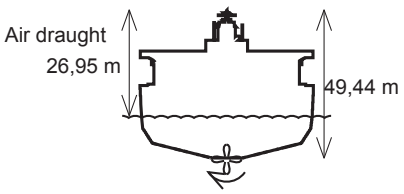
Length overall 332 m **Anchor chain:** **Port** 28.1 shackles **Starboard** 28.1 shackles

Breadth 58 m

Bulbous bow Yes

(1 shackle = 27,432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 29431 kW (40015 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	76.0	N/A	16.8	N/A
Full Ahead	**0.8**	57.0	N/A	12.7	N/A
Half Ahead	**0.5**	47.0	N/A	10.4	N/A
Slow Ahead	**0.25**	33.0	N/A	7.2	N/A
Dead Slow Ahead	**0.125**	28.0	N/A	6.1	N/A
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect -0.2 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±**		°
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type**		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

WHEELHOUSE POSTER

VLCC18L
Version 6

Ship's name Elizabeth I. Angelicoussi **Call Sign** SZHJ **Gross tonnage** _____ **Net tonnage** _____

Max. Displacement 349000 tonnes, and **Deadweight** 306200 tonnes, and **Block coefficient** 0.816 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Ballast
Trial / Estimated	Trial / Estimated
22.49 m forward	N/A m forward
22.49 m aft	N/A m aft

STEERING PARTICULARS

Type of rudder(s) Normal

Maximum rudder angle 35 °

Time hard-over to hard-over

with one power unit 50 s

with two power units 25 s

Min. speed to maintain course propeller stopped _____ knots

Rudder angle for neutral effect -0.2 °

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving min / shackle
Port	28.1	0.894
Starboard	28.1	0.894
(1 shackle = 27,432 m = 15 fathoms)		

PROPULSION PARTICULARS

Type of engine Diesel , 29431 kW (40015 hp) **Type of propulsion** Propelle

Engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	**1**	76.0	N/A	16.8	N/A
Full Ahead	**0.8**	57.0	N/A	12.7	N/A
Half Ahead	**0.5**	47.0	N/A	10.4	N/A
Slow Ahead	**0.25**	33.0	N/A	7.2	N/A
Dead Slow Ahead	**0.125**	28.0	N/A	6.1	N/A
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

Critical revolutions 20 rpm

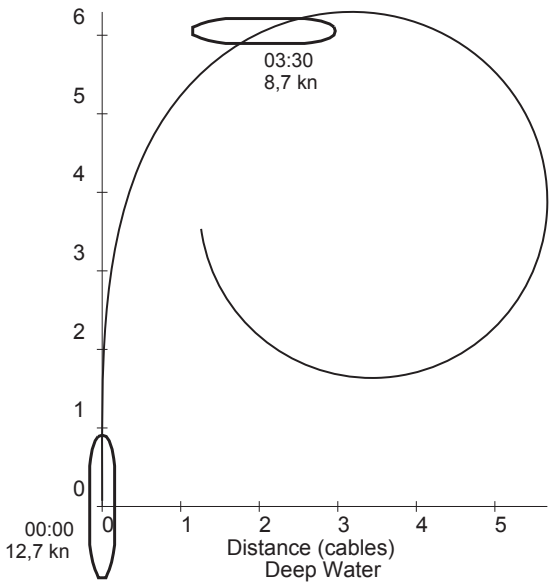
THRUSTER EFFECT at trial conditions

Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	N/A	N/A	N/A	N/A	N/A
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

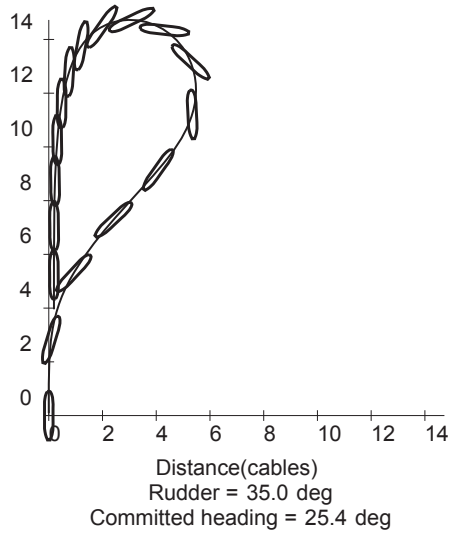
DRAUGHT INCREASE (LOADED)

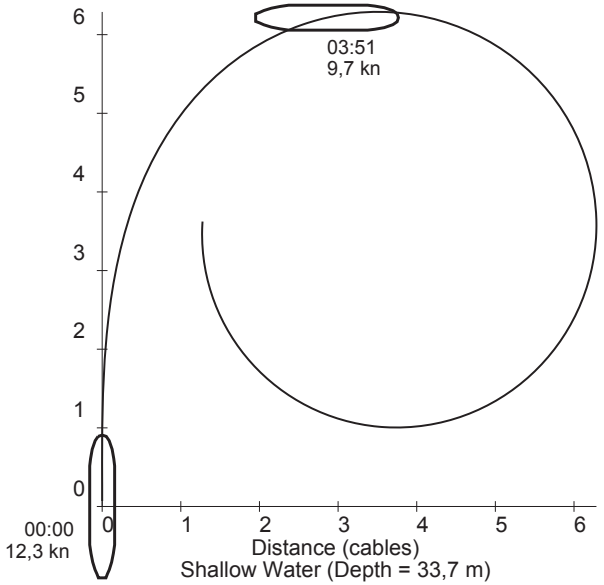
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
22.5	7.2	0.09
	10.2	0.16
	16.0	0.36
11.2	7.2	0.11
	10.2	0.20

TURNING CIRCLES AT MAX. RUDDER ANGLE (35 °)

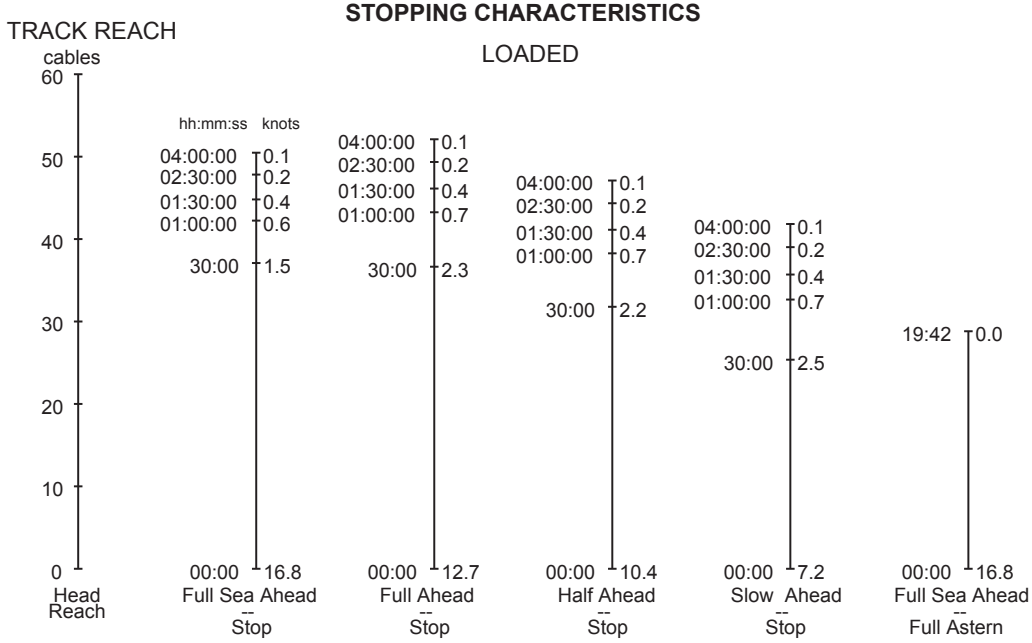


WILLIAMSON TURN



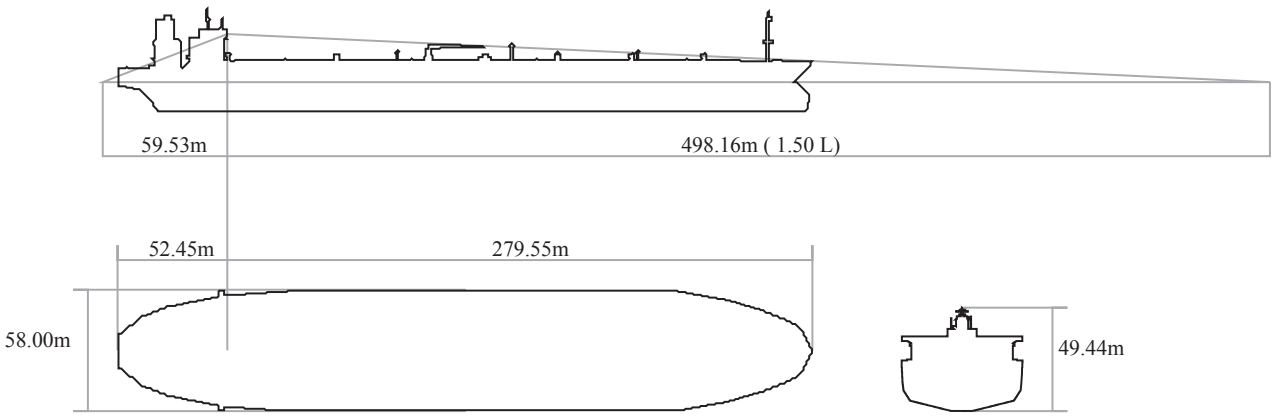


STOPPING CHARACTERISTICS



PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE





Description of Ship Model

VLCC18Q1

Tanker
Elizabeth I. Angelicoussi
QLoaded

Version 1

© 2019 Kongsberg Digital
All rights reserved
No part of this work covered by the copyright hereon may be reproduced or otherwise copied without prior written permission of Kongsberg Digital

Table of Contents

General Description 6
Ship Data 7
Blind Zone 9
Speed 10
Statistics 11
Acceleration 14
Acceleration from Slow to Half 17
Crash Stop 20
Deceleration from Half to Slow 23
Coasting Stop 26
Time for effective changes in telegraph settings in stopping conditions 29
Turning Circle Starboard, Deep Water 30
Turning Circle Starboard, Shallow Water 33
Turning Circle Port, Deep Water 36
Accelerated Turning 39
Coasting Circle 42
Course Change Manoeuvre 45
Zigzag 10°–10° 48
Zigzag 10°–10° Slow Speed 52
Zigzag 20°–20° 56
Pull Out 60
Spiral Test 63
Wind Forces 66
Williamson Turn 67
Wind Effect—Stopped 71
Wind Effect—Under Way 74
Free Oscillations 77

Model Identification

VLCC18Q represents the 306,230 DWT VLCC M/T *Elizabeth I. Angelicoussi partially loaded at 15.85m draft*. *Elizabeth I. Angelicoussi* was built by Daewoo Shipbuilding & Marine Engineering Co. Ltd., Koje, Republic of Korea in 2004.

Revision History

Ver 0 WH
Aug 06, 2019

Ver 1 WH
Aug 07, 2019

Model Sources

The modelling of VLCC18Q was based on the information of 300K DWT VLCC from

- National Seoul University Open Courseware
- SIMMAN 2014 Proceedings
- Fairplay ship information sheet of Elizabeth I. Angelicoussi

The original source informaton for modeling VLCC18Q was not available.

References

- "Propulsion Trends in Container Vessels", MAN B&W Diesel A/S. Copenhagen, Denmark.
- "Standards for Ship Manoeuvrability", Resolution MSC.137(76), adopted on 4 December 2002. Web site: http://www.navcen.uscg.gov/marcomms/imo/msc_resolutions/Resolution%20MSC.137(76).pdf
- Inoue, S., et al, "A Practical Calculation Method of Ship Maneuvering Motion", International shipbuilding Progress, Vol. 28, #325, Sept., '81.
- Crane, C. L., Maneuvering Trials of te 278,000 DWT ESSO OSAKA in Shallow and Deep Waters, U. S. Maritime Admin. Rept No. MA-RD-940-79108, Jan. 1979

General Description

Power Plant

VLCC18Q1 Tanker Elizabeth I. Angelicoussi is powered by 1 diesel engine rating 29431 kW at 76 rpm.

Propulsors

VLCC18Q1 is propelled by 1 fixed pitch propeller. Direction of propulsor revolution is right.

Speed

Top speed of VLCC18Q1 at 100% throttle setting and calm conditions is 17.5 kn ahead and 8.7 kn astern.

Rudders

This ship is steered with 1 rudder with maximum angle 35 deg. The rudder uses 25.0 s from full port to full starboard.

Thrusters

This ship has no auxilliary thrusters.

Stopping Ability

Stopping performance can be judged from crash stop manoeuvre. Crash stop distance of VLCC18Q1 is 3701 m which makes 11.6 ship lengths. Such crash stop performance is fair and satisfies IMO's requirements as described in IMO Resolution MCS.137(76) Standards for Ship Manoeuverability.

Turning Ability

The turning ability may be judged from turning circles. Turning cirlce test performed at 100% throttle setting and 35 deg starboard steering order results in advance 940 m or 2.9 ship's length and tactical diameter 958 m or 3.0 ship's length. Turning ability of VLCC18Q1 is good and satisfies IMO's requirements.

Manoeuvring Ability

Zigzag test performed at 80% throttle setting show first overshoot angle 5.4 deg in the 10-10° test and 9.9 deg in the 20-20° test. Zigzag test results indicate that manouevring ability of VLCC18Q1 is fair and satisfies IMO's Resolution MCS.137(76).

Steering Ability

Steering ability of VLCC18Q1 is good. The ship is course stable.

Ship Data

Identification

Model name	VLCC18Q1
Ship database file name	VLCC18Q1.sdb
Type of ship	Tanker
Loading condition	QLoaded
Ship's name	Elizabeth I. Angelicoussi

General Data

IMO#	9257149
Year Built	2004
Builder	Daewoo S&ME
Call Sign	SZHJ
MMSI	240165000
Bulbous Bow	Yes
Gross Tonnage, RT	153911
Net Tonnage, RT	107642
Deadweight, t	306229
Displacement, t	243801
Length between perpendiculars, m	320
Length overall, m	332
Beam moulded, m	58
Draught fore, m	15.9
Draught aft, m	15.9
Block coefficient	0.809
Radius of inertia, multiples of L_{pp}	0.24
Lateral windage area, m²	5720
Speed ahead, kn	17.5
Speed astern, kn	8.7
Minimum speed to maintain course with engine stopped, kn	
Transverse metacentric height, m	15

Engines

Number of engines	1
Type of engine	Diesel
Total shaft power, kW	29431
Revolutions, rpm	76.0
Stall Revolutions, rpm	76.0

Propellers

Number of propellers	1
Type of propulsion	Propeller
Max azimuting angle, deg	0.0
Max azimuting rate, deg/s	0.0
Revolutions, rpm	76.0
Direction of rotation	Clockwise
Diameter, m	9.9
Pitch, P/D @ 0.7R	0.752

Rudders

Number of rudders	1
Rudder type	Normal
Max rudder angle, deg	35.0
Max rudder rate, deg/s	2.8
Rudder area, m²	130.7
Total rudder area, % of $L_{pp}T_{\alpha}$	2.6

Bow Anchors

Number of bow anchors	2
Mass, t	17.3/17.0
Chain break load, t	1018.0

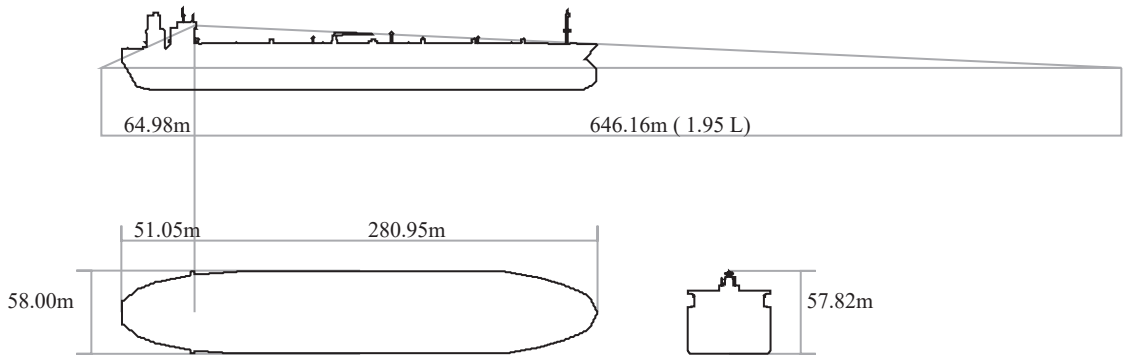
Radar Position

Longitudinal radar position, m	-121.1
Lateral radar position, m	0.0
Vertical radar position, m	-42.6

Viewpoint Position

Longitudinal viewpoint position, m	-115.4
Lateral viewpoint position, m	0.0
Vertical viewpoint position, m	29.5

Blind Zone



Speed

Throttle Setting		Propeller		Speed	
		revolutions	pitch	deep H/T = ∞	shallow H/T = 1.5
		rpm	P/D	kn	kn
Full sea speed	1	76.0	N/A	17.5	15.8
Full Ahead	0.8	57.0	N/A	13.3	12.6
Half Ahead	0.5	47.0	N/A	10.9	10.5
Slow Ahead	0.25	33.0	N/A	7.5	7.5
Dead Slow Ahead	0.125	28.0	N/A	6.3	6.3
Dead Slow Astern	-0.125	-28.0	N/A	-4.2	-4.0
Slow Astern	-0.25	-33.0	N/A	-4.9	-4.8
Half Astern	-0.5	-47.0	N/A	-7.1	-6.9
Full Astern	-1	-57.0	N/A	-8.7	-8.3

Table 1. Propeller revolutions and pitch and ship speed as function of machinery telegraph setting. Deep and shallow water.

Statistics

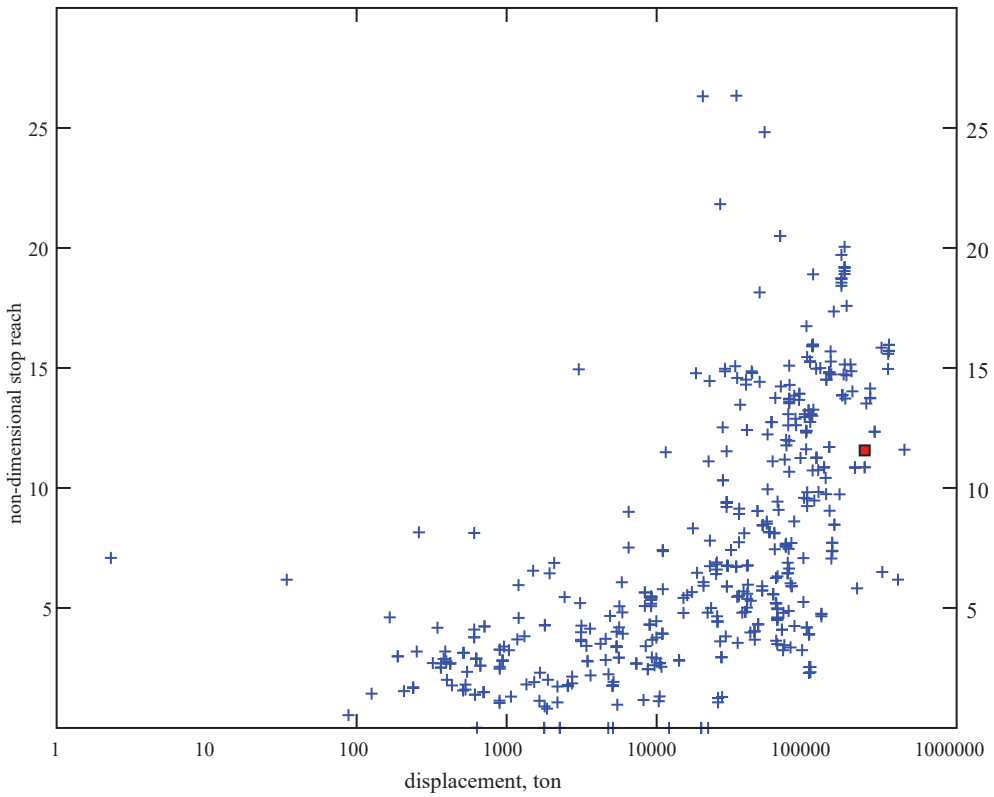


Fig. 1. Stop reach of the ship compared with other ship models.

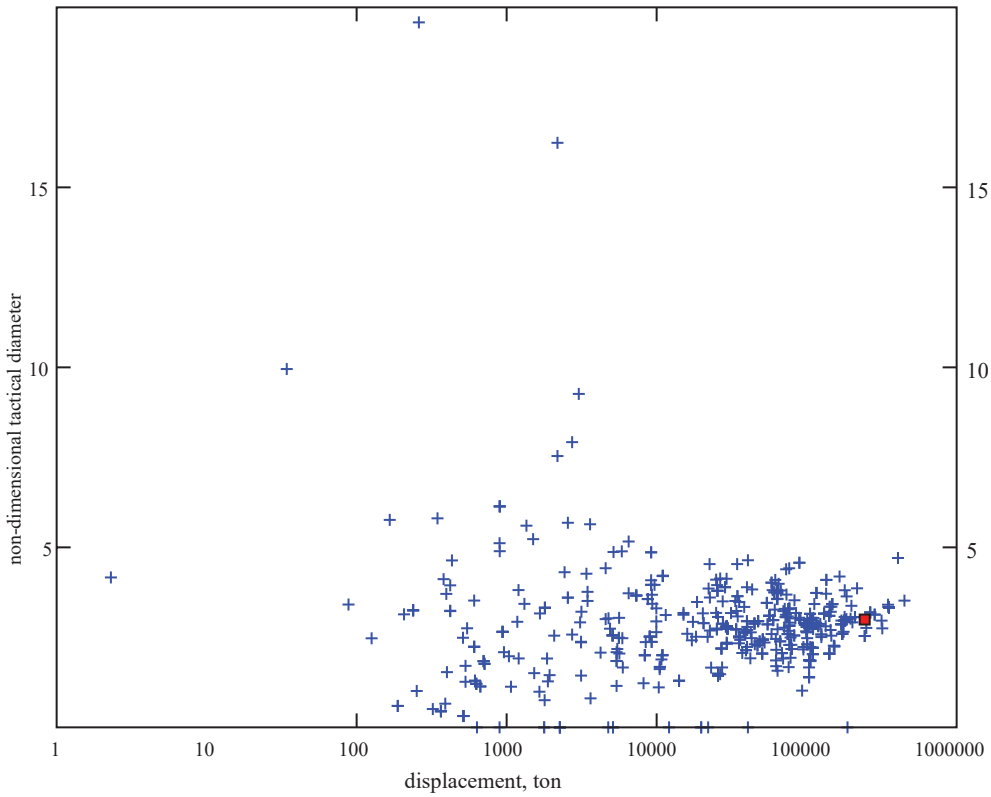


Fig. 2. Tactical diameter of the ship compared with other ship models.

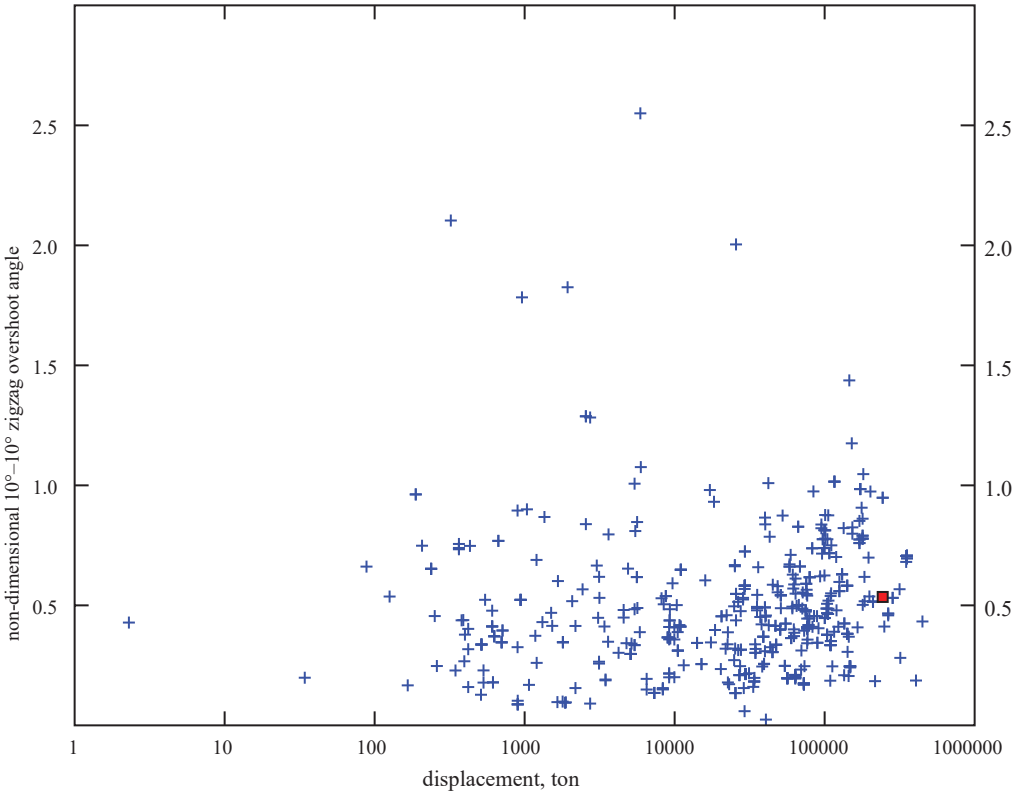


Fig. 3. Zig-zag overshoot angle of the ship compared with other ship models.

Acceleration

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 0.0
to, % 100.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	0.0	0.752	0.0	0.0
00:01:00	66.9	0.752	1.3	18.0
00:02:00	67.4	0.752	2.8	80.7
00:03:00	68.4	0.752	4.2	188.0
00:04:00	69.8	0.752	5.6	338.6
00:05:00	71.4	0.752	6.9	530.8
00:06:00	72.4	0.752	8.1	762.7
00:07:00	73.3	0.752	9.3	1031.8
00:08:00	74.2	0.752	10.4	1335.5
00:09:00	75.0	0.752	11.4	1670.9
00:10:00	75.7	0.752	12.2	2035.4
00:11:00	76.1	0.752	13.1	2426.1
00:12:00	76.1	0.752	13.8	2840.1
00:13:00	76.1	0.752	14.4	3274.1
00:14:00	76.1	0.752	14.9	3725.4
00:15:00	76.1	0.752	15.3	4191.5
00:16:00	76.1	0.752	15.7	4670.0
00:17:00	76.1	0.752	16.0	5158.0

Table 2. Acceleration.

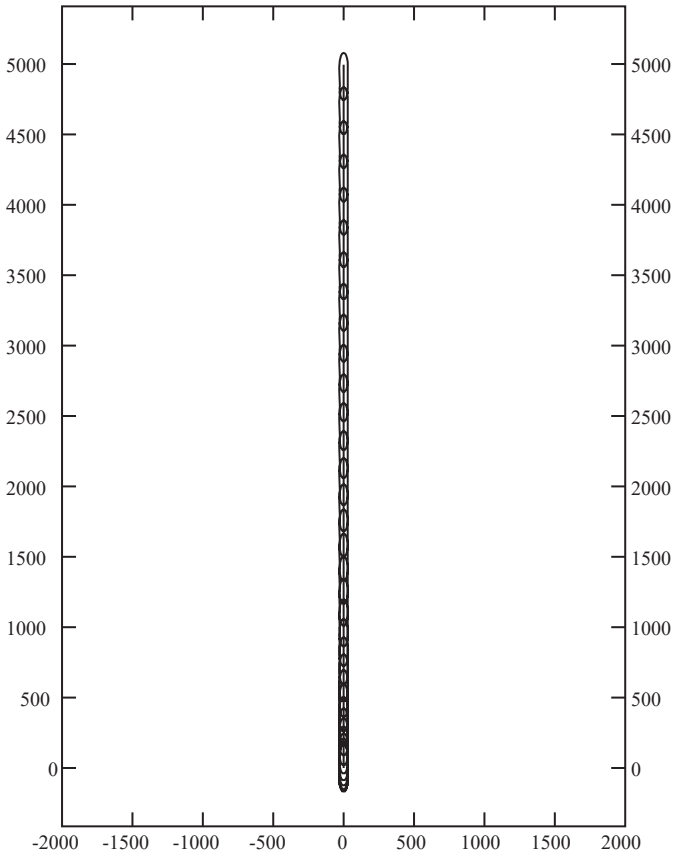


Fig. 4. Acceleration. Ship position plot.

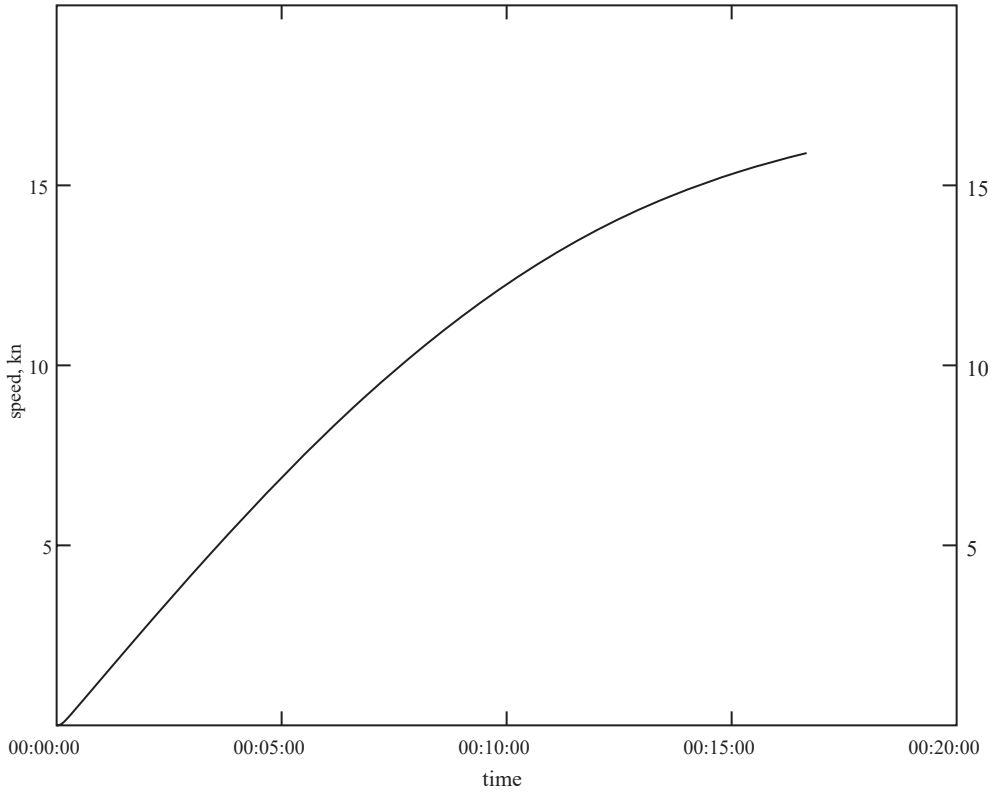


Fig. 5. Acceleration. Speed plot.

Acceleration from Slow to Half

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 25.0
to, % 50.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	33.0	0.752	7.5	0.0
00:01:00	47.1	0.752	7.8	236.3
00:02:00	47.1	0.752	8.1	481.8
00:03:00	47.1	0.752	8.4	735.9
00:04:00	47.1	0.752	8.6	997.6
00:05:00	47.1	0.752	8.8	1266.5
00:06:00	47.1	0.752	9.0	1541.8
00:07:00	47.1	0.752	9.2	1822.9
00:08:00	47.1	0.752	9.4	2109.4
00:09:00	47.1	0.752	9.5	2400.7
00:10:00	47.1	0.752	9.6	2696.3
00:11:00	47.1	0.752	9.8	2995.9
00:12:00	47.1	0.752	9.9	3299.0
00:13:00	47.1	0.752	10.0	3605.4
00:14:00	47.1	0.752	10.1	3914.6
00:15:00	47.1	0.752	10.1	4226.5
00:16:00	47.1	0.752	10.2	4540.8
00:17:00	47.1	0.752	10.3	4857.0

Table 3. Acceleration from Slow to Half.

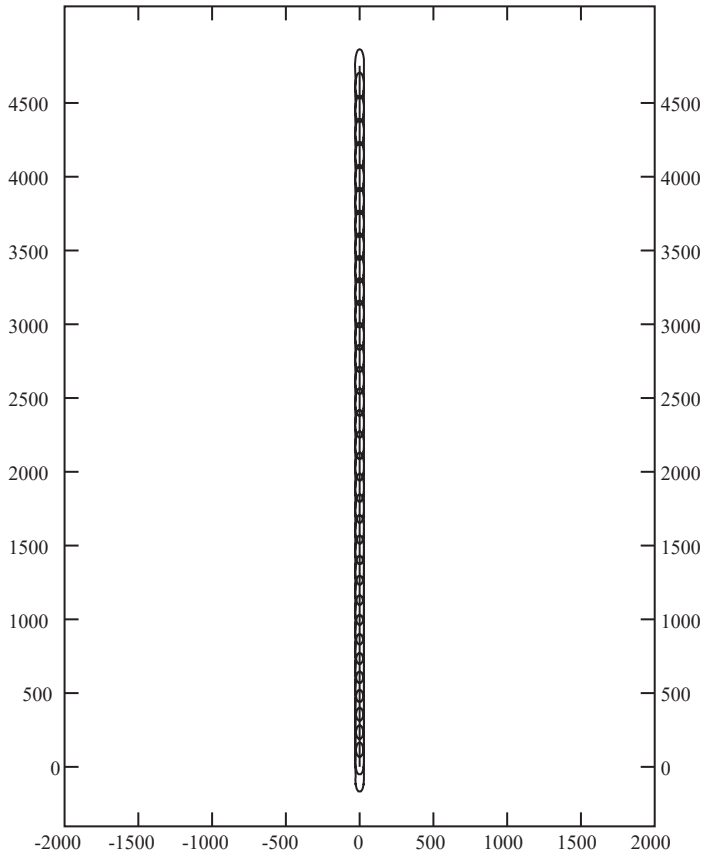


Fig. 6. Acceleration from Slow to Half. Ship position plot.

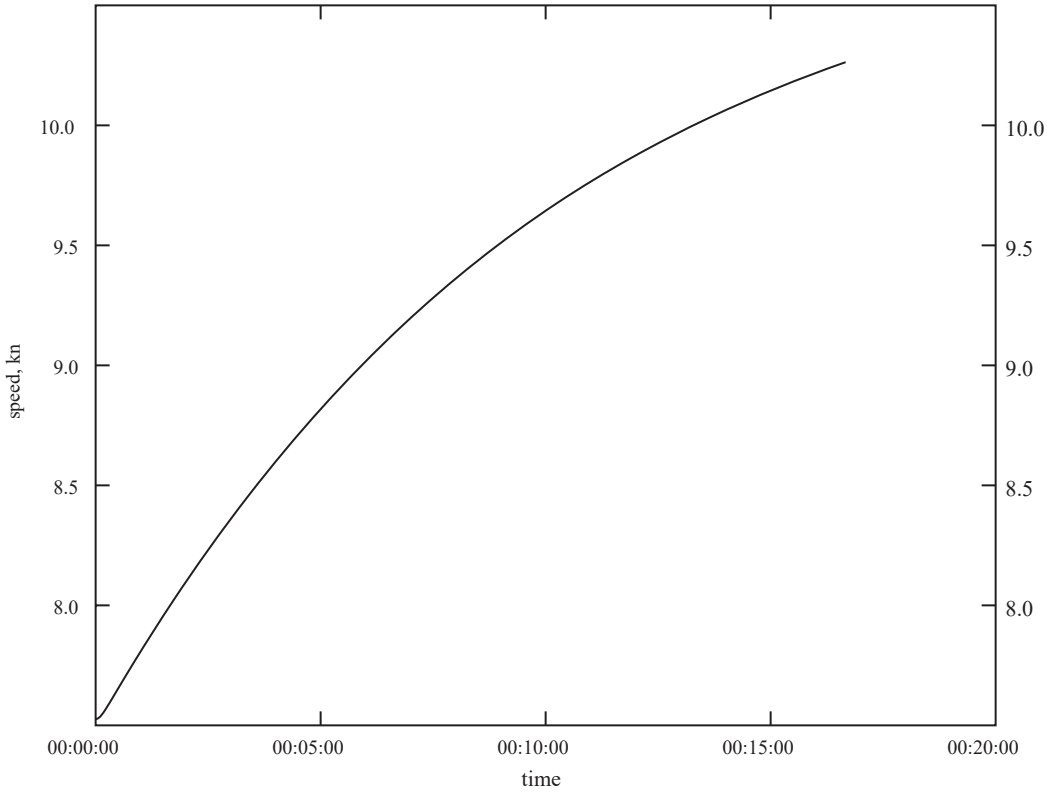


Fig. 7. Acceleration from Slow to Half. Speed plot.

Crash Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % ..... -100.0
Rudder, deg 0.0

Performance

Stop time, s 00:13:09
Advance at stop time, m 3700.7
Transfer at stop time, m 858.5
Heading at stop time, deg 149.0

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	17.5	0.0	0.0
00:00:45	26.5	0.752	16.7	396.3	0.0
00:01:30	24.6	0.752	15.9	773.0	0.0
00:02:15	23.1	0.752	15.1	1131.7	0.0
00:03:00	21.7	0.752	14.5	1474.2	0.0
00:03:45	-56.8	0.752	13.6	1800.4	0.3
00:04:30	-57.0	0.752	12.6	2103.9	3.4
00:05:15	-57.0	0.752	11.6	2384.3	11.0
00:06:00	-57.0	0.752	10.4	2640.0	24.8
00:06:45	-56.9	0.752	9.1	2866.3	42.6
00:07:30	-56.9	0.752	7.7	3060.3	60.4
00:08:15	-56.9	0.752	6.4	3223.2	76.7
00:09:00	-56.9	0.752	5.2	3357.8	91.3
00:09:45	-56.9	0.752	4.2	3466.8	104.5
00:10:30	-56.9	0.752	3.2	3552.4	116.6
00:11:15	-56.9	0.752	2.3	3616.6	127.2
00:12:00	-56.9	0.752	1.6	3661.5	136.6
00:12:45	-56.9	0.752	1.0	3690.0	145.0
00:13:30	-57.0	0.752	0.7	3709.1	152.4

Table 4. Crash stop test.

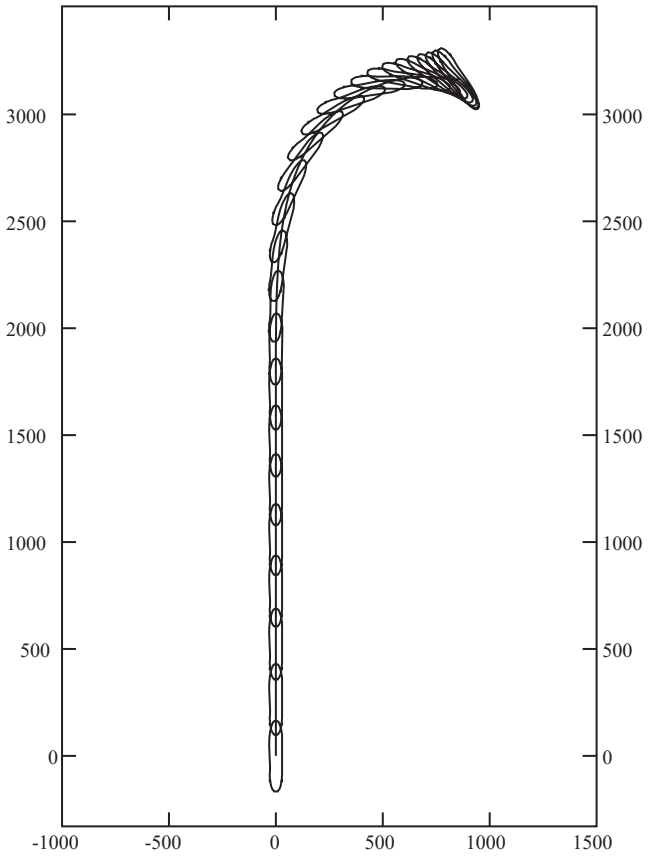


Fig. 8. Crash stop test. Ship position plot.

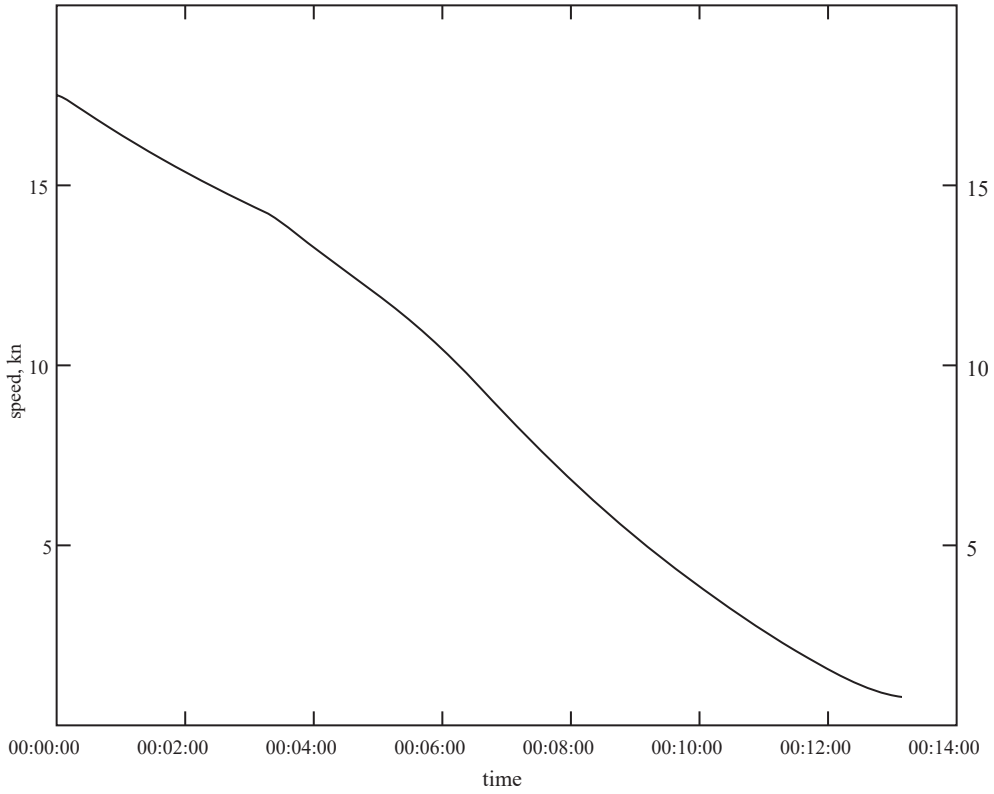


Fig. 9. Crash stop test. Speed plot.

Deceleration from Half to Slow

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 50.0
to, % 25.0
Rudder, deg 0.0

Performance

Stop time, s 00:16:40
Advance at stop time, m 4798.9

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	47.0	0.752	10.9	0.0	0.0
00:01:00	32.9	0.752	10.6	331.9	0.0
00:02:00	32.9	0.752	10.4	655.6	0.0
00:03:00	32.9	0.752	10.1	971.6	0.0
00:04:00	32.9	0.752	9.9	1280.8	0.0
00:05:00	32.9	0.752	9.7	1583.7	0.0
00:06:00	32.9	0.752	9.5	1880.9	0.0
00:07:00	32.9	0.752	9.4	2172.9	0.0
00:08:00	32.9	0.752	9.2	2460.0	0.0
00:09:00	32.9	0.752	9.1	2742.8	0.0
00:10:00	32.9	0.752	9.0	3021.6	0.0
00:11:00	32.9	0.752	8.9	3296.7	0.0
00:12:00	32.9	0.752	8.7	3568.3	0.0
00:13:00	32.9	0.752	8.7	3836.9	0.0
00:14:00	32.9	0.752	8.6	4102.6	0.0
00:15:00	32.9	0.752	8.5	4365.7	0.0
00:16:00	32.9	0.752	8.4	4626.3	0.0
00:17:00	32.9	0.752	8.3	4884.8	0.0

Table 5. Deceleration from Half to Slow .

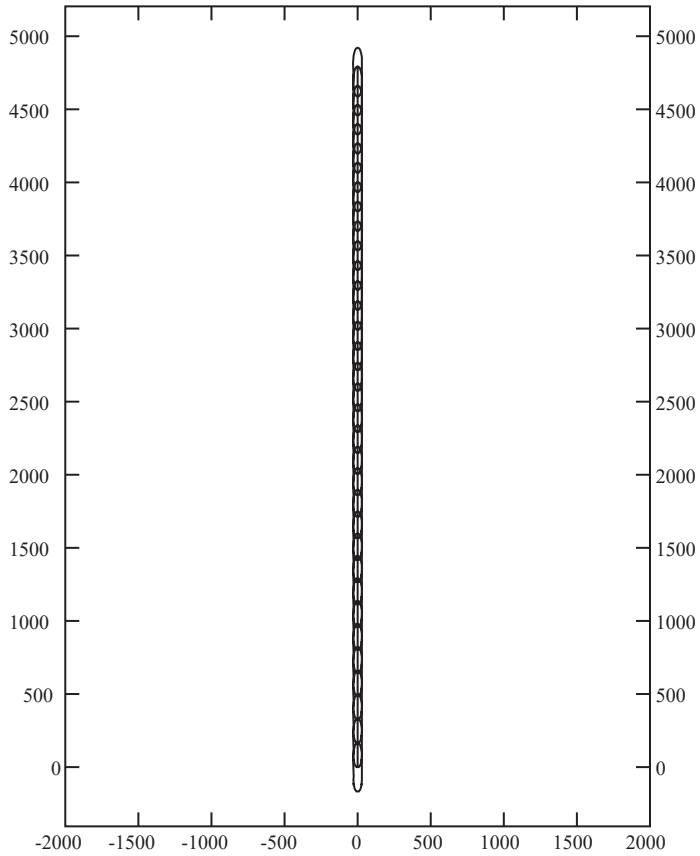


Fig. 10. Deceleration from Half to Slow . Ship position plot.

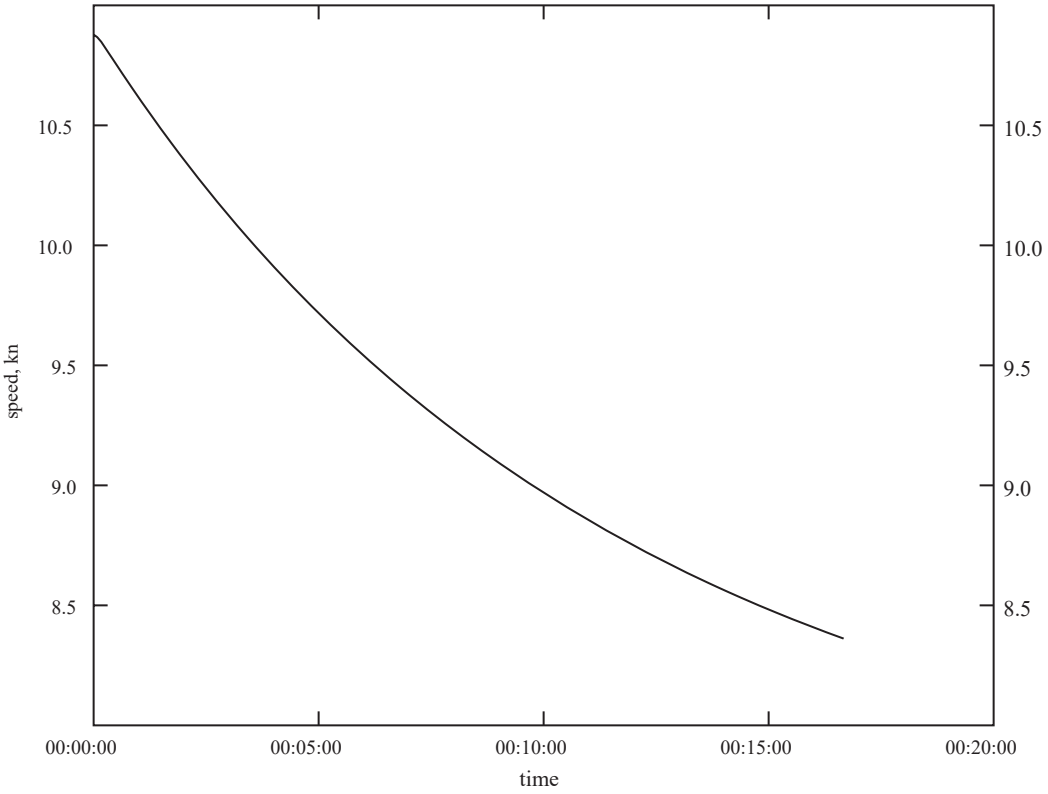


Fig. 11. Deceleration from Half to Slow . Speed plot.

Coasting Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder, deg 0.0

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	17.5	0.0	0.0
00:01:00	25.7	0.752	16.4	524.0	0.0
00:02:00	23.6	0.752	15.4	1014.0	0.0
00:03:00	21.7	0.752	14.5	1474.2	0.0
00:04:00	20.0	0.752	13.6	1907.8	0.0
00:05:00	18.5	0.752	12.9	2317.6	0.0
00:06:00	17.1	0.752	12.3	2705.9	0.0
00:07:00	15.8	0.752	11.7	3074.7	0.0
00:08:00	14.5	0.752	11.1	3425.7	0.0
00:09:00	13.1	0.752	10.6	3760.4	0.0
00:10:00	11.9	0.752	10.1	4079.9	0.0
00:11:00	10.7	0.752	9.7	4385.5	0.0
00:12:00	9.5	0.752	9.3	4678.2	0.0
00:13:00	8.5	0.752	8.9	4958.8	0.0
00:14:00	7.5	0.752	8.6	5228.2	0.0
00:15:00	6.6	0.752	8.2	5487.1	0.0
00:16:00	5.8	0.752	7.9	5736.3	0.0
00:17:00	4.9	0.752	7.6	5977.3	0.0

Table 6. Coasting stop test.

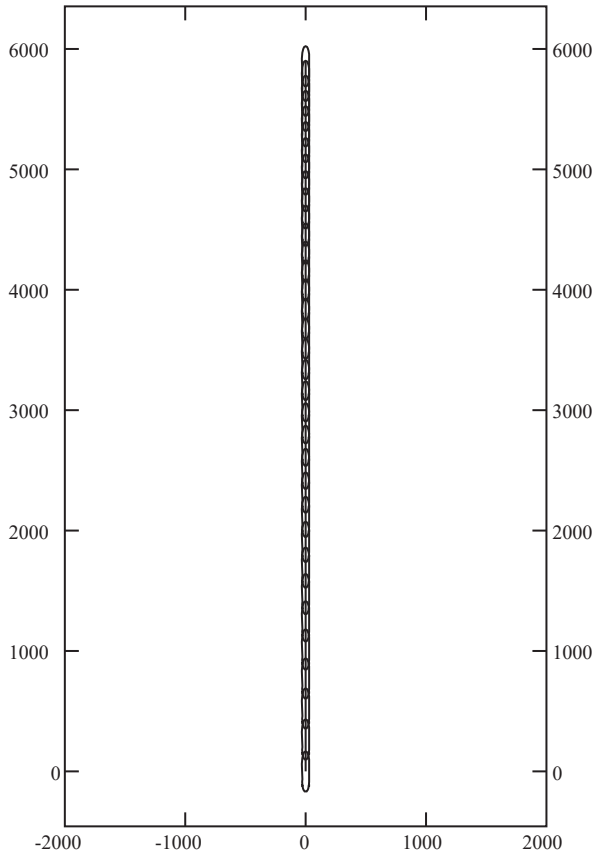


Fig. 12. Coasting stop test. Ship position plot.

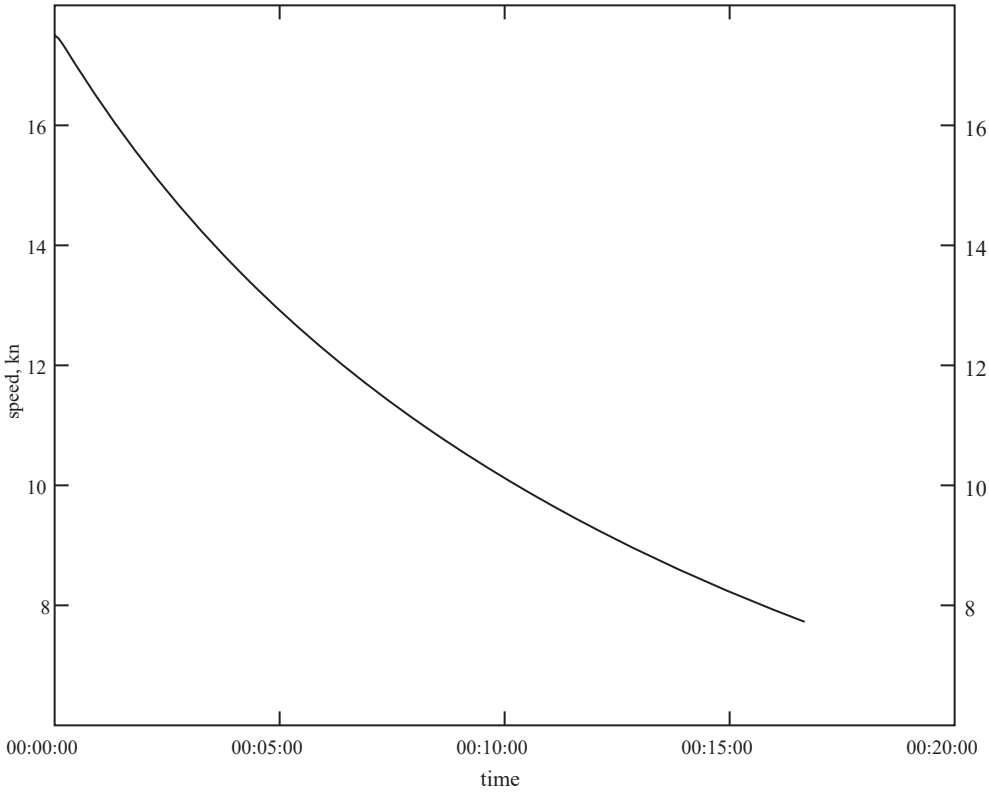


Fig. 13. Coasting stop test. Speed plot.

Time for effective changes in telegraph settings in stopping conditions

Initial Throttle	Initial Speed	Set Throttle	Reached Speed	Time
	kn		kn	s
Full Sea Speed	17.5	Full Astern	0.0	00:12:43
Full Ahead	13.3	Full Astern	0.0	00:09:43
Half Ahead	10.9	Full Astern	0.0	00:08:59
Slow Ahead	7.5	Full Astern	0.0	00:07:23
Full Sea Speed	17.5	Stop	3.5	00:33:20
Full Ahead	13.3	Stop	3.5	00:33:20
Half Ahead	10.9	Stop	3.5	00:33:20
Slow Ahead	7.5	Stop	3.5	00:30:00

Turning Circle Starboard, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting% 100.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:02:20
Advance, m 939.6
Transfer, m 406.1
Time 180°, s 00:04:34
Tactical diameter, m 958.5
Circulation diameter, m 506.7
Turn rate, deg/min 33.9
Speed loss, % 72.2

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.5	0.0	0	0
00:00:45	16.9	16.2	s41.9	s9.0
00:01:30	14.6	51.4	s48.1	s15.2
00:02:15	12.2	86.3	s44.7	s17.6
00:03:00	10.3	118.6	s41.5	s19.2
00:03:45	9.0	148.9	s39.3	s20.5
00:04:30	7.9	177.6	s37.4	s21.5
00:05:15	7.1	-154.9	s36.1	s22.3
00:06:00	6.5	-128.1	s35.4	s23.1
00:06:45	6.1	-101.8	s34.9	s23.9
00:07:30	5.7	-75.8	s34.6	s24.6
00:08:15	5.4	-49.9	s34.3	s25.2
00:09:00	5.2	-24.3	s34.2	s25.8
00:09:45	5.0	1.3	s34.0	s26.3
00:10:30	4.8	26.8	s33.9	s26.7

Table 7. Turning circle starboard, deep water.

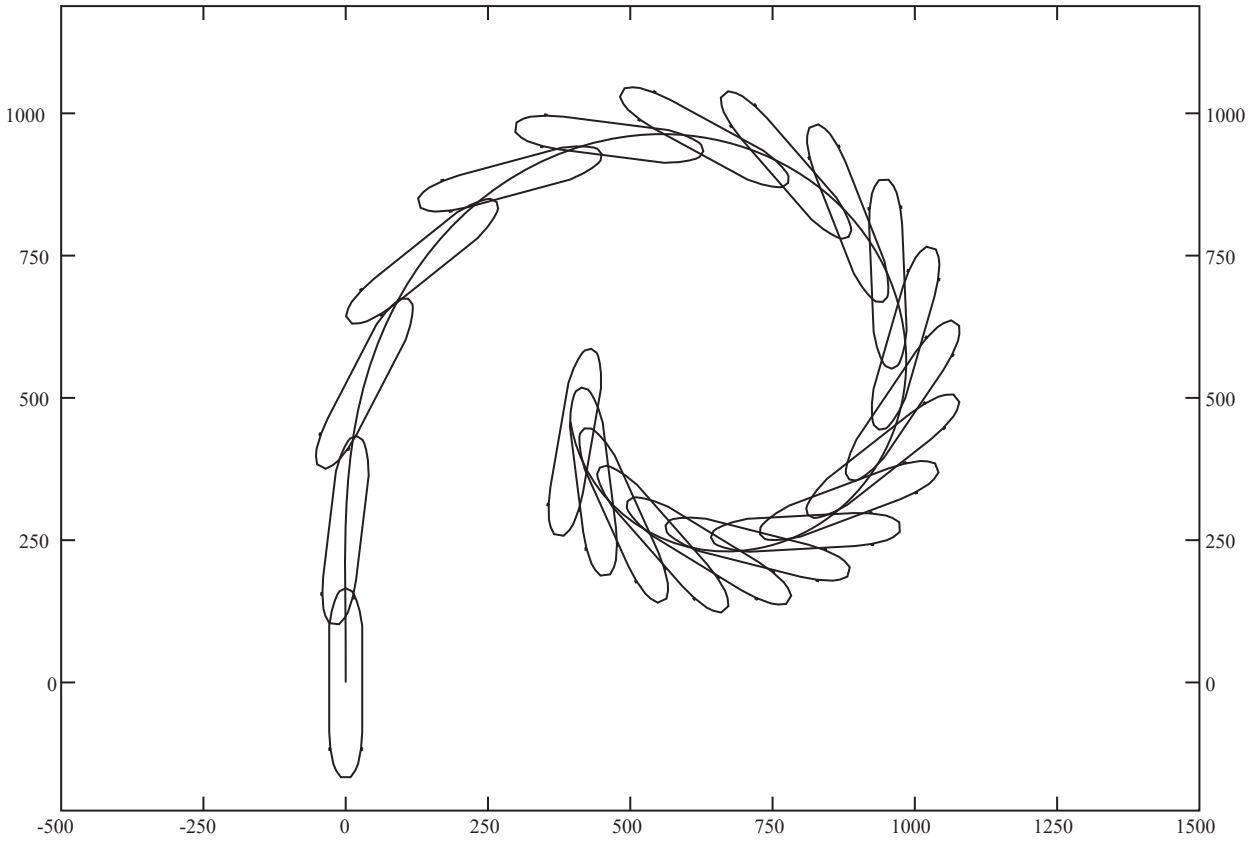


Fig. 14. Turning circle starboard, deep water. Ship position plot.

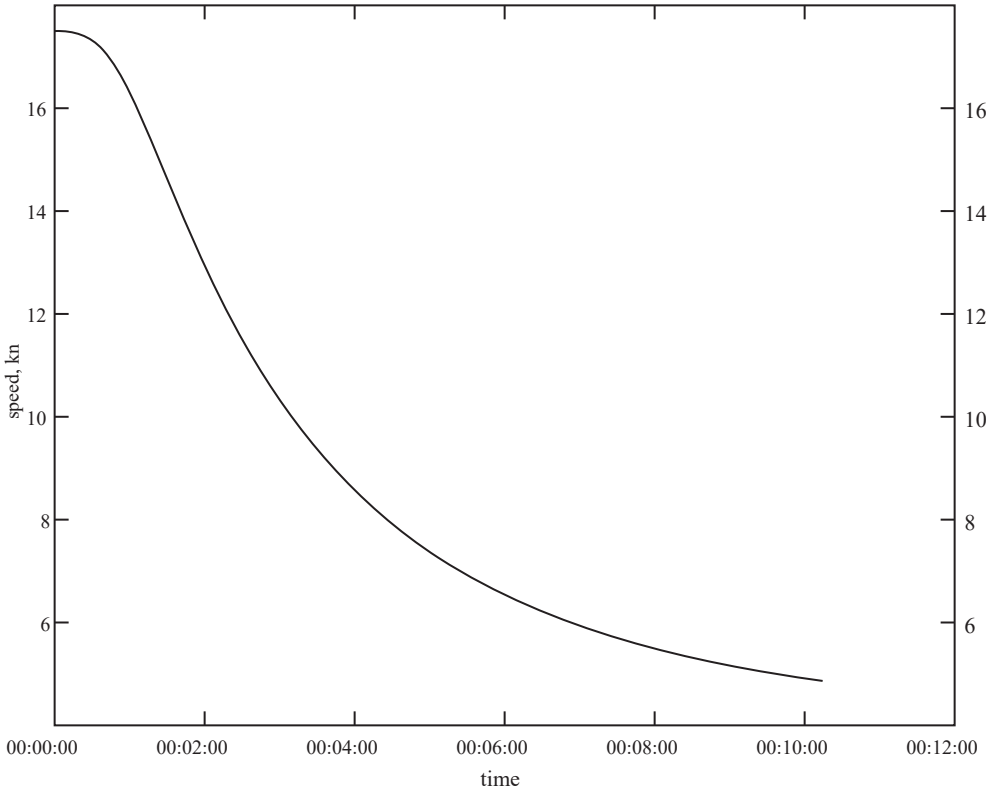


Fig. 15. Turning circle starboard, deep water. Speed plot.

Turning Circle Starboard, Shallow Water

Environment

Water depth, H/T 1.5
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 50.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:04:14
Advance, m 1008.9
Transfer, m 538.1
Time 180°, s 00:07:40
Tactical diameter, m 1118.5
Circulation diameter, m 708.0
Turn rate, deg/min 22.3
Speed loss, % 57.6

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	10.5	0.0	0	0
00:01:00	10.4	8.0	s16.1	s3.5
00:02:00	9.9	29.4	s25.3	s6.4
00:03:00	9.2	56.1	s27.6	s7.8
00:04:00	8.5	83.8	s27.5	s8.6
00:05:00	7.8	110.9	s26.8	s9.1
00:06:00	7.3	137.4	s26.2	s9.5
00:07:00	6.8	163.2	s25.4	s9.8
00:08:00	6.4	-171.7	s24.8	s10.2
00:09:00	6.0	-147.1	s24.3	s10.6
00:10:00	5.7	-123.0	s23.9	s11.0
00:11:00	5.4	-99.3	s23.5	s11.3
00:12:00	5.2	-76.0	s23.2	s11.6
00:13:00	5.0	-52.9	s22.9	s12.0
00:14:00	4.8	-30.1	s22.7	s12.2
00:15:00	4.6	-7.5	s22.5	s12.5

00:16:00	4.5	14.9	s22.3	s12.8
00:17:00	4.4	37.2	s22.2	s13.0

Table 8. Turning circle starboard, shallow water.

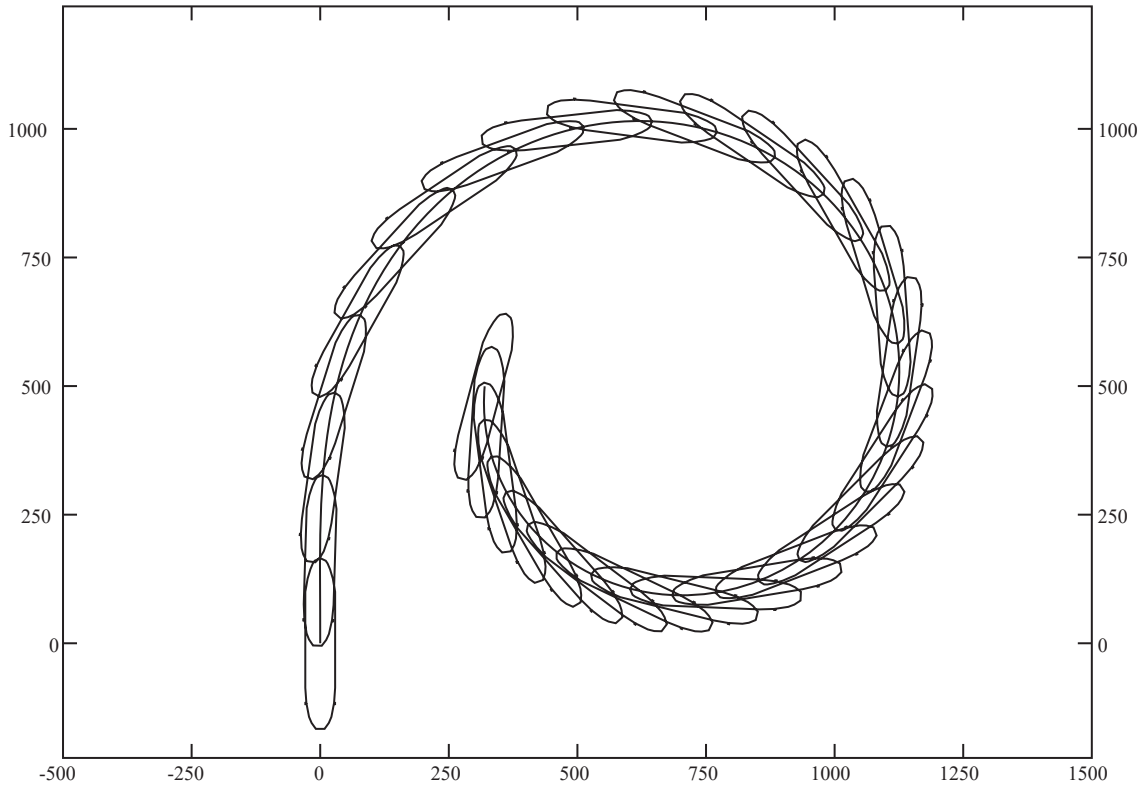


Fig. 16. Turning circle starboard, shallow water. Ship position plot.

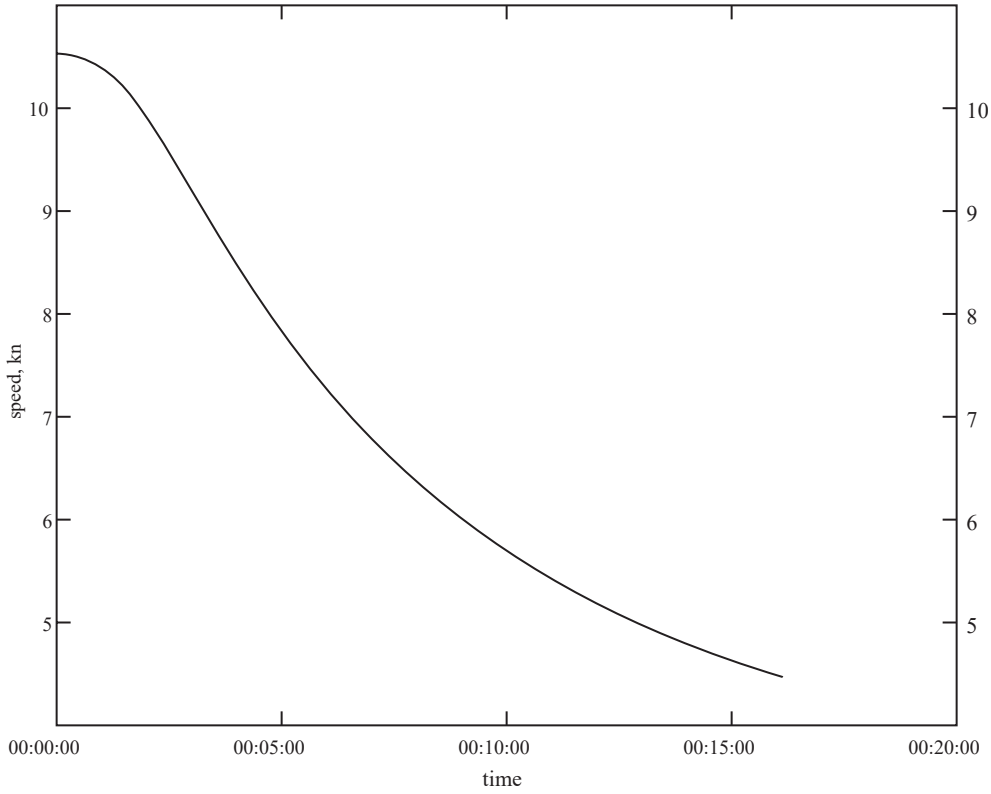


Fig. 17. Turning circle starboard, shallow water. Speed plot.

Turning Circle Port, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder command
from, deg 0.0
to, deg ..... -35.0

Performance

Time 90°, s 00:02:20
Advance, m 939.6
Transfer, m 406.1
Time 180°, s 00:04:34
Tactical diameter, m 958.5
Circulation diameter, m 506.7
Turn rate, deg/min ..... -33.9
Speed loss, % 72.2

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.5	0.0	0	0
00:00:45	16.9	-16.2	p41.9	p9.0
00:01:30	14.6	-51.4	p48.1	p15.2
00:02:15	12.2	-86.3	p44.7	p17.6
00:03:00	10.3	-118.6	p41.5	p19.2
00:03:45	9.0	-148.9	p39.3	p20.5
00:04:30	7.9	-177.6	p37.4	p21.5
00:05:15	7.1	154.9	p36.1	p22.3
00:06:00	6.5	128.1	p35.4	p23.1
00:06:45	6.1	101.8	p34.9	p23.9
00:07:30	5.7	75.8	p34.6	p24.6
00:08:15	5.4	49.9	p34.3	p25.2
00:09:00	5.2	24.3	p34.2	p25.8
00:09:45	5.0	-1.3	p34.0	p26.3
00:10:30	4.8	-26.8	p33.9	p26.7

Table 9. Turning circle port, deep water.

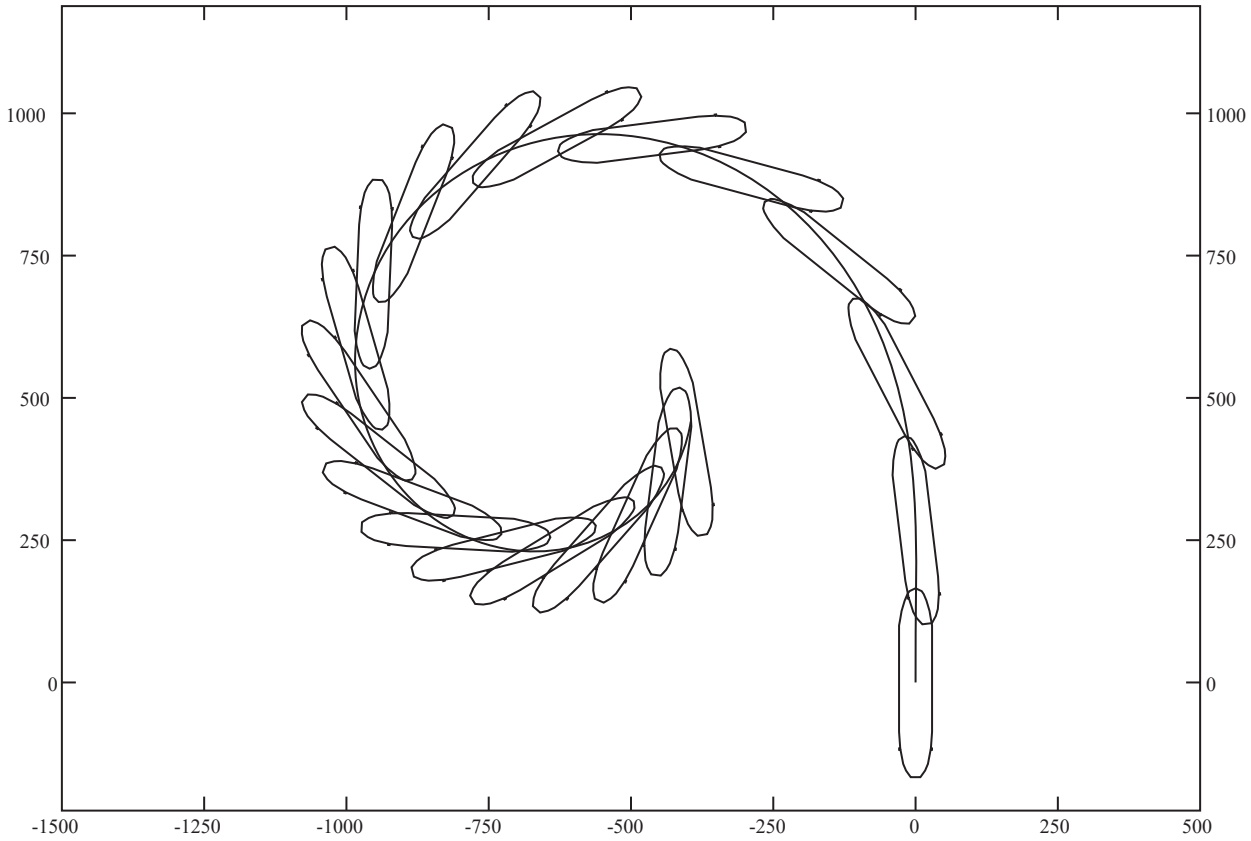


Fig. 18. Turning circle port, deep water. Ship position plot.

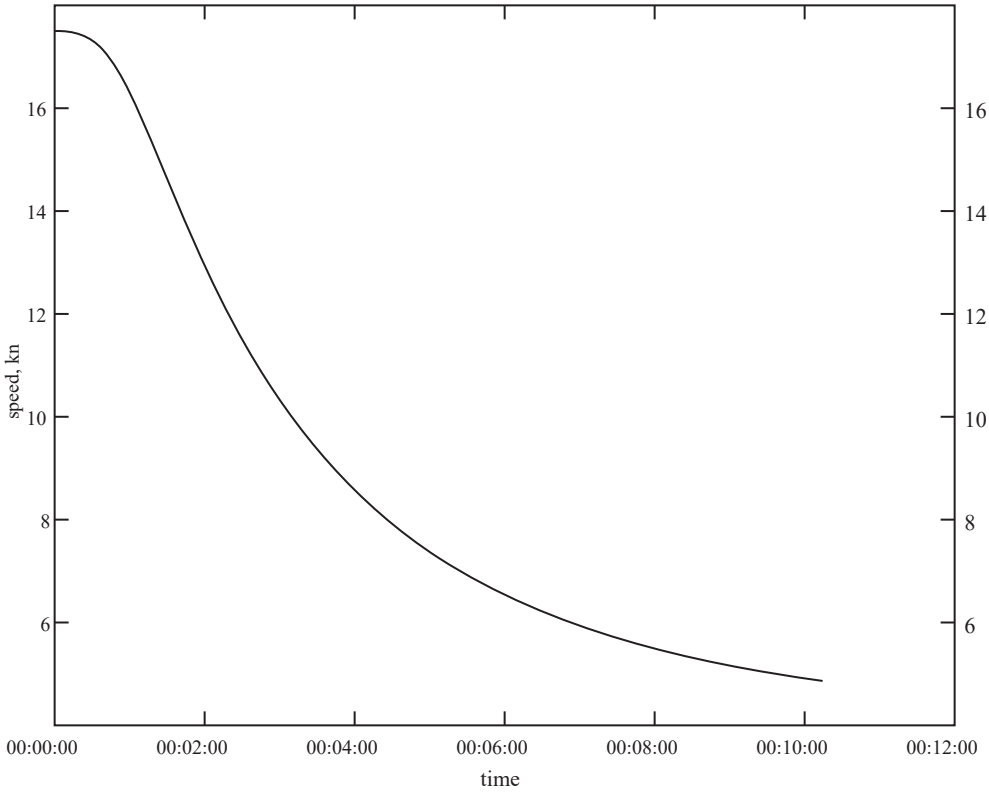


Fig. 19. Turning circle port, deep water. Speed plot.

Accelerated Turning

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
- from, % 0.0
- to, % 50.0

Rudder command
- from, deg 0.0
- to, deg 35.0

Performance

Time 90°, ... 00:04:23
Advance, m 138.5
Transfer, m 25.6
Time 180° 00:08:21
Tactical diameter, m 249.5
Circulation diameter, m 419.1
Turn rate, deg/min 22.4

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	0.0	0.0	0	0
00:01:00	0.8	10.5	s20.3	s48.6
00:02:00	1.3	33.5	s24.1	s42.9
00:03:00	1.5	57.5	s23.8	s39.2
00:04:00	1.8	81.0	s23.2	s36.3
00:05:00	1.9	104.1	s22.9	s34.2
00:06:00	2.1	126.9	s22.7	s32.9
00:07:00	2.2	149.5	s22.6	s32.0
00:08:00	2.3	172.1	s22.5	s31.4
00:09:00	2.4	-165.4	s22.5	s30.9
00:10:00	2.5	-142.9	s22.5	s30.6
00:11:00	2.5	-120.5	s22.4	s30.3
00:12:00	2.5	-98.1	s22.4	s30.0
00:13:00	2.6	-75.7	s22.4	s29.8
00:14:00	2.6	-53.3	s22.4	s29.7

00:15:00	2.6	-30.9	s22.4	s29.5
00:16:00	2.6	-8.5	s22.4	s29.4
00:17:00	2.7	13.9	s22.4	s29.3

Table 10. Accelerated turning.

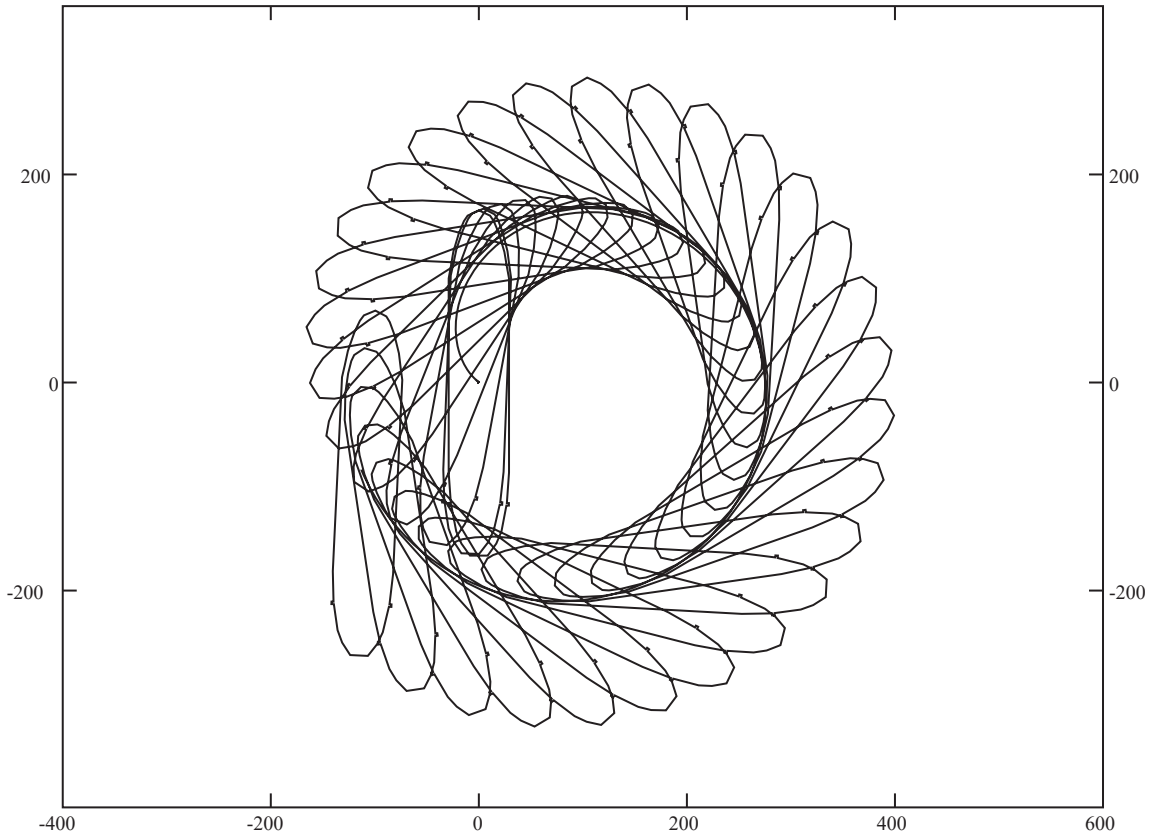


Fig. 20. Accelerated turning. Ship position plot.

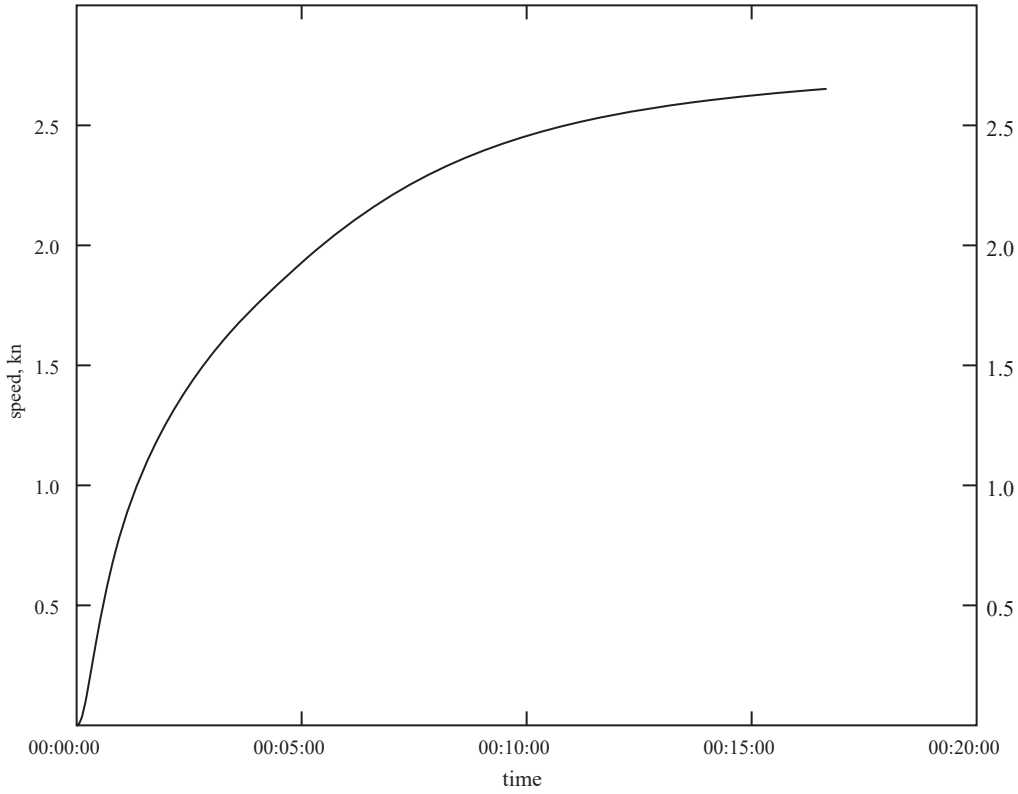


Fig. 21. Accelerated turning. Speed plot.

Coasting Circle

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder command
from, deg 0.0
to, deg 35.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.5	0.0	0	0
00:01:00	16.2	12.0	s23.7	s5.9
00:02:00	13.8	42.8	s34.4	s11.9
00:03:00	11.2	76.0	s31.2	s14.4
00:04:00	9.2	104.7	s26.3	s15.2
00:05:00	7.7	128.8	s22.3	s15.6
00:06:00	6.6	149.5	s19.2	s15.8
00:07:00	5.7	167.4	s16.8	s15.9
00:08:00	5.0	-176.8	s14.9	s16.1
00:09:00	4.5	-162.7	s13.4	s16.2
00:10:00	4.0	-150.0	s12.1	s16.3
00:11:00	3.7	-138.4	s11.0	s16.4
00:12:00	3.4	-127.9	s10.1	s16.4
00:13:00	3.1	-118.2	s9.3	s16.5
00:14:00	2.9	-109.2	s8.7	s16.5
00:15:00	2.7	-100.8	s8.1	s16.5
00:16:00	2.5	-93.0	s7.6	s16.6
00:17:00	2.4	-85.6	s7.1	s16.6

Table 11. Coasting Circle.

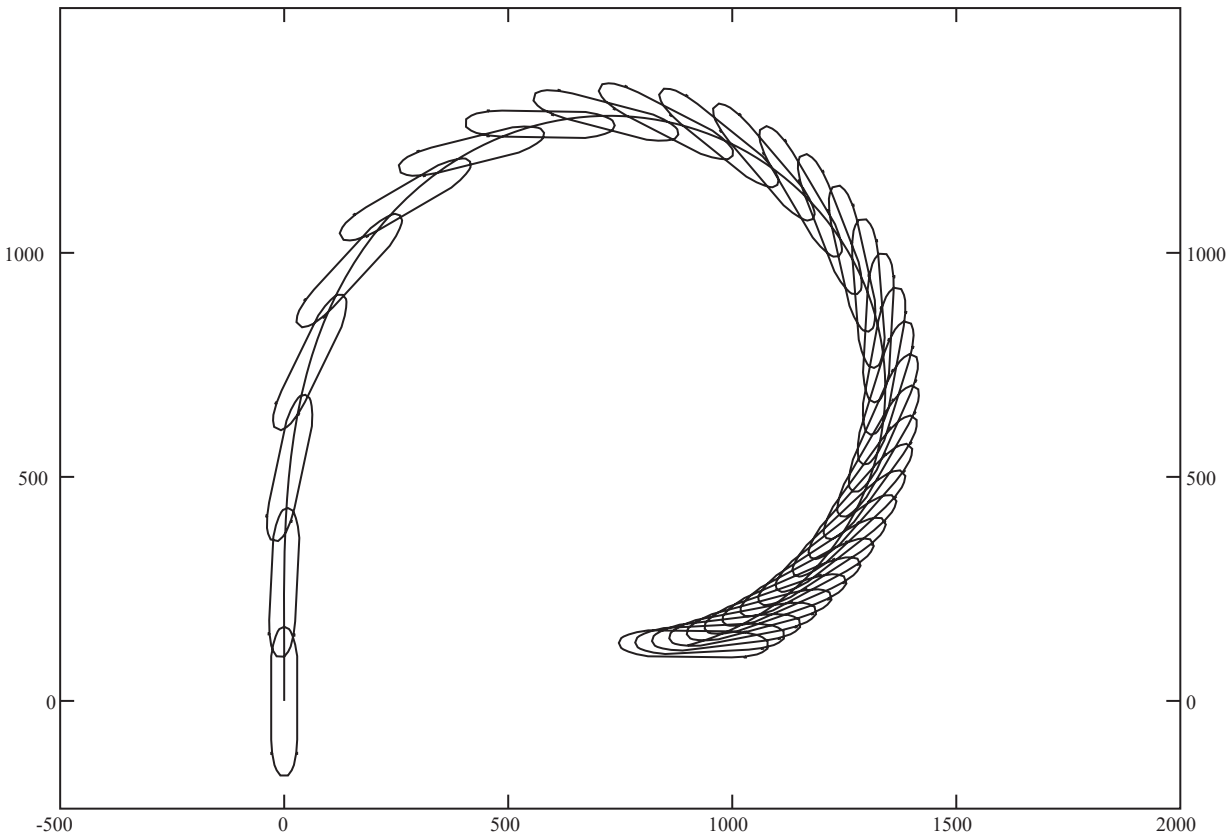


Fig. 22. Coasting Circle. Ship position plot.

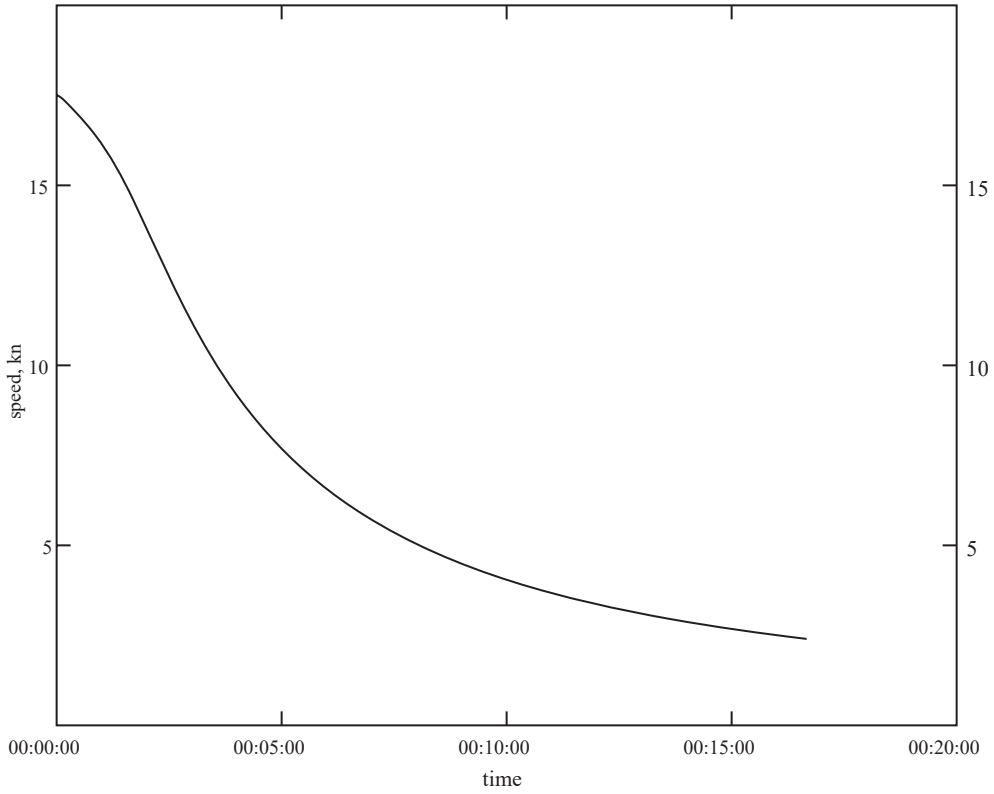


Fig. 23. Coasting Circle. Speed plot

Course Change Manoeuvre

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

Track reach, ship lengths 1.6

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	13.3	0
00:00:05	s9.7	0.0	13.3	s0.8
00:00:10	s10.0	0.2	13.3	s2.5
00:00:15	s10.0	0.4	13.3	s4.0
00:00:20	s10.0	0.8	13.3	s5.3
00:00:25	s10.0	1.3	13.3	s6.5
00:00:30	s10.0	1.9	13.3	s7.6
00:00:35	s10.0	2.6	13.3	s8.6
00:00:40	s10.0	3.3	13.3	s9.5
00:00:45	s10.0	4.2	13.2	s10.3
00:00:50	s10.0	5.1	13.2	s11.1
00:00:55	s10.0	6.0	13.2	s11.9
00:01:00	s10.0	7.0	13.2	s12.6
00:01:05	s10.0	8.1	13.2	s13.2
00:01:10	s10.0	9.2	13.2	s13.9
00:01:15	s10.0	10.4	13.2	s14.5

Table 12. Course Change Manoeuvre.

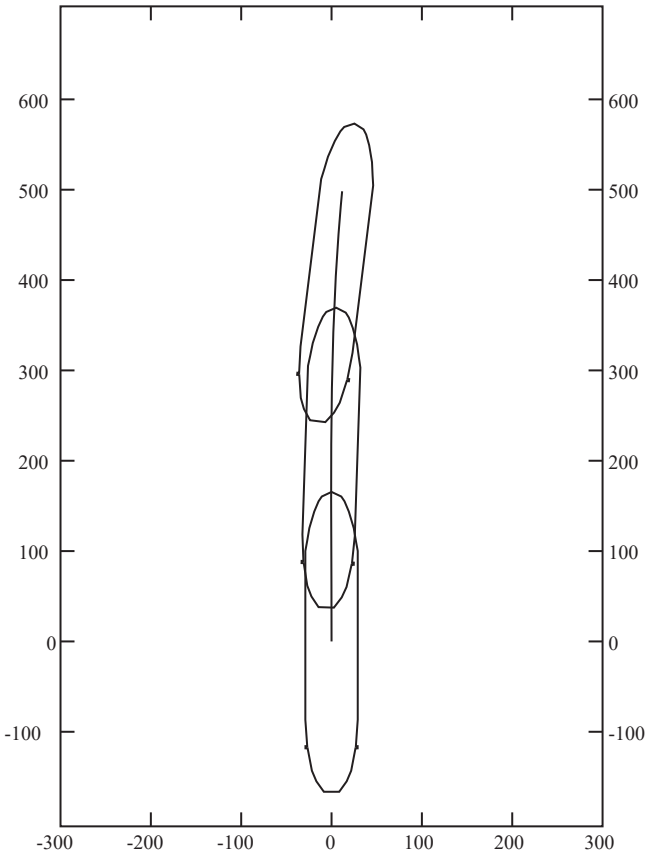


Fig. 24. Course Change Manoeuvre. Ship position plot.

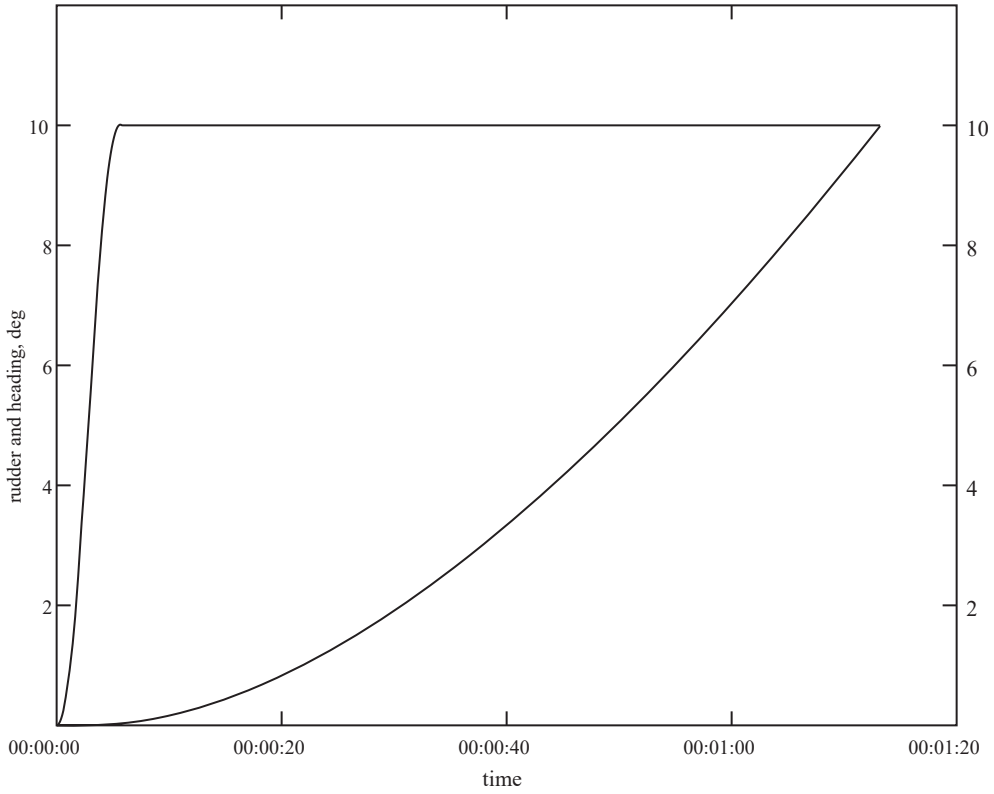


Fig. 25. Course Change Manoeuvre. Rudder and heading plot.

Zigzag 10°–10°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 5.4
Second overshoot angle, deg 8.2

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	13.3	0
00:00:20	s10.0	0.8	13.3	s5.3
00:00:40	s10.0	3.3	13.3	s9.5
00:01:00	s10.0	7.0	13.2	s12.6
00:01:20	p6.0	11.6	13.1	s13.2
00:01:40	p10.0	14.4	13.1	s5.0
00:02:00	p10.0	15.3	13.0	s0.7
00:02:20	p10.0	15.0	13.0	p2.6
00:02:40	p10.0	13.6	13.0	p5.7
00:03:00	p10.0	11.2	13.0	p8.9
00:03:20	p10.0	7.7	13.0	p11.7
00:03:40	p10.0	3.4	13.0	p14.2
00:04:00	p10.0	-1.7	12.9	p16.1
00:04:20	p10.0	-7.3	12.7	p17.6
00:04:40	s10.0	-13.1	12.6	p14.2
00:05:00	s10.0	-16.3	12.5	p6.6
00:05:20	s10.0	-17.8	12.4	p2.6
00:05:40	s10.0	-18.2	12.4	s0.5

Table 13. Zigzag 10°–10°.

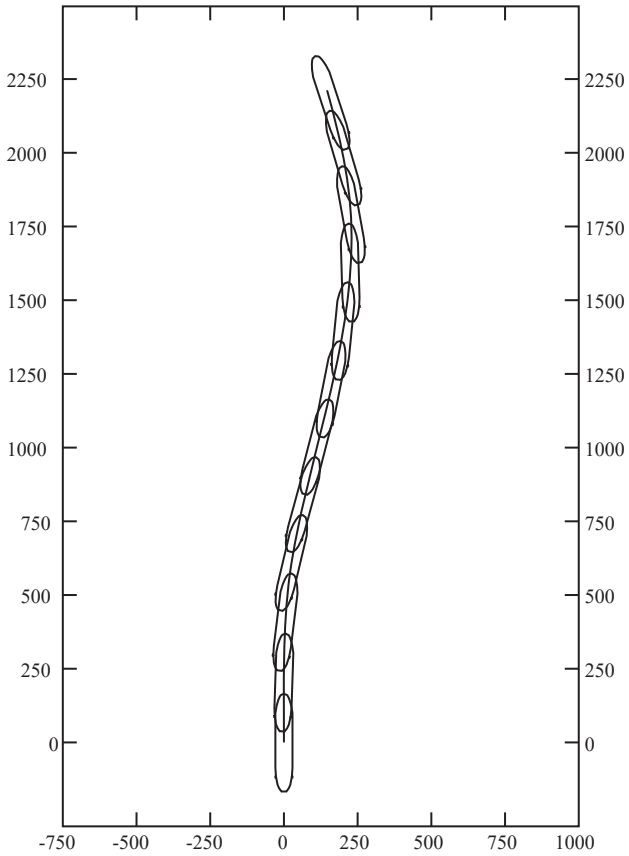


Fig. 26. Zigzag 10°–10°. Ship position plot.

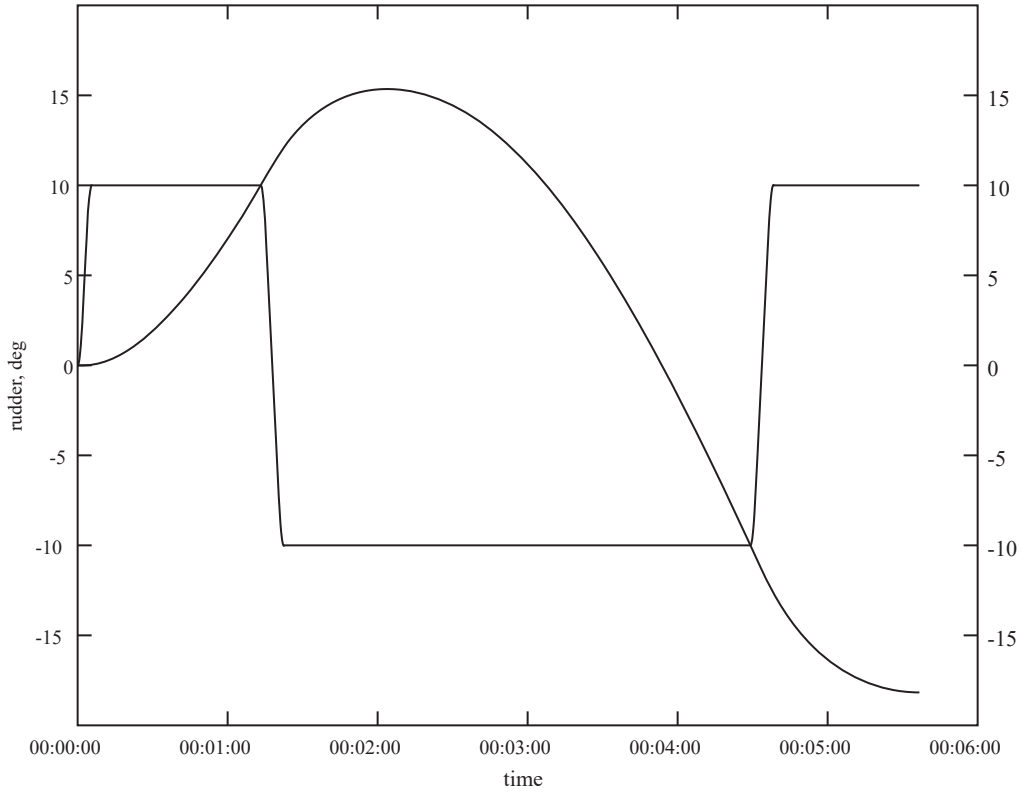


Fig. 27. Zigzag test 10°–10°. Rudder and heading plot.

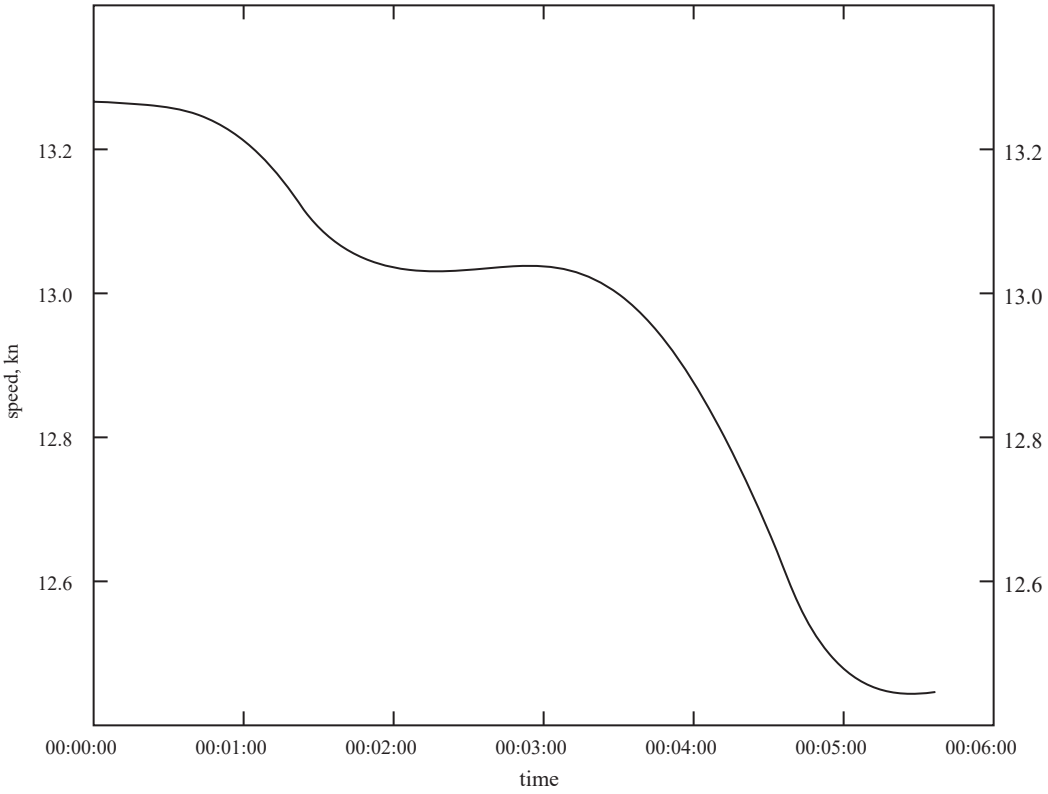


Fig. 28. Zigzag test 10°–10°. Speed plot.

Zigzag 10°–10° Slow Speed

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 12.5
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 4.5
Second overshoot angle, deg 7.0

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	6.3	0
00:00:45	s10.0	1.2	6.3	s3.0
00:01:30	s10.0	4.2	6.3	s5.1
00:02:15	s10.0	8.6	6.3	s6.6
00:03:00	p10.0	12.9	6.3	s3.6
00:03:45	p10.0	14.4	6.2	s0.7
00:04:30	p10.0	14.2	6.2	p1.1
00:05:15	p10.0	12.8	6.2	p2.8
00:06:00	p10.0	10.0	6.2	p4.5
00:06:45	p10.0	6.0	6.2	p6.0
00:07:30	p10.0	1.1	6.2	p7.2
00:08:15	p10.0	-4.7	6.1	p8.1
00:09:00	s7.4	-11.0	6.1	p8.3
00:09:45	s10.0	-15.1	6.0	p3.4
00:10:30	s10.0	-16.8	6.0	p1.1
00:11:15	s10.0	-17.0	6.0	s0.5

Table 14. Zigzag 10°–10° Slow Speed.

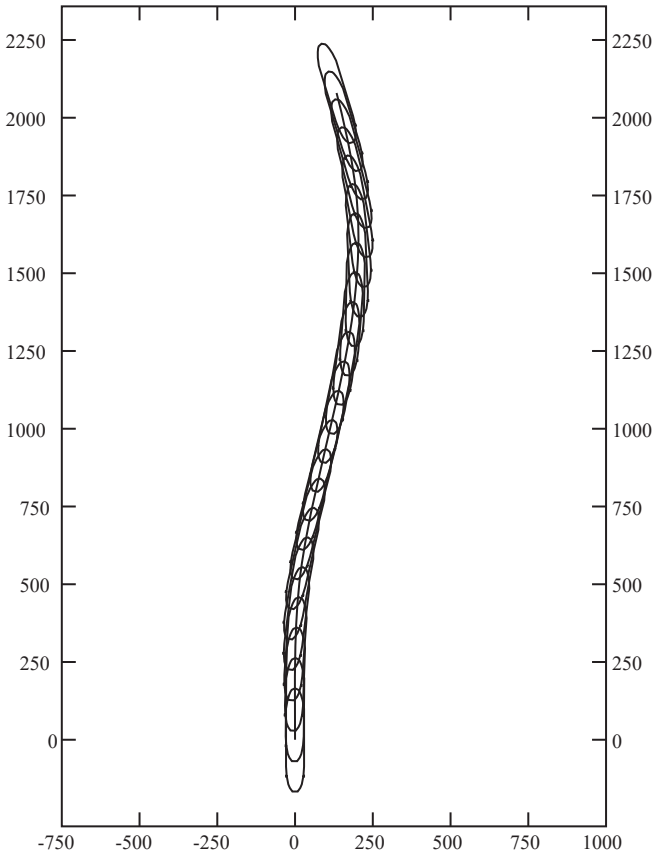


Fig. 29. Zigzag 10°–10° Slow Speed. Ship position plot.

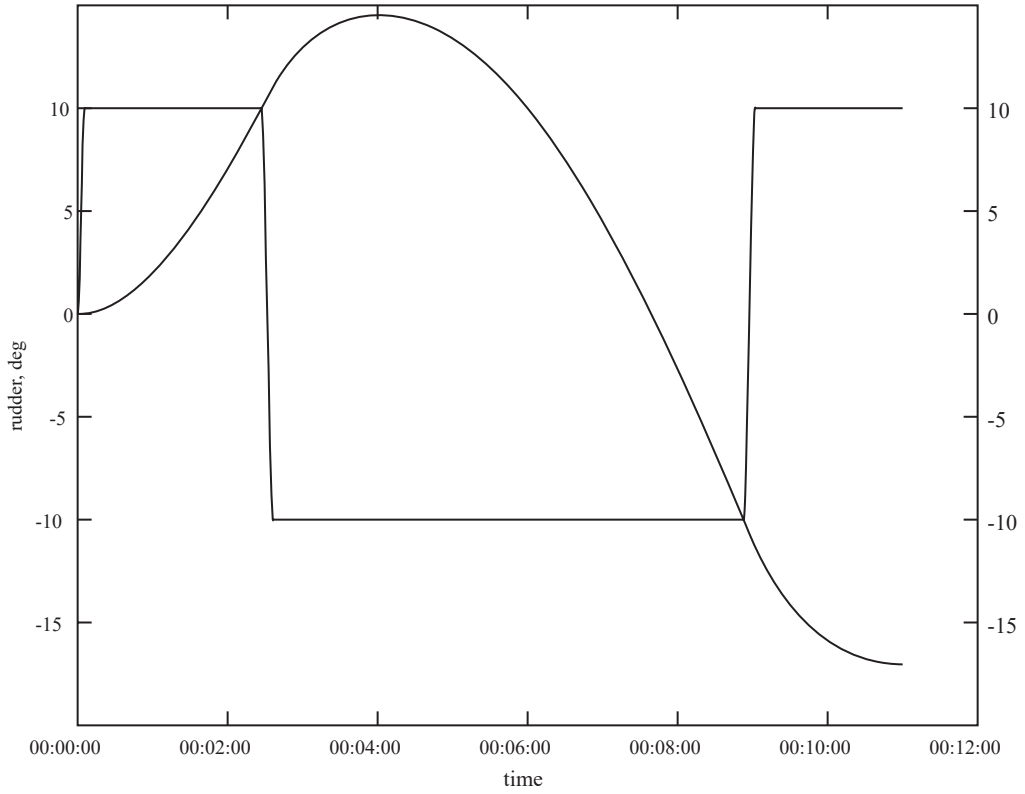


Fig. 30. Zigzag test 10°–10° Slow Speed. Rudder and heading plot.

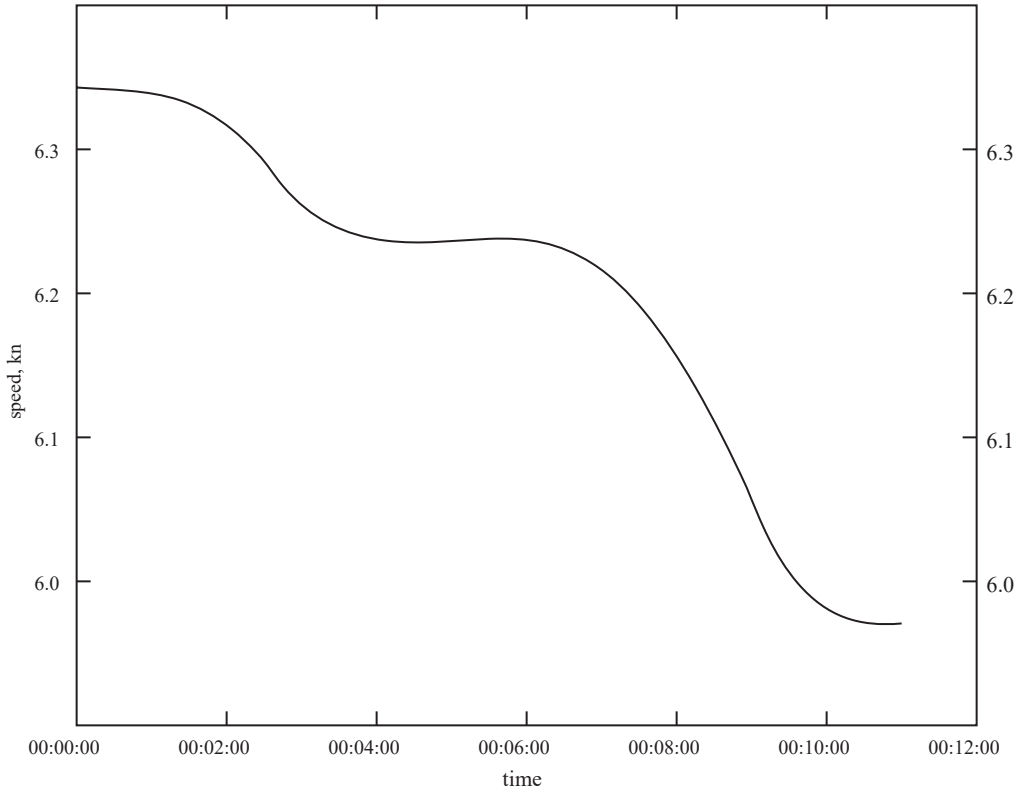


Fig. 31. Zigzag test 10°–10° Slow Speed. Speed plot.

Zigzag 20°–20°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 20.0
Committed heading, deg 20.0

Performance

First overshoot angle, deg 9.9
Second overshoot angle, deg 10.9

time	rudder	heading	speed	turn rate
s	deg	kn	deg	deg/min
00:00:00	0	0.0	13.3	0
00:00:20	s20.0	1.3	13.3	s9.2
00:00:40	s20.0	5.8	13.2	s17.0
00:01:00	s20.0	12.3	13.1	s22.2
00:01:20	s19.6	20.3	12.8	s25.5
00:01:40	p20.0	27.3	12.5	s13.1
00:02:00	p20.0	29.7	12.4	s2.6
00:02:20	p20.0	29.4	12.4	p4.0
00:02:40	p20.0	27.1	12.4	p10.1
00:03:00	p20.0	22.7	12.4	p15.8
00:03:20	p20.0	16.7	12.3	p20.5
00:03:40	p20.0	9.2	12.2	p23.9
00:04:00	p20.0	0.8	11.9	p26.0
00:04:20	p20.0	-8.0	11.6	p27.1
00:04:40	p20.0	-17.2	11.3	p27.5
00:05:00	s15.7	-25.8	10.9	p20.3
00:05:20	s20.0	-30.0	10.7	p6.6
00:05:40	s20.0	-30.9	10.7	s1.0

Table 15. Zigzag 20°–20°.

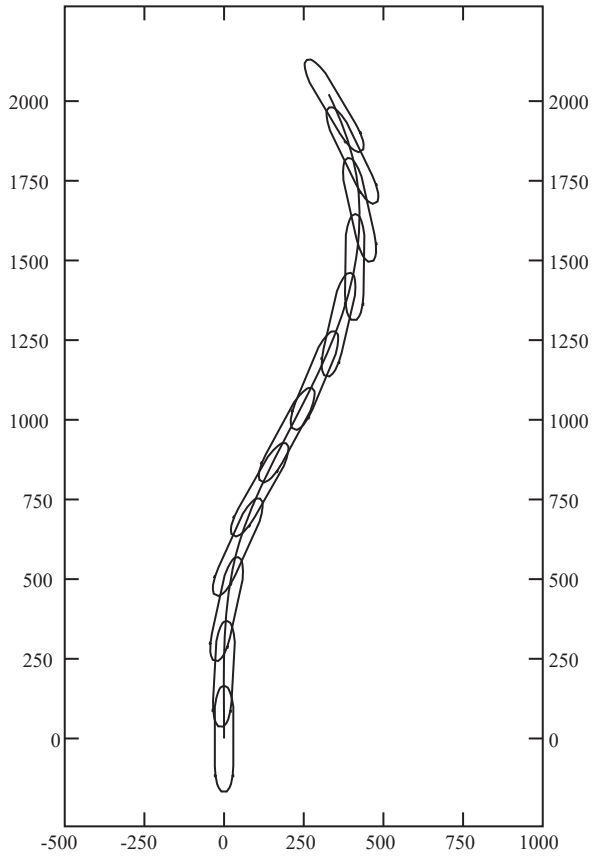


Fig. 32. Zigzag 20°–20°. Ship position plot.

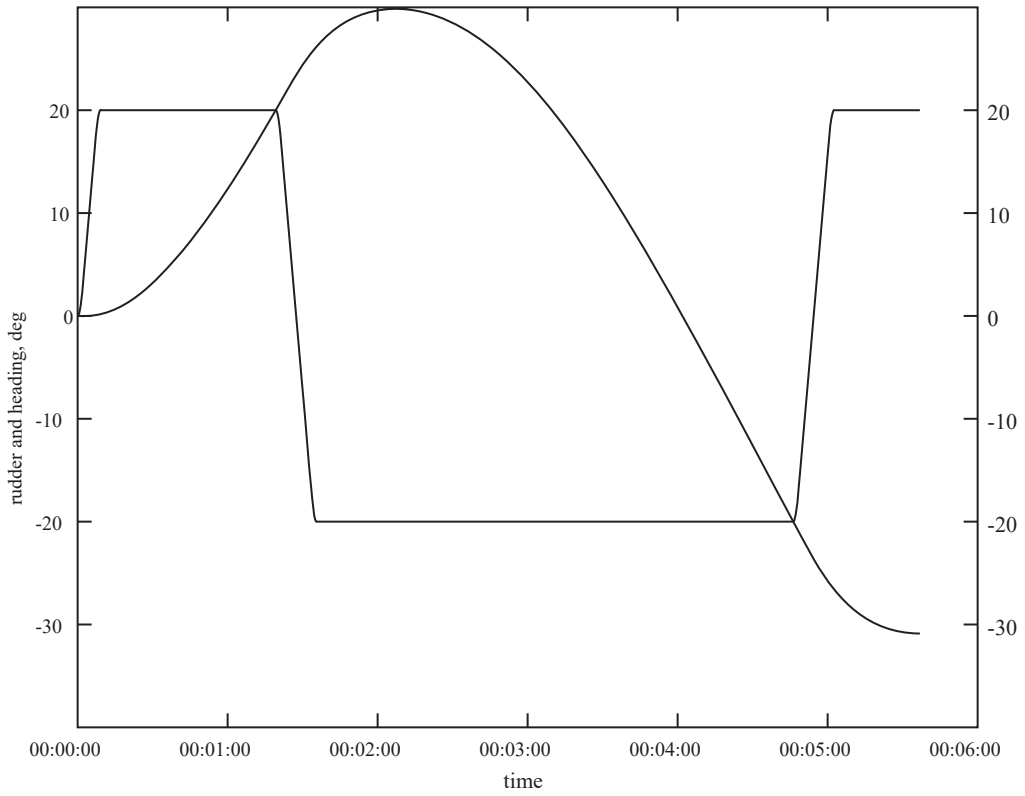


Fig. 33. Zigzag test 20°–20°. Rudder and heading plot.

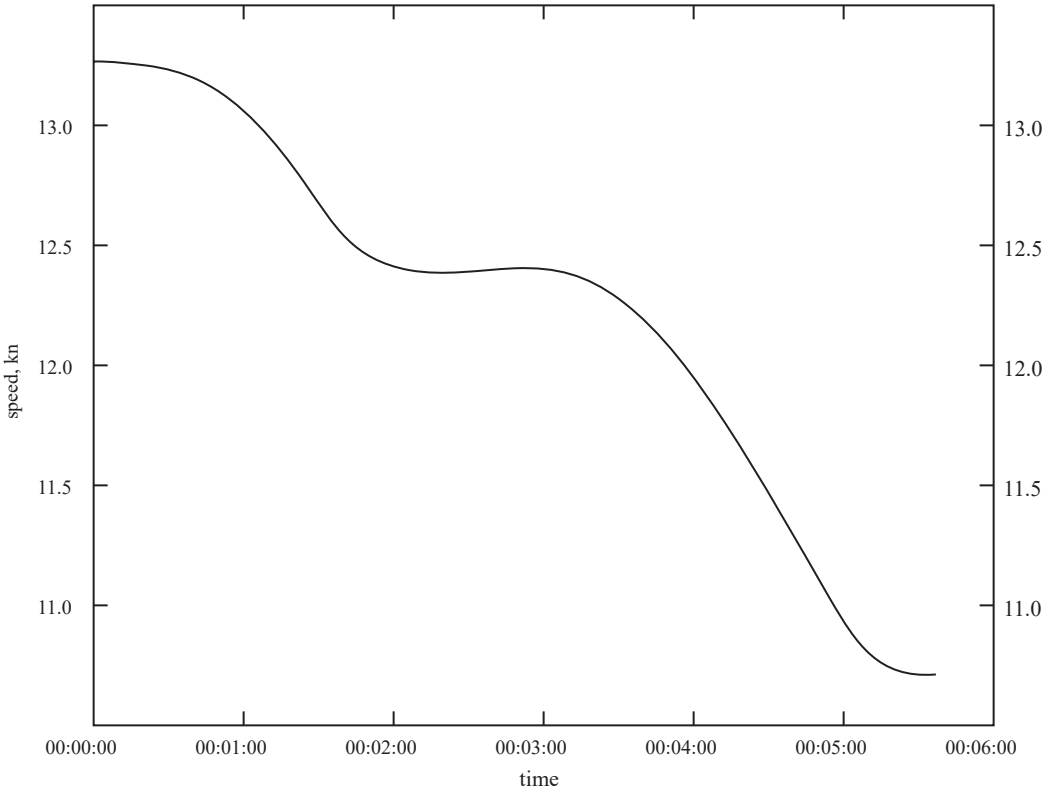


Fig. 34. Zigzag test 20°–20°. Speed plot.

Pull Out

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0

Rudder

From, deg 0.0
To, deg 10.0
And then to, deg 0.0

time	rudder	heading	turn rate
s	deg	deg	deg/min
00:00:00	0	0.0	0
00:00:45	s10.0	6.8	s16.5
00:01:30	0	18.6	s12.4
00:02:15	0	27.1	s10.6
00:03:00	0	34.7	s9.7
00:03:45	0	41.7	s9.0
00:04:30	0	48.2	s8.5
00:05:15	0	54.5	s8.1
00:06:00	0	60.5	s7.9
00:06:45	0	66.3	s7.6
00:07:30	0	71.9	s7.4
00:08:15	0	77.5	s7.3
00:09:00	0	82.9	s7.2
00:09:45	0	88.3	s7.1
00:10:30	0	93.6	s7.0
00:00:00	0	0.0	0
00:00:45	p10.0	-6.8	p16.5
00:01:30	0	-18.6	p12.4
00:02:15	0	-27.1	p10.6
00:03:00	0	-34.7	p9.7
00:03:45	0	-41.7	p9.0
00:04:30	0	-48.2	p8.5
00:05:15	0	-54.5	p8.1

00:06:00	0	-60.5	p7.9
00:06:45	0	-66.3	p7.6
00:07:30	0	-71.9	p7.4
00:08:15	0	-77.5	p7.3
00:09:00	0	-82.9	p7.2
00:09:45	0	-88.3	p7.1
00:10:30	0	-93.6	p7.0

Table 16. Pull Out.

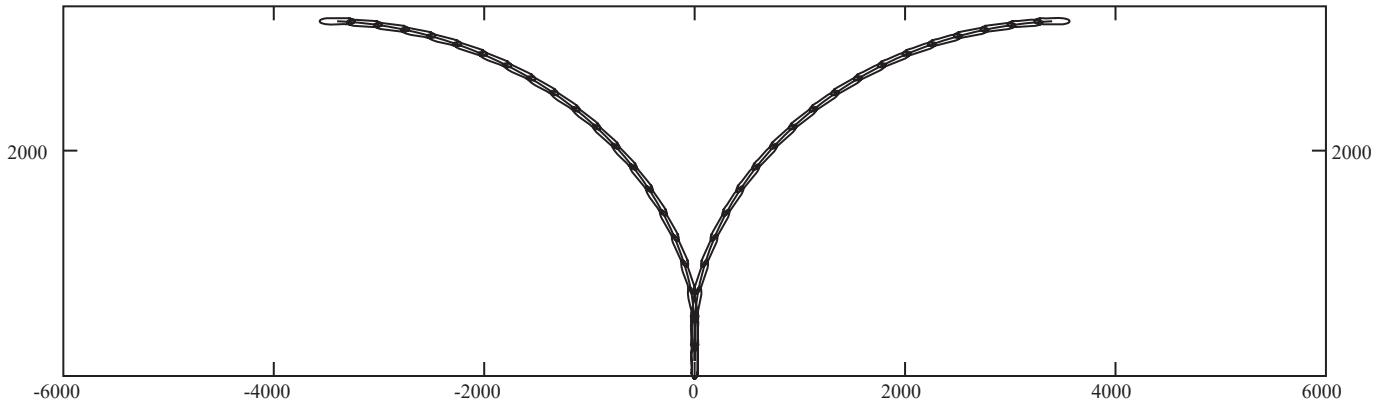


Fig. 35. Pull Out. Ship position plot.

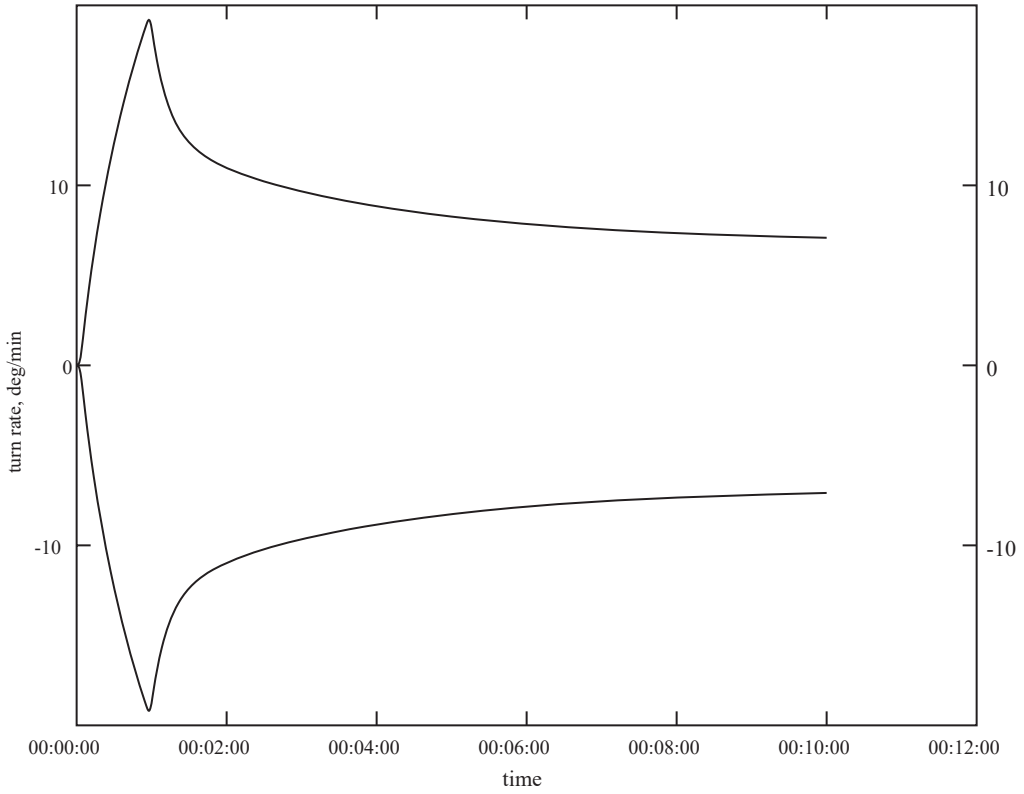


Fig. 36. Pull Out plot.

Environment

Environment

Water depth, H/T	∞
Wind speed, m/s	0.0
Water current speed, kn	0.0

Controls

Machinery telegraph setting%	80.0
Rudder, deg	s35.0, s30.0, s25.0, s20.0, s15.0, s10.0, s5.0, s4.0, s3.0, s2.0
	s1.0, s0.0, p1.0, p5.0, p10.0, p15.0, p20.0, p25.0, p30.0, p35.0
	p30.0, p25.0, p20.0, p15.0, p10.0, p5.0, p4.0, p3.0, p2.0, p1.0
	p0.0, s1.0, s5.0, s10.0, s15.0, s20.0, s25.0, s30.0, s35.0

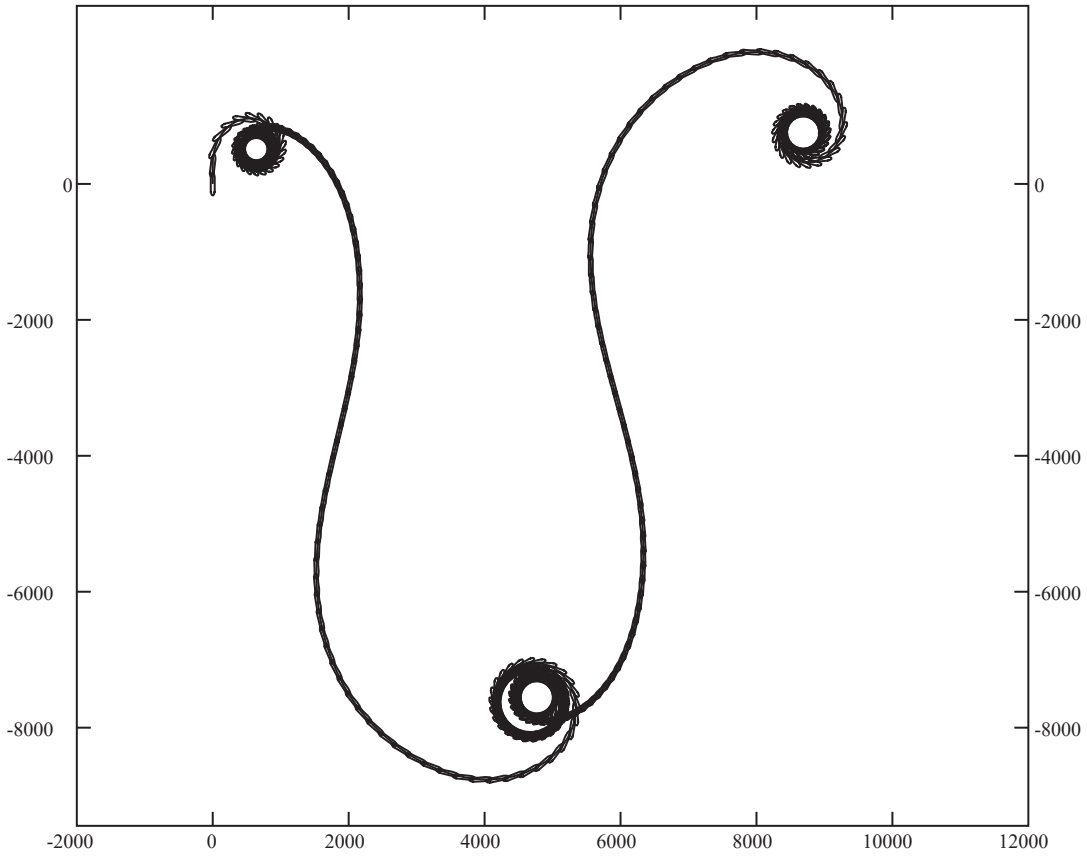


Fig. 37. Spiral test. Ship position plot.

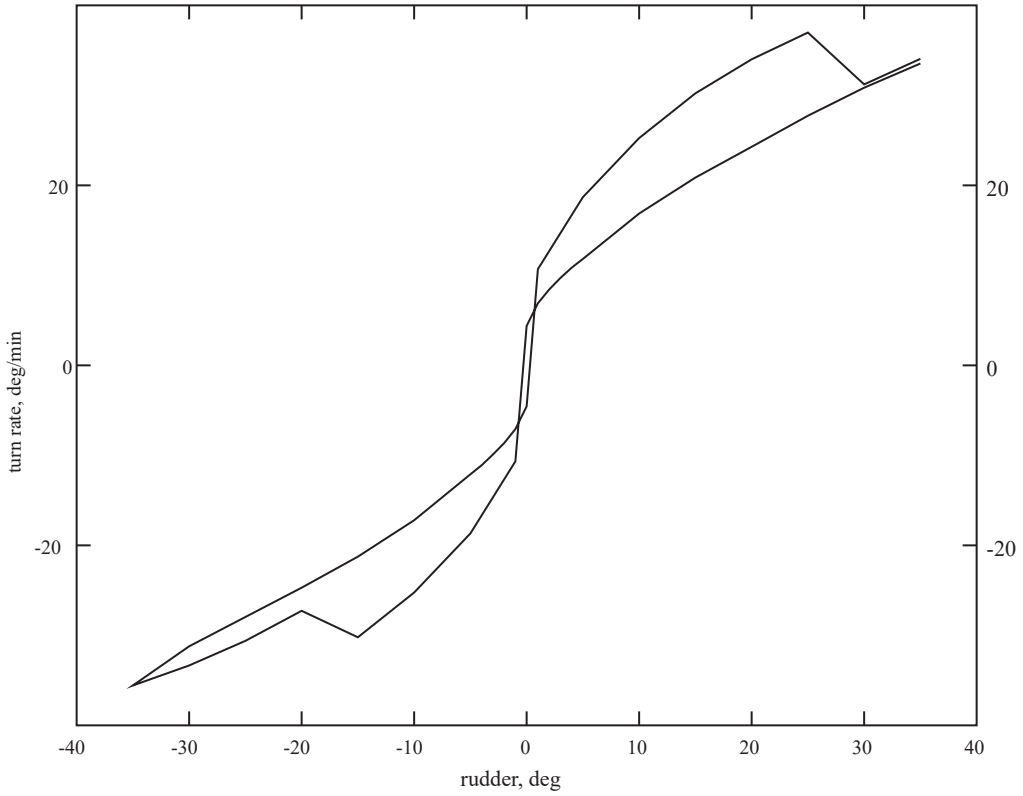


Fig. 38. Spiral test. Equilibrium turn rate plot

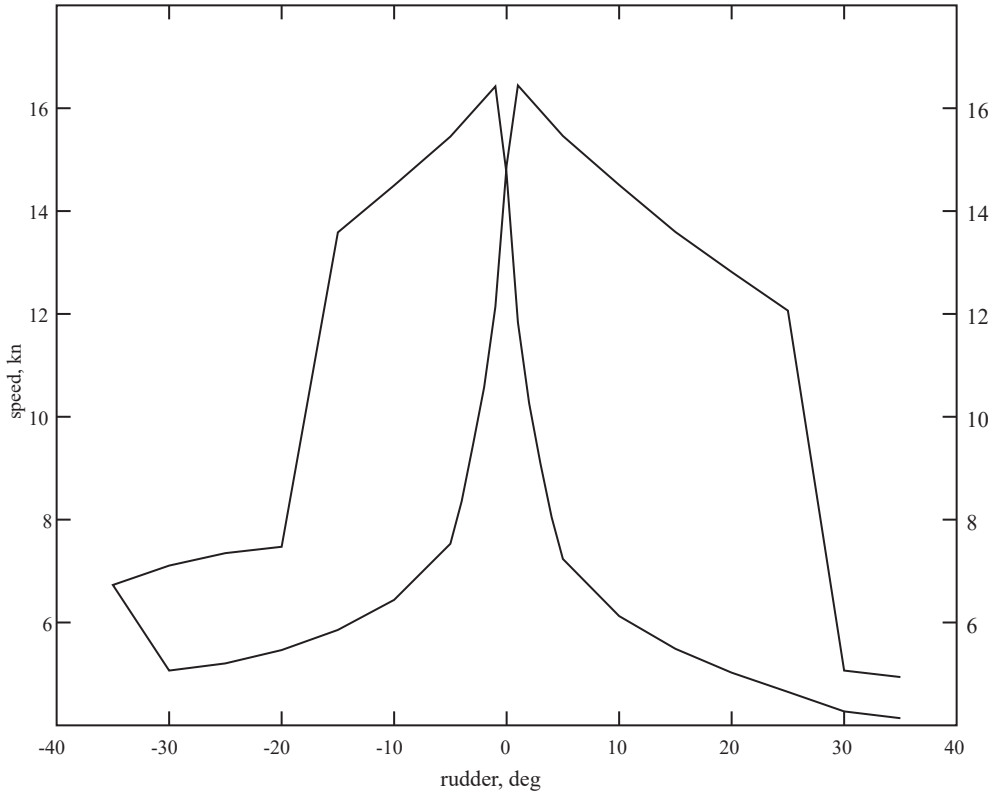
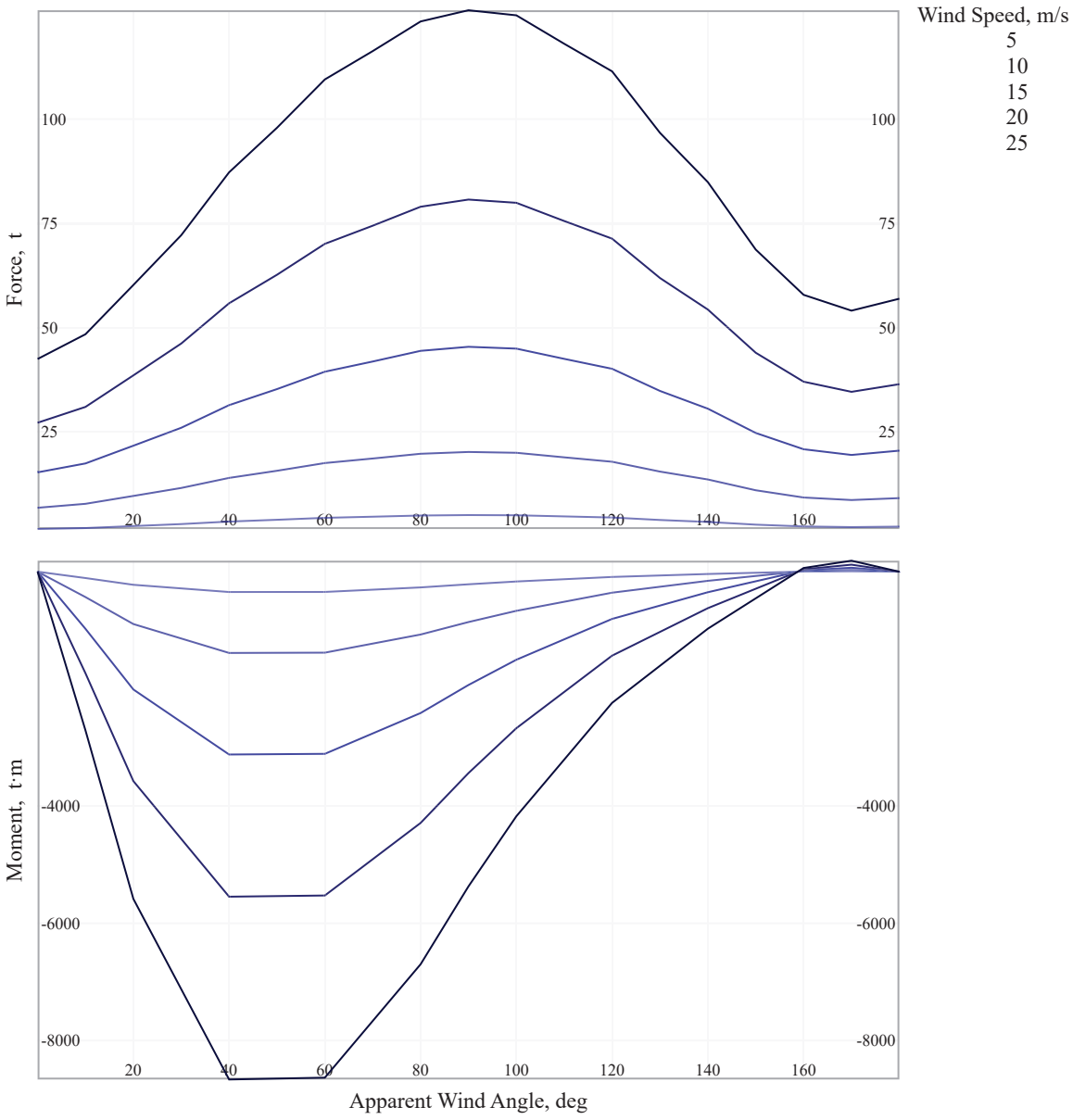


Fig. 39. Spiral test. Equilibrium speed plot

Wind Forces


Wind Speed, m/s
5
10
15
20
25
Force, t
100
75
50
25
20
40
60
80
100
120
140
160
Moment, t·m
-4000
-6000
-8000
Apparent Wind Angle, deg

Williamson Turn

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Rudder, deg 35.0
Committed heading, deg 28.3

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.5	0.0	0	0
00:01:00	16.3	27.4	s46.9	s11.8
00:02:00	14.6	53.5	s11.4	s7.3
00:03:00	14.6	43.4	p34.5	p6.4
00:04:00	12.7	0.5	p45.0	p15.8
00:05:00	10.3	-42.8	p41.5	p18.9
00:06:00	8.6	-82.8	p38.7	p20.8
00:07:00	7.4	-120.3	p36.5	p22.0
00:08:00	6.6	-156.1	p34.1	p22.7
00:09:00	6.9	-169.3	p17.0	p13.0
00:10:00	7.9	-175.9	p4.8	p6.3
00:11:00	9.0	-178.8	p1.8	p3.1
00:12:00	10.0	-179.8	p0.6	p1.4
00:13:00	11.1	179.8	p0.2	p0.6
00:14:00	12.0	179.7	p0.0	p0.2
00:15:00	12.8	179.7	s0.0	p0.0
00:16:00	13.6	179.8	s0.0	s0.0

Table 20. Williamson Turn.

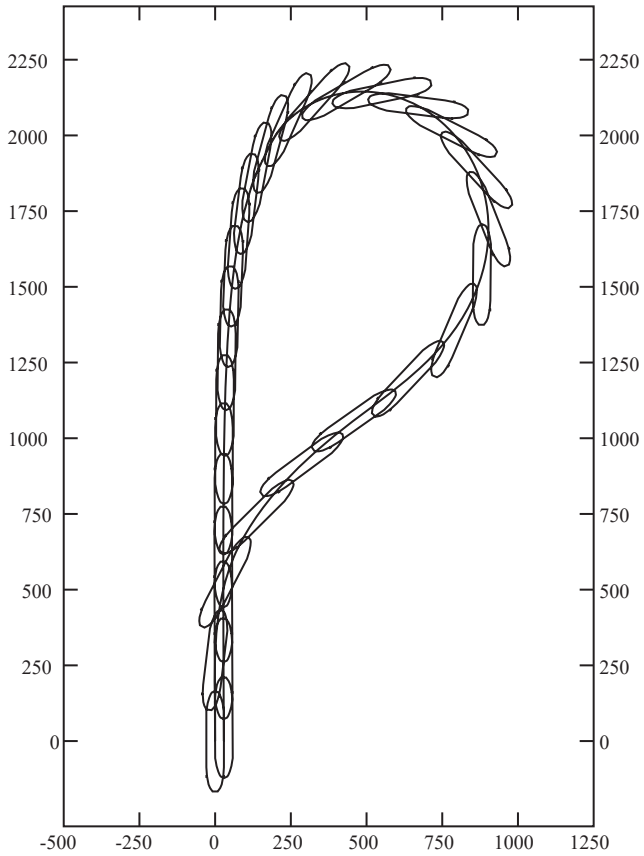


Fig. 44. Williamson Turn. Ship position plot.

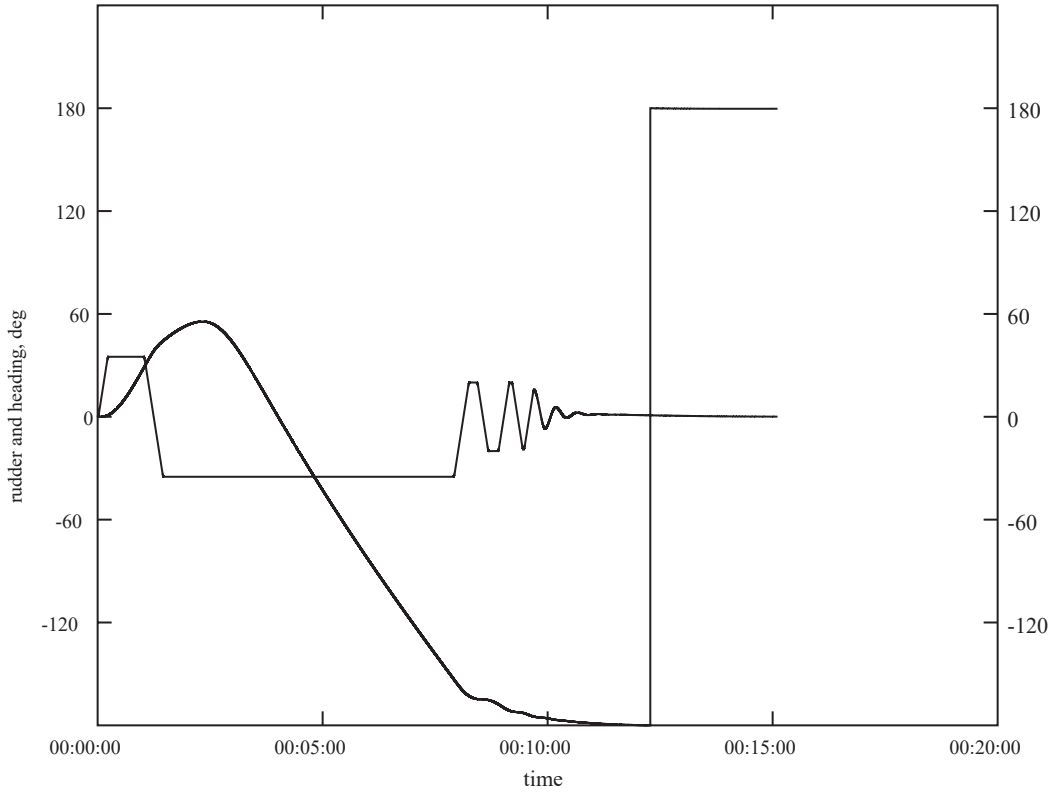


Fig. 45. Williamson Turn. Rudder and heading plot.

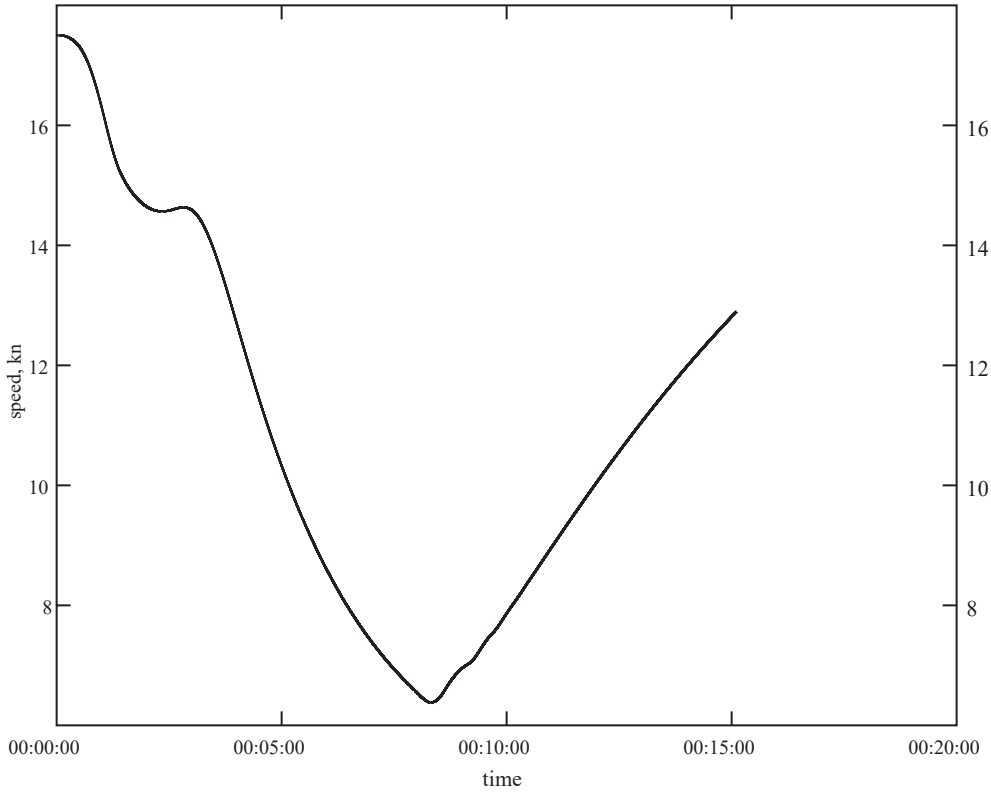


Fig. 46. Williamson Turn. Speed plot.

Wind Effect—Stopped

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	2.4	0.0	0
00:00:20	2.4	0.1	s2.0
00:00:40	2.4	0.6	s3.9
00:01:00	2.4	1.3	s5.9
00:01:20	2.4	2.3	s7.8
00:01:40	2.4	3.5	s9.6
00:02:00	2.4	5.0	s11.3
00:02:20	2.4	6.6	s12.9
00:02:40	2.4	8.4	s14.4
00:03:00	2.4	10.3	s15.8
00:03:20	2.4	12.3	s17.1
00:03:40	2.4	14.4	s18.2
00:04:00	2.3	16.5	s19.3
00:04:20	2.3	18.7	s20.4
00:04:40	2.3	20.8	s21.3
00:05:00	2.2	23.0	s22.3

Table 21. Wind effect—stopped.

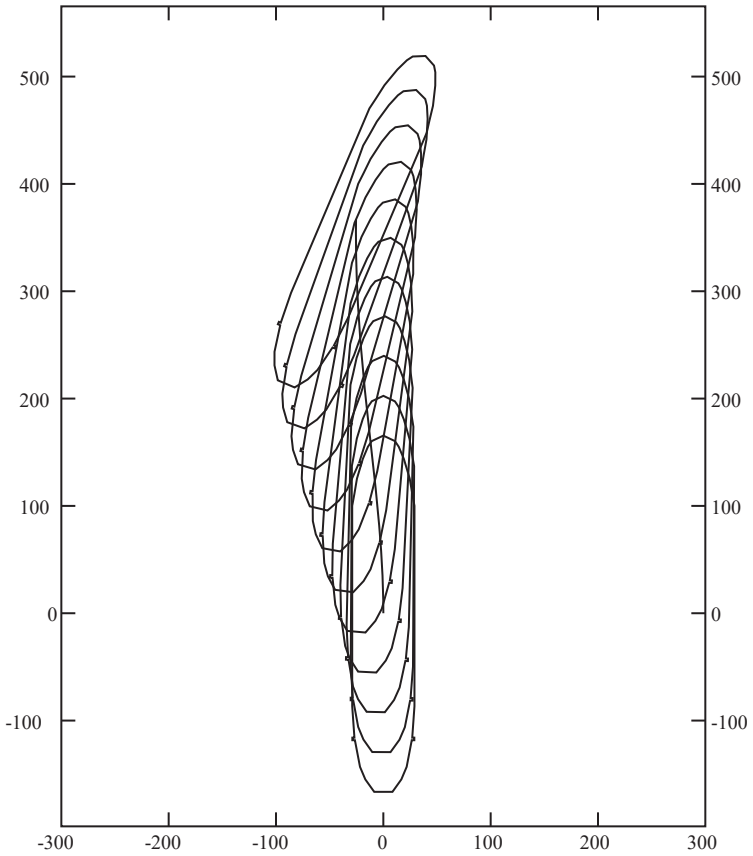


Fig. 47. Wind effect—stopped. Ship position plot.

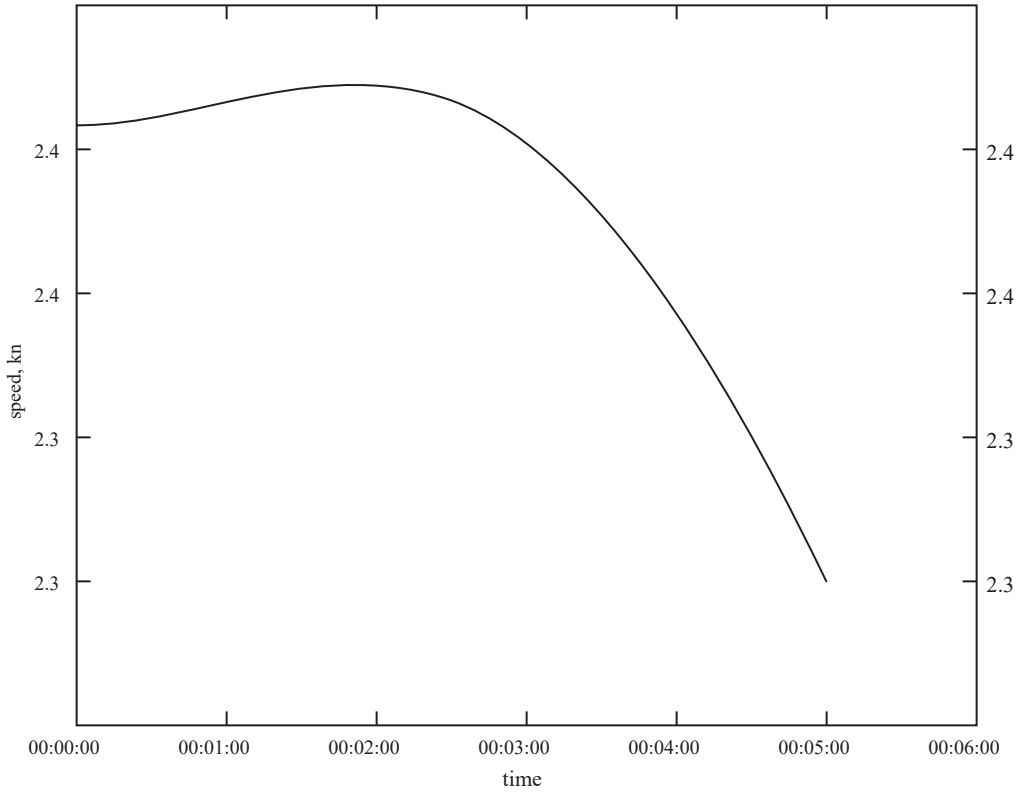


Fig. 48. Wind effect—stopped. Speed plot.

Wind Effect—Under Way

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	17.7	0.0	0
00:00:20	17.7	0.1	s0.3
00:00:40	17.7	0.5	s0.6
00:01:00	17.7	1.1	s0.9
00:01:20	17.7	2.0	s1.2
00:01:40	17.7	3.3	s1.5
00:02:00	17.7	4.8	s1.9
00:02:20	17.7	6.6	s2.2
00:02:40	17.7	8.7	s2.5
00:03:00	17.6	11.1	s2.8
00:03:20	17.6	13.6	s3.1
00:03:40	17.5	16.4	s3.3
00:04:00	17.5	19.4	s3.6
00:04:20	17.4	22.5	s3.7
00:04:40	17.3	25.8	s3.9
00:05:00	17.2	29.1	s4.0

Table 22. Wind effect—under way.

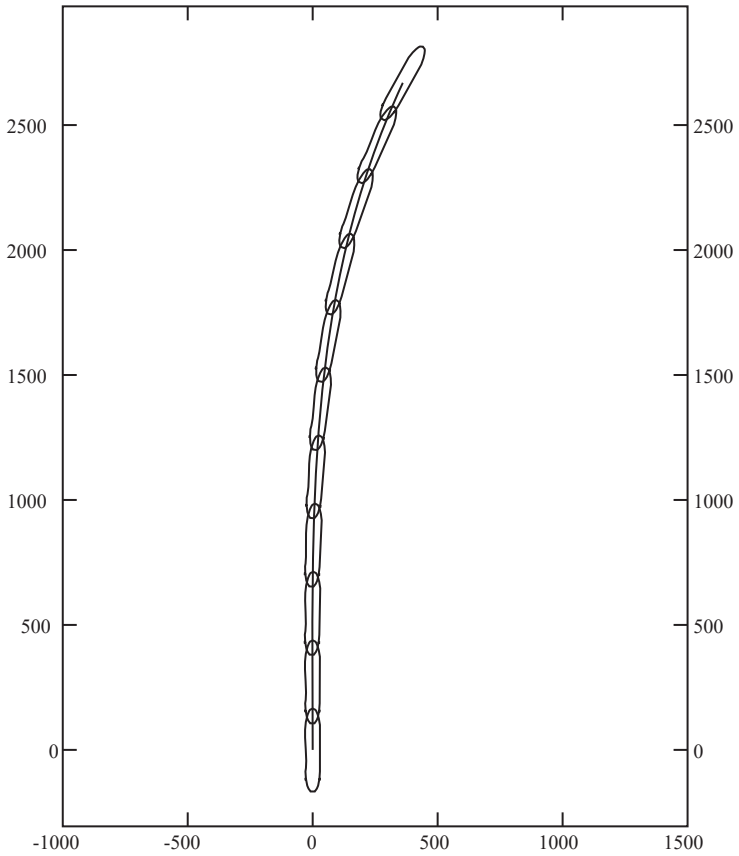


Fig. 49. Wind effect—under way. Ship position plot.

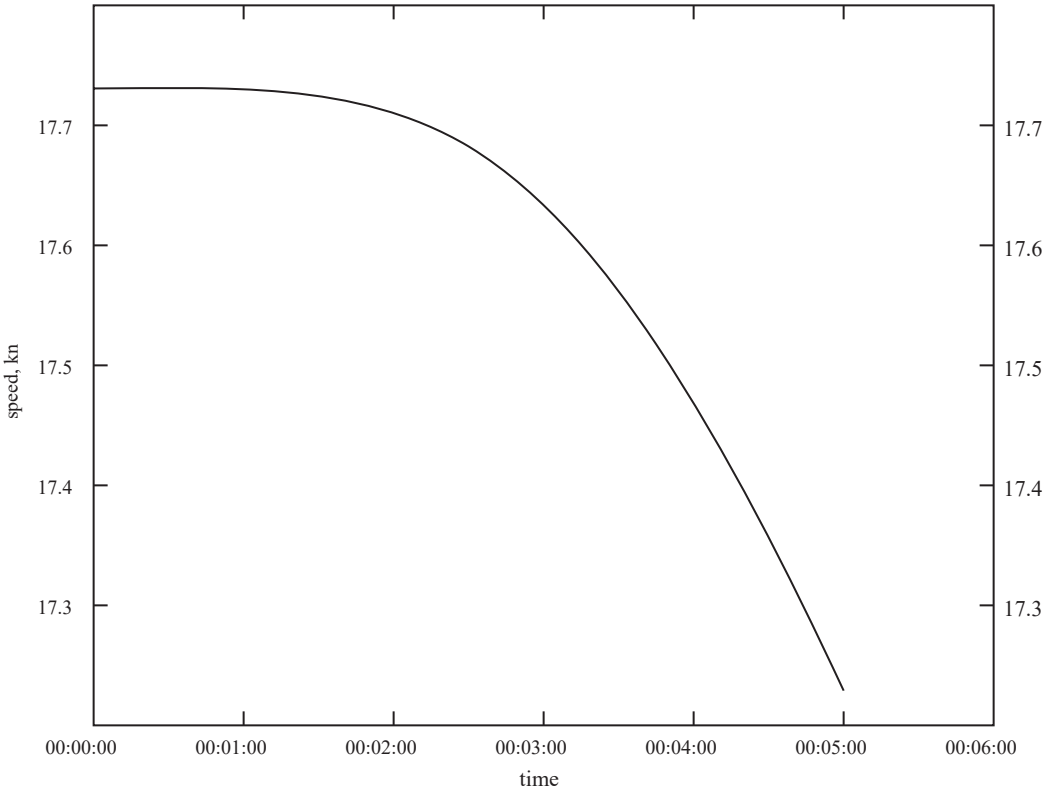


Fig. 50. Wind effect—under way. Speed plot.

Free Oscillations

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0
Wave height, m 0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

Initial Inclination

Roll, deg 10.0
Pitch, deg 5.0
Heave, m 0

time	roll	pitch	heave
s	deg	deg	m
00:00:00	10.0	5.0	0.0
00:00:05	-5.6	-1.6	0.1
00:00:10	3.4	0.0	0.9
00:00:15	-2.1	0.4	-0.2
00:00:20	1.3	-0.3	0.4
00:00:25	-0.9	0.1	0.2
00:00:30	0.6	0.0	0.1
00:00:35	-0.4	0.0	0.2
00:00:40	0.2	0.0	0.1
00:00:45	-0.2	0.0	0.1
00:00:50	0.1	0.0	0.1
00:00:55	-0.1	0.0	0.1
00:01:00	0.0	0.0	0.1
00:01:05	0.0	0.0	0.1
00:01:10	0.0	0.0	0.1
00:01:15	0.0	0.0	0.1
00:01:20	0.0	0.0	0.1
00:01:25	0.0	0.0	0.1
00:01:30	0.0	0.0	0.1
00:01:35	0.0	0.0	0.1
00:01:40	0.0	0.0	0.1

Table 23. Free Oscillations.

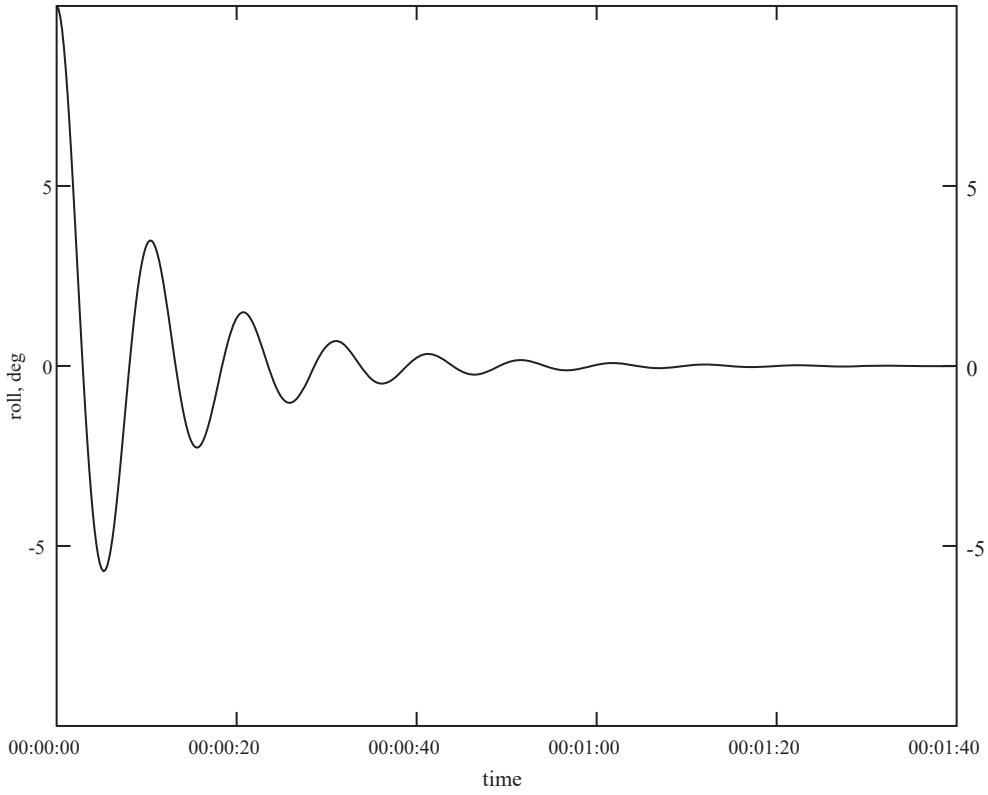


Fig. 51. Free Oscillations. Roll plot.

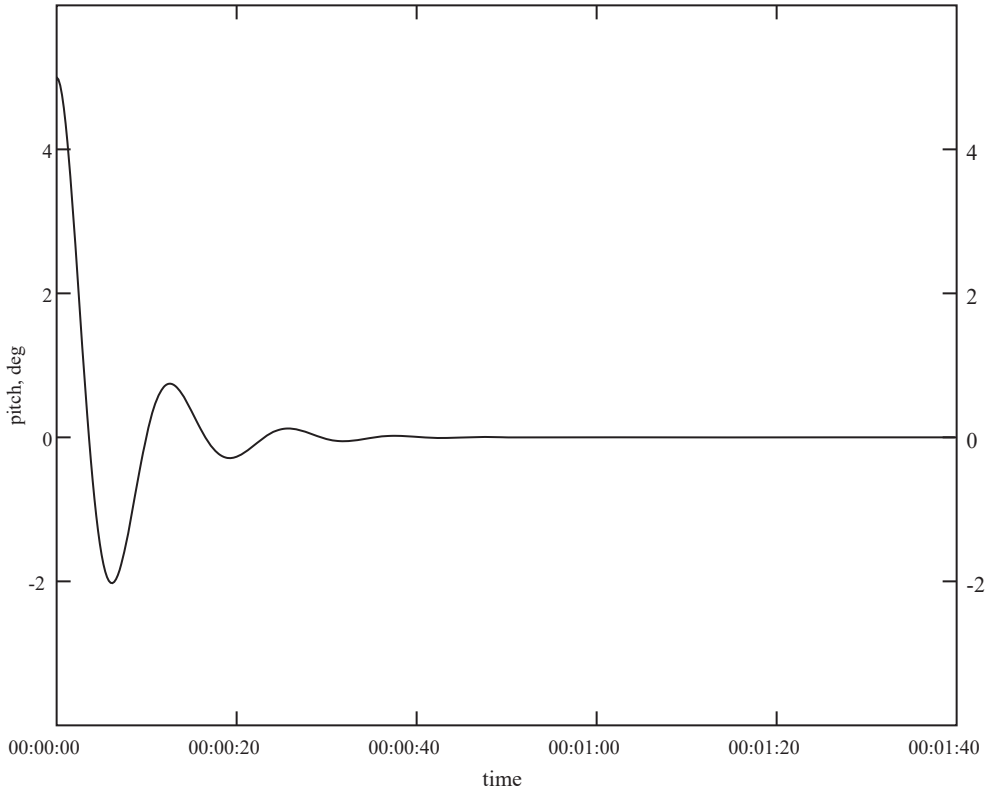


Fig. 52. Free Oscillations. Pitch plot.

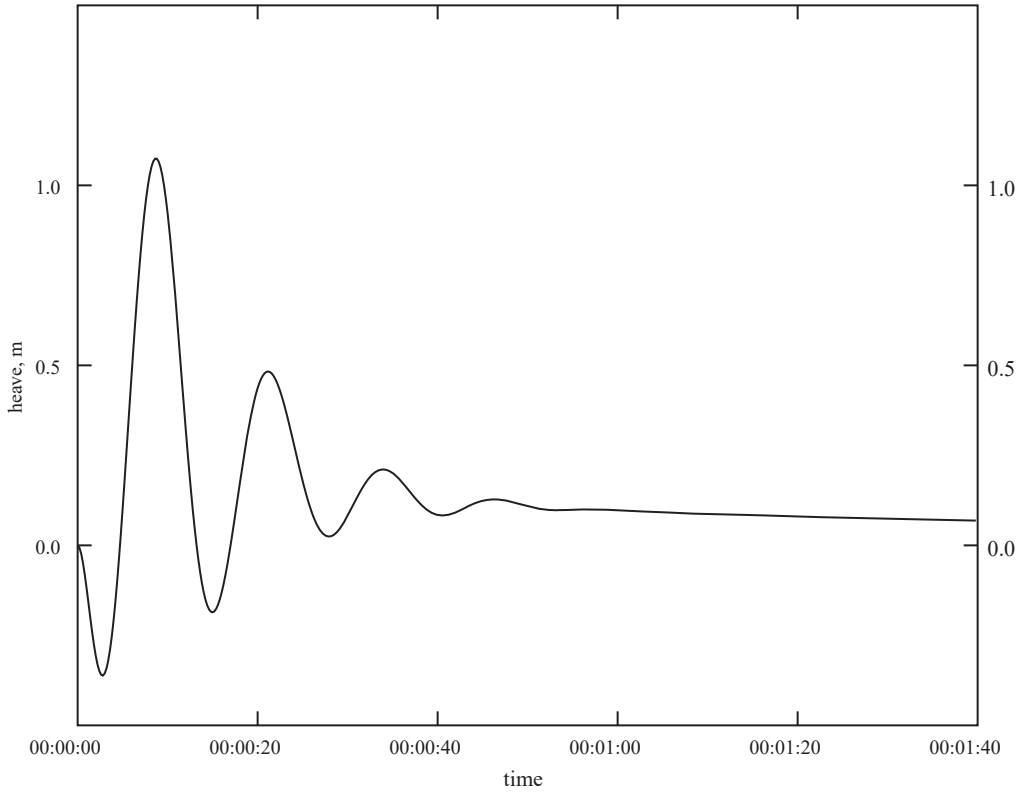


Fig. 53. Free Oscillations. Heave plot.

PILOT CARD

VLCC18Q1
Version 1

Ship's name Elizabeth I. Angelicoussi

Call Sign SZHJ **Deadweight** 306229 tonnes **Year built** 2004

Draught aft 15.85 m / 52 ft 0 in **Forward** 15.85 m / 52 ft 0 in **Displacement** 243801 tonnes

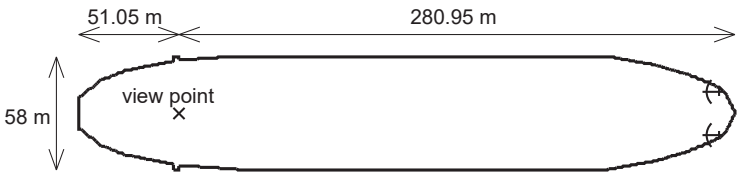
SHIP'S PARTICULARS

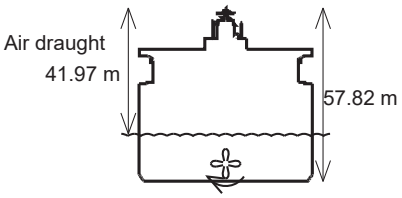
Length overall 332 m **Anchor chain:** **Port** 28.1 shackles **Starboard** 28.1 shackles

Breadth 58 m

Bulbous bow Yes

(1 shackle = 27.432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 29431 kW (40015 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Qloaded
Full sea speed	**1**	76.0	N/A	N/A	17.5
Full Ahead	**0.8**	57.0	N/A	N/A	13.3
Half Ahead	**0.5**	47.0	N/A	N/A	10.9
Slow Ahead	**0.25**	33.0	N/A	N/A	7.5
Dead Slow Ahead	**0.125**	28.0	N/A	N/A	6.3
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**	
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type**		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

WHEELHOUSE POSTER

VLCC18Q1
Version 1

Ship's name Elizabeth I. Angelicoussi **Call Sign** SZHJ **Gross tonnage** 153911 **Net tonnage** 107642

Max. Displacement 243801 tonnes, and **Deadweight** 306229 tonnes, and **Block coefficient** 0.809 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	QLoaded
Trial / Estimated	Trial / Estimated
N/A m forward	15.85 m forward
N/A m aft	15.85 m aft

STEERING PARTICULARS

Type of rudder(s) Normal

Maximum rudder angle 35 °

Time hard-over to hard-over

with one power unit 50 s

with two power units 25 s

Min. speed to maintain course propeller stopped knots

Rudder angle for neutral effect 0 °

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving min / shackle
Port	28.1	0.894
Starboard	28.1	0.894
(1 shackle = 27.432 m = 15 fathoms)		

PROPULSION PARTICULARS

Type of engine Diesel , 29431 kW (40015 hp) **Type of propulsion** Propelle

Engine order		RPM	Pitch	Speed (knots)	
				Loaded	QLoaded
Full sea speed	**1**	76.0	N/A	N/A	17.5
Full Ahead	**0.8**	57.0	N/A	N/A	13.3
Half Ahead	**0.5**	47.0	N/A	N/A	10.9
Slow Ahead	**0.25**	33.0	N/A	N/A	7.5
Dead Slow Ahead	**0.125**	28.0	N/A	N/A	6.3
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

Critical revolutions rpm

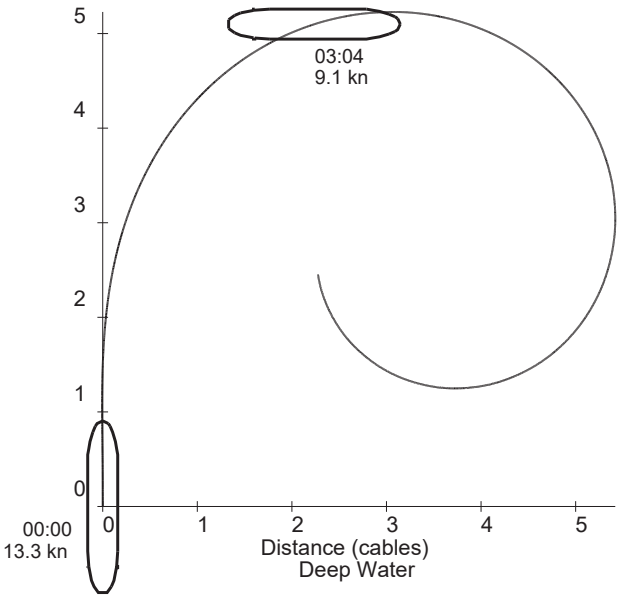
THRUSTER EFFECT at trial conditions

Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	N/A	N/A	N/A	N/A	N/A
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

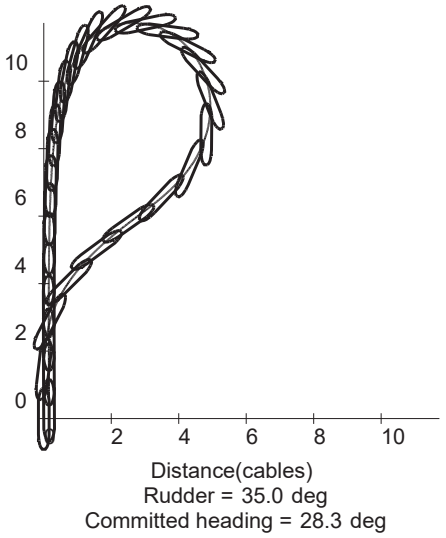
DRAUGHT INCREASE (QLOADED)

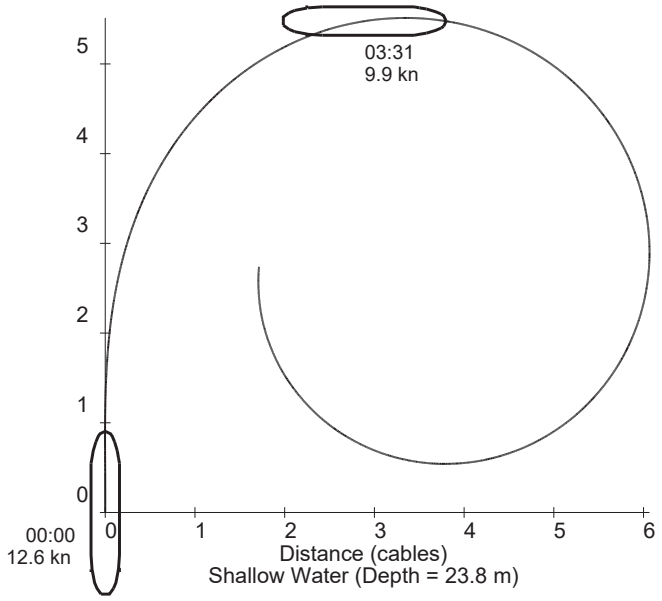
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
15.9	7.6	0.40
	10.9	0.83
	16.8	1.98
7.9	7.5	0.40
	10.5	0.81

TURNING CIRCLES AT MAX. RUDDER ANGLE (35 °)

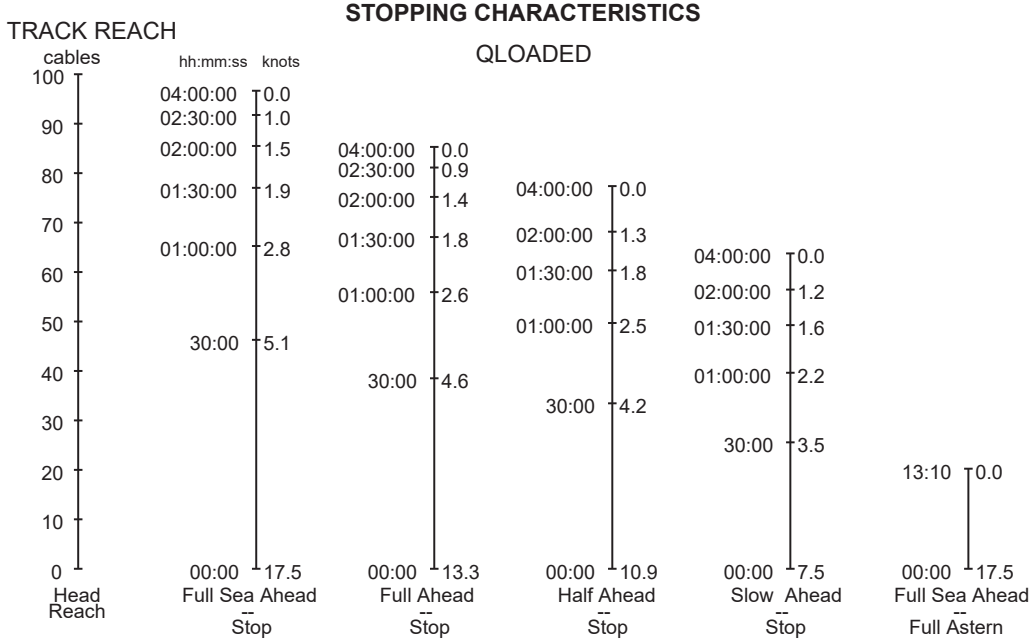


WILLIAMSON TURN



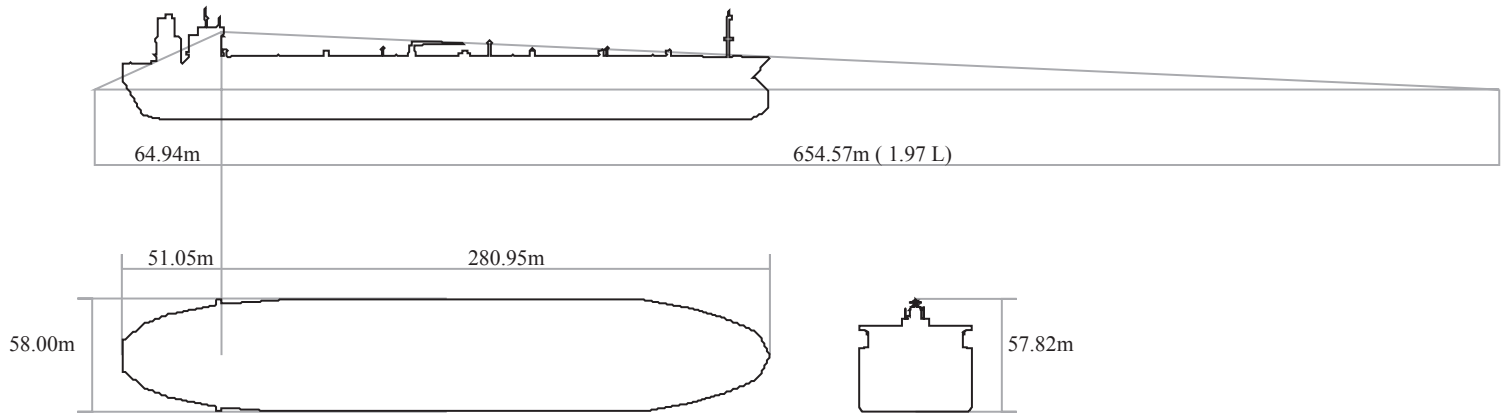


STOPPING CHARACTERISTICS



PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE





Description of Ship Model

VLCC18R1

Tanker
Elizabeth I. Angelicoussi
RLoaded

Version 1

© 2021 Kongsberg Digital
All rights reserved
No part of this work covered by the copyright hereon may be reproduced or otherwise copied without prior written permission of Kongsberg Digital

Table of Contents

General Description 6
Ship Data 7
Blind Zone 9
Speed 10
Statistics 11
Acceleration 14
Acceleration from Slow to Half 17
Crash Stop 20
Deceleration from Half to Slow 23
Coasting Stop 26
Time for effective changes in telegraph settings in stopping conditions 29
Turning Circle Starboard, Deep Water 30
Turning Circle Starboard, Shallow Water 33
Turning Circle Port, Deep Water 36
Accelerated Turning 39
Coasting Circle 42
Course Change Manoeuvre 45
Zigzag 10°–10° 48
Zigzag 10°–10° Slow Speed 52
Zigzag 20°–20° 56
Pull Out 60
Spiral Test 63
Wind Forces 66
Williamson Turn 67
Wind Effect—Stopped 71
Wind Effect—Under Way 74
Free Oscillations 77

Model Identification

The model VLCC18R represents a 153,911 GT 306,230 DWT VLCC M/T *Elizabeth I. Angelicoussi* loaded at 68' (20.73m) draft. *Elizabeth I. Angelicoussi* was built by Daewoo Shipbuilding & Marine Engineering Co. Ltd., Koje, Republic of Korea in 2004.

Revision History

Ver 0 WH
Aug 12, 2021

Ver 1 WH
Aug 17, 2021

Model Sources

The modelling was based on the information of a 300K DWT VLCC from

- National Seoul University Open Courseware
- SIMMAN 2014 Proceedings
- Fairplay ship information sheet of Elizabeth I. Angelicoussi

The original source information for modelling VLCC18L was not available.

References

- "Propulsion Trends in Container Vessels", MAN B&W Diesel A/S. Copenhagen, Denmark.
- "Standards for Ship Manoeuvrability", Resolution MSC.137(76), adopted on 4 December 2002. Web site: http://www.navcen.uscg.gov/marcomms/imo/msc_resolutions/Resolution%20MSC.137(76).pdf
- Inoue, S., et al, "A Practical Calculation Method of Ship Maneuvering Motion", International shipbuilding Progress, Vol. 28, #325, Sept., '81.

General Description

Power Plant

VLCC18R1 Tanker Elizabeth I. Angelicoussi is powered by 1 diesel engine rating 29431 kW at 76 rpm.

Propulsors

VLCC18R1 is propelled by 1 fixed pitch propeller. Direction of propulsor revolution is right.

Speed

Top speed of VLCC18R1 at 100% throttle setting and calm conditions is 17.0 kn ahead and 8.5 kn astern.

Rudders

This ship is steered with 1 rudder with maximum angle 35 deg. The rudder uses 25.0 s from full port to full starboard.

Thrusters

This ship has no auxilliary thrusters.

Stopping Ability

Stopping performance can be judged from crash stop manoeuvre. Crash stop distance of VLCC18R1 is 4651 m which makes 14.5 ship lengths. Such crash stop performance is fair and satisfies IMO's requirements as described in IMO Resolution MCS.137(76) Standards for Ship Manoeuverability.

Turning Ability

The turning ability may be judged from turning circles. Turning cirlce test performed at 100% throttle setting and 35 deg starboard steering order results in advance 1033 m or 3.2 ship's length and tactical diameter 1077 m or 3.4 ship's length. Turning ability of VLCC18R1 is fair and satisfies IMO's requirements.

Manoeuvring Ability

Zigzag test performed at 80% throttle setting show first overshoot angle 6.5 deg in the 10-10° test and 11.4 deg in the 20-20° test. Zigzag test results indicate that manouevring ability of VLCC18R1 is fair and satisfies IMO's Resolution MCS.137(76).

Steering Ability

Steering ability of VLCC18R1 is good. The ship is course stable.

Ship Data

Identification

Model name	VLCC18R1
Ship database file name	VLCC18R1.sdb
Type of ship	Tanker
Loading condition	RLoaded
Ship's name	Elizabeth I. Angelicoussi

General Data

IMO#	9257149
Year Built	2004
Builder	Daewoo S&ME
Call Sign	SZHJ
MMSI	240165000
Bulbous Bow	Yes
Gross Tonnage, RT	153911
Net Tonnage, RT	107642
Deadweight, t	306229
Displacement, t	321001
Length between perpendiculars, m	320
Length overall, m	332
Beam moulded, m	58
Draught fore, m	20.7
Draught aft, m	20.7
Block coefficient	0.814
Radius of inertia, multiples of L_{pp}	0.25
Lateral windage area, m²	4126
Speed ahead, kn	17
Speed astern, kn	8.5
Minimum speed to maintain course with engine stopped, kn	
Transverse metacentric height, m	10.9

Engines

Number of engines	1
Type of engine	Diesel
Total shaft power, kW	29431
Revolutions, rpm	76.0
Stall Revolutions, rpm	76.0

Propellers

Number of propellers	1
Type of propulsion	Propeller
Max azimuting angle, deg	0.0
Max azimuting rate, deg/s	0.0
Revolutions, rpm	76.0
Direction of rotation	Clockwise
Diameter, m	9.9
Pitch, P/D @ 0.7R	0.752

Rudders

Number of rudders	1
Rudder type	Normal
Max rudder angle, deg	35.0
Max rudder rate, deg/s	2.8
Rudder area, m²	130.7
Total rudder area, % of $L_{pp}T_{\alpha}$	2.0

Bow Anchors

Number of bow anchors	2
Mass, t	17.3/17.0
Chain break load, t	1018.0

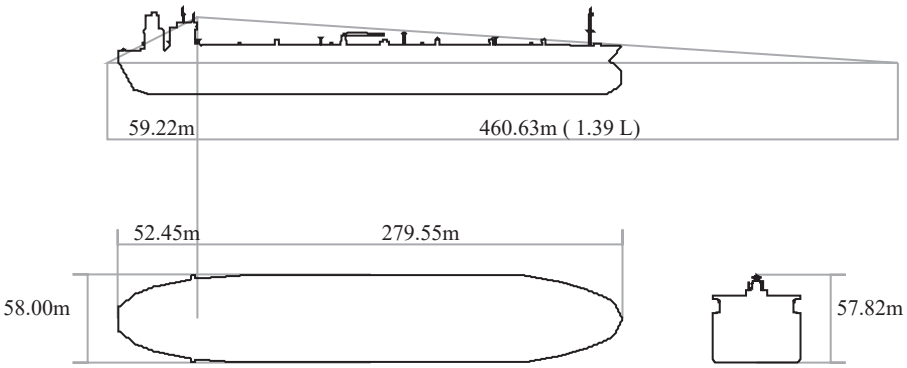
Radar Position

Longitudinal radar position, m	-121.1
Lateral radar position, m	0.0
Vertical radar position, m	-44.2

Viewpoint Position

Longitudinal viewpoint position, m	-114.0
Lateral viewpoint position, m	0.0
Vertical viewpoint position, m	30.1

Blind Zone



Speed

Throttle Setting		Propeller		Speed	
		revolutions	pitch	deep H/T = ∞	shallow H/T = 1.5
		rpm	P/D	kn	kn
Full sea speed	1	76.0	N/A	17.0	15.7
Full Ahead	0.8	57.0	N/A	12.9	12.3
Half Ahead	0.5	47.0	N/A	10.5	10.2
Slow Ahead	0.25	33.0	N/A	7.3	7.2
Dead Slow Ahead	0.125	28.0	N/A	6.1	6.0
Dead Slow Astern	-0.125	-28.0	N/A	-4.1	-3.9
Slow Astern	-0.25	-33.0	N/A	-4.8	-4.6
Half Astern	-0.5	-47.0	N/A	-7.0	-6.7
Full Astern	-1	-57.0	N/A	-8.5	-8.1

Table 1. Propeller revolutions and pitch and ship speed as function of machinery telegraph setting. Deep and shallow water.

Statistics

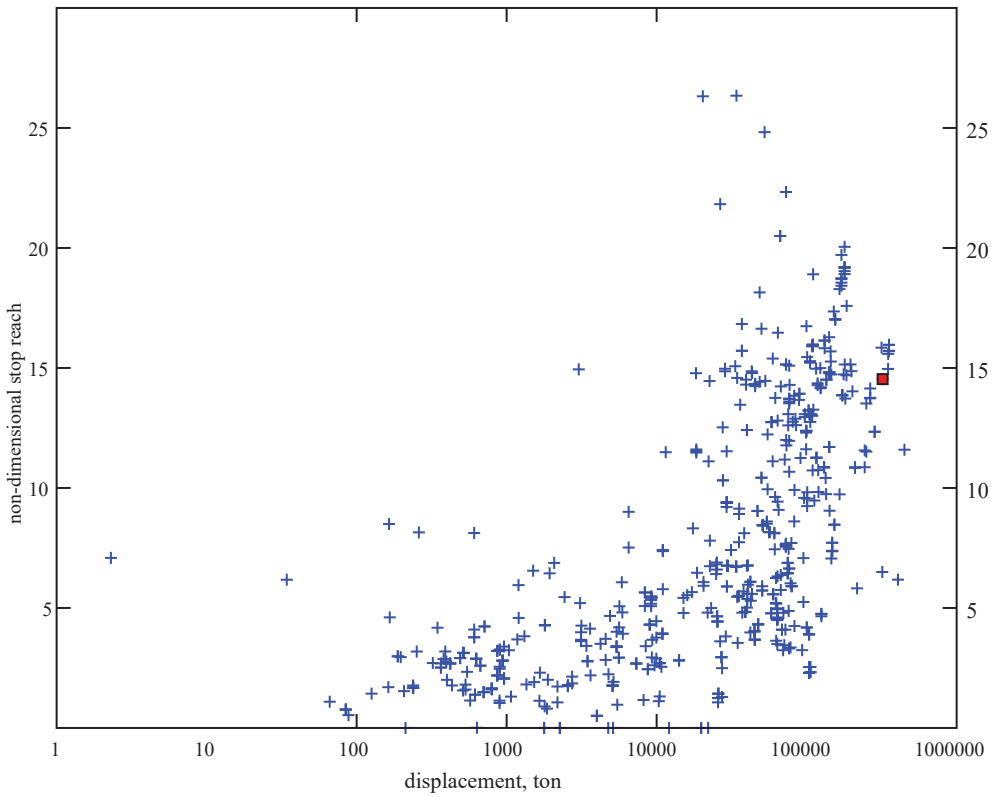


Fig. 1. Stop reach of the ship compared with other ship models.

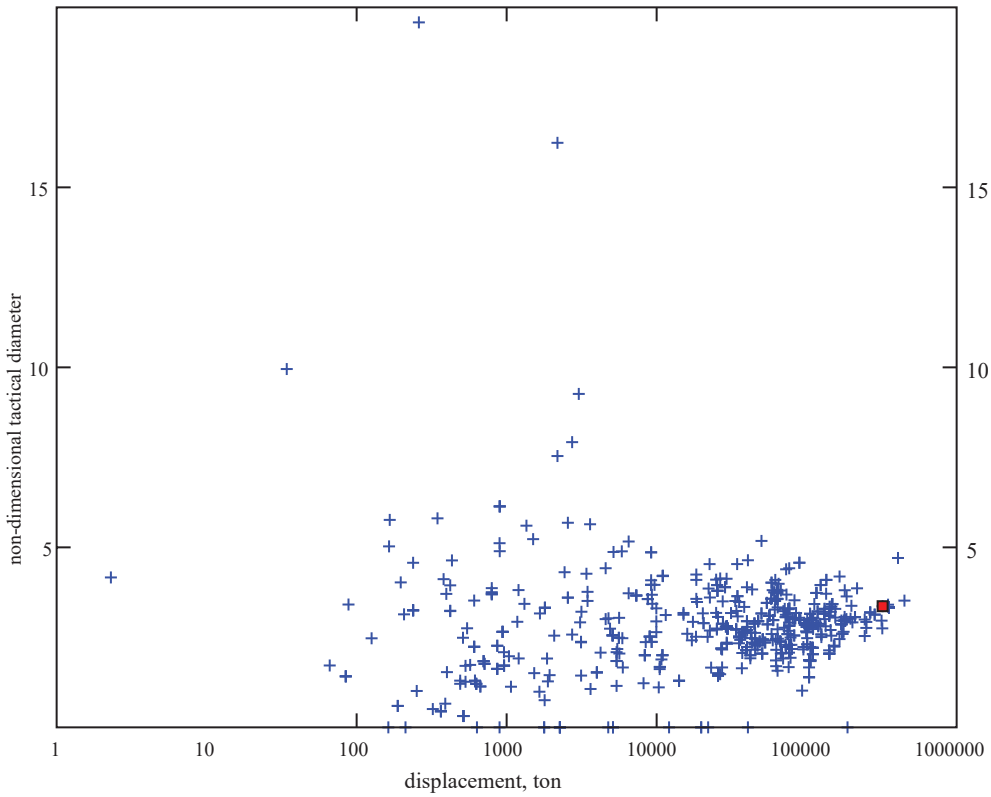


Fig. 2. Tactical diameter of the ship compared with other ship models.

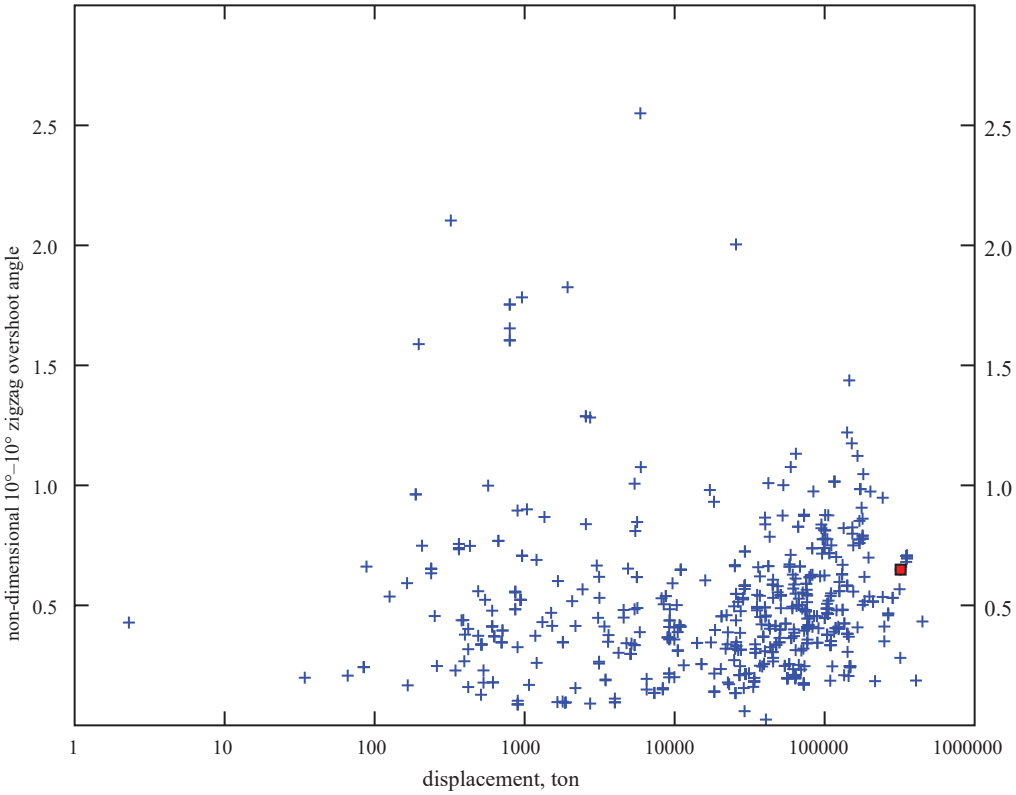


Fig. 3. Zig-zag overshoot angle of the ship compared with other ship models.

Acceleration

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 0.0
to, % 100.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	0.0	0.752	0.0	0.0
00:01:00	66.8	0.752	0.9	12.9
00:02:00	67.1	0.752	2.0	57.9
00:03:00	67.6	0.752	3.0	135.4
00:04:00	68.3	0.752	4.0	244.6
00:05:00	69.2	0.752	5.0	385.0
00:06:00	70.3	0.752	6.0	555.6
00:07:00	71.5	0.752	6.9	755.3
00:08:00	72.1	0.752	7.8	983.2
00:09:00	72.8	0.752	8.7	1237.8
00:10:00	73.4	0.752	9.5	1517.6
00:11:00	74.1	0.752	10.2	1821.3
00:12:00	74.7	0.752	10.9	2147.3
00:13:00	75.1	0.752	11.6	2494.1
00:14:00	75.6	0.752	12.2	2860.3
00:15:00	76.0	0.752	12.7	3244.5
00:16:00	76.1	0.752	13.2	3645.2
00:17:00	76.1	0.752	13.7	4059.8

Table 2. Acceleration.

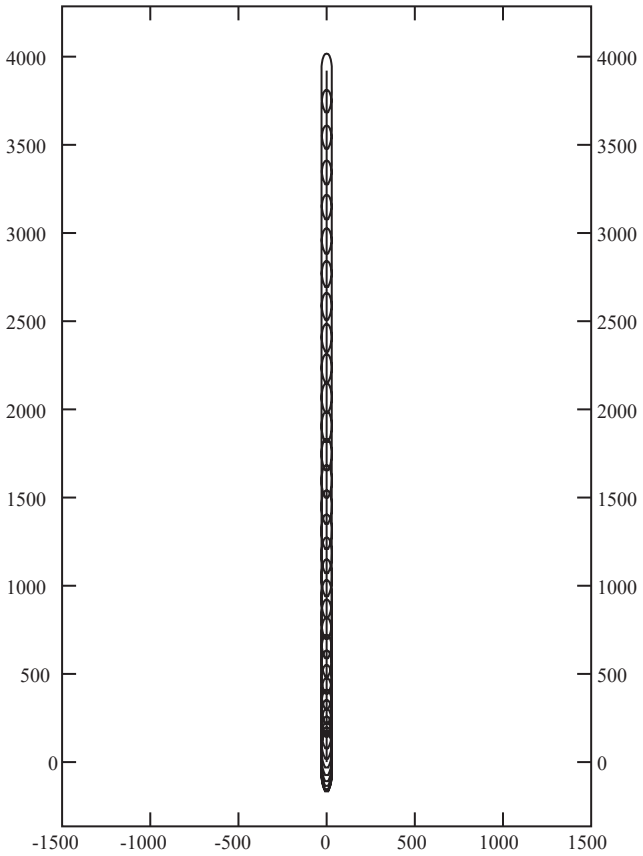


Fig. 4. Acceleration. Ship position plot.

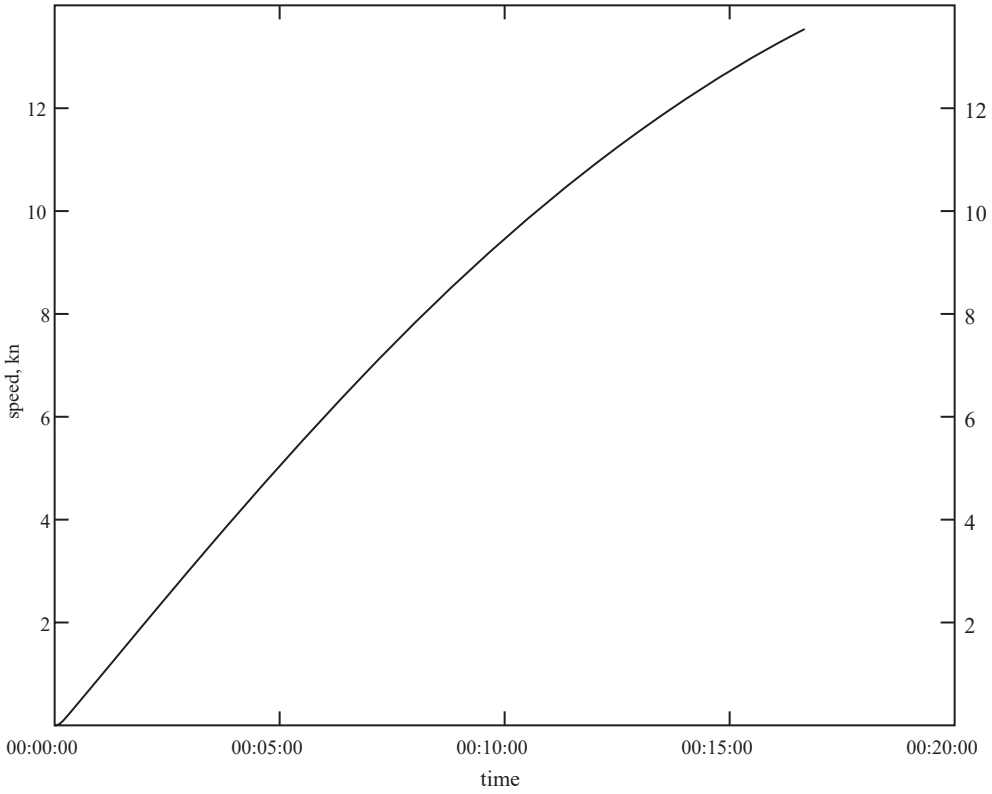


Fig. 5. Acceleration. Speed plot.

Acceleration from Slow to Half

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 25.0
to, % 50.0
Rudder ..... Autopilot

time	propeller	pitch ratio	speed	distance
s	rpm	P/D	kn	m
00:00:00	33.0	0.752	7.3	0.0
00:01:00	47.1	0.752	7.5	228.0
00:02:00	47.1	0.752	7.7	462.8
00:03:00	47.1	0.752	7.9	704.1
00:04:00	47.1	0.752	8.1	951.3
00:05:00	47.1	0.752	8.3	1204.1
00:06:00	47.1	0.752	8.4	1462.1
00:07:00	47.1	0.752	8.6	1725.0
00:08:00	47.1	0.752	8.7	1992.4
00:09:00	47.1	0.752	8.9	2264.1
00:10:00	47.1	0.752	9.0	2539.7
00:11:00	47.1	0.752	9.1	2819.0
00:12:00	47.1	0.752	9.2	3101.7
00:13:00	47.1	0.752	9.3	3387.6
00:14:00	47.1	0.752	9.4	3676.4
00:15:00	47.1	0.752	9.5	3967.9
00:16:00	47.1	0.752	9.6	4262.0
00:17:00	47.1	0.752	9.6	4557.9

Table 3. Acceleration from Slow to Half.

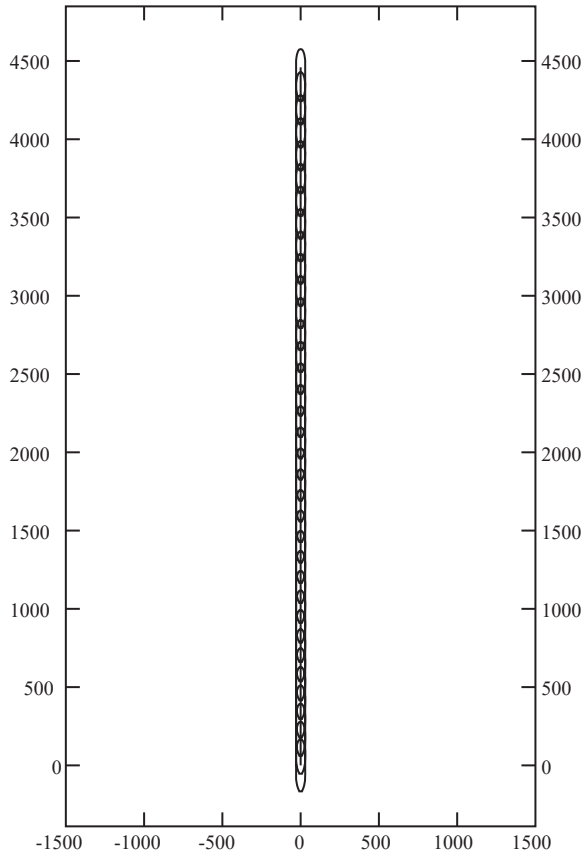


Fig. 6. Acceleration from Slow to Half. Ship position plot.

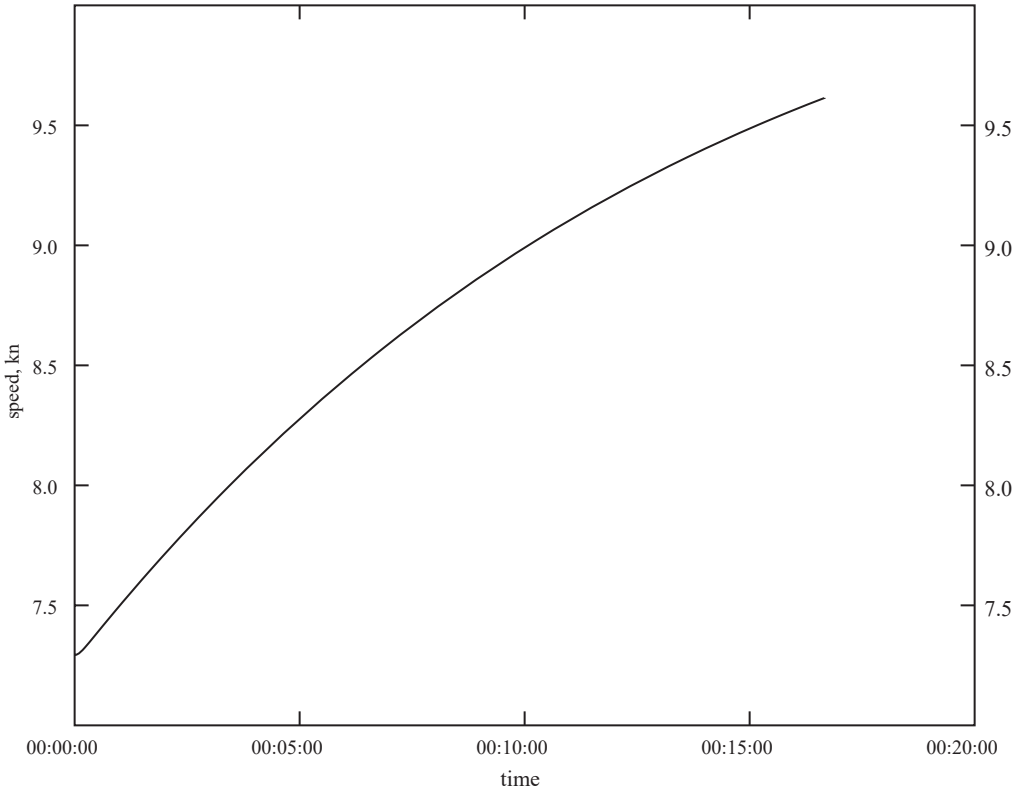


Fig. 7. Acceleration from Slow to Half. Speed plot.

Crash Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % ..... -100.0
Rudder, deg 0.0

Performance

Stop time, s 00:16:40
Advance at stop time, m 4651.3
Transfer at stop time, m 1220.5
Heading at stop time, deg 173.6

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	17.0	0.0	0.0
00:01:00	25.8	0.752	16.2	512.7	0.0
00:02:00	24.1	0.752	15.4	1000.1	0.0
00:03:00	22.7	0.752	14.7	1464.4	0.0
00:04:00	21.3	0.752	14.0	1907.8	0.0
00:05:00	-57.0	0.752	13.1	2327.1	1.2
00:06:00	-57.0	0.752	12.1	2715.9	6.5
00:07:00	-57.0	0.752	11.1	3074.0	18.2
00:08:00	-56.9	0.752	9.8	3397.1	37.0
00:09:00	-56.9	0.752	8.4	3678.8	58.9
00:10:00	-56.9	0.752	7.0	3917.1	80.1
00:11:00	-56.9	0.752	5.8	4115.2	99.2
00:12:00	-56.9	0.752	4.7	4277.5	116.0
00:13:00	-56.9	0.752	3.7	4407.5	131.4
00:14:00	-56.9	0.752	2.8	4508.0	145.3
00:15:00	-56.9	0.752	2.0	4581.3	157.4
00:16:00	-56.9	0.752	1.2	4630.3	167.6
00:17:00	-56.9	0.752	0.7	4660.1	176.5

Table 4. Crash stop test.

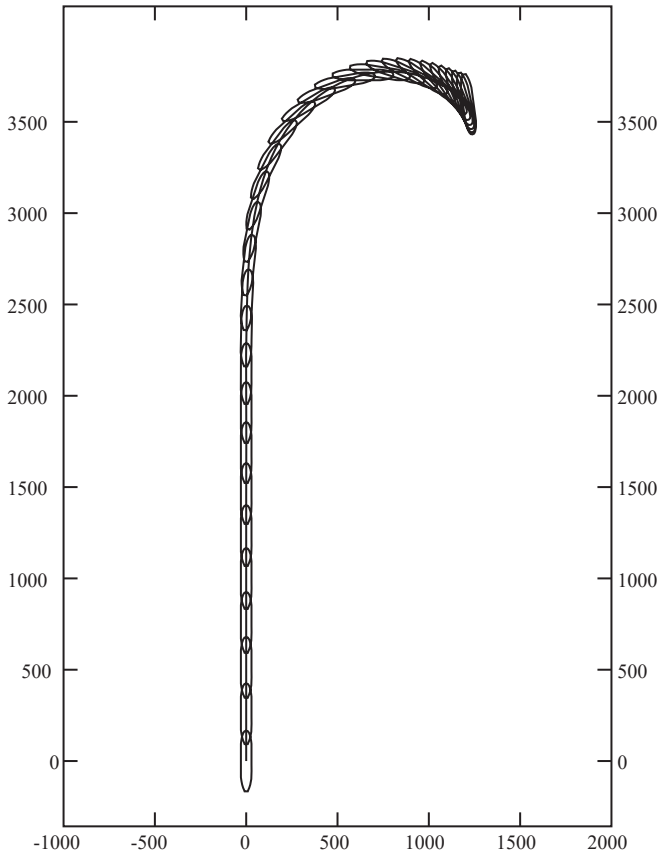


Fig. 8. Crash stop test. Ship position plot.

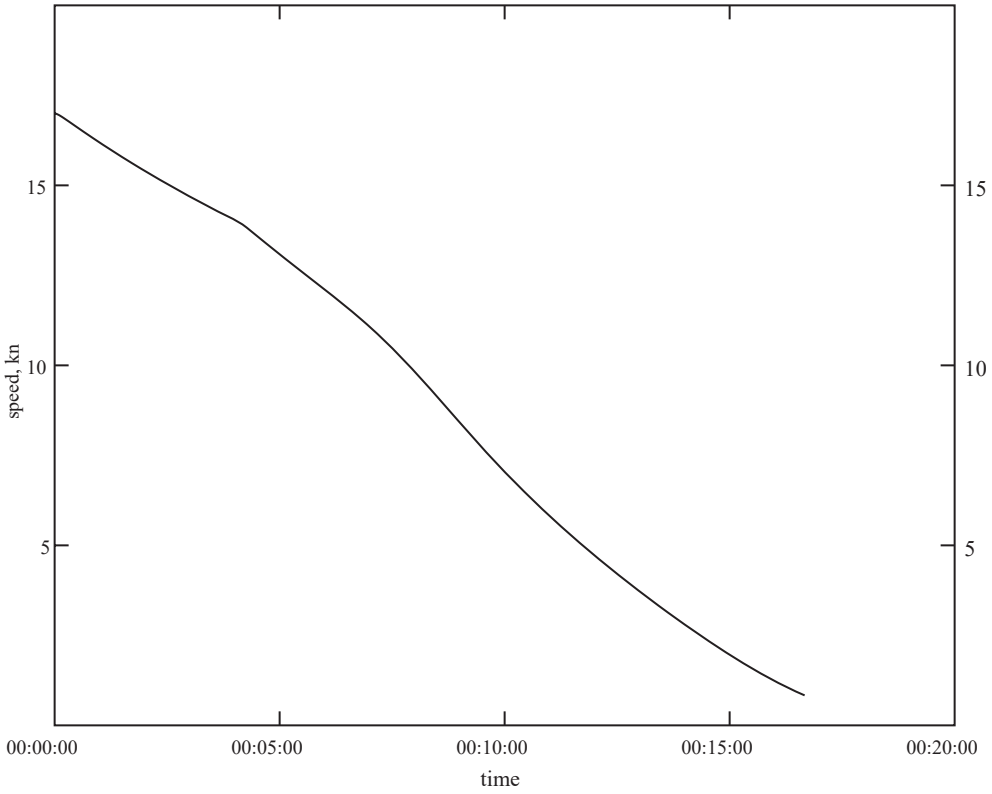


Fig. 9. Crash stop test. Speed plot.

Deceleration from Half to Slow

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 50.0
to, % 25.0
Rudder, deg 0.0

Performance

Stop time, s 00:16:40
Advance at stop time, m 4787.6

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	47.0	0.752	10.5	0.0	0.0
00:01:00	32.9	0.752	10.4	322.7	0.0
00:02:00	32.9	0.752	10.2	639.2	0.0
00:03:00	32.9	0.752	10.0	950.0	0.0
00:04:00	32.9	0.752	9.8	1255.5	0.0
00:05:00	32.9	0.752	9.7	1556.0	0.0
00:06:00	32.9	0.752	9.5	1851.9	0.0
00:07:00	32.9	0.752	9.4	2143.4	0.0
00:08:00	32.9	0.752	9.3	2431.0	0.0
00:09:00	32.9	0.752	9.1	2714.7	0.0
00:10:00	32.9	0.752	9.0	2994.9	0.0
00:11:00	32.9	0.752	8.9	3271.8	0.0
00:12:00	32.9	0.752	8.8	3545.6	0.0
00:13:00	32.9	0.752	8.7	3816.5	0.0
00:14:00	32.9	0.752	8.6	4084.6	0.0
00:15:00	32.9	0.752	8.6	4350.2	0.0
00:16:00	32.9	0.752	8.5	4613.3	0.0
00:17:00	32.9	0.752	8.4	4874.4	0.0

Table 5. Deceleration from Half to Slow .

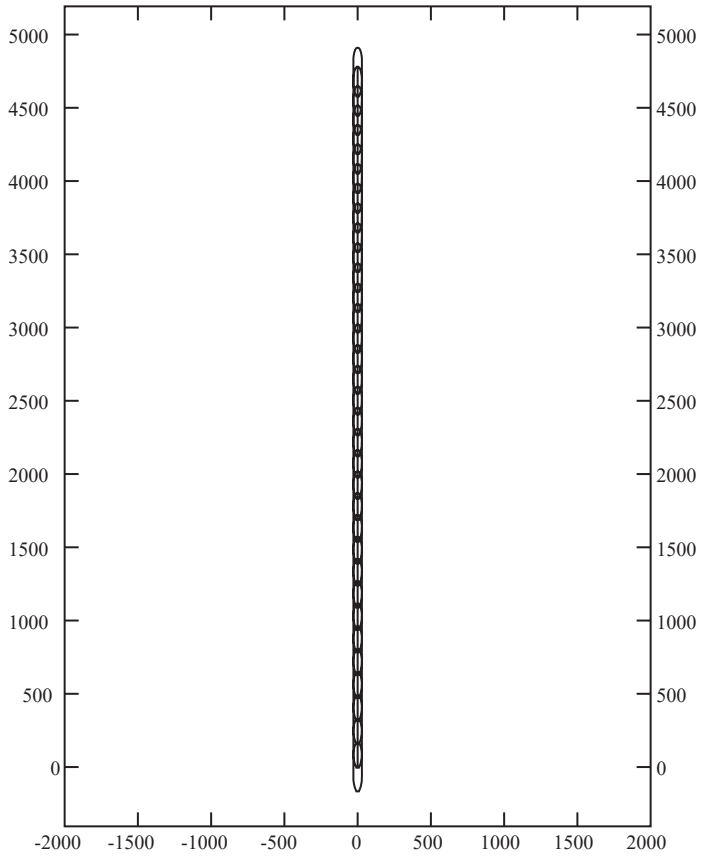


Fig. 10. Deceleration from Half to Slow . Ship position plot.

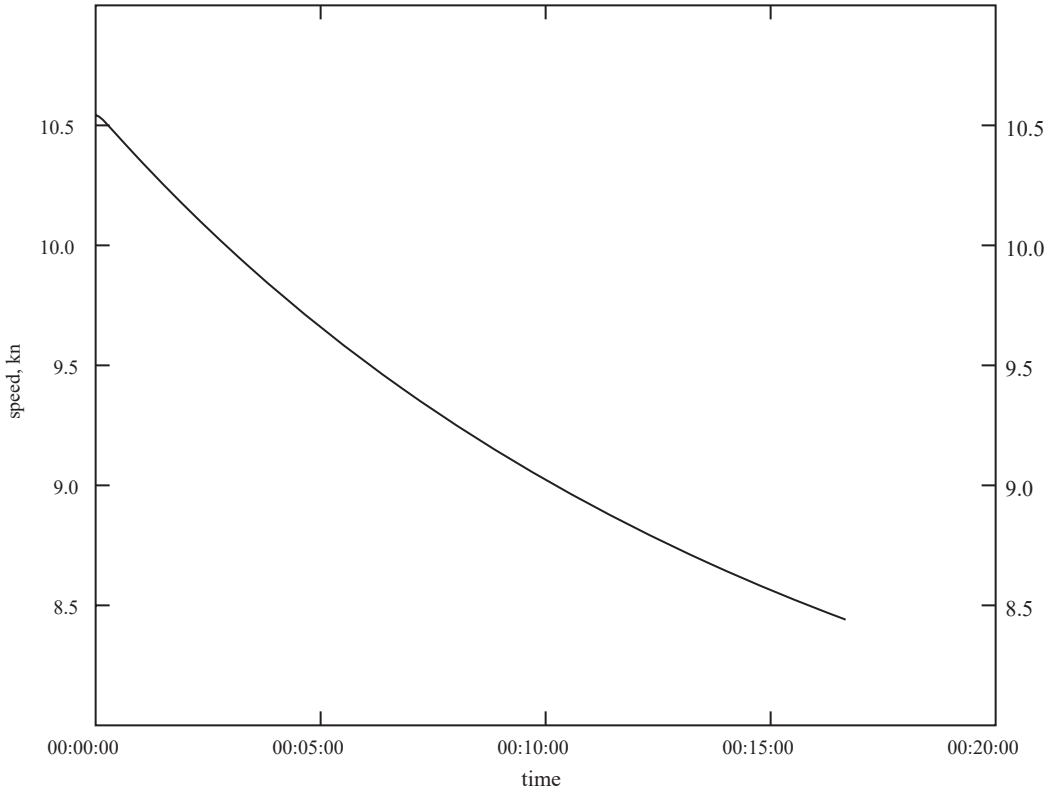


Fig. 11. Deceleration from Half to Slow . Speed plot.

Coasting Stop

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder, deg 0.0

time	propeller	pitch ratio	speed	distance	heading
s	rpm	P/D	kn	m	deg
00:00:00	76.0	0.752	17.0	0.0	0.0
00:01:00	25.8	0.752	16.2	512.7	0.0
00:02:00	24.1	0.752	15.4	1000.1	0.0
00:03:00	22.7	0.752	14.7	1464.4	0.0
00:04:00	21.3	0.752	14.0	1907.8	0.0
00:05:00	20.1	0.752	13.4	2331.9	0.0
00:06:00	18.9	0.752	12.9	2738.2	0.0
00:07:00	17.8	0.752	12.4	3128.2	0.0
00:08:00	16.7	0.752	11.9	3503.0	0.0
00:09:00	15.7	0.752	11.5	3863.6	0.0
00:10:00	14.8	0.752	11.0	4210.9	0.0
00:11:00	13.7	0.752	10.7	4545.9	0.0
00:12:00	12.7	0.752	10.3	4869.2	0.0
00:13:00	11.8	0.752	9.9	5181.5	0.0
00:14:00	10.9	0.752	9.6	5483.4	0.0
00:15:00	10.0	0.752	9.3	5775.6	0.0
00:16:00	9.1	0.752	9.0	6058.5	0.0
00:17:00	8.4	0.752	8.7	6334.0	0.0

Table 6. Coasting stop test.

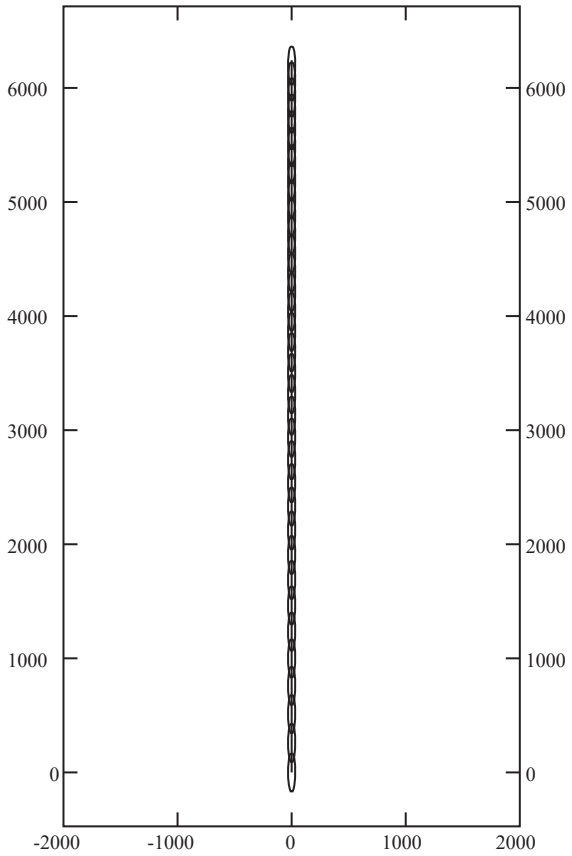


Fig. 12. Coasting stop test. Ship position plot.

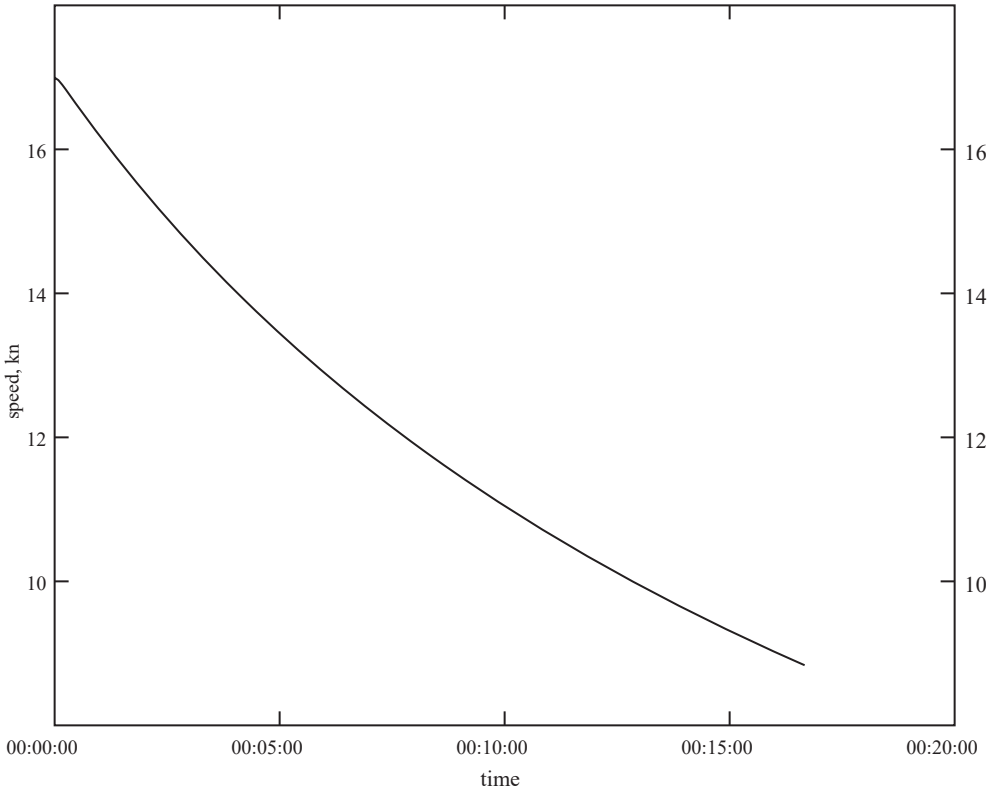


Fig. 13. Coasting stop test. Speed plot.

Time for effective changes in telegraph settings in stopping conditions

Initial Throttle	Initial Speed	Set Throttle	Reached Speed	Time
	kn		kn	s
Full Sea Speed	17.0	Full Astern	0.0	00:16:54
Full Ahead	12.9	Full Astern	0.0	00:12:58
Half Ahead	10.5	Full Astern	0.0	00:11:56
Slow Ahead	7.3	Full Astern	0.0	00:09:48
Full Sea Speed	17.0	Stop	3.4	00:33:20
Full Ahead	12.9	Stop	3.4	00:33:20
Half Ahead	10.5	Stop	3.4	00:33:20
Slow Ahead	7.3	Stop	3.4	00:33:20

Turning Circle Starboard, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting% 100.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:02:38
Advance, m 1033.4
Transfer, m 481.6
Time 180°, s 00:05:02
Tactical diameter, m 1076.9
Circulation diameter, m 567.6
Turn rate, deg/min 28.7
Speed loss, % 72.9

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.0	0.0	0	0
00:00:45	16.7	11.9	s31.7	s6.1
00:01:30	15.2	41.3	s43.1	s11.3
00:02:15	13.2	73.6	s42.5	s13.8
00:03:00	11.4	104.6	s40.1	s15.2
00:03:45	10.0	133.8	s37.7	s16.3
00:04:30	8.9	161.3	s35.7	s17.3
00:05:15	8.0	-172.6	s34.0	s18.3
00:06:00	7.2	-147.7	s32.6	s19.1
00:06:45	6.6	-123.7	s31.6	s20.0
00:07:30	6.1	-100.3	s30.7	s20.7
00:08:15	5.7	-77.6	s30.1	s21.3
00:09:00	5.4	-55.2	s29.6	s21.9
00:09:45	5.1	-33.1	s29.2	s22.5
00:10:30	4.9	-11.3	s29.0	s23.0
00:11:15	4.7	10.4	s28.8	s23.5

00:12:00	4.5	31.9	s28.6	s23.9

Table 7. Turning circle starboard, deep water.

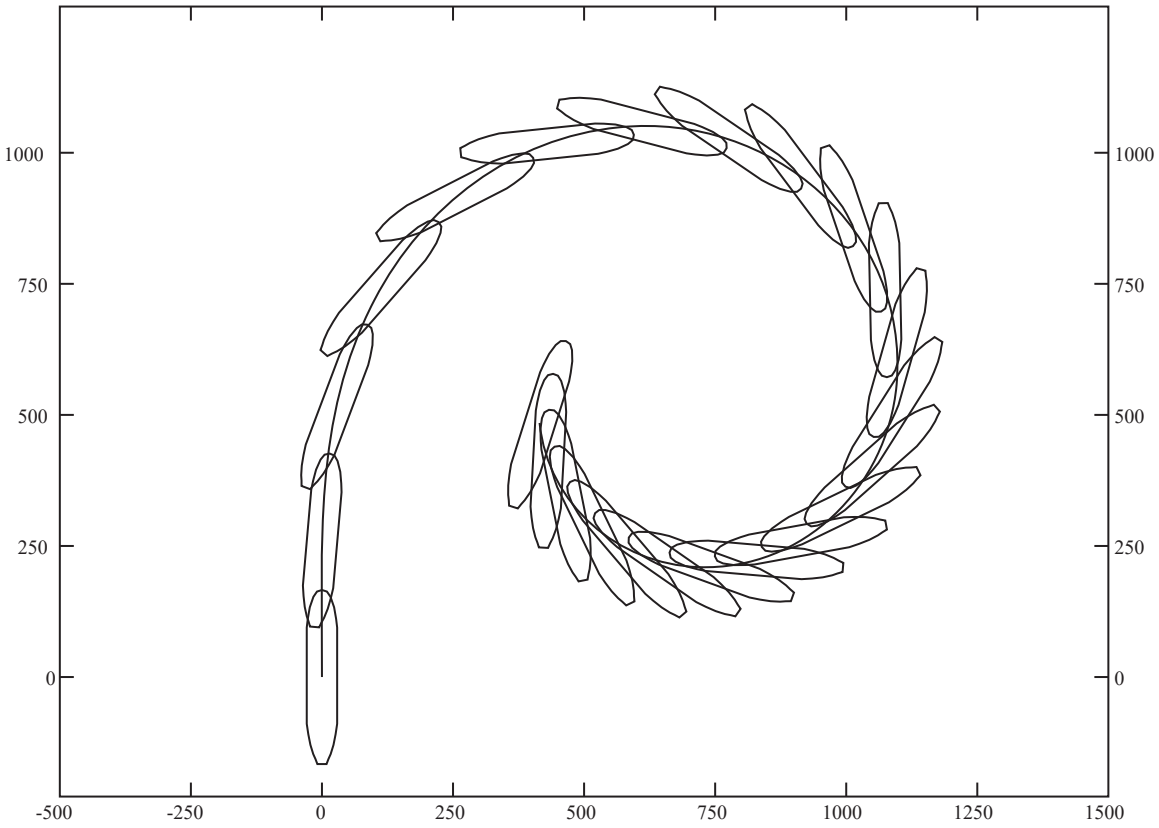


Fig. 14. Turning circle starboard, deep water. Ship position plot.

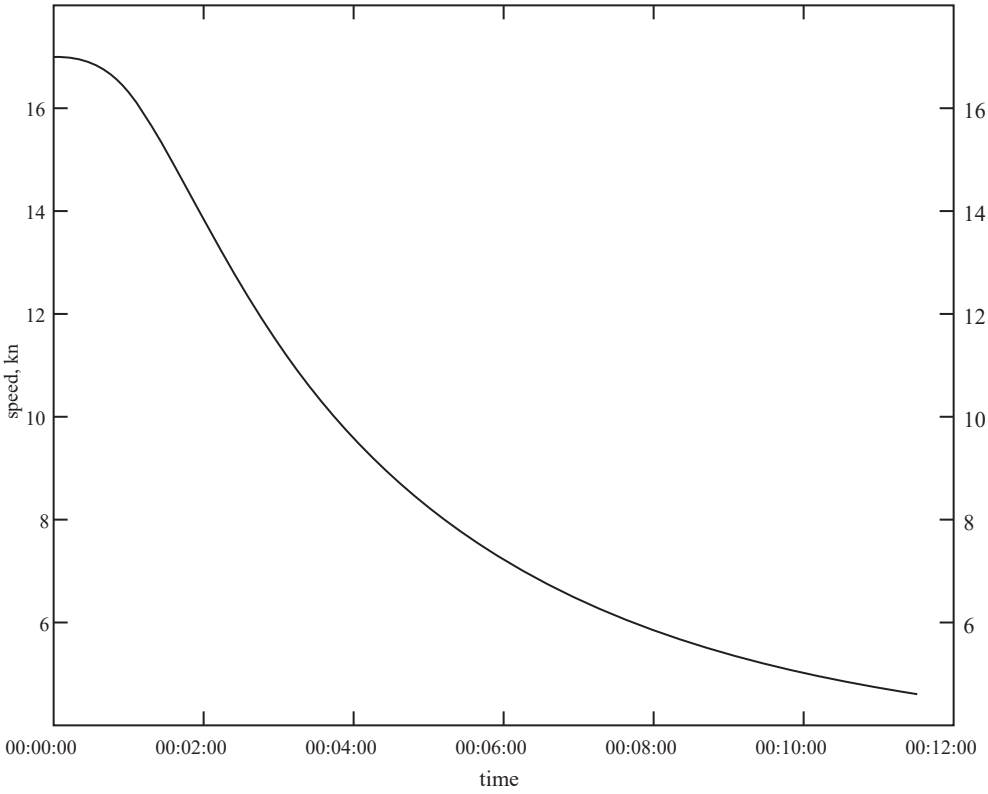


Fig. 15. Turning circle starboard, deep water. Speed plot.

Turning Circle Starboard, Shallow Water

Environment

Water depth, H/T 1.5
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 50.0
Rudder command
from, deg 0.0
to, deg 35.0

Performance

Time 90°, s 00:05:10
Advance, m 1190.0
Transfer, m 679.5
Time 180°, s 00:09:16
Tactical diameter, m 1377.6
Circulation diameter, m 933.2
Turn rate, deg/min 19.4
Speed loss, % 50.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	10.2	0.0	0	0
00:01:00	10.1	5.6	s11.4	s2.3
00:02:00	9.9	20.9	s18.4	s4.3
00:03:00	9.5	41.2	s21.7	s5.6
00:04:00	9.0	63.5	s22.7	s6.3
00:05:00	8.5	86.2	s22.6	s6.7
00:06:00	8.1	108.7	s22.3	s7.0
00:07:00	7.6	130.9	s22.0	s7.3
00:08:00	7.3	152.7	s21.6	s7.6
00:09:00	6.9	174.2	s21.3	s7.8
00:10:00	6.6	-164.7	s21.0	s8.1
00:11:00	6.3	-143.8	s20.8	s8.3
00:12:00	6.1	-123.2	s20.5	s8.6
00:13:00	5.8	-102.8	s20.3	s8.8
00:14:00	5.6	-82.6	s20.1	s9.0
00:15:00	5.4	-62.7	s19.8	s9.2

00:16:00	5.2	-43.0	s19.5	s9.4
00:17:00	5.1	-23.6	s19.3	s9.7

Table 8. Turning circle starboard, shallow water.

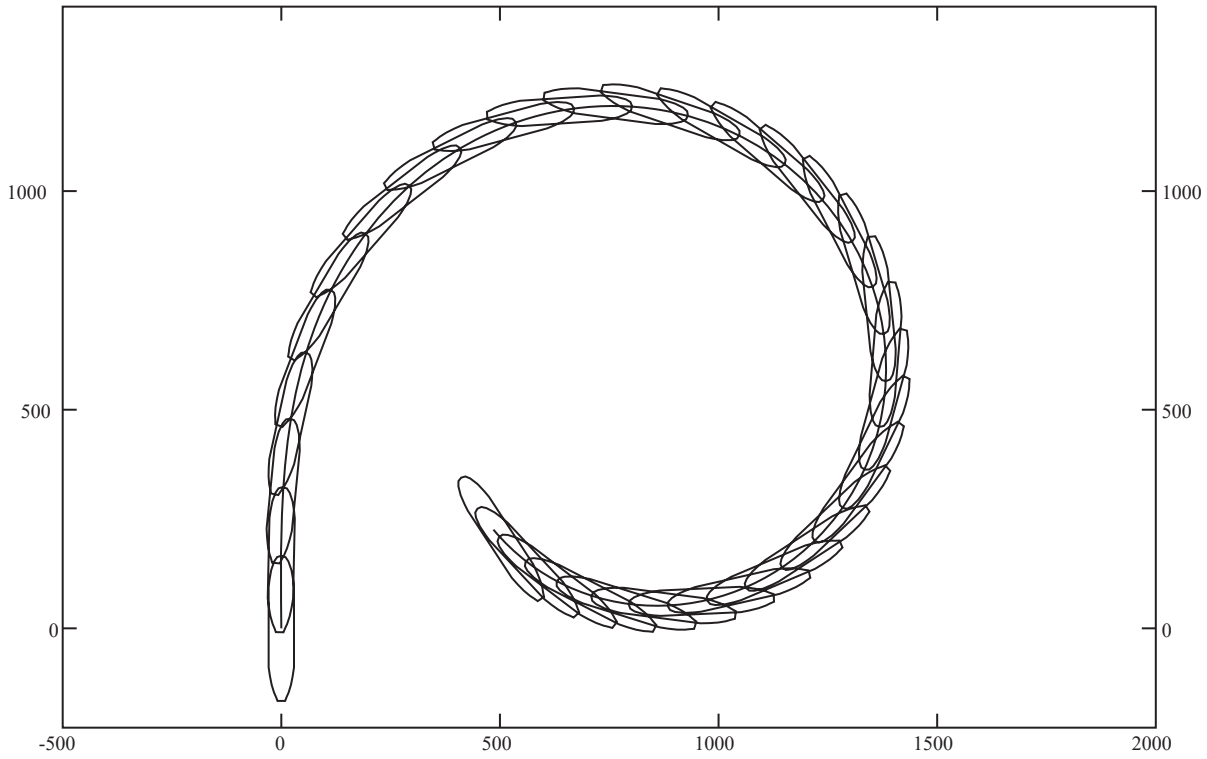


Fig. 16. Turning circle starboard, shallow water. Ship position plot.

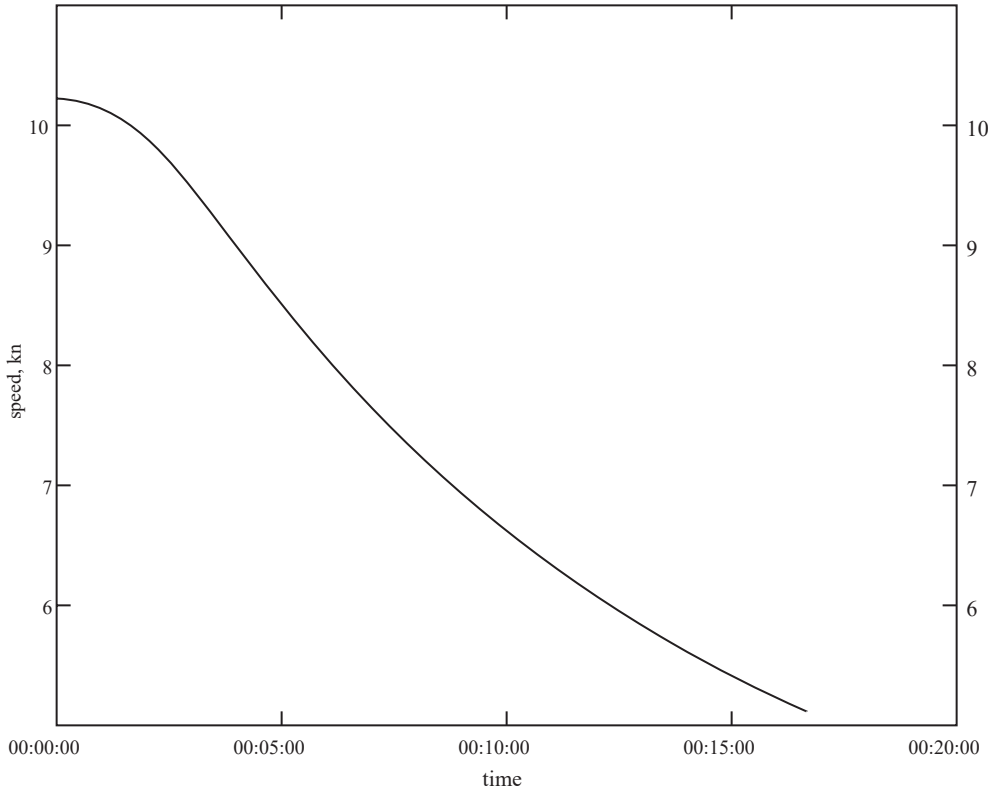


Fig. 17. Turning circle starboard, shallow water. Speed plot.

Turning Circle Port, Deep Water

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder command
from, deg 0.0
to, deg ..... -35.0

Performance

Time 90°, s 00:02:38
Advance, m 1033.4
Transfer, m 481.6
Time 180°, s 00:05:02
Tactical diameter, m 1076.9
Circulation diameter, m 567.4
Turn rate, deg/min ..... -28.7
Speed loss, % 72.9

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.0	0.0	0	0
00:00:45	16.7	-11.9	p31.7	p6.1
00:01:30	15.2	-41.3	p43.1	p11.3
00:02:15	13.2	-73.6	p42.5	p13.8
00:03:00	11.4	-104.6	p40.1	p15.2
00:03:45	10.0	-133.8	p37.7	p16.3
00:04:30	8.9	-161.3	p35.7	p17.3
00:05:15	8.0	172.6	p34.0	p18.3
00:06:00	7.2	147.7	p32.6	p19.1
00:06:45	6.6	123.7	p31.6	p20.0
00:07:30	6.1	100.3	p30.7	p20.7
00:08:15	5.7	77.6	p30.1	p21.3
00:09:00	5.4	55.2	p29.6	p21.9
00:09:45	5.1	33.1	p29.2	p22.5
00:10:30	4.9	11.3	p29.0	p23.0
00:11:15	4.7	-10.4	p28.8	p23.5

00:12:00	4.5	-31.9	p28.6	p23.9

Table 9. Turning circle port, deep water.

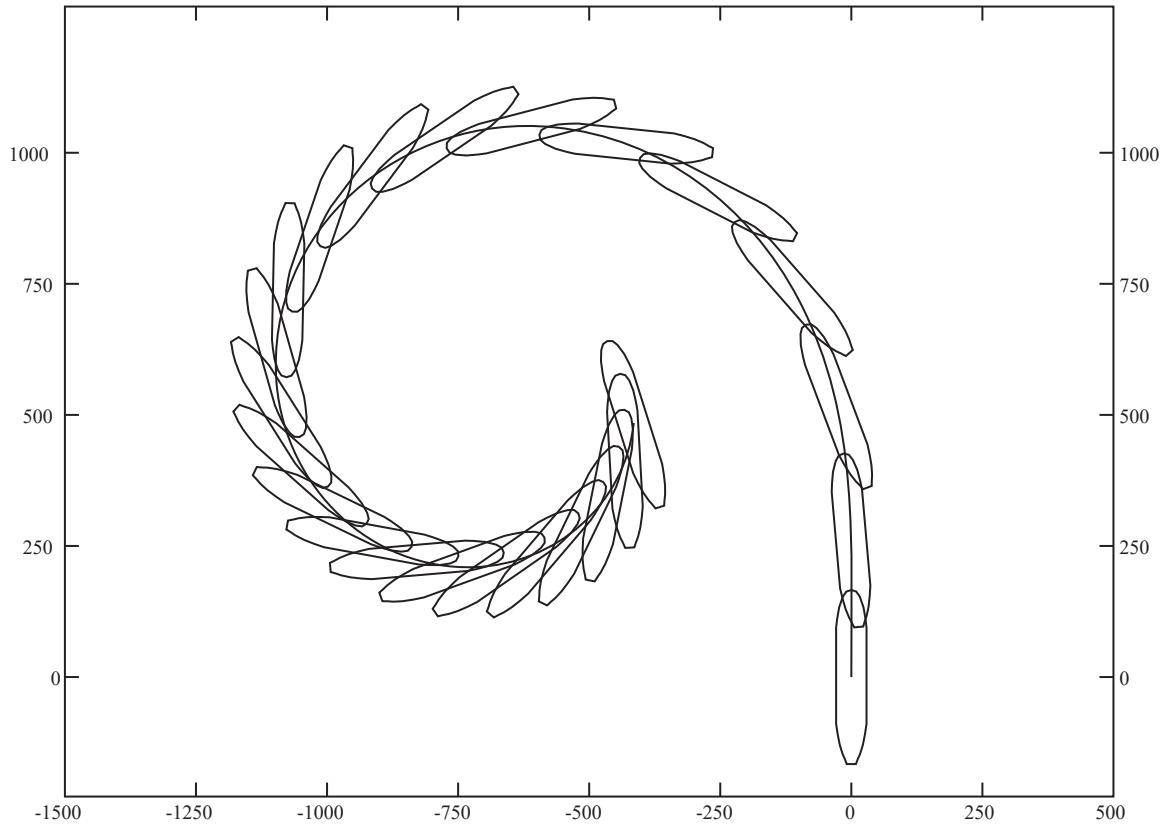


Fig. 18. Turning circle port, deep water. Ship position plot.

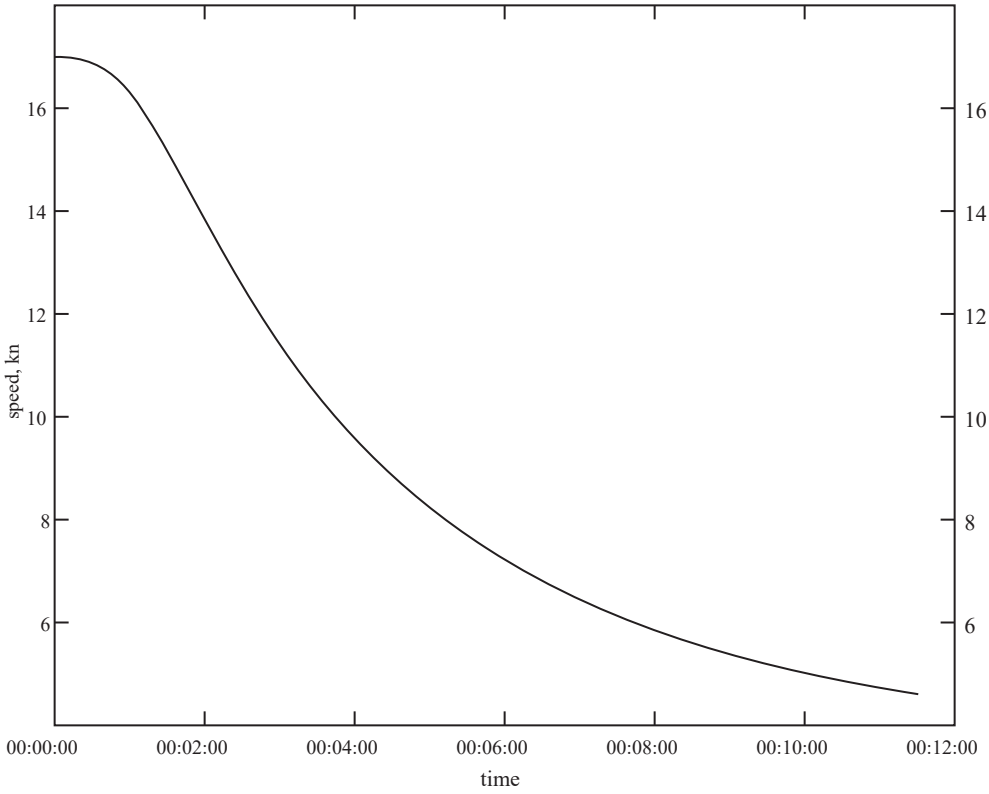


Fig. 19. Turning circle port, deep water. Speed plot.

Accelerated Turning

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
- from, % 0.0
- to, % 50.0

Rudder command
- from, deg 0.0
- to, deg 35.0

Performance

Time 90°, ... 00:05:20
Advance, m 143.2
Transfer, m 34.9
Time 180° 00:10:11
Tactical diameter, m 272.5
Circulation diameter, m 427.7
Turn rate, deg/min 18.6

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	0.0	0.0	0	0
00:01:00	0.6	7.9	s15.8	s47.4
00:02:00	1.0	26.2	s19.6	s42.2
00:03:00	1.2	45.8	s19.5	s38.6
00:04:00	1.4	65.1	s19.0	s35.9
00:05:00	1.5	83.9	s18.7	s33.9
00:06:00	1.7	102.5	s18.6	s32.5
00:07:00	1.8	121.1	s18.5	s31.5
00:08:00	1.9	139.5	s18.5	s30.8
00:09:00	2.0	158.1	s18.5	s30.2
00:10:00	2.0	176.6	s18.6	s29.8
00:11:00	2.1	-164.8	s18.6	s29.4
00:12:00	2.1	-146.2	s18.6	s29.1
00:13:00	2.2	-127.7	s18.6	s28.8
00:14:00	2.2	-109.1	s18.6	s28.6

00:15:00	2.2	-90.5	s18.6	s28.4
00:16:00	2.2	-71.9	s18.6	s28.2
00:17:00	2.3	-53.2	s18.6	s28.1

Table 10. Accelerated turning.

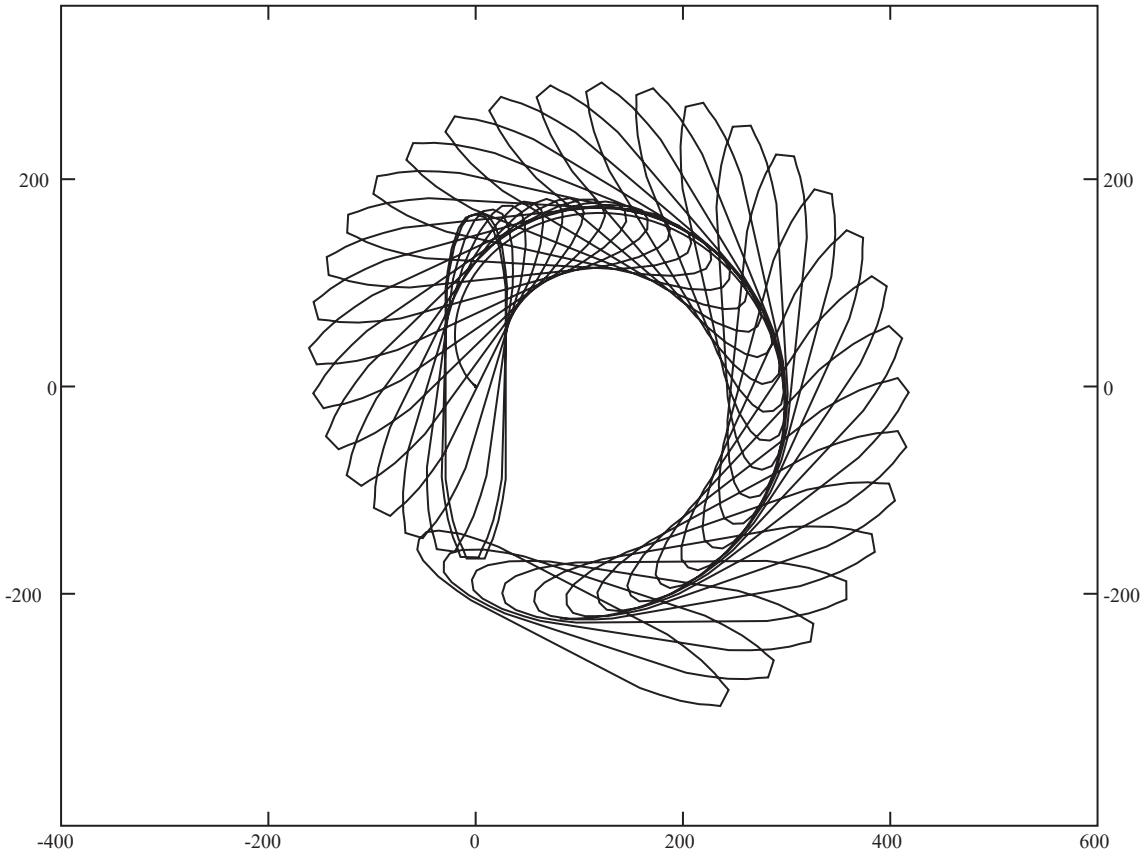


Fig. 20. Accelerated turning. Ship position plot.

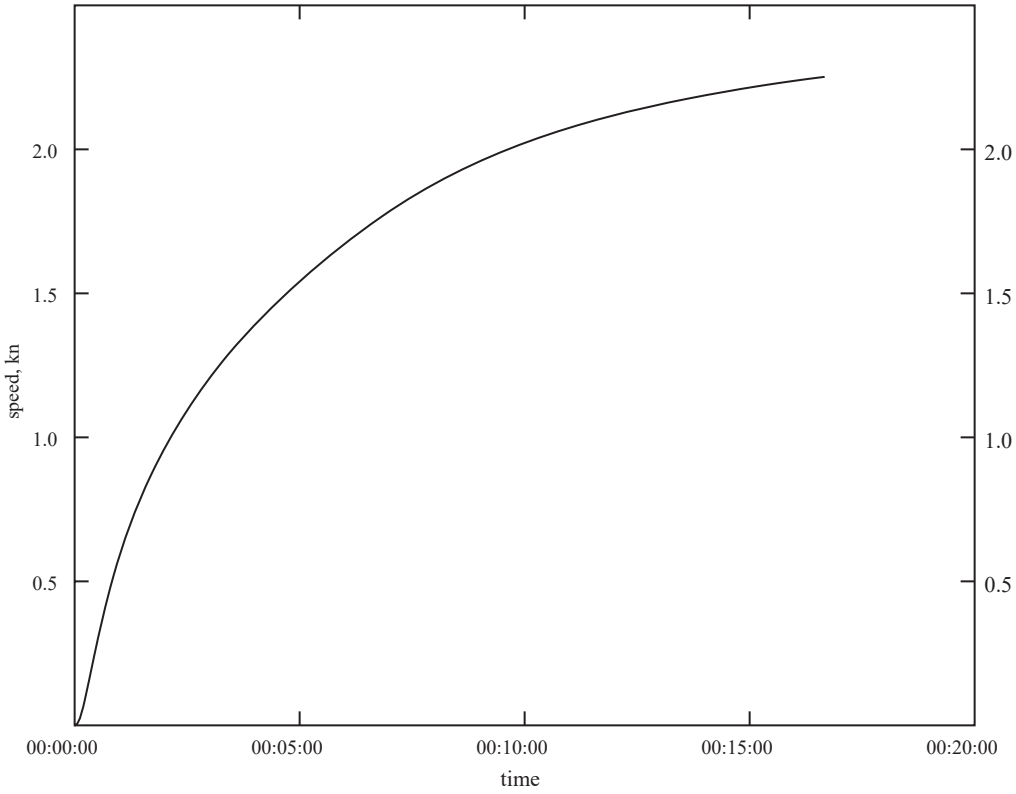


Fig. 21. Accelerated turning. Speed plot.

Coasting Circle

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting
from, % 100.0
to, % 0.0
Rudder command
from, deg 0.0
to, deg 35.0

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.0	0.0	0	0
00:01:00	16.0	8.5	s17.0	s3.7
00:02:00	14.5	32.1	s28.7	s8.1
00:03:00	12.5	62.6	s30.8	s10.7
00:04:00	10.7	92.1	s27.9	s11.9
00:05:00	9.2	118.3	s24.6	s12.4
00:06:00	8.0	141.4	s21.7	s12.7
00:07:00	7.0	161.8	s19.2	s12.8
00:08:00	6.2	-180.0	s17.2	s13.0
00:09:00	5.6	-163.6	s15.6	s13.1
00:10:00	5.1	-148.7	s14.2	s13.1
00:11:00	4.7	-135.1	s13.0	s13.2
00:12:00	4.3	-122.6	s12.0	s13.3
00:13:00	4.0	-111.0	s11.1	s13.3
00:14:00	3.7	-100.2	s10.4	s13.3
00:15:00	3.4	-90.2	s9.7	s13.4
00:16:00	3.2	-80.8	s9.1	s13.4
00:17:00	3.0	-71.9	s8.6	s13.4

Table 11. Coasting Circle.

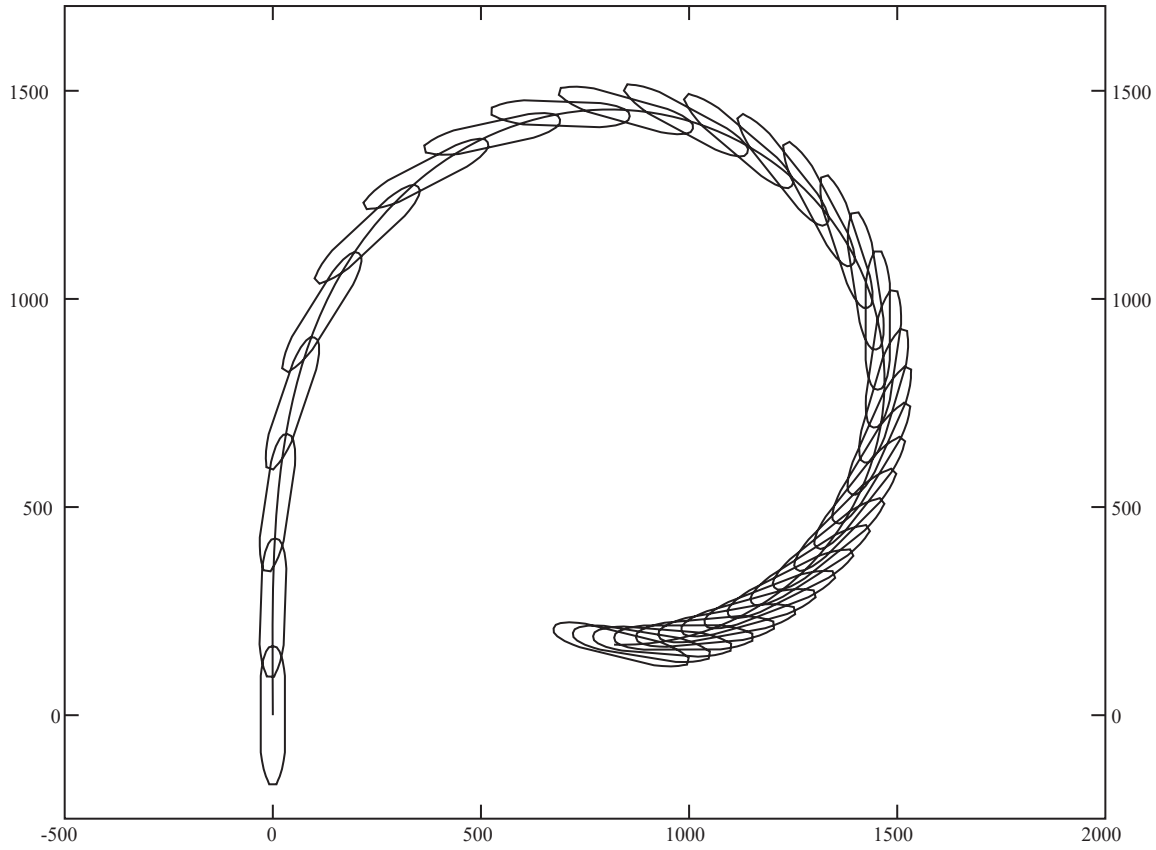


Fig. 22. Coasting Circle. Ship position plot.

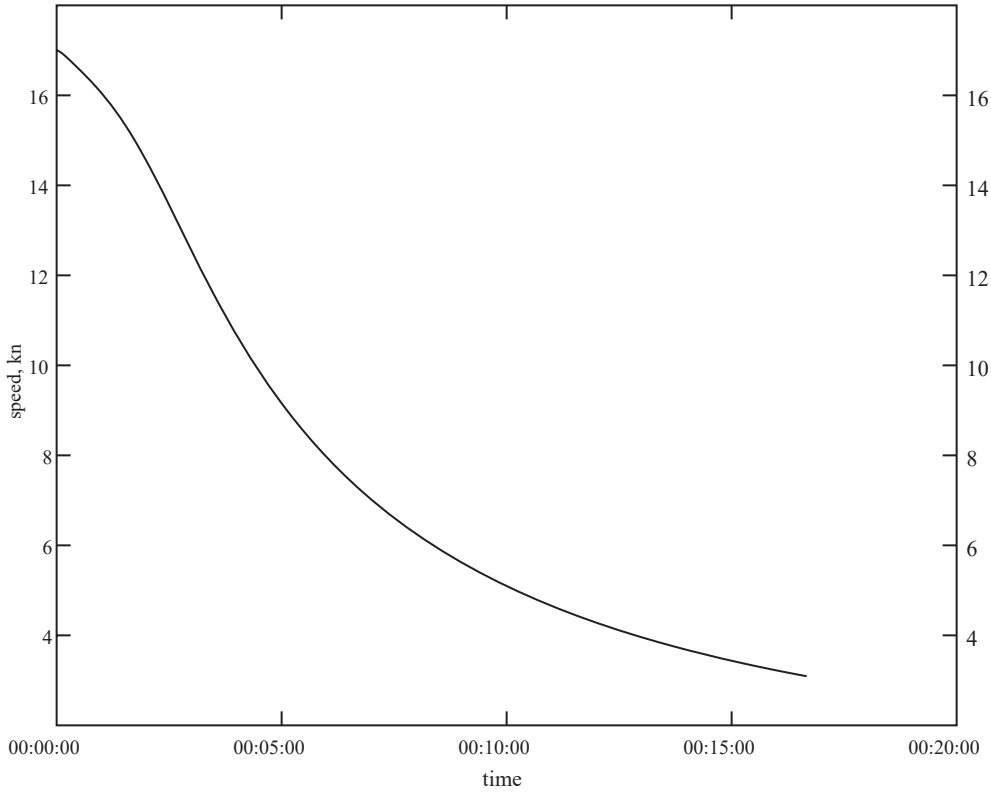


Fig. 23. Coasting Circle. Speed plot

Course Change Manoeuvre

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

Track reach, ship lengths 1.8

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.9	0
00:00:05	s9.7	0.0	12.9	s0.6
00:00:10	s10.0	0.1	12.9	s1.8
00:00:15	s10.0	0.3	12.9	s2.9
00:00:20	s10.0	0.6	12.9	s3.9
00:00:25	s10.0	1.0	12.9	s4.7
00:00:30	s10.0	1.4	12.9	s5.5
00:00:35	s10.0	1.9	12.9	s6.3
00:00:40	s10.0	2.4	12.9	s7.0
00:00:45	s10.0	3.0	12.9	s7.7
00:00:50	s10.0	3.7	12.8	s8.4
00:00:55	s10.0	4.4	12.8	s9.0
00:01:00	s10.0	5.2	12.8	s9.6
00:01:05	s10.0	6.0	12.8	s10.2
00:01:10	s10.0	6.9	12.8	s10.8
00:01:15	s10.0	7.8	12.8	s11.4
00:01:20	s10.0	8.8	12.8	s11.9
00:01:25	s10.0	9.8	12.8	s12.5
00:01:30	s10.0	10.9	12.8	s13.0

Table 12. Course Change Manoeuvre.

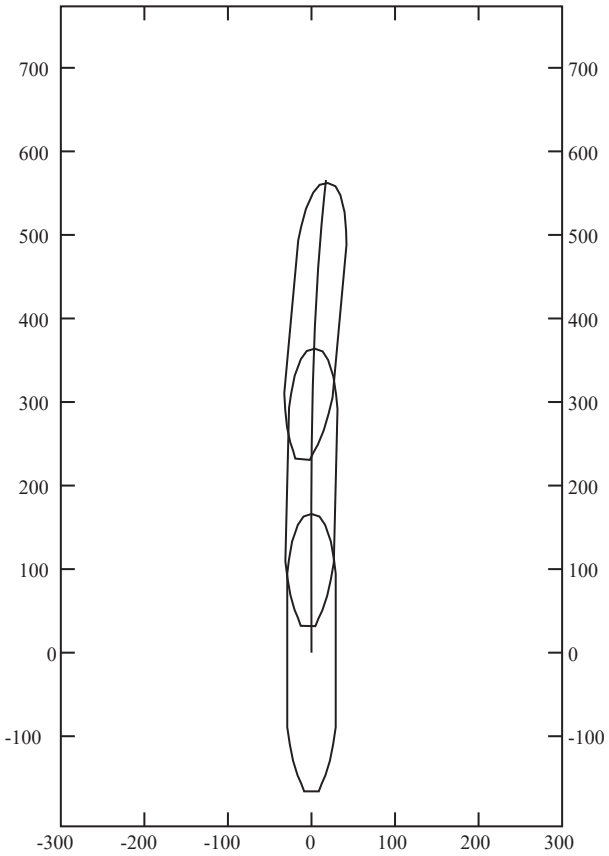


Fig. 24. Course Change Manoeuvre. Ship position plot.

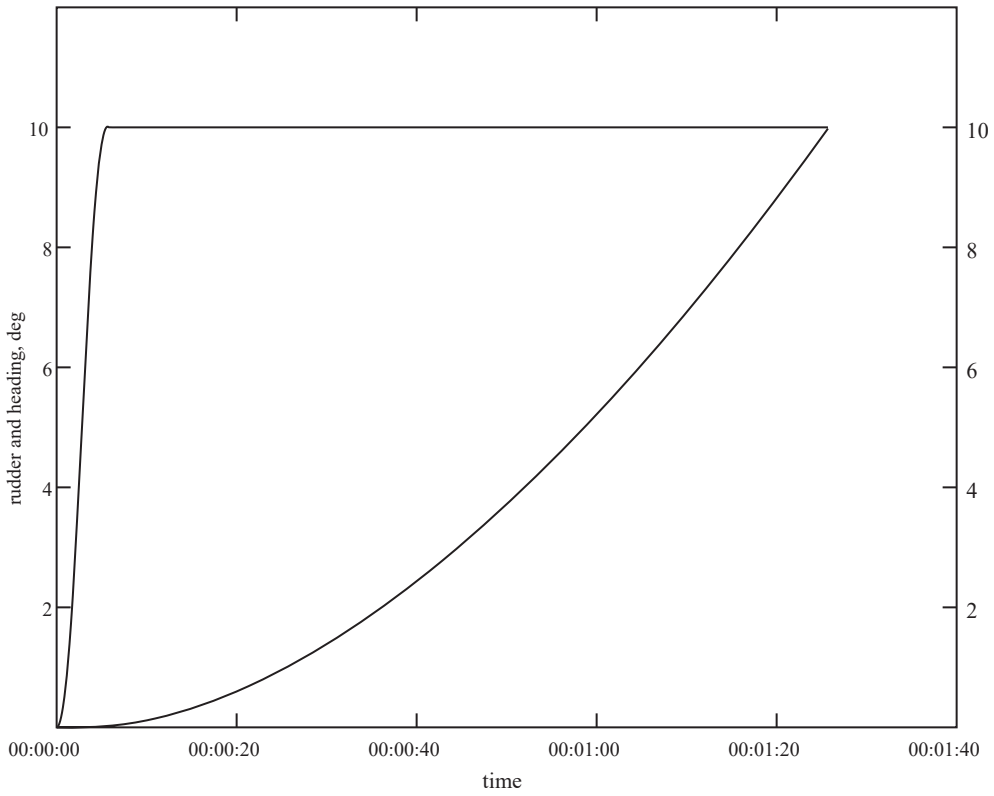


Fig. 25. Course Change Manoeuvre. Rudder and heading plot.

Zigzag 10°–10°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 6.5
Second overshoot angle, deg 11.8

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	12.9	0
00:00:30	s10.0	1.4	12.9	s5.5
00:01:00	s10.0	5.2	12.8	s9.6
00:01:30	s1.1	10.9	12.8	s12.6
00:02:00	p10.0	15.0	12.7	s4.9
00:02:30	p10.0	16.4	12.7	s1.0
00:03:00	p10.0	16.0	12.7	p2.5
00:03:30	p10.0	13.9	12.7	p6.2
00:04:00	p10.0	9.8	12.7	p9.8
00:04:30	p10.0	4.1	12.6	p13.0
00:05:00	p10.0	-3.1	12.5	p15.6
00:05:30	s0.2	-11.3	12.3	p16.8
00:06:00	s10.0	-17.3	12.2	p8.4
00:06:30	s10.0	-20.4	12.1	p4.3
00:07:00	s10.0	-21.7	12.1	p1.0
00:07:30	s10.0	-21.8	12.1	s2.2

Table 13. Zigzag 10°–10°.

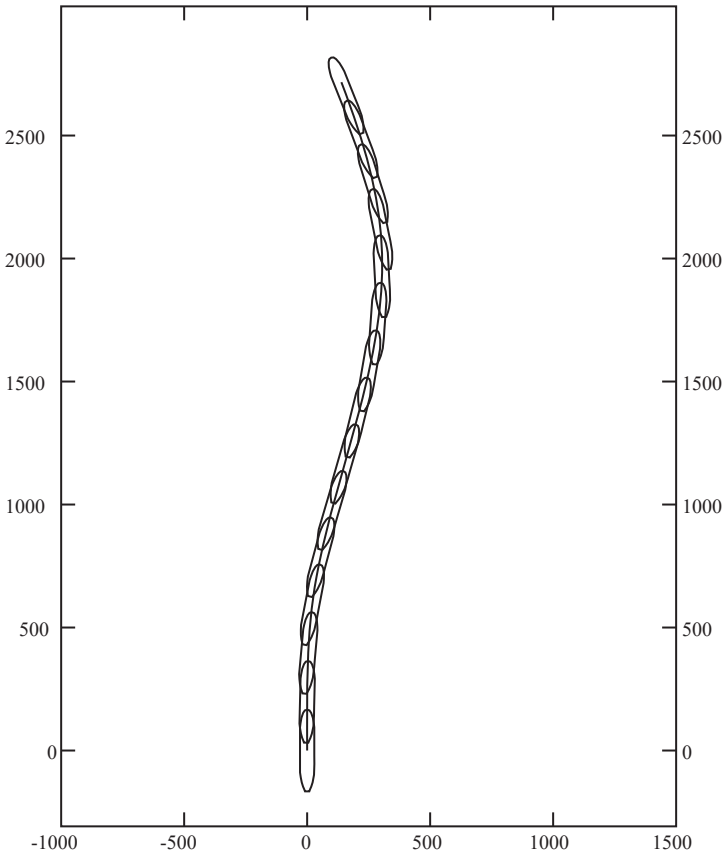


Fig. 26. Zigzag 10°–10°. Ship position plot.

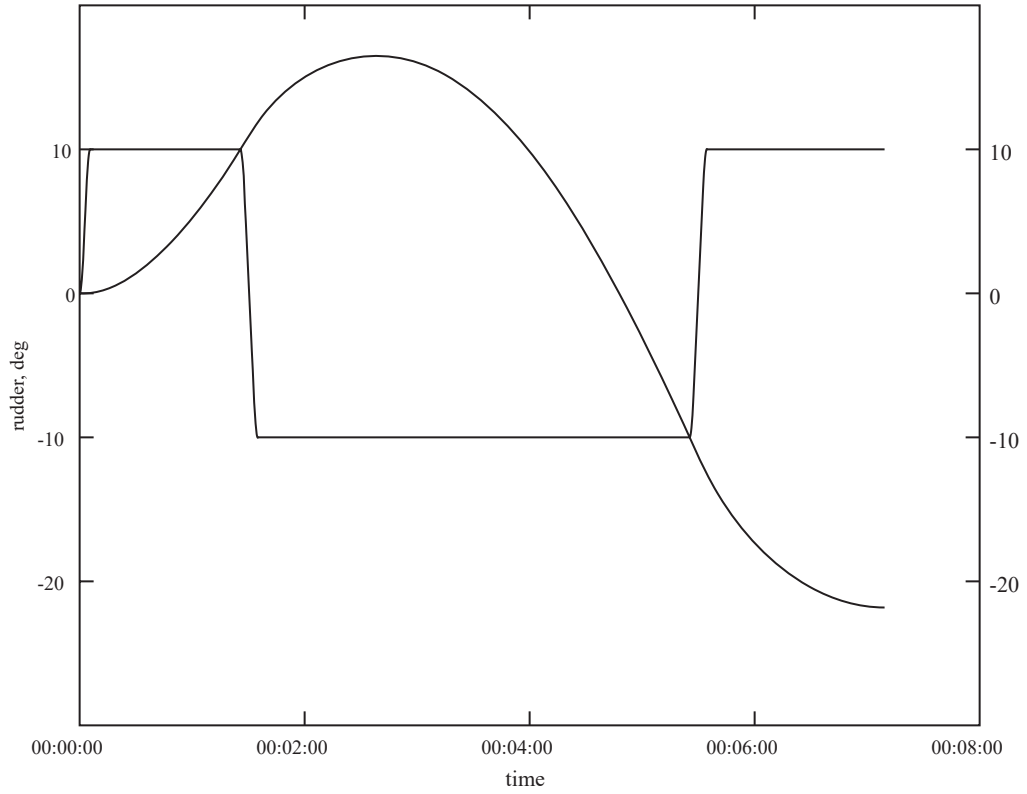


Fig. 27. Zigzag test 10°–10°. Rudder and heading plot.

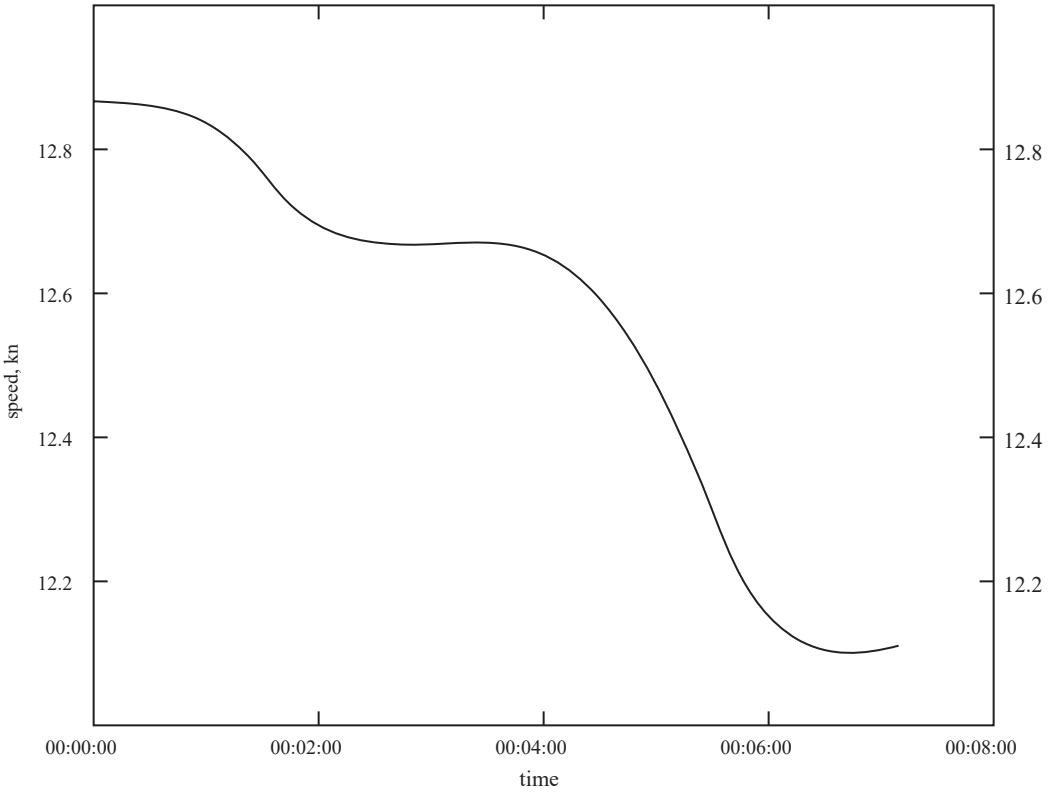


Fig. 28. Zigzag test 10°–10°. Speed plot.

Zigzag 10°–10° Slow Speed

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 12.5
Rudder commands, deg 10.0
Committed heading, deg 10.0

Performance

First overshoot angle, deg 5.6
Second overshoot angle, deg 10.4

time	rudder	heading	speed	turn rate
s	deg	deg	kn	deg/min
00:00:00	0	0.0	6.1	0
00:01:00	s10.0	1.5	6.1	s2.8
00:02:00	s10.0	5.2	6.1	s4.7
00:03:00	p7.1	10.7	6.1	s5.9
00:04:00	p10.0	14.4	6.1	s2.1
00:05:00	p10.0	15.6	6.1	s0.3
00:06:00	p10.0	15.0	6.1	p1.4
00:07:00	p10.0	12.7	6.1	p3.2
00:08:00	p10.0	8.7	6.0	p4.8
00:09:00	p10.0	3.1	6.0	p6.4
00:10:00	p10.0	-3.9	6.0	p7.6
00:11:00	s10.0	-11.8	5.9	p7.2
00:12:00	s10.0	-16.9	5.8	p3.6
00:13:00	s10.0	-19.5	5.8	p1.7
00:14:00	s10.0	-20.4	5.8	p0.1
00:15:00	s10.0	-20.4	5.8	s1.4

Table 14. Zigzag 10°–10° Slow Speed.

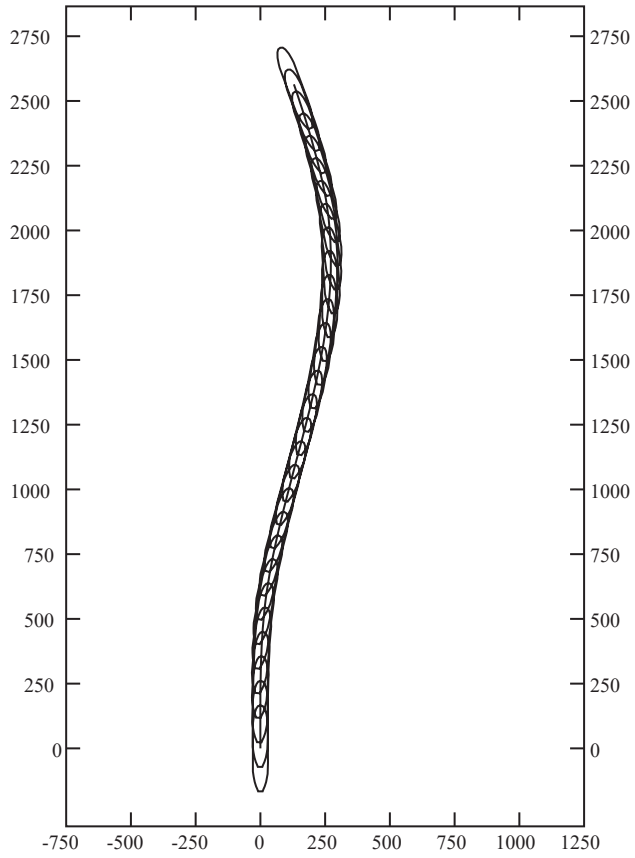


Fig. 29. Zigzag 10°–10° Slow Speed. Ship position plot.

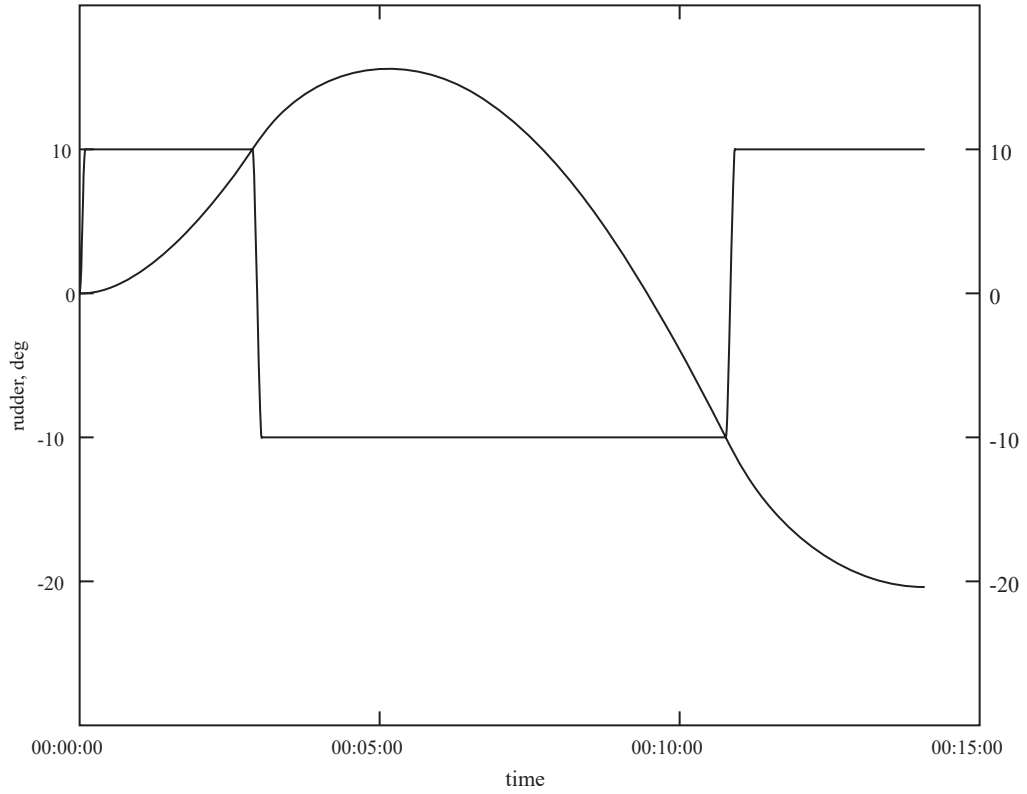


Fig. 30. Zigzag test 10°–10° Slow Speed. Rudder and heading plot.

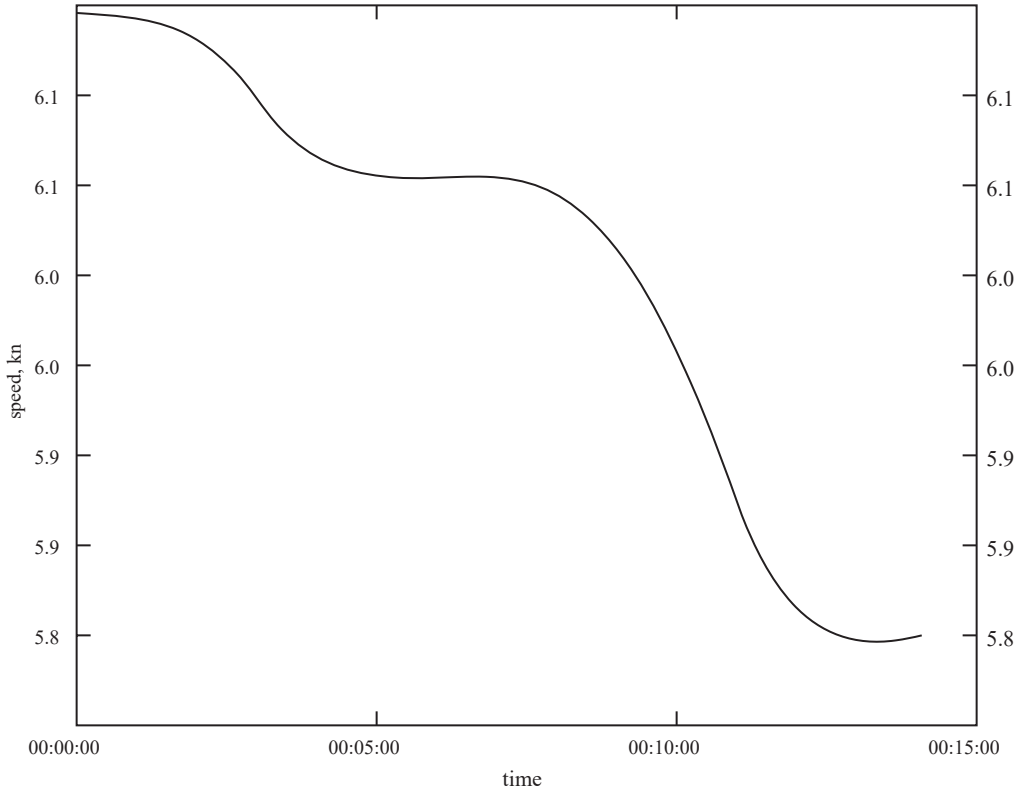


Fig. 31. Zigzag test 10°–10° Slow Speed. Speed plot.

Zigzag 20°–20°

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 80.0
Rudder commands, deg 20.0
Committed heading, deg 20.0

Performance

First overshoot angle, deg 11.4
Second overshoot angle, deg 14.1

time	rudder	heading	speed	turn rate
s	deg	kn	deg	deg/min
00:00:00	0	0.0	12.9	0
00:00:30	s20.0	2.3	12.8	s9.9
00:01:00	s20.0	9.2	12.7	s17.2
00:01:30	s20.0	19.1	12.5	s22.0
00:02:00	p20.0	28.1	12.2	s10.9
00:02:30	p20.0	31.2	12.1	s2.2
00:03:00	p20.0	30.7	12.1	p4.4
00:03:30	p20.0	26.8	12.1	p11.1
00:04:00	p20.0	19.7	12.1	p17.2
00:04:30	p20.0	9.9	11.9	p21.6
00:05:00	p20.0	-1.6	11.6	p24.3
00:05:30	p20.0	-14.1	11.2	p25.6
00:06:00	s20.0	-26.4	10.7	p19.2
00:06:30	s20.0	-32.5	10.5	p6.9
00:07:00	s20.0	-34.1	10.5	p0.1
00:07:30	s20.0	-34.1	10.6	s5.9

Table 15. Zigzag 20°–20°.

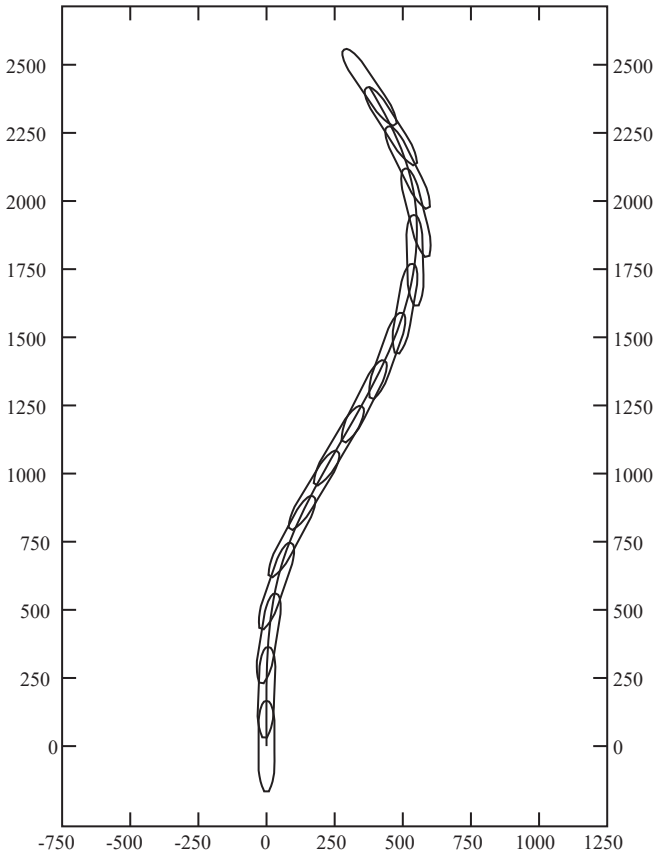


Fig. 32. Zigzag 20°–20°. Ship position plot.

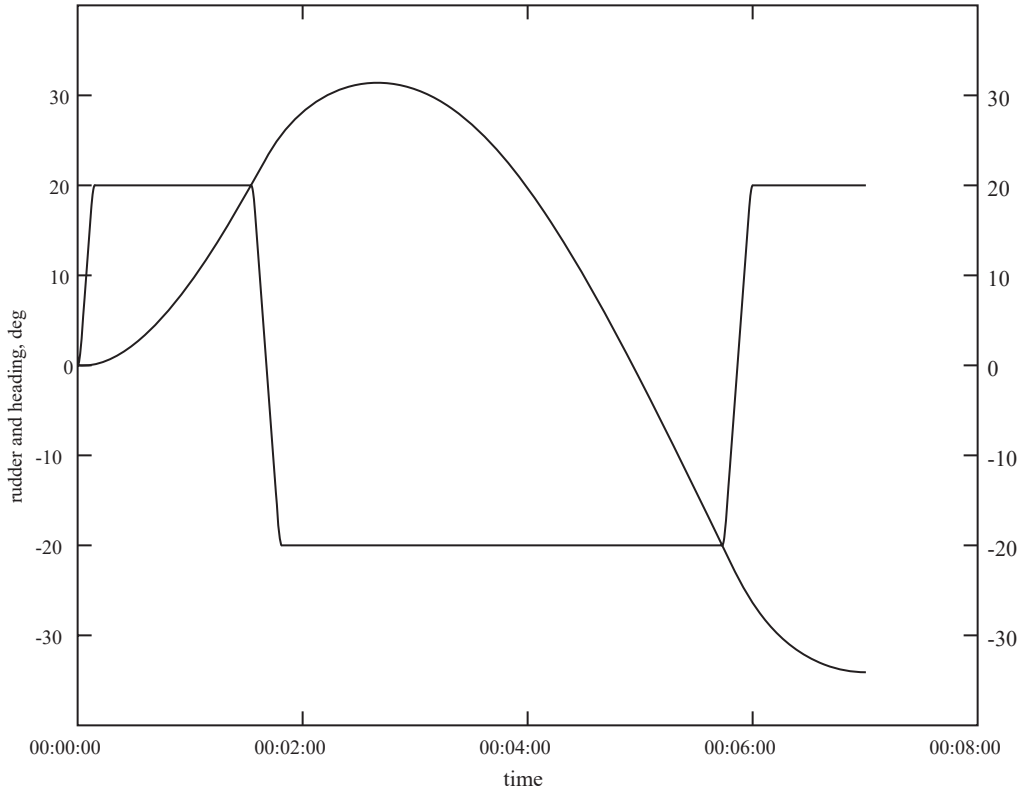


Fig. 33. Zigzag test 20°–20°. Rudder and heading plot.

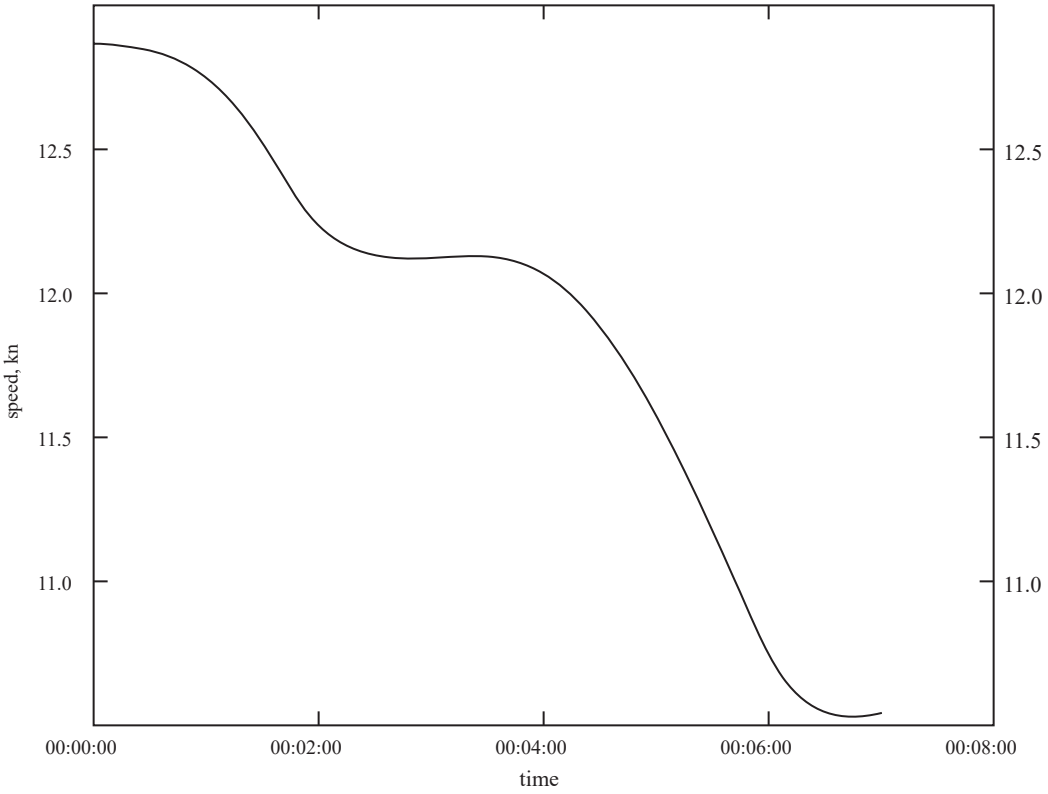


Fig. 34. Zigzag test 20°–20°. Speed plot.

Pull Out

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0

Rudder

From, deg 0.0
To, deg 10.0
And then to, deg 0.0

time	rudder	heading	turn rate
s	deg	deg	deg/min
00:00:00	0	0.0	0
00:00:45	s10.0	5.1	s12.6
00:01:30	0	16.2	s13.4
00:02:15	0	25.6	s12.0
00:03:00	0	34.4	s11.4
00:03:45	0	42.7	s10.9
00:04:30	0	50.8	s10.5
00:05:15	0	58.5	s10.1
00:06:00	0	65.9	s9.8
00:06:45	0	73.2	s9.6
00:07:30	0	80.3	s9.4
00:08:15	0	87.3	s9.2
00:09:00	0	94.2	s9.1
00:09:45	0	100.9	s9.0
00:10:30	0	107.6	s8.9
00:00:00	0	0.0	0
00:00:45	p10.0	-5.1	p12.6
00:01:30	0	-16.2	p13.4
00:02:15	0	-25.6	p12.0
00:03:00	0	-34.4	p11.4
00:03:45	0	-42.7	p10.9
00:04:30	0	-50.8	p10.5
00:05:15	0	-58.5	p10.1

00:06:00	0	-65.9	p9.8
00:06:45	0	-73.2	p9.6
00:07:30	0	-80.3	p9.4
00:08:15	0	-87.3	p9.2
00:09:00	0	-94.2	p9.1
00:09:45	0	-100.9	p9.0
00:10:30	0	-107.6	p8.9

Table 16. Pull Out.

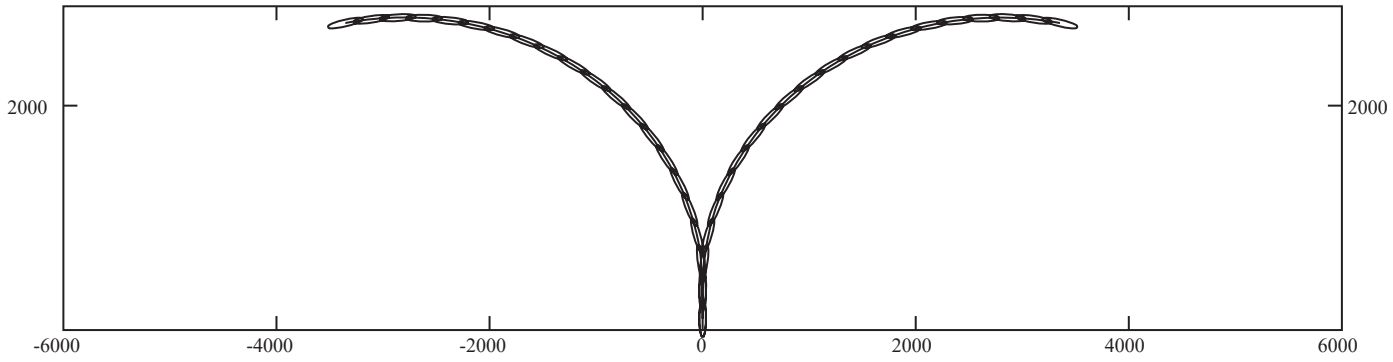


Fig. 35. Pull Out. Ship position plot.

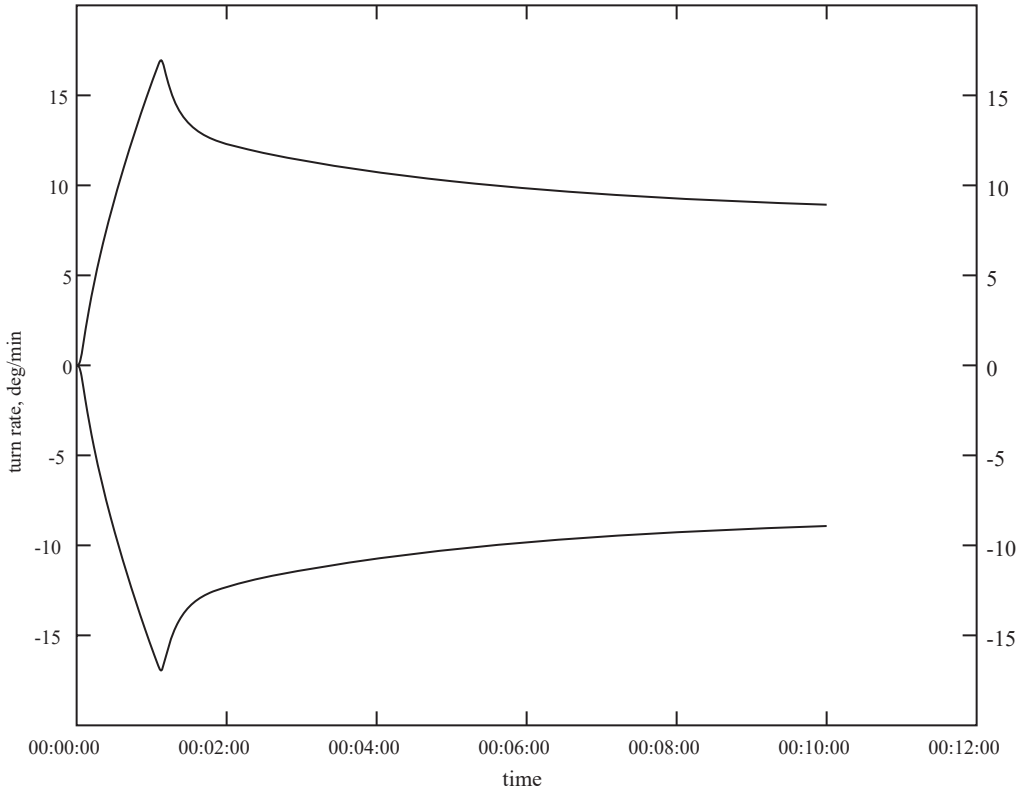


Fig. 36. Pull Out plot.

Environment

Environment

Water depth, H/T	∞
Wind speed, m/s	0.0
Water current speed, kn	0.0

Controls

Machinery telegraph setting%	80.0
Rudder, deg	s35.0, s30.0, s25.0, s20.0, s15.0, s10.0, s5.0, s4.0, s3.0, s2.0
	s1.0, s0.0, p1.0, p5.0, p10.0, p15.0, p20.0, p25.0, p30.0, p35.0
	p30.0, p25.0, p20.0, p15.0, p10.0, p5.0, p4.0, p3.0, p2.0, p1.0
	p0.0, s1.0, s5.0, s10.0, s15.0, s20.0, s25.0, s30.0, s35.0

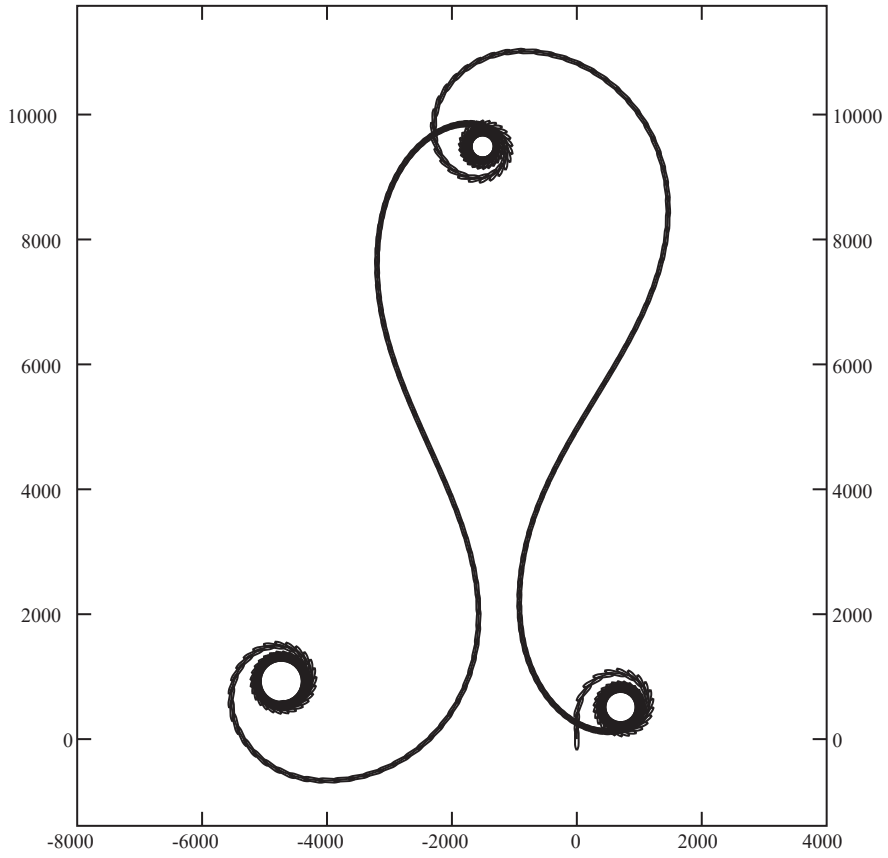


Fig. 37. Spiral test. Ship position plot.

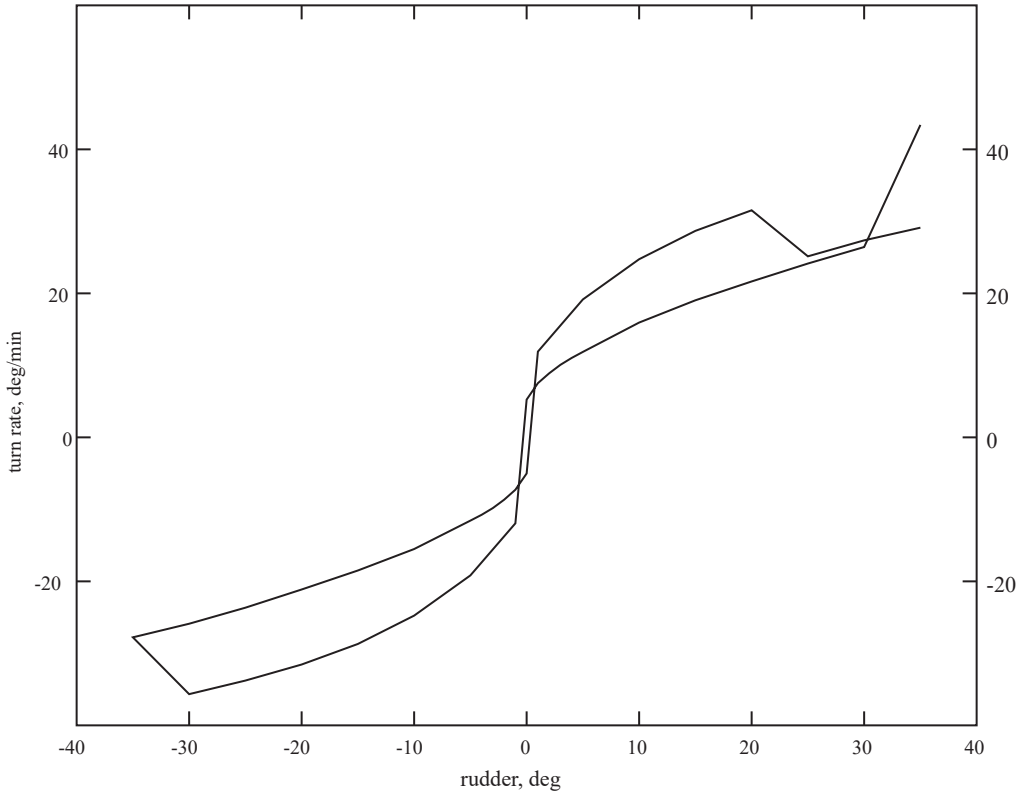


Fig. 38. Spiral test. Equilibrium turn rate plot

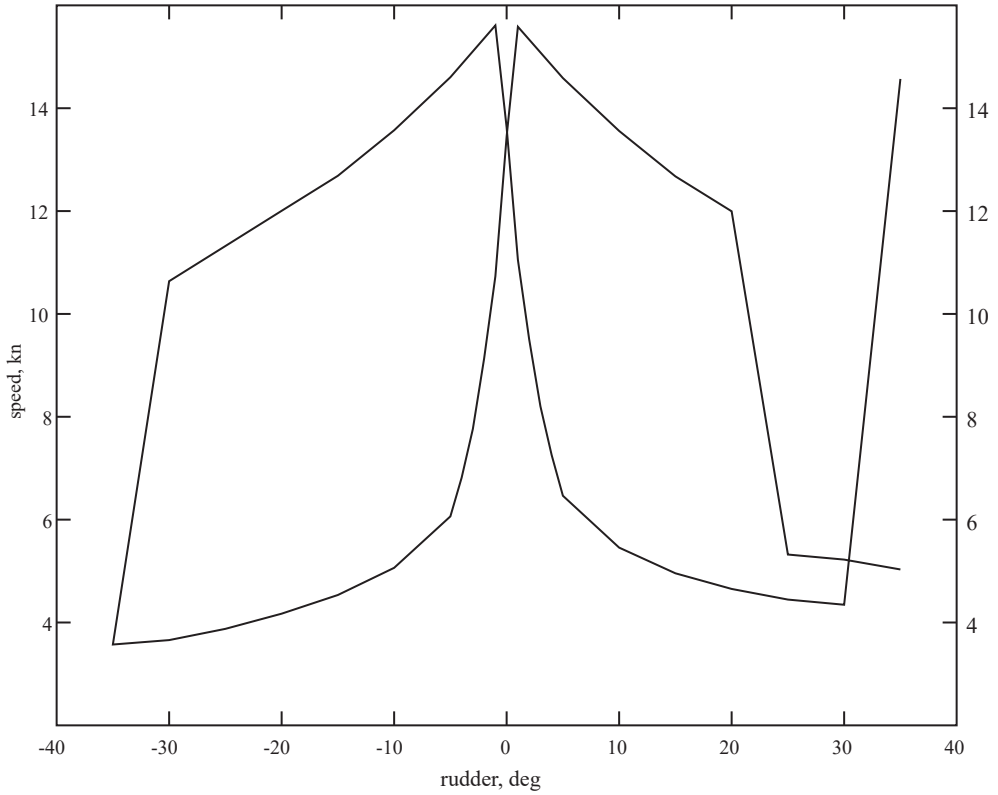
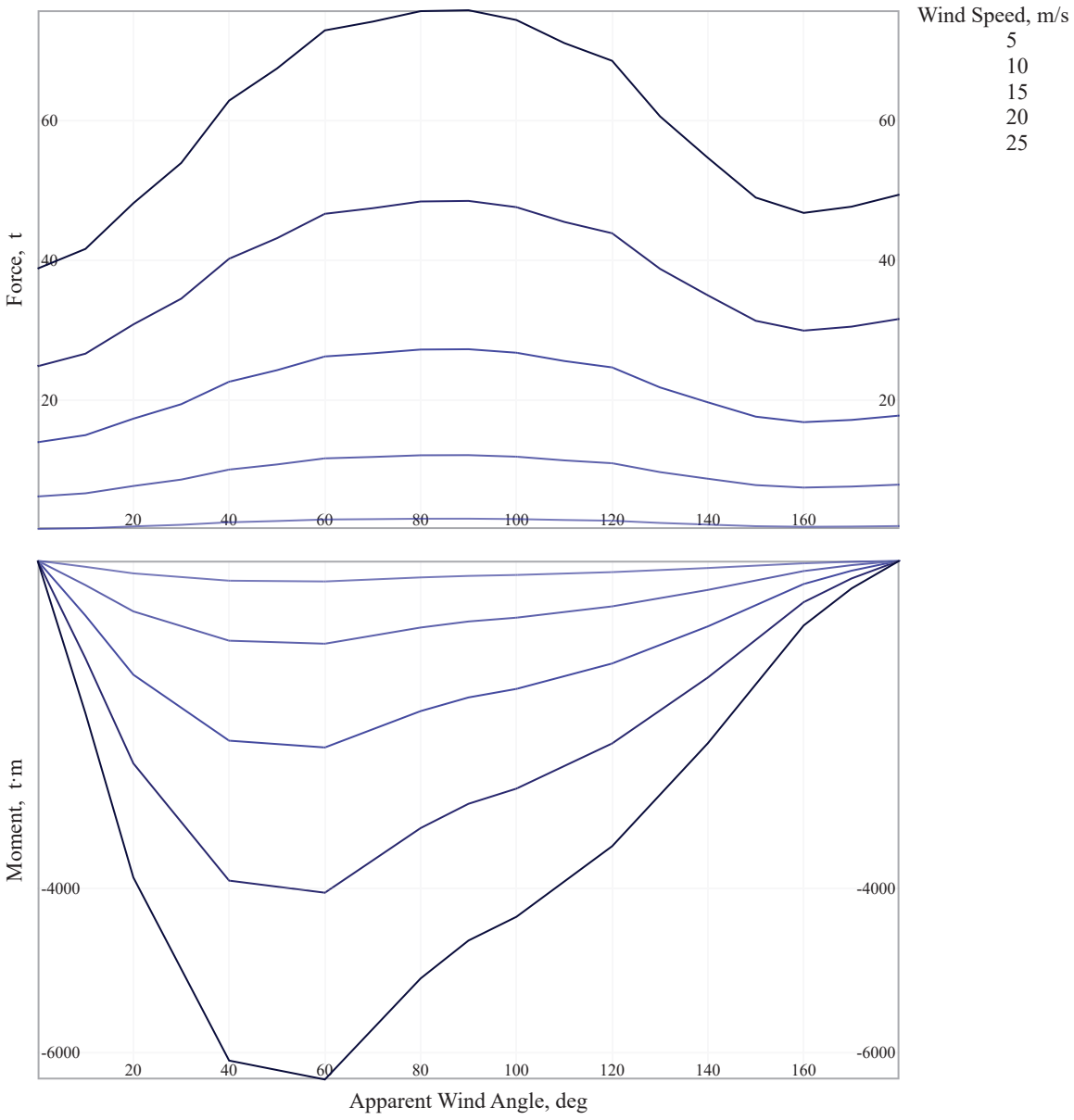


Fig. 39. Spiral test. Equilibrium speed plot

Wind Forces


Wind Speed, m/s
5
10
15
20
25
Force, t
60
40
20
Moment, t·m
-4000
-6000
20
40
60
80
100
120
140
160
Apparent Wind Angle, deg

Williamson Turn

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0

Controls

Rudder, deg 35.0
Committed heading, deg 22.9

time	speed	heading	turn rate	drift angle
s	kn	deg	deg/min	deg
00:00:00	17.0	0.0	0	0
00:01:00	16.3	20.6	s38.1	s8.2
00:02:00	15.0	47.4	s15.9	s6.4
00:03:00	14.8	50.9	p13.6	p0.7
00:04:00	14.1	21.9	p39.0	p10.2
00:05:00	12.0	-18.6	p40.5	p14.2
00:06:00	10.1	-57.9	p37.8	p16.1
00:07:00	8.7	-94.4	p35.2	p17.5
00:08:00	7.5	-128.5	p33.2	p18.7
00:09:00	6.7	-159.3	p18.4	p16.3
00:10:00	7.0	-171.0	p7.6	p9.2
00:11:00	7.7	-176.8	p3.8	p4.9
00:12:00	8.5	-179.2	p1.4	p2.3
00:13:00	9.3	180.0	p0.5	p1.0
00:14:00	10.1	179.7	p0.1	p0.3
00:15:00	10.8	179.7	s0.0	p0.1
00:16:00	11.4	179.7	s0.0	p0.0
00:17:00	12.1	179.7	s0.0	s0.0

Table 20. Williamson Turn.

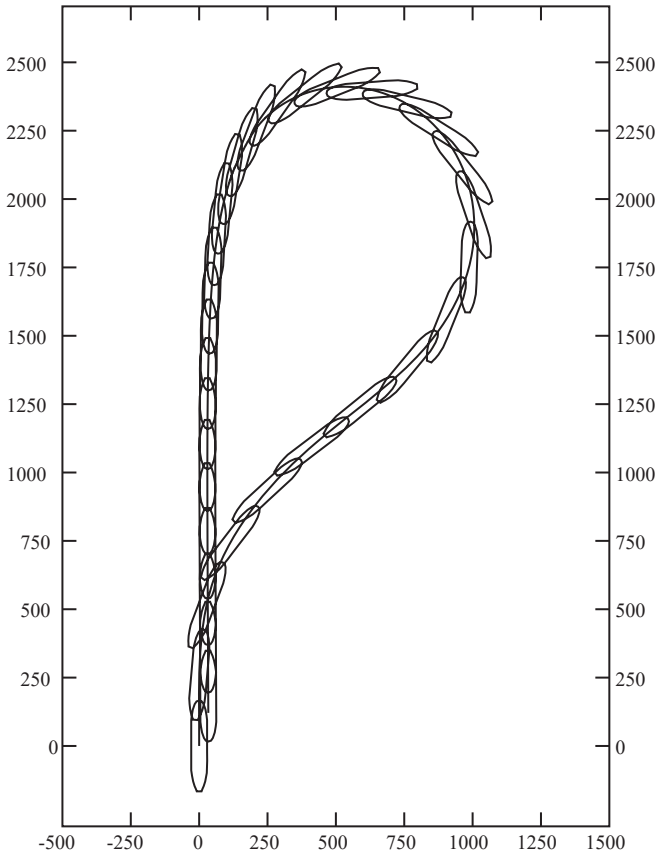


Fig. 44. Williamson Turn. Ship position plot.

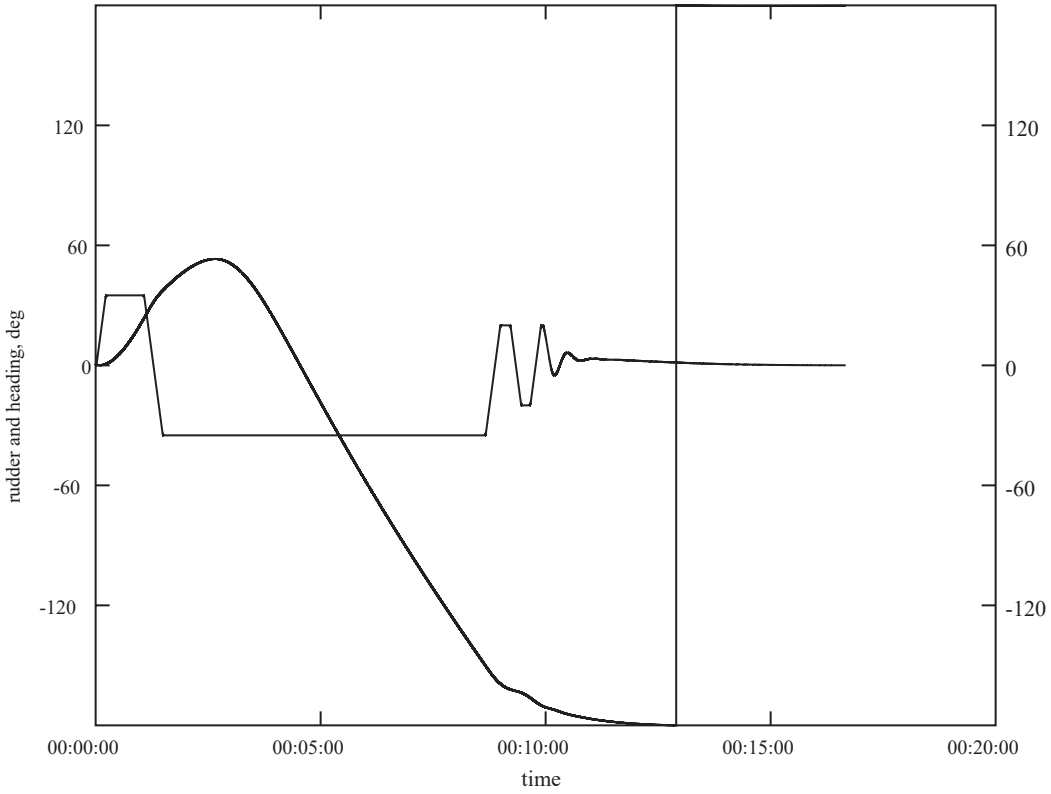


Fig. 45. Williamson Turn. Rudder and heading plot.

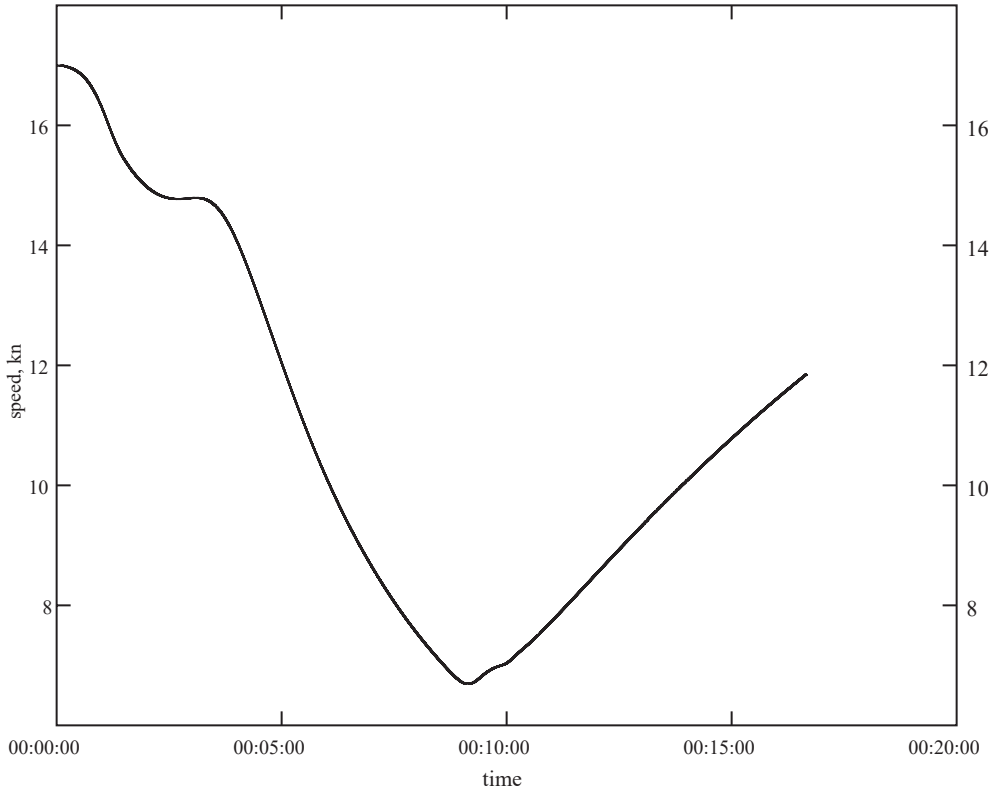


Fig. 46. Williamson Turn. Speed plot.

Wind Effect—Stopped

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	0.0	0.0	0
00:00:20	0.1	0.1	s41.3
00:00:40	0.1	0.4	s65.7
00:01:00	0.1	0.9	s76.3
00:01:20	0.1	1.5	s81.6
00:01:40	0.2	2.4	s84.8
00:02:00	0.2	3.3	s87.1
00:02:20	0.2	4.4	s88.9
00:02:40	0.2	5.6	s90.5
00:03:00	0.3	6.9	s92.0
00:03:20	0.3	8.2	s93.6
00:03:40	0.3	9.6	s95.2
00:04:00	0.3	11.1	s96.8
00:04:20	0.3	12.5	s98.6
00:04:40	0.4	14.0	s100.3
00:05:00	0.4	15.5	s102.2

Table 21. Wind effect—stopped.

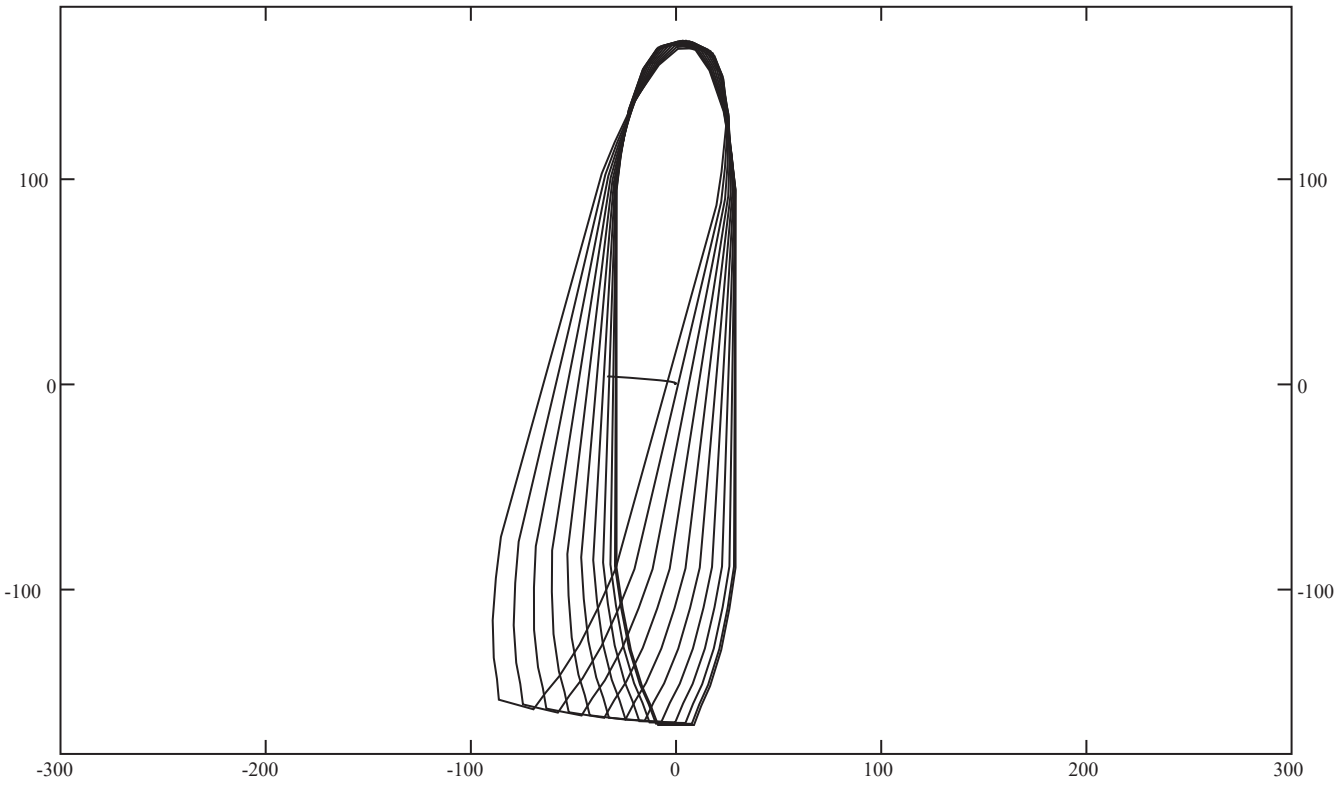


Fig. 47. Wind effect—stopped. Ship position plot.

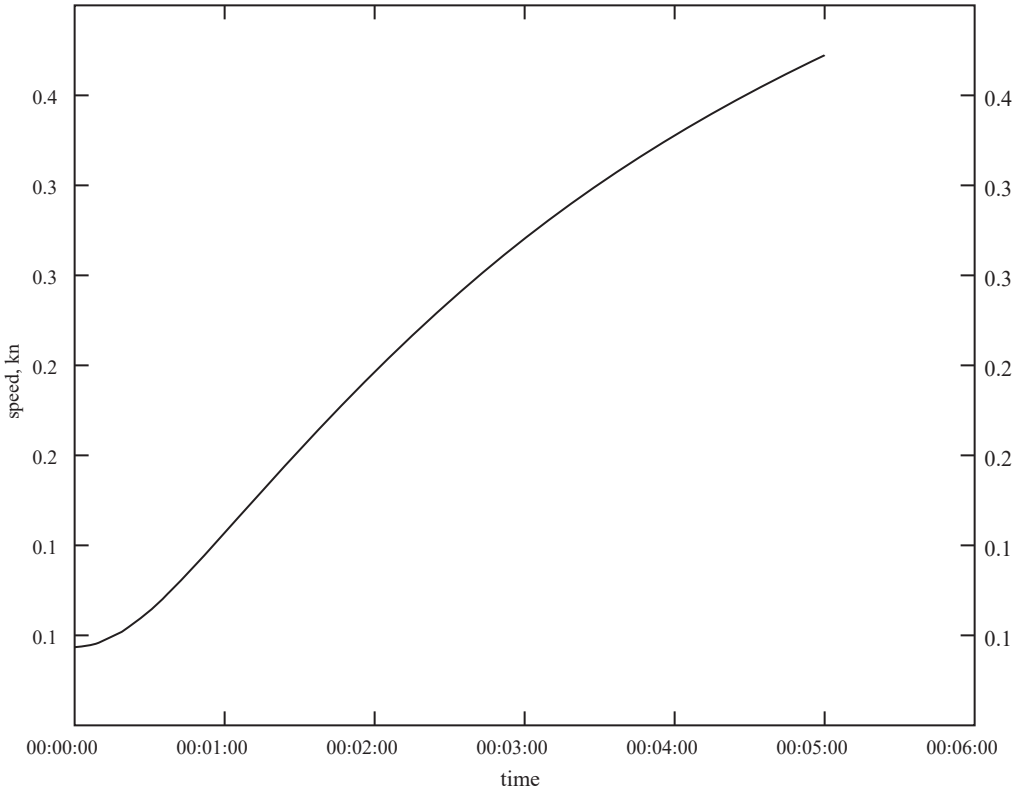


Fig. 48. Wind effect—stopped. Speed plot.

Wind Effect—Under Way

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 20.0
Wind direction “from”, deg 90.0
Water current speed, kn 0.0

Controls

Machinery telegraph setting, % 100.0
Rudder, deg 0

time	speed	heading	drift angle
s	kn	deg	deg
00:00:00	16.9	0.0	0
00:00:20	16.9	0.1	s0.1
00:00:40	16.9	0.4	s0.3
00:01:00	16.9	0.8	s0.4
00:01:20	16.9	1.4	s0.6
00:01:40	16.9	2.2	s0.8
00:02:00	16.9	3.2	s1.0
00:02:20	16.9	4.5	s1.2
00:02:40	16.9	5.9	s1.3
00:03:00	16.9	7.5	s1.5
00:03:20	16.9	9.4	s1.7
00:03:40	16.8	11.4	s1.9
00:04:00	16.8	13.7	s2.1
00:04:20	16.8	16.2	s2.3
00:04:40	16.7	18.8	s2.5
00:05:00	16.7	21.6	s2.6

Table 22. Wind effect—under way.

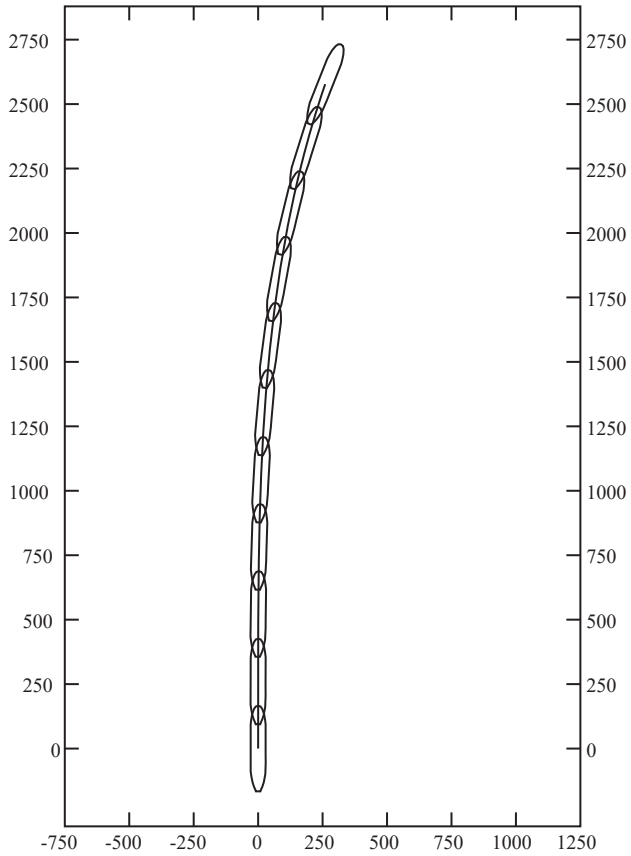


Fig. 49. Wind effect—under way. Ship position plot.

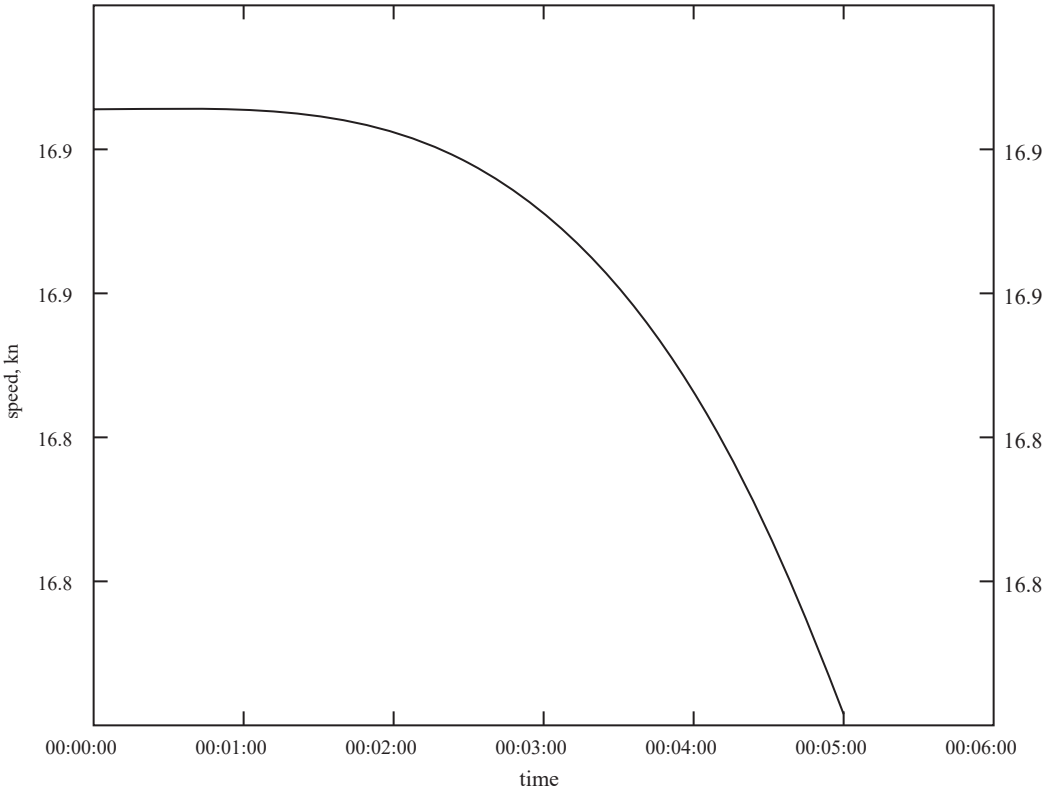


Fig. 50. Wind effect—under way. Speed plot.

Free Oscillations

Environment

Water depth, H/T ..... ∞
Wind speed, m/s 0.0
Water current speed, kn 0.0
Wave height, m 0

Controls

Machinery telegraph setting, % 0.0
Rudder, deg 0

Initial Inclination

Roll, deg 10.0
Pitch, deg 5.0
Heave, m 0

time	roll	pitch	heave
s	deg	deg	m
00:00:00	10.0	5.0	0.0
00:00:05	-6.4	-1.8	0.0
00:00:10	3.5	0.1	0.9
00:00:15	-1.6	0.3	-0.2
00:00:20	0.2	-0.3	0.4
00:00:25	0.6	0.1	0.2
00:00:30	-1.1	0.0	0.0
00:00:35	1.2	0.0	0.2
00:00:40	-1.1	0.0	0.1
00:00:45	0.9	0.0	0.1
00:00:50	-0.7	0.0	0.1
00:00:55	0.5	0.0	0.1
00:01:00	-0.3	0.0	0.1
00:01:05	0.1	0.0	0.1
00:01:10	0.0	0.0	0.1
00:01:15	-0.1	0.0	0.1
00:01:20	0.1	0.0	0.1
00:01:25	-0.2	0.0	0.1
00:01:30	0.1	0.0	0.1
00:01:35	-0.1	0.0	0.1
00:01:40	0.1	0.0	0.1

Table 23. Free Oscillations.

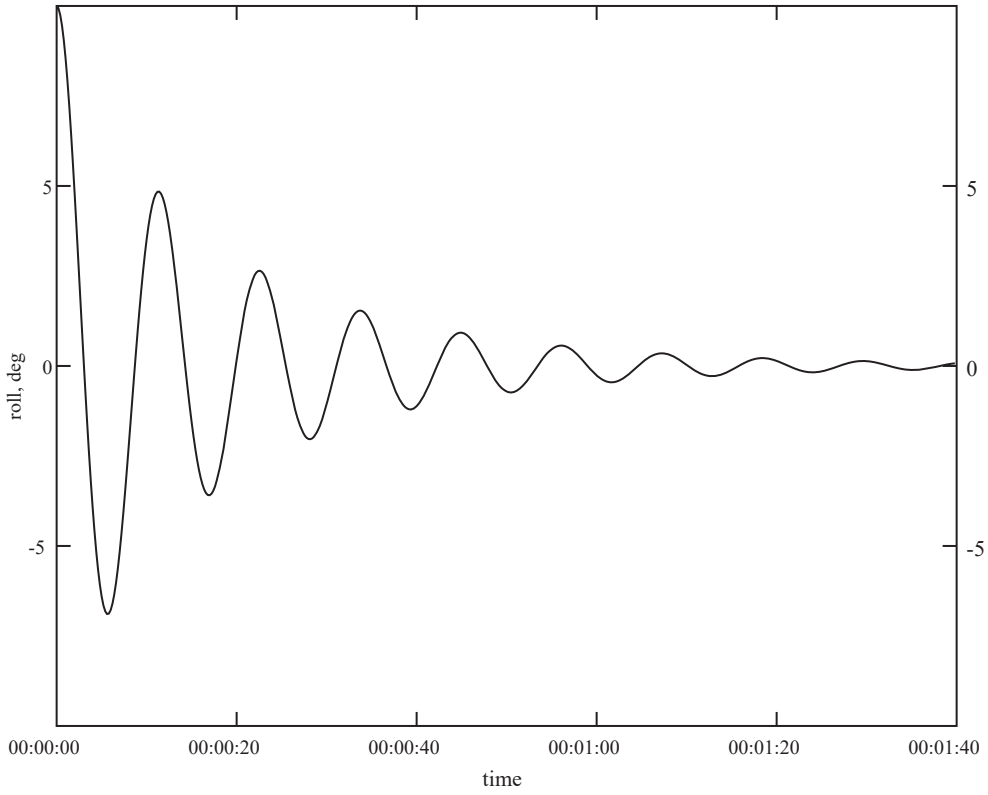


Fig. 51. Free Oscillations. Roll plot.

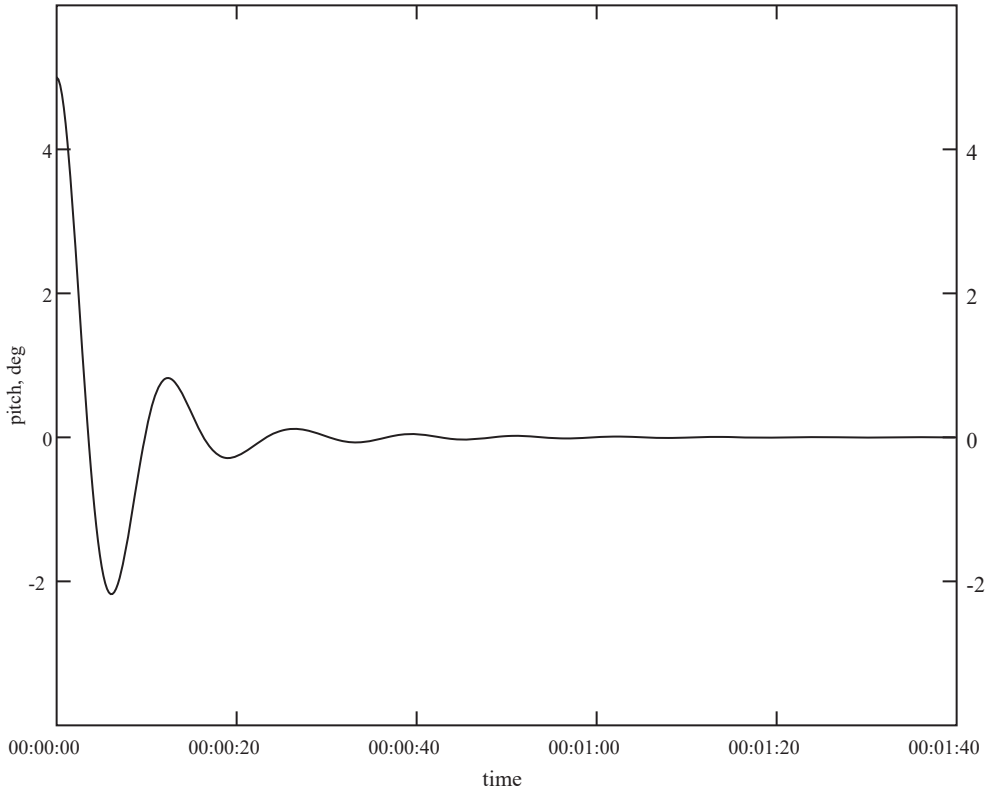


Fig. 52. Free Oscillations. Pitch plot.

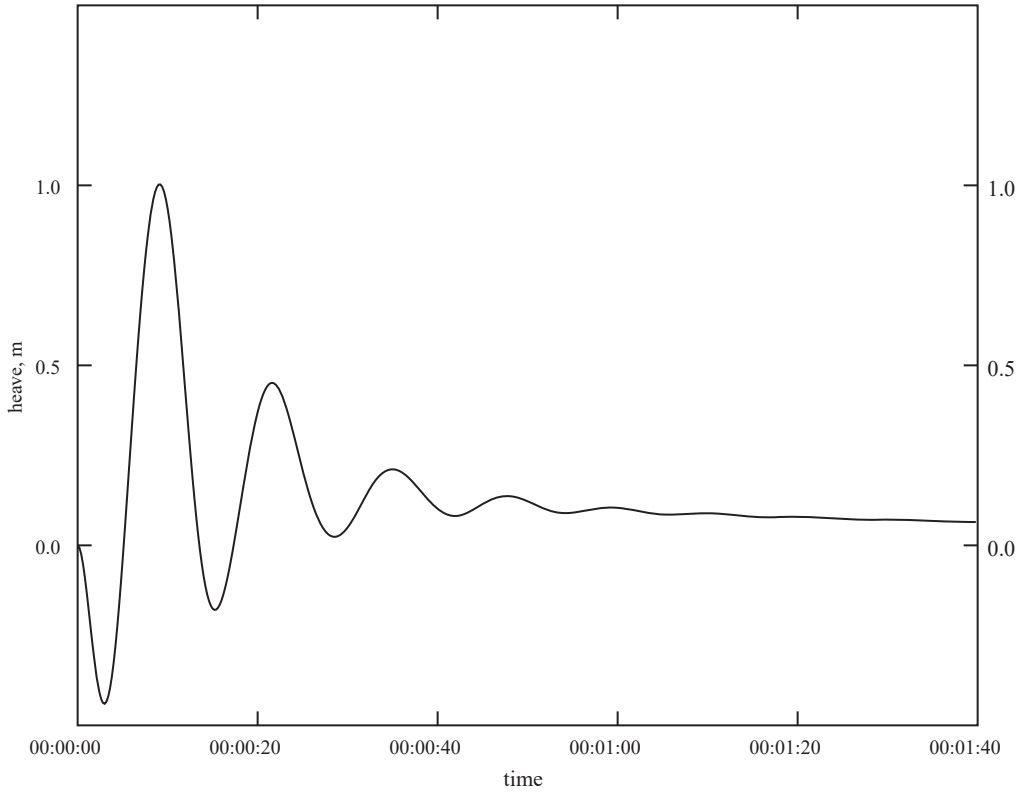


Fig. 53. Free Oscillations. Heave plot.

PILOT CARD

VLCC18R1
Version 1

Ship's name Elizabeth I. Angelicoussi

Call Sign SZHJ **Deadweight** 306229 tonnes **Year built** 2004

Draught aft 20.73 m / 68 ft 0 in **Forward** 20.73 m / 68 ft 0 in **Displacement** 321001 tonnes

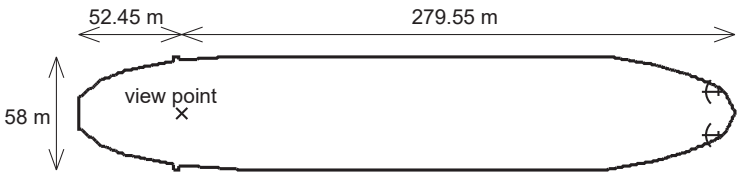
SHIP'S PARTICULARS

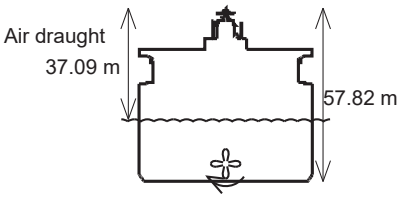
Length overall 332 m **Anchor chain:** **Port** 28.1 shackles **Starboard** 28.1 shackles

Breadth 58 m

Bulbous bow Yes

(1 shackle = 27.432 m = 15 fathoms)





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 29431 kW (40015 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	RLoaded
Full sea speed	**1**	76.0	N/A	N/A	17.0
Full Ahead	**0.8**	57.0	N/A	N/A	12.9
Half Ahead	**0.5**	47.0	N/A	N/A	10.5
Slow Ahead	**0.25**	33.0	N/A	N/A	7.3
Dead Slow Ahead	**0.125**	28.0	N/A	N/A	6.1
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °

Hard-over to hard-over 25 s

Rudder angle for neutral effect 0 °

Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**	
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type**		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

WHEELHOUSE POSTER

VLCC18R1
Version 1

Ship's name Elizabeth I. Angelicoussi **Call Sign** SZHJ **Gross tonnage** 153911 **Net tonnage** 107642

Max. Displacement 321001 tonnes, and **Deadweight** 306229 tonnes, and **Block coefficient** 0.814 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	RLoaded
Trial / Estimated	Trial / Estimated
N/A m forward	20.73 m forward
N/A m aft	20.73 m aft

STEERING PARTICULARS

Type of rudder(s) Normal

Maximum rudder angle 35 °

Time hard-over to hard-over

with one power unit 50 s

with two power units 25 s

Min. speed to maintain course propeller stopped knots

Rudder angle for neutral effect 0 °

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving min / shackle
Port	28.1	0.894
Starboard	28.1	0.894
(1 shackle = 27.432 m = 15 fathoms)		

PROPULSION PARTICULARS

Type of engine Diesel , 29431 kW (40015 hp) **Type of propulsion** Propelle

Engine order		RPM	Pitch	Speed (knots)	
				Loaded	RLoaded
Full sea speed	**1**	76.0	N/A	N/A	17.0
Full Ahead	**0.8**	57.0	N/A	N/A	12.9
Half Ahead	**0.5**	47.0	N/A	N/A	10.5
Slow Ahead	**0.25**	33.0	N/A	N/A	7.3
Dead Slow Ahead	**0.125**	28.0	N/A	N/A	6.1
Dead Slow Astern	**-0.125**	-28.0	N/A		
Slow Astern	**-0.25**	-33.0	N/A		
Half Astern	**-0.5**	-47.0	N/A		
Full Astern	**-1**	-57.0	N/A		

Critical revolutions rpm

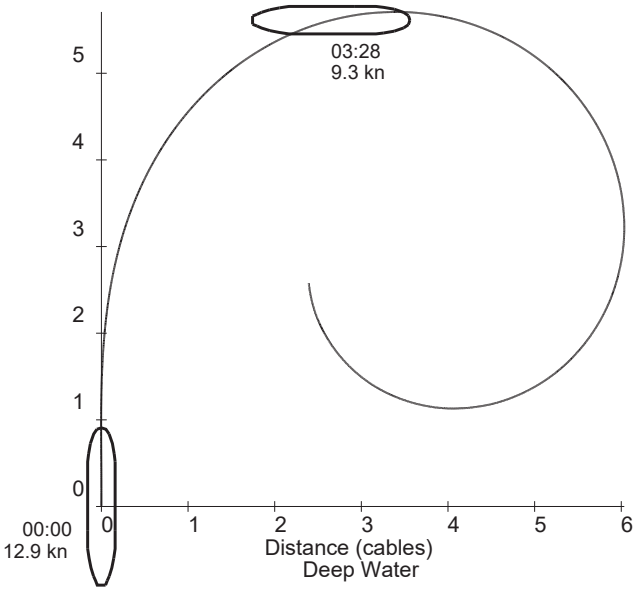
THRUSTER EFFECT at trial conditions

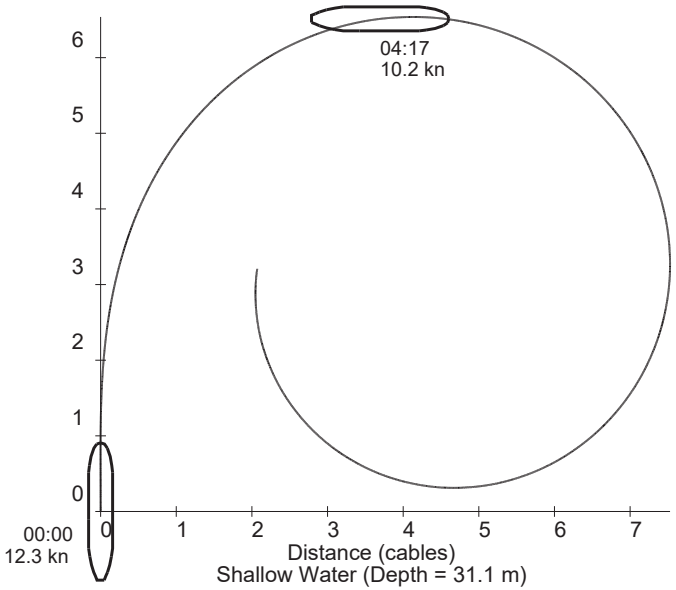
Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	N/A	N/A	N/A	N/A	N/A
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

DRAUGHT INCREASE (RLOADED)

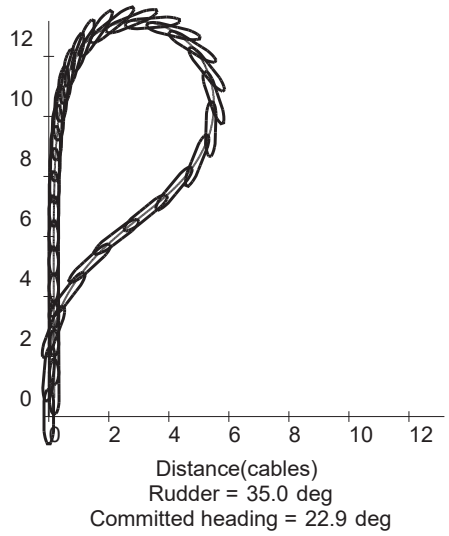
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
20.7	7.3	0.38
	10.5	0.77
	16.5	2.00
10.4	7.2	0.37
	10.2	0.75

TURNING CIRCLES AT MAX. RUDDER ANGLE (35 °)

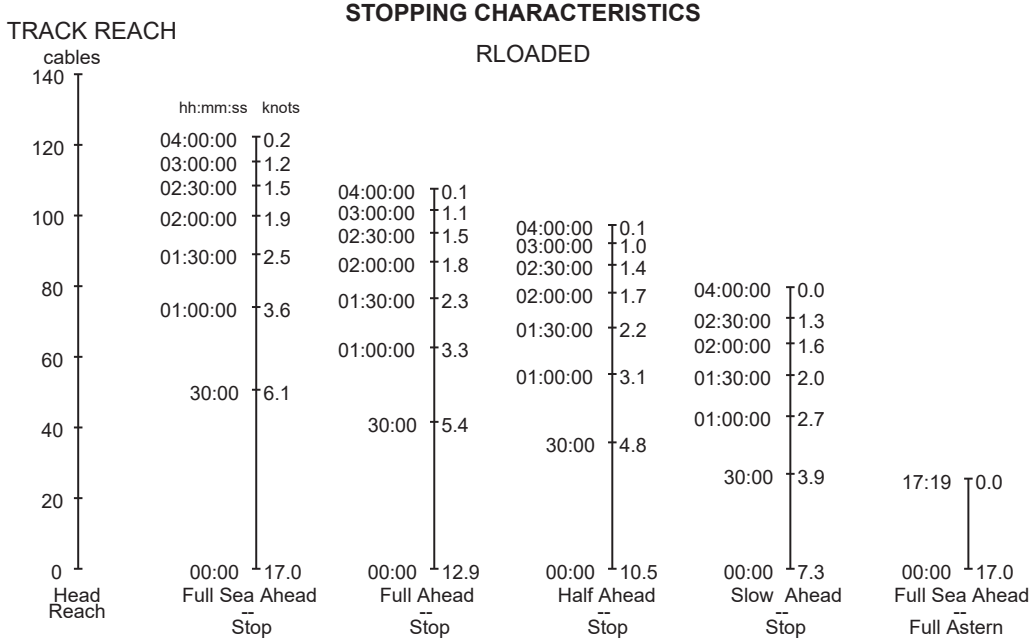




WILLIAMSON TURN

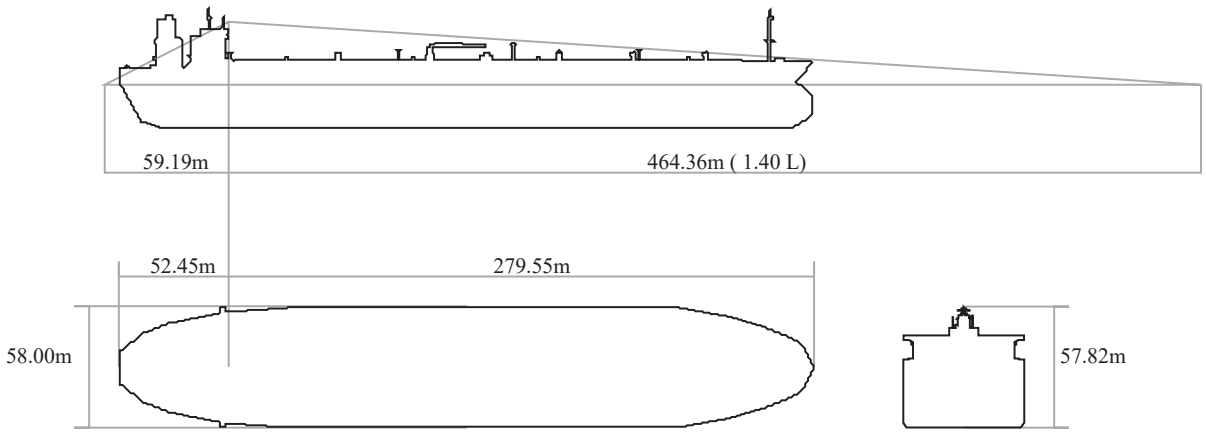


STOPPING CHARACTERISTICS



PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE



Appendix G: Pilot Questionnaire

Please see Appendix G in Appendixes folder.

EIS Facilitator Form 2022

Previewing Questionnaire

Facilitator form

Print Blank

Page 1

1 * Did this run contain an emergency?

○ Yes ○ No

Page 2

Parent Question : position 1 (Q1->Yes) set

2 * What type of emergency was it? Please type in the answer.

Page 3

3 * What was the status of the run?

○ Successful ○ Near Miss ○ Failure ○ Run was not completed

Page 4

Parent Question : position 5 (Q3->Successful) not set

4 * Explain why the run was not successful.

Page 5

5 * Please add additional notes about the run that may be important to the study's recommendation.

Submit preview Reset

◄ Facilitator form - template (hidden)

Jump to...

Run 2 (hidden) ►

You are logged in as System Administrator (Log out)
eis_fac_22

Pilots Survey

Location: Destination: Dredge Plan:

Wind and Current: Ship Draft: Docking:

Comments:

1 * The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

2 If the channel configuration was inadequate in any way, please explain why.

3 * Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – *5 being the channel is adequate and 1 being the channel is inadequate.*

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

4 If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.

5 * The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

6 If the tug configuration was not adequate, please explain why.

7 * The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

8 If not safe, please explain why.

9 * Run was _____ based on run parameters

○ successful ○ unsuccessful

10 If the run was not successful, please explain why.

11 Additional comments:

tug captain

Location: Destination: Dredge Plan:
Wind and Current: Ship Draft: Docking:
Comments:

1 * Tug Type:

Choose...

2 * Tug Location - Beginning:

Choose...

3 * Tug location - End:

Choose...

4 * I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

5 If the maneuvering room was not adequate, please explain why.

6 * Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?

○ Yes ○ No

7 If any of the environmental forces caused vessel operational limits to be exceeded, please explain why, and if the forces prevented you from performing any specific maneuver, what occurred.

8 * The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

9 If the tug configuration was not adequate, please explain why.

10 * The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

11 If not safe, please explain why.

12 * Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?

○ Yes ○ No

13 * If Yes, please explain why

14 * Did you feel that you were asked to operate at max power for an extended period of time?

○ Yes ○ No

15 * Run was _____ based on run parameters

○ successful ○ unsuccessful

16 If the run was not successful, please explain why.

17 Additional Comments:

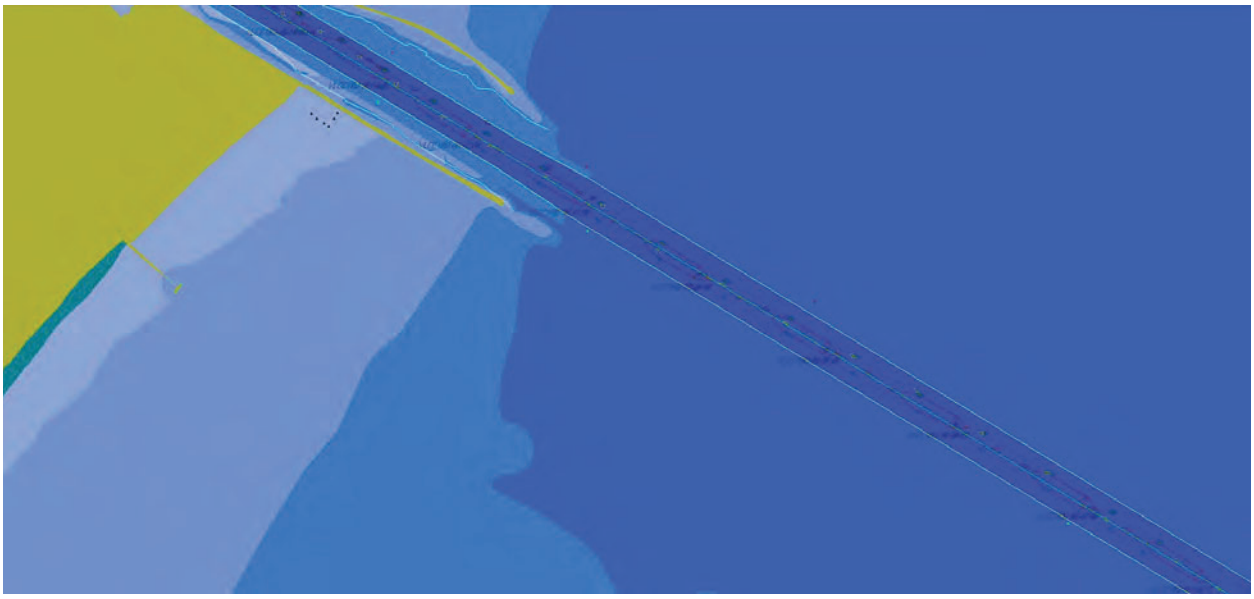
Close this window

Appendix H: Run evaluation forms

Please see Appendix H in Appendixes folder.

Run 1

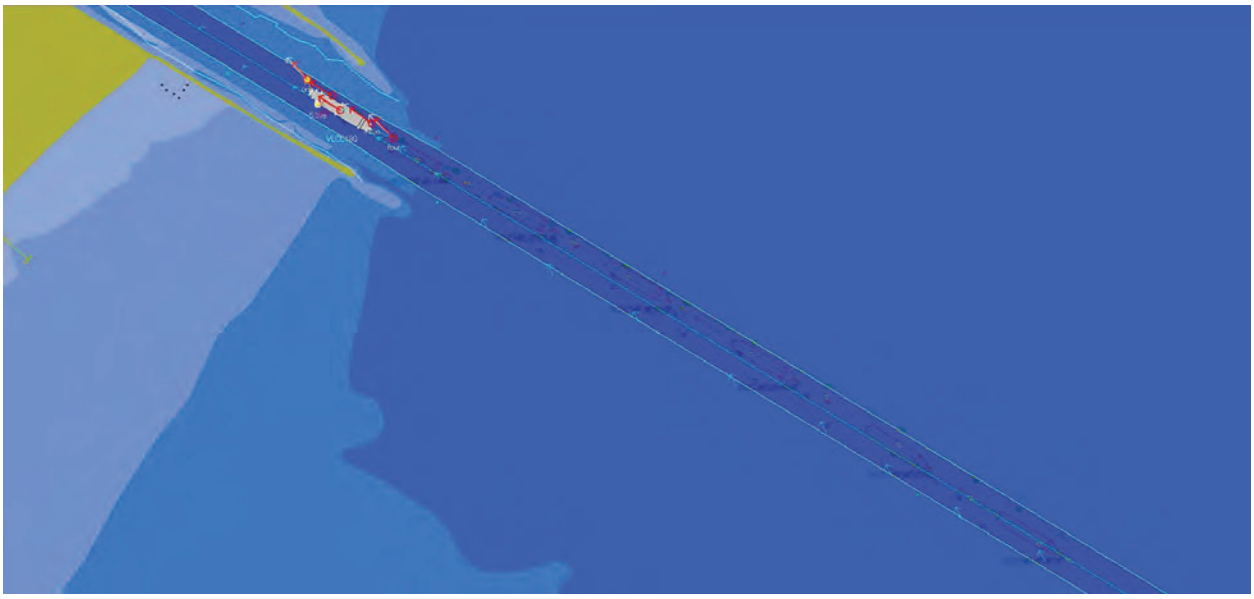
Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: N Medium Comments:



Question	Answers
Did this run contain an emergency?	**admin: No** **jrivera: No** **kjones: No**
What was the status of the run?	admin: Near Miss jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: All good kjones: Tug 1 tripped, disconnected line. Repostioned himself and caught line again.

Run 2

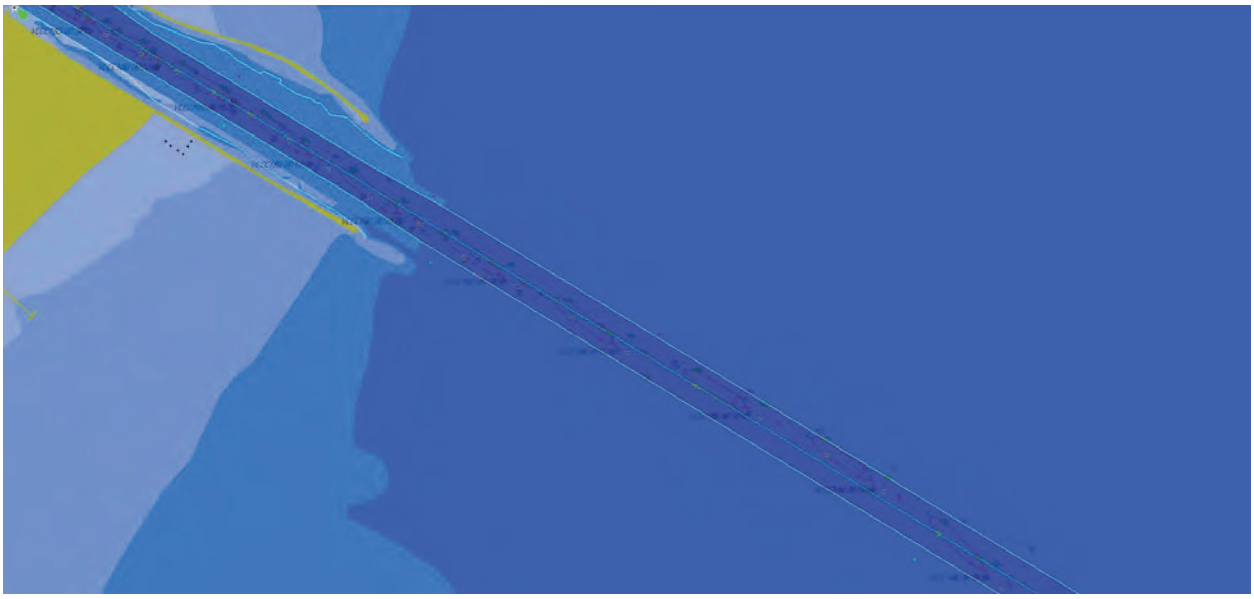
Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: N High Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Start with wind from 000 corrected to 150. Opened SSE wave file after start. Make the matrix more clear about what numbers/files need to be plugged in for the offshore wind current. jrivera: Safe run tug escorting, no commands given.

Run 3

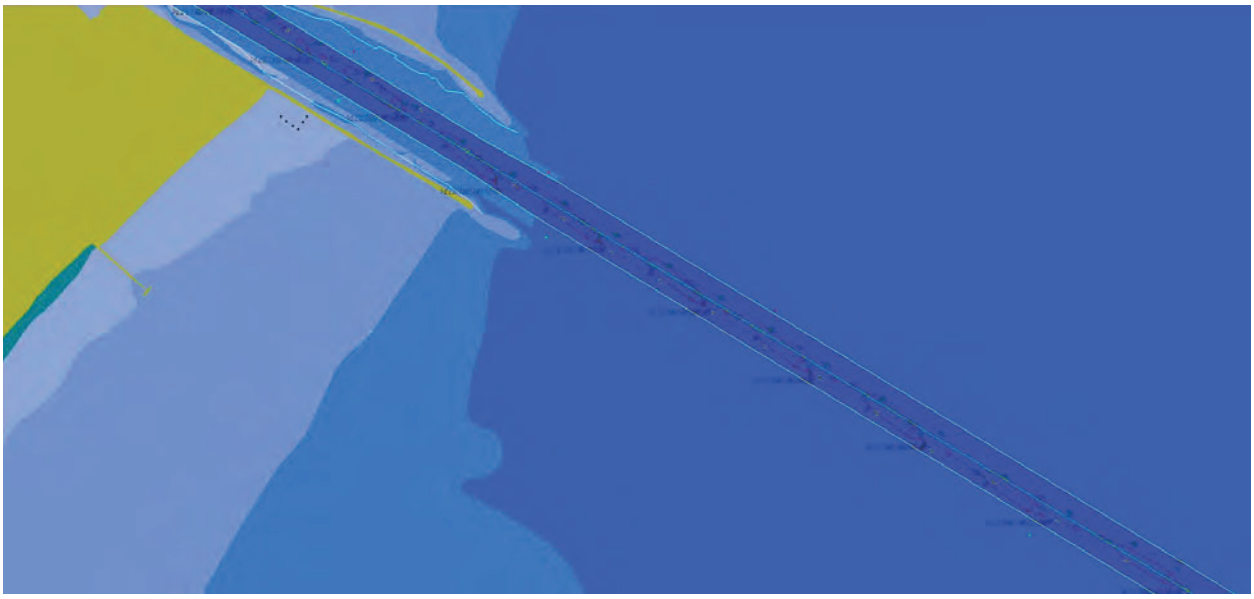
Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: S Medium Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Failure
Explain why the run was not successful.	jrivera: ran aground on port quarter
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Roving tug started port mid ships full towards, shifted to port quarter full towards, shifted to port bow full towards, then slack. jrivera: tugs behaved correctly

Run 4

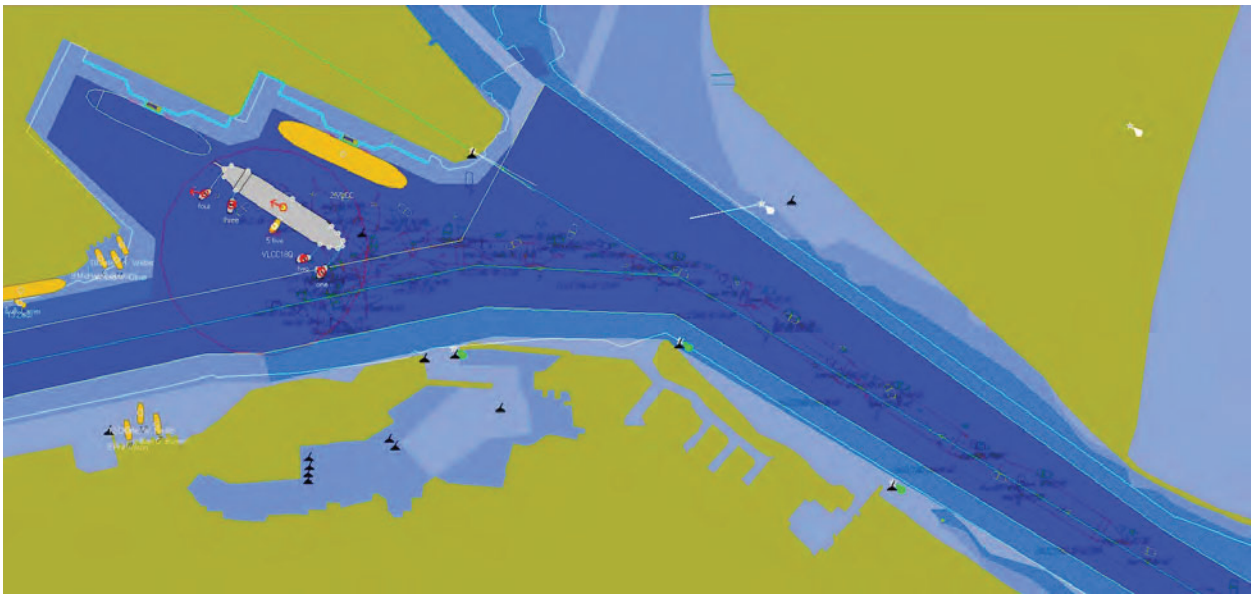
Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: S High Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Robot tug 5 port bow. Combined with Run 8 going onto dock at HI W jrivera: easy

Run 5

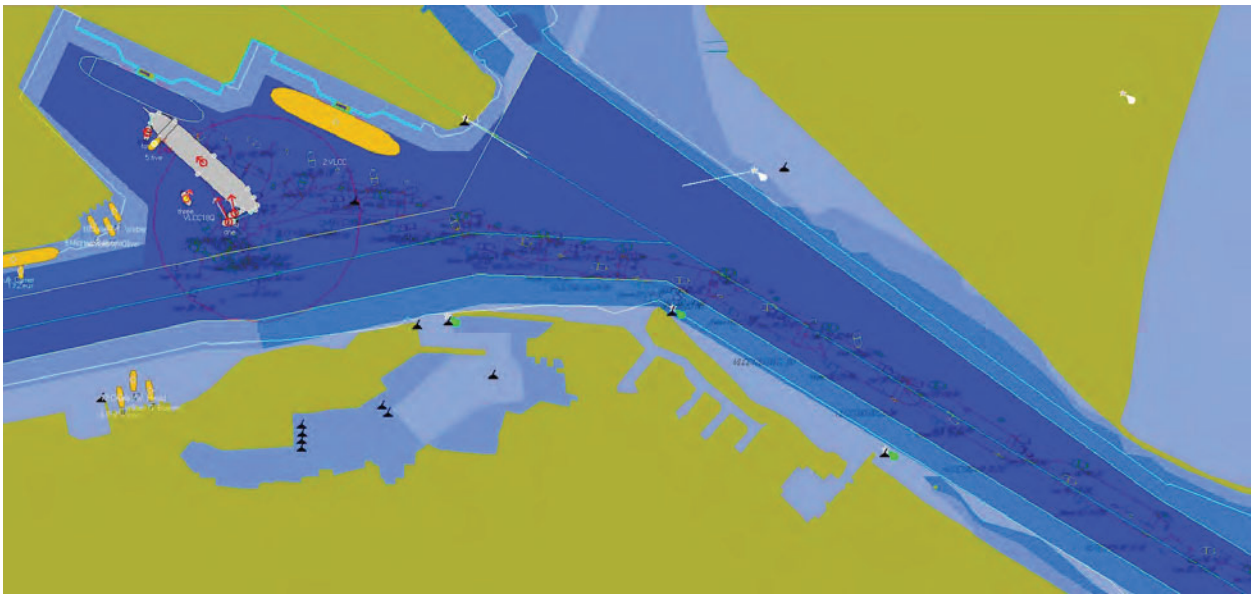
Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 1 robot tug jrivera: short bursts of full power for corrections, but was quickly reduced. Overall safe run.

Run 6

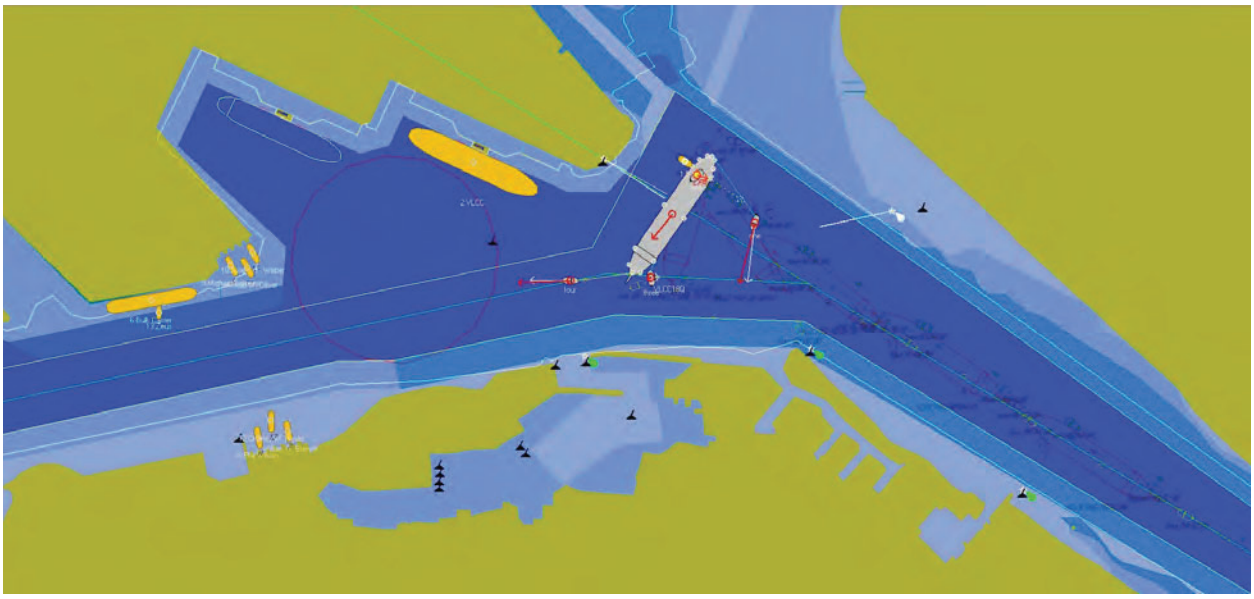
Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Tug 1 tripped and lost a line. He was able to reset himself and get back to position. jrivera: all good

Run 7

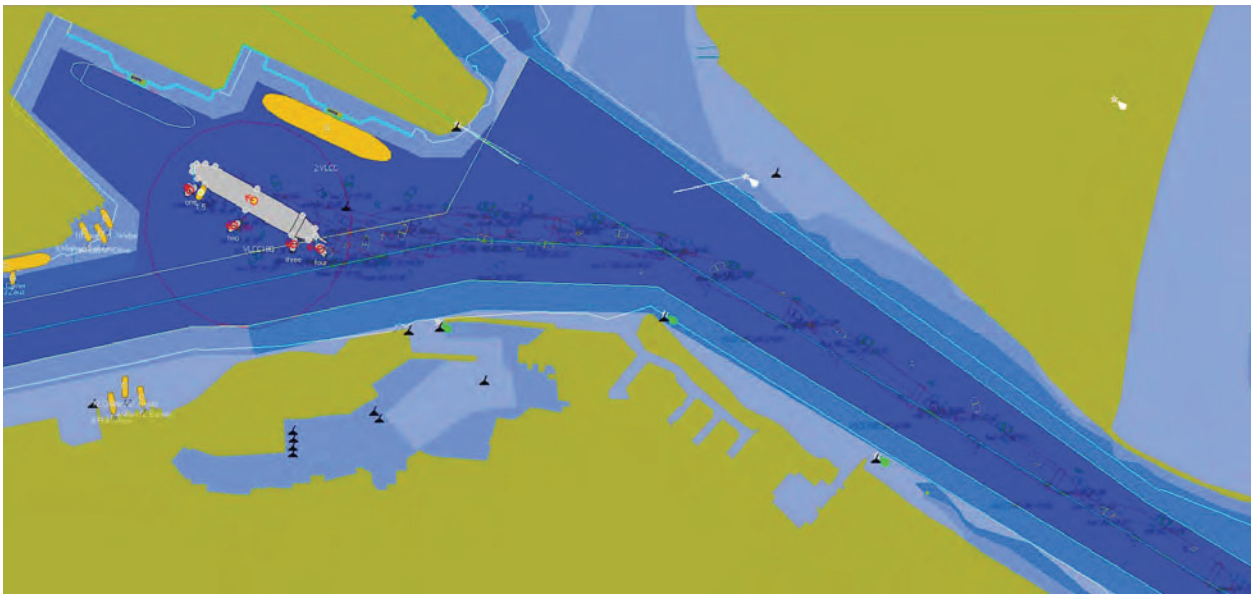
Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Run was not completed kjones: Run was not completed
Explain why the run was not successful.	jrivera: Simulator glitch. kjones: Fender broken on ship (tug hit too hard?) Could not complete, reloaded exercise for Run 7.2
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Run 7.2 will replace this run kjones: Not completed, reset for Run 7.2

Run 8

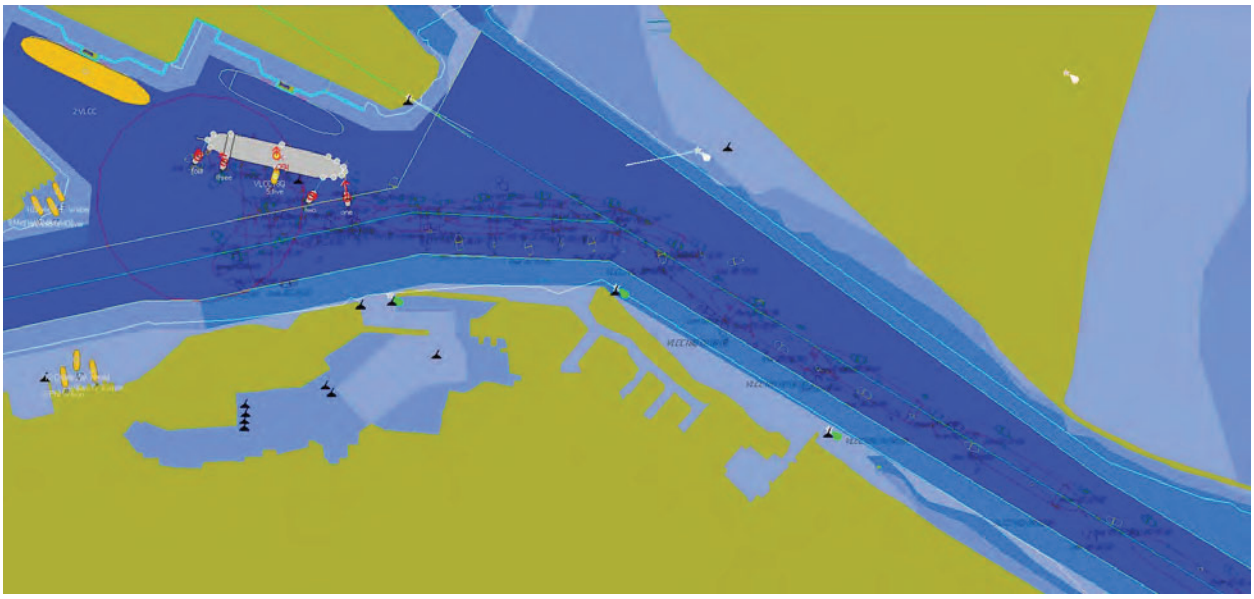
Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: Yes** **kjones: Yes**
What type of emergency was it? Please type in the answer.	jrivera: engine failure kjones: Ship lost engine at the HI intersection
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: engine failure, aborted turn and docked ship head in. Tugs had everything under control and towed the ship safely to dock. kjones: Instead of topping all the way around, the pilot states they will go stbd S2 on the west dock. Got the ship under control and used tug power to head towards the dock.

Run 9

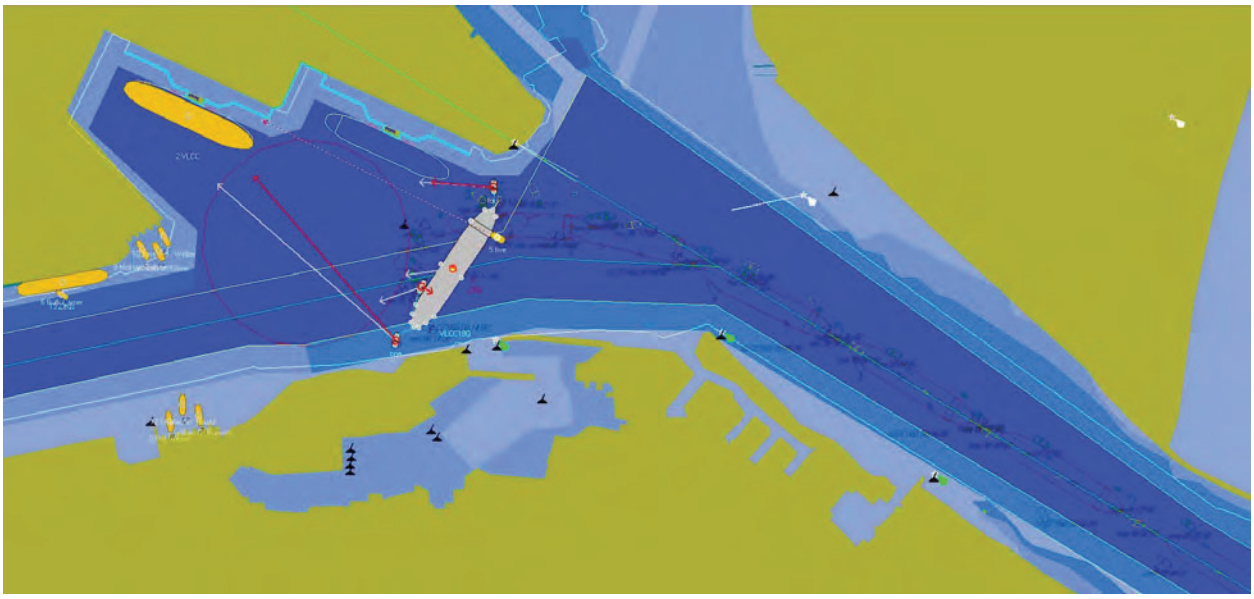
Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: comfortable maneuver. all performed as expected. overall safety high. kjones: Shifted robot tug from board port 2 to port quarter

Run 10

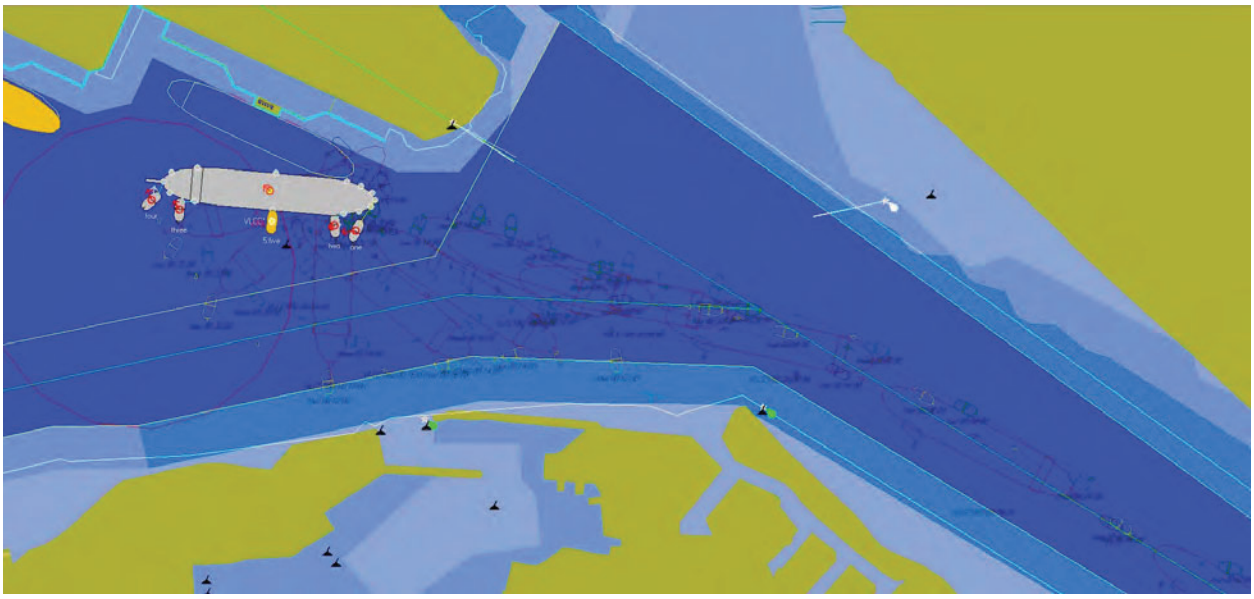
Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: Yes**
What type of emergency was it? Please type in the answer.	jrivera: lost tug two and three
What was the status of the run?	jrivera: Failure
Explain why the run was not successful.	jrivera: grounded
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: lost to much tug asset.

Run 11

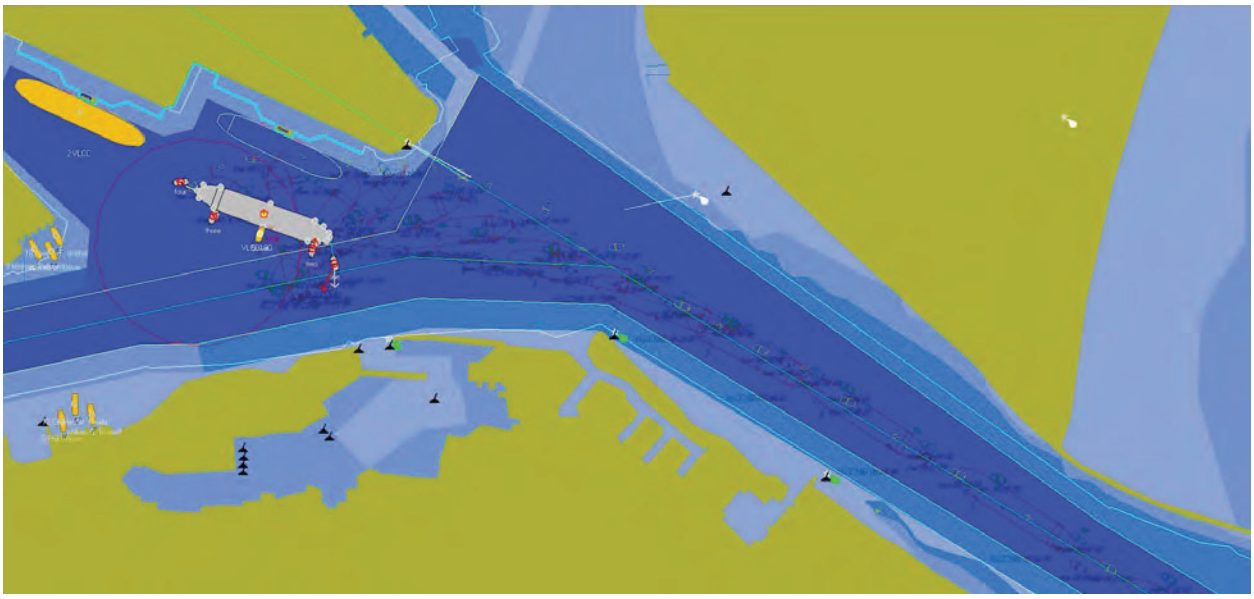
Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 1 robot tug. Bow of the ship was getting somewhat close to dock. jrivera: thumbs up

Run 12

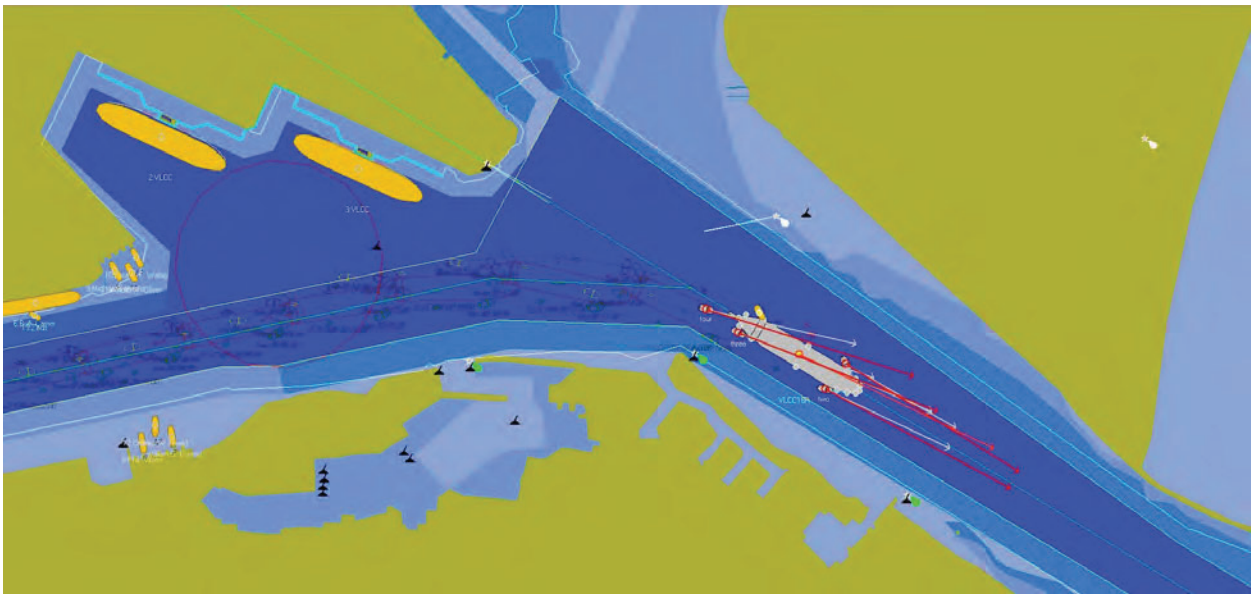
Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Stern tug (Tug 4) bumped the ground 3 times on stern in front of dock (never got stuck). jrivera: everything was good. Tug 4 miscalculated the depth contour and bumped the bottom.

Run 13

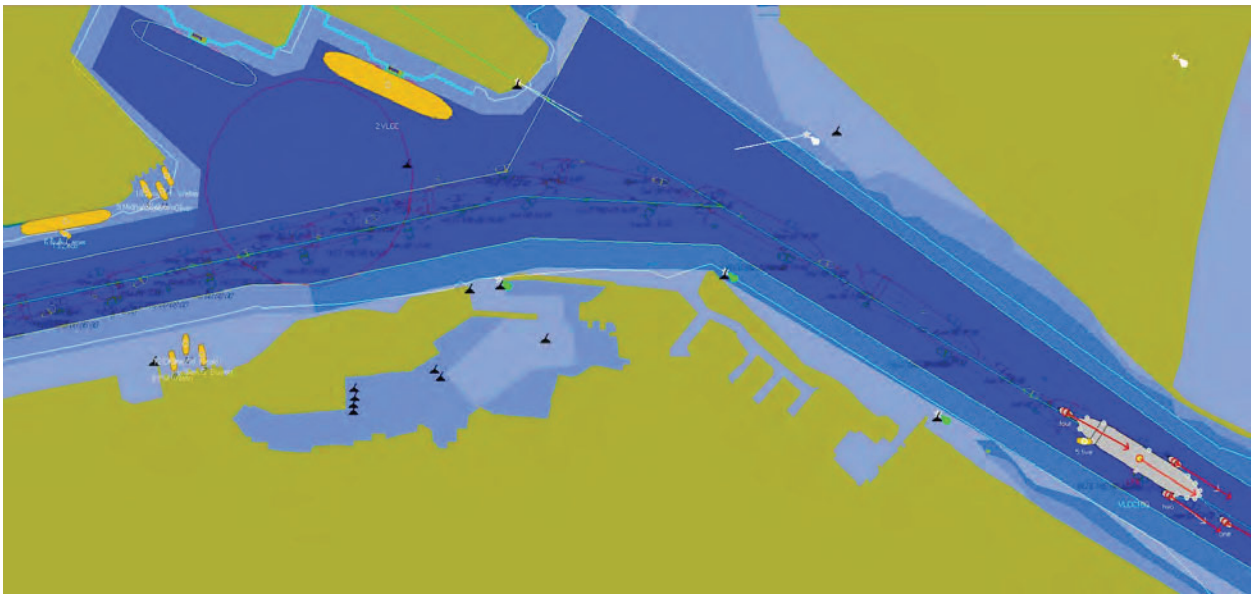
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments: This was run as a 68 not 52 draft. only 4 tugs used.



Question	Answers
Did this run contain an emergency?	**jrivera: No**
What was the status of the run?	jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: all good.

Run 14

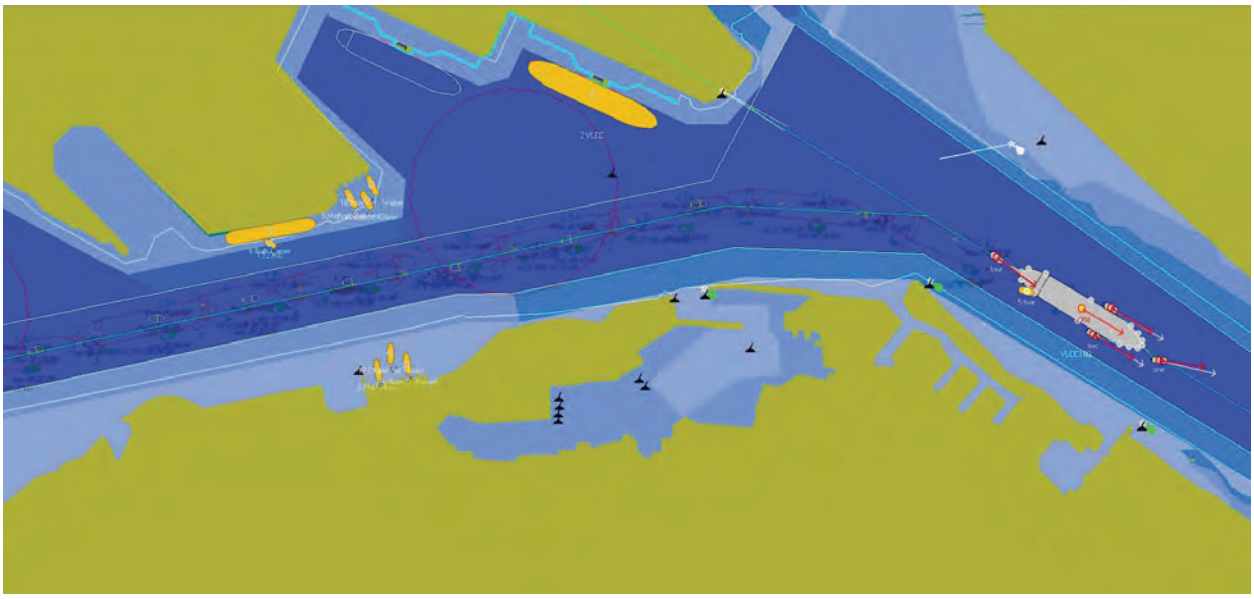
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Ship make 5 kts by HI. No commands given. jrivera: same as run 12

Run 15

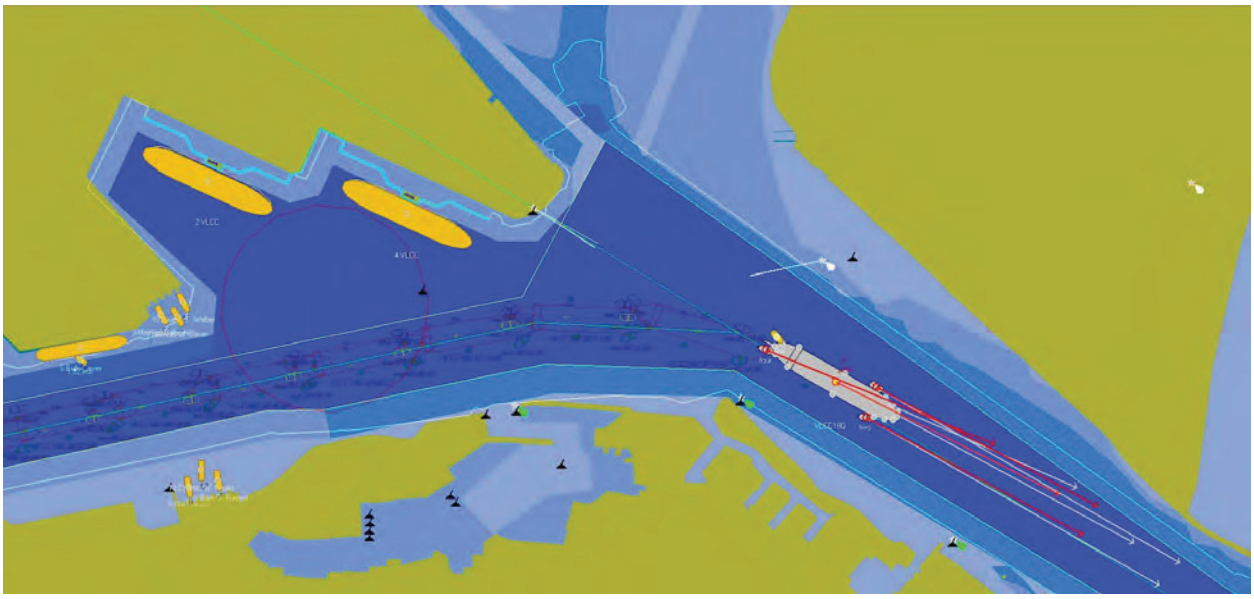
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Everything worked as plan. Minimal tug use. kjones: No commands given. Ship made 4.6-5 kts by HI. Figured out how to save the parameter log settings. Runs prior to this may not have all the parameters showing in the logging data.

Run 16

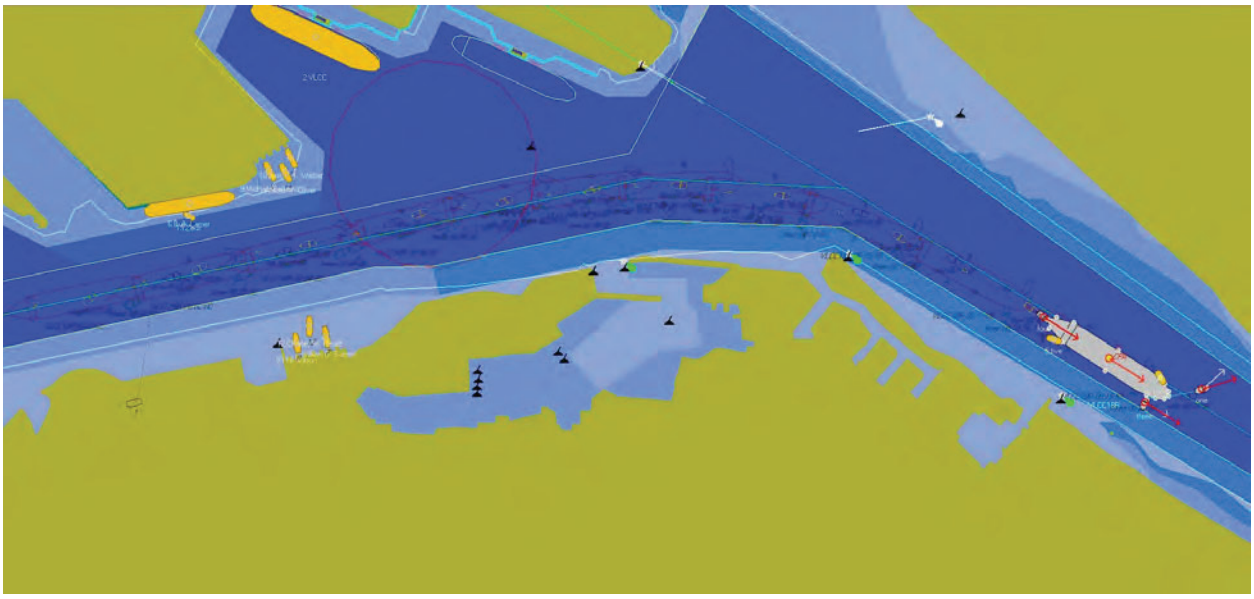
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No**
What was the status of the run?	jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Done without any tug assistance

Run 17

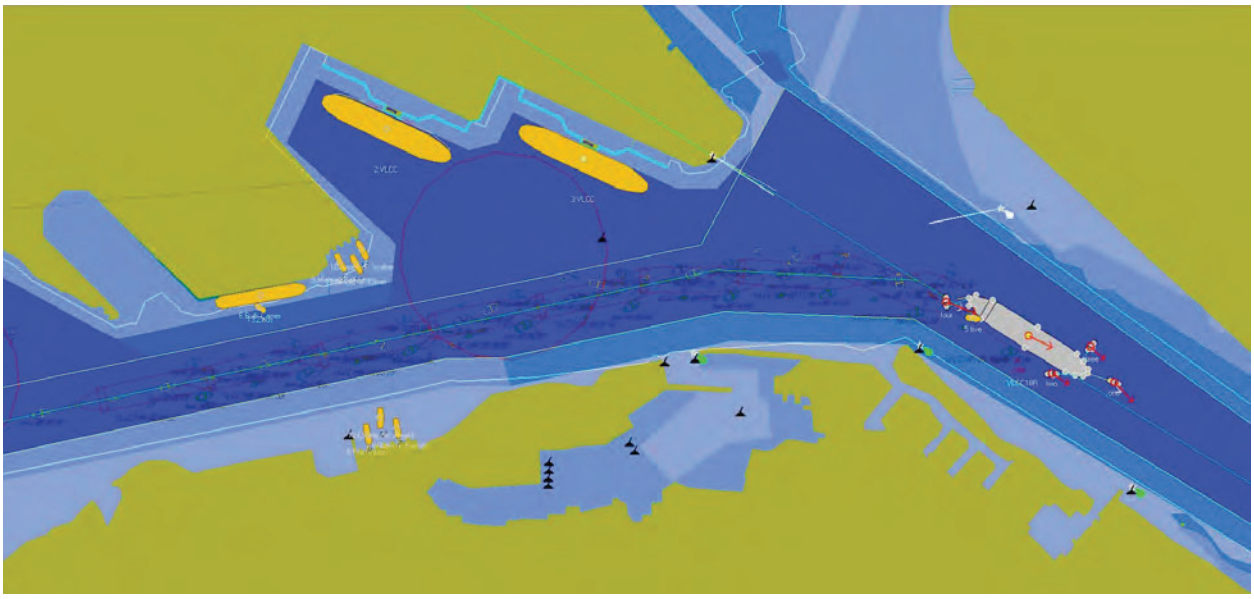
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**admin: Yes** **kjones: Yes** **jrivera: Yes**
What type of emergency was it? Please type in the answer.	admin: Ship lost engine kjones: Ship lost the engine jrivera: Engine failure and ship was towed to sea
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 2 robot tugs, 2 and 5. jrivera: Successful run

Run 18

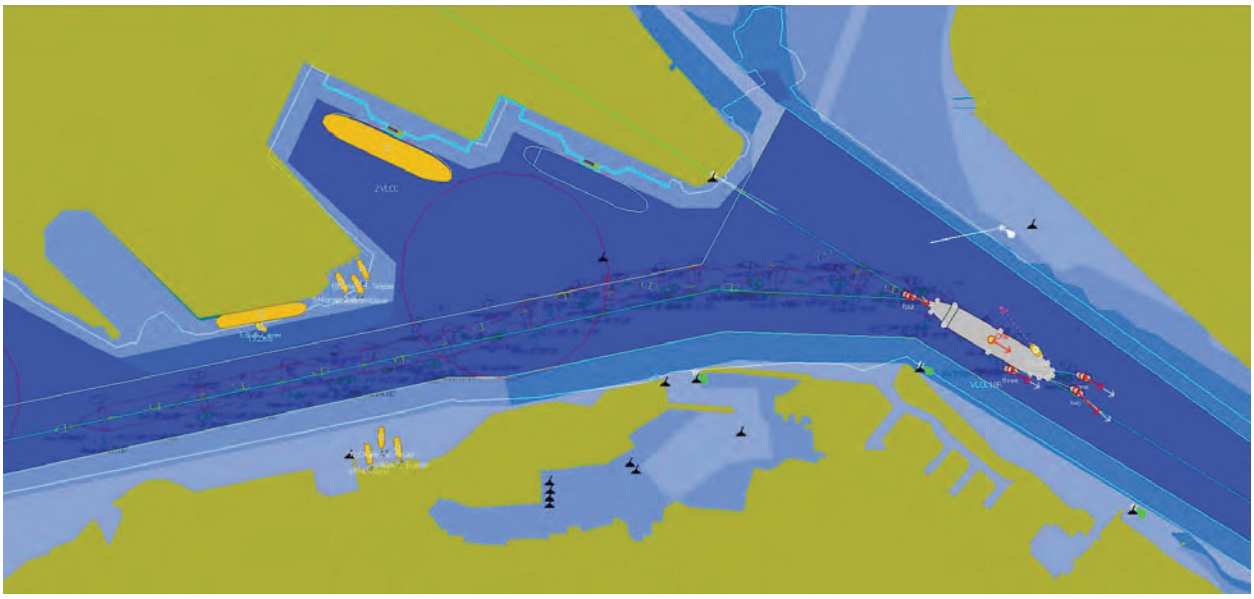
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: Yes** **jrivera: Yes**
What type of emergency was it? Please type in the answer.	kjones: Ship rudder jammed hard stbd jrivera: rudder failure jammed hard to stbd.
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: No commands given to Robot Tug 5. Facilitator shifted target ship onto the open dock at HI to force the ship to continue outbound to sea. jrivera: Tugs overcame the rudder failure and towed the ship safely out.

Run 19

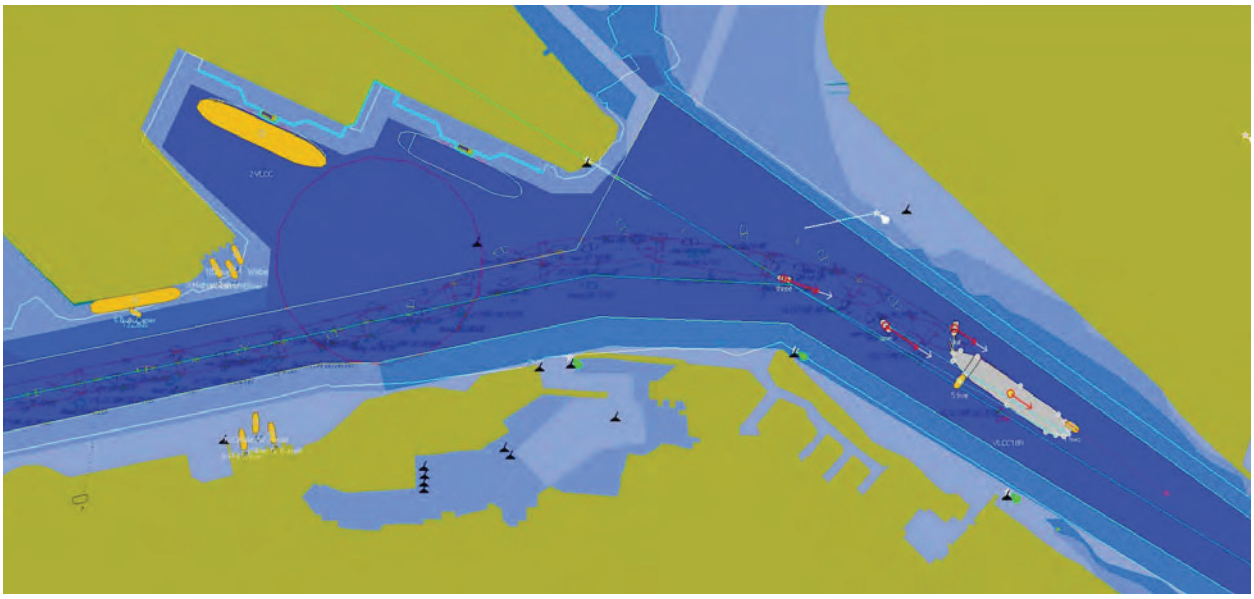
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**admin: No** **jrivera: No**
What was the status of the run?	admin: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Overall good run. Slow speed around HI turn and facilities at 3 kts.

Run 20

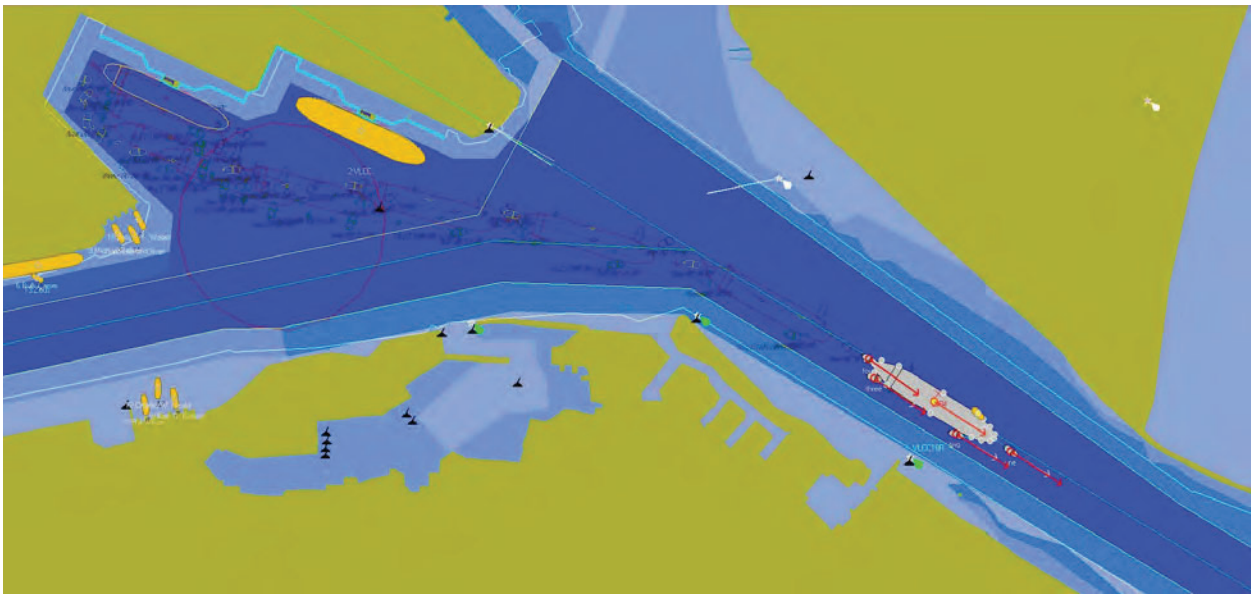
Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: Yes** **kjones: Yes**
What type of emergency was it? Please type in the answer.	jrivera: Rudder failure - locked hard to port. Tugs were able to overcome it. kjones: Rudder failure
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Successful run kjones: Tugs 1 and 3 worked fine in the simulation; however, their images on the instructor station were frozen.

Run 21

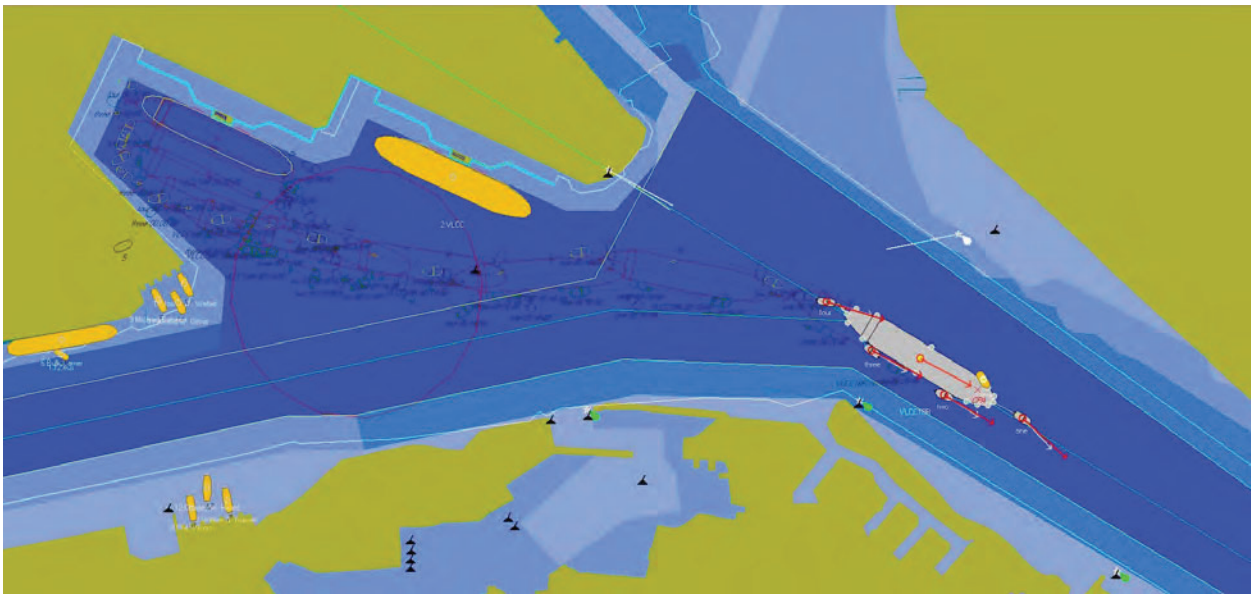
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Easy run. kjones: Corrected the wind from 150 to 000 at the beginning of the exercise. Same tug config as run 26.

Run 22

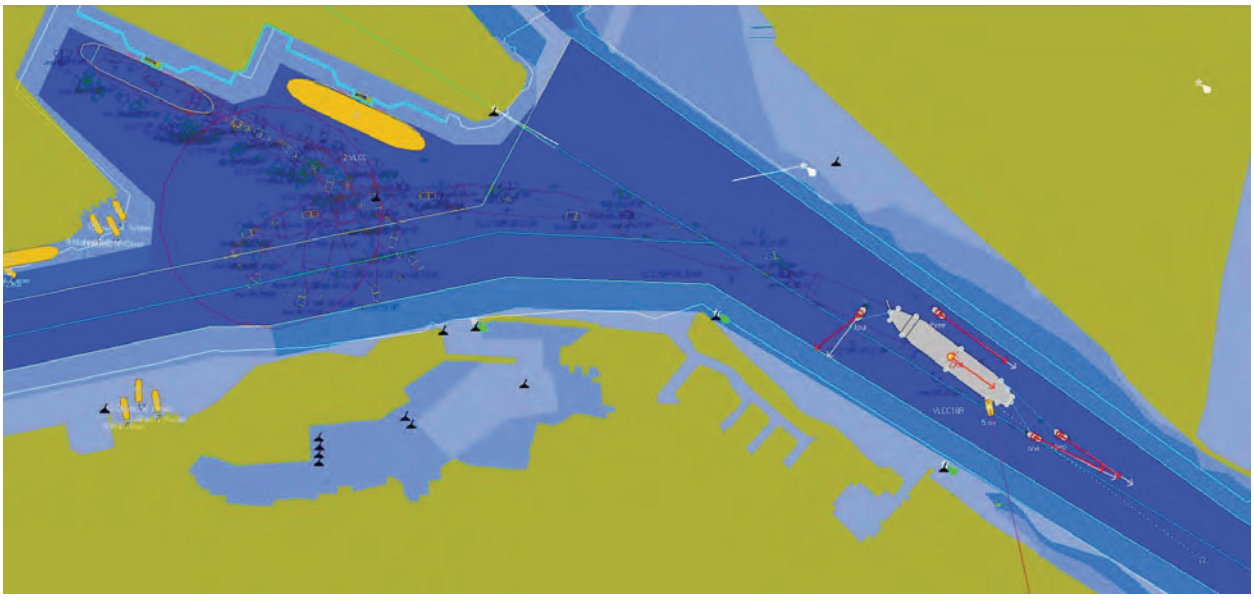
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 1 robot tug jrivera: good overall run. plenty of reserve power. tugs overcame the elements.

Run 23

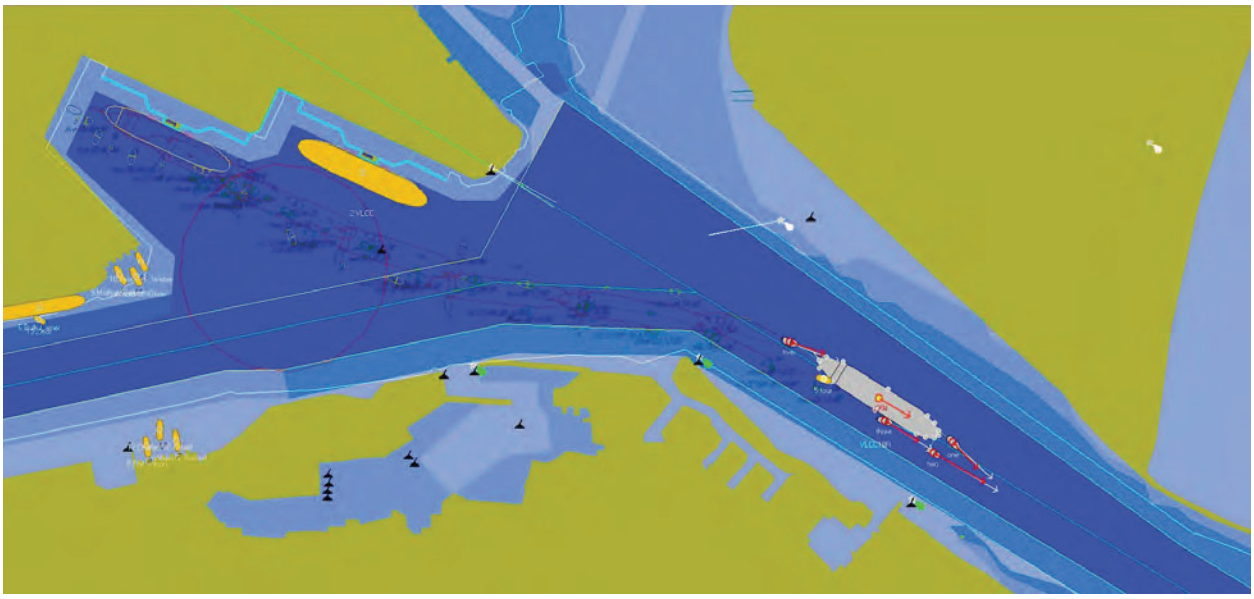
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments: Head-in with 6 tugs



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Head in sailing. with 6 tugs (6th tug was 80t). turned around with moderate flood. successful run kjones: Pilot released robot tug 5.

Run 24

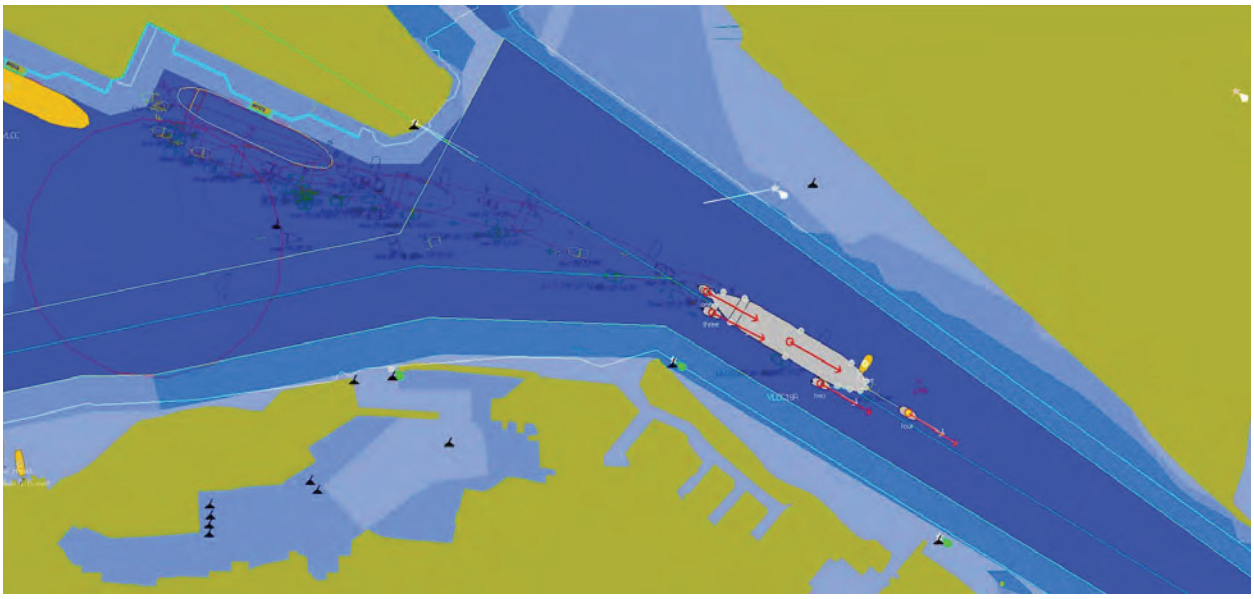
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: The Robot Tug is 4 and he started at stbd 1/4 jrivera: overall good. Tug 3 got in close to beacon 11 Cline's point but was in good water.

Run 25

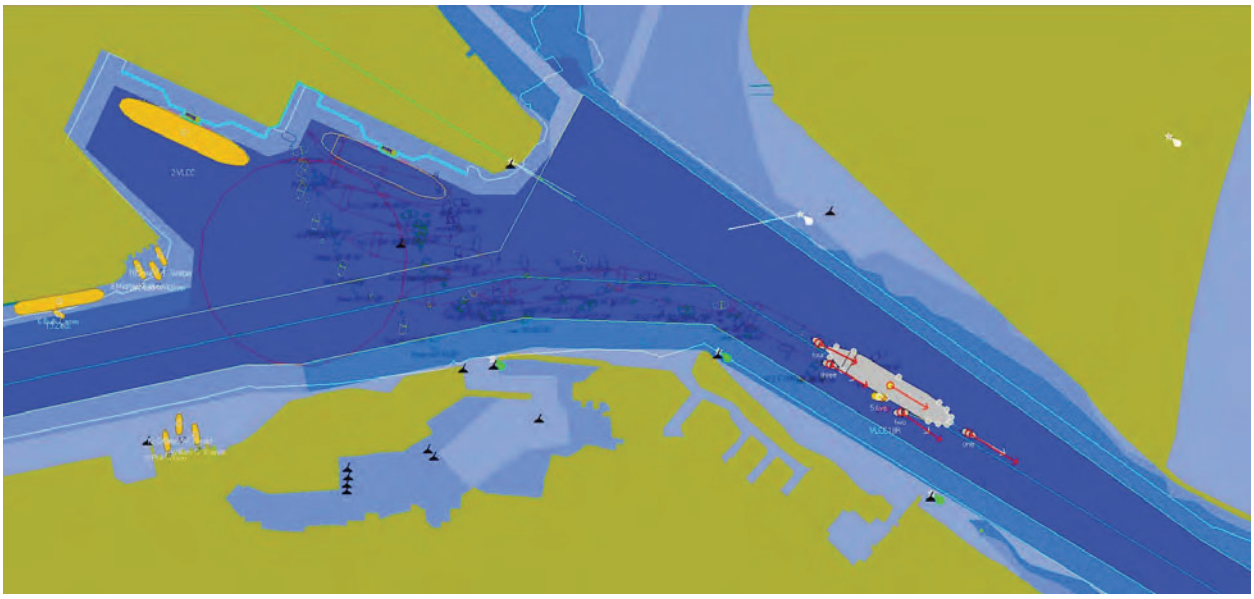
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: Yes** **jrivera: Yes**
What type of emergency was it? Please type in the answer.	kjones: Tug 1 winch stopped working and could not maintain position as bow tug. Swapped positions with tug 4 and run continued successfully toward the jetties. jrivera: Tug 1 winch failure and swapped 1 with 4
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: No additional comments. jrivera: No additional comments

Run 26

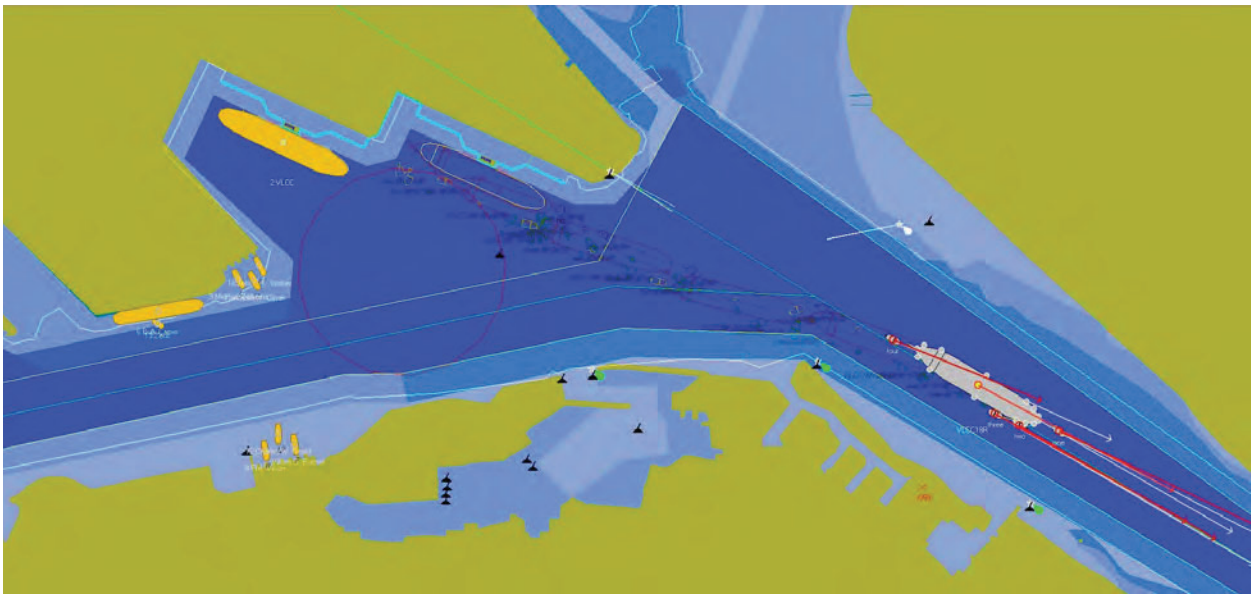
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: Smooth run. nothing out of the ordinary kjones: The tugs were set up with center lead forward and two on either side of the bow. 1 stbd quarter and 1 center aft

Run 27

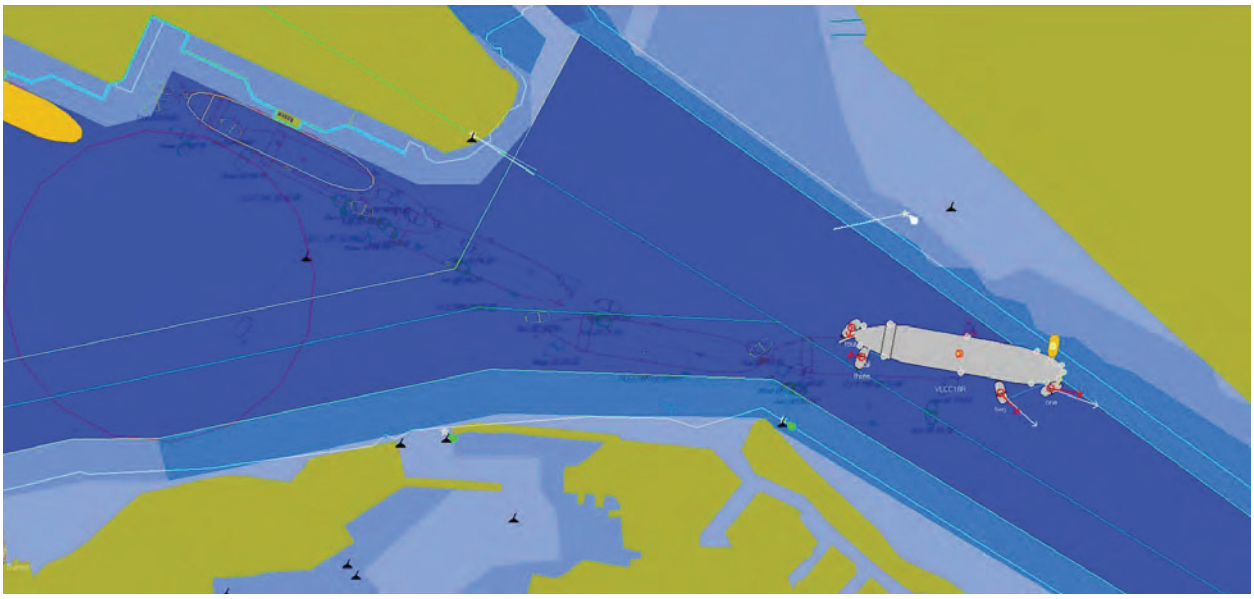
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**spolk: No** **jrivera: No**
What was the status of the run?	spolk: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	spolk: Pilot shaved the point, but it looked like that was his plan. jrivera: Tugs were able to overcome anything thrown at them. Tug performance was able to counteract any under or oversteering for making the turn.

Run 28

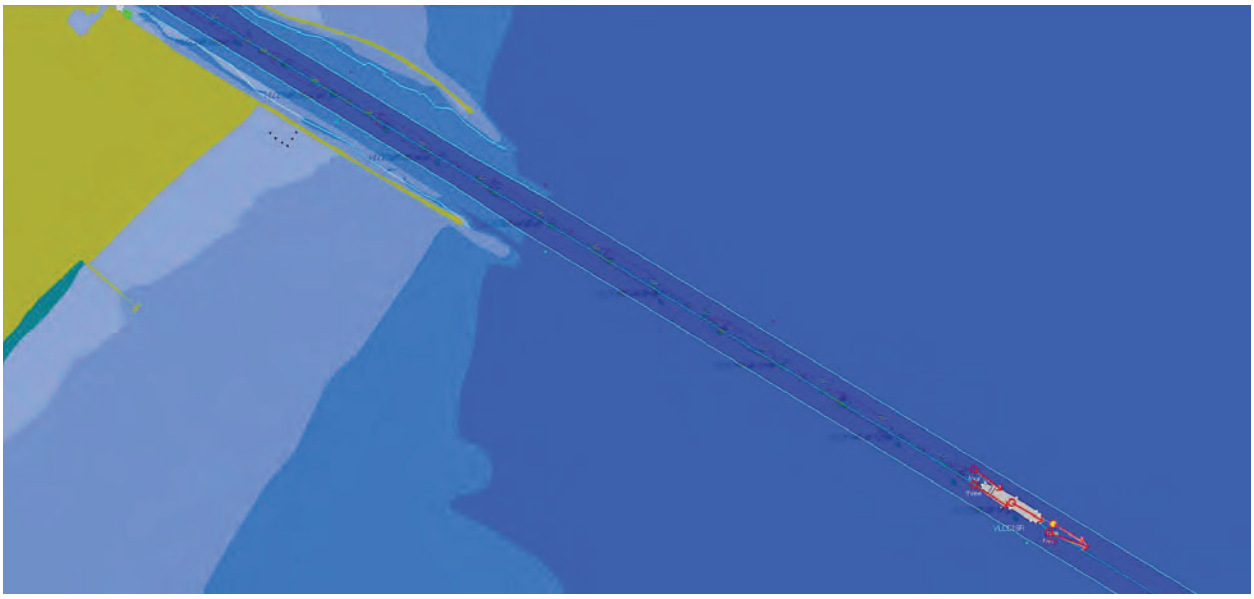
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Failure jrivera: Failure
Explain why the run was not successful.	kjones: Ship ran aground making turn at Harbor Island intersection on St. Joe island. jrivera: angle of ship into the current was nearly parallel, causing ship to run aground.
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Reopened exercise. Robot tug 5 at port bow 1. Was going to run all the way out pass jetties but ship ran aground at the Harbor Island intersection turn on St. Joe Island. jrivera: none

Run 29

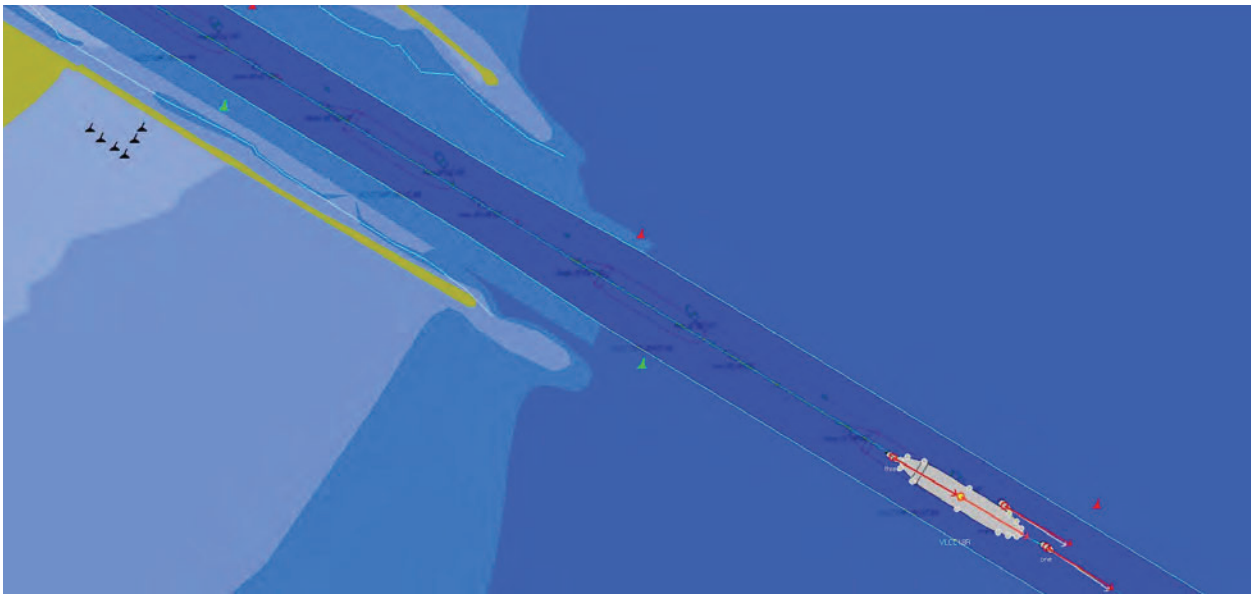
Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: N Med Comments: 4 tugs only



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: No robot tug, only 4 live tugs. No issues. Smooth run. jrivera: Escort outbound and everything went well.

Run 30

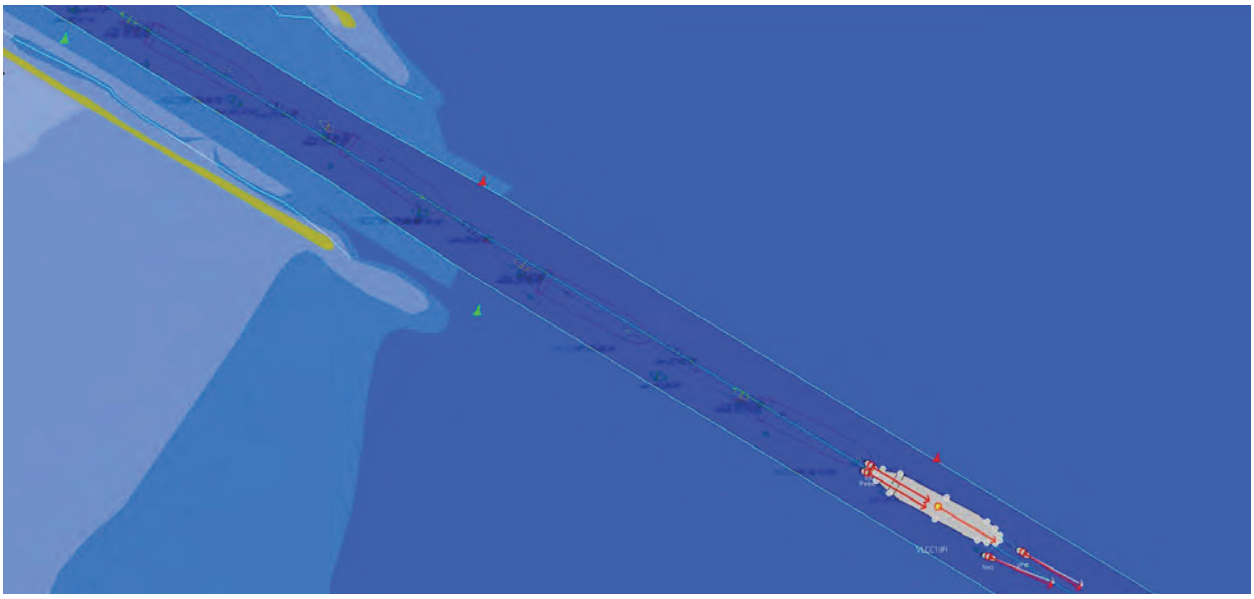
Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: N High Comments: Only 3 tugs total



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Only 3 tugs; facilitator and robot tug not used. jrivera: Easy, all good. 3 tugs only

Run 31

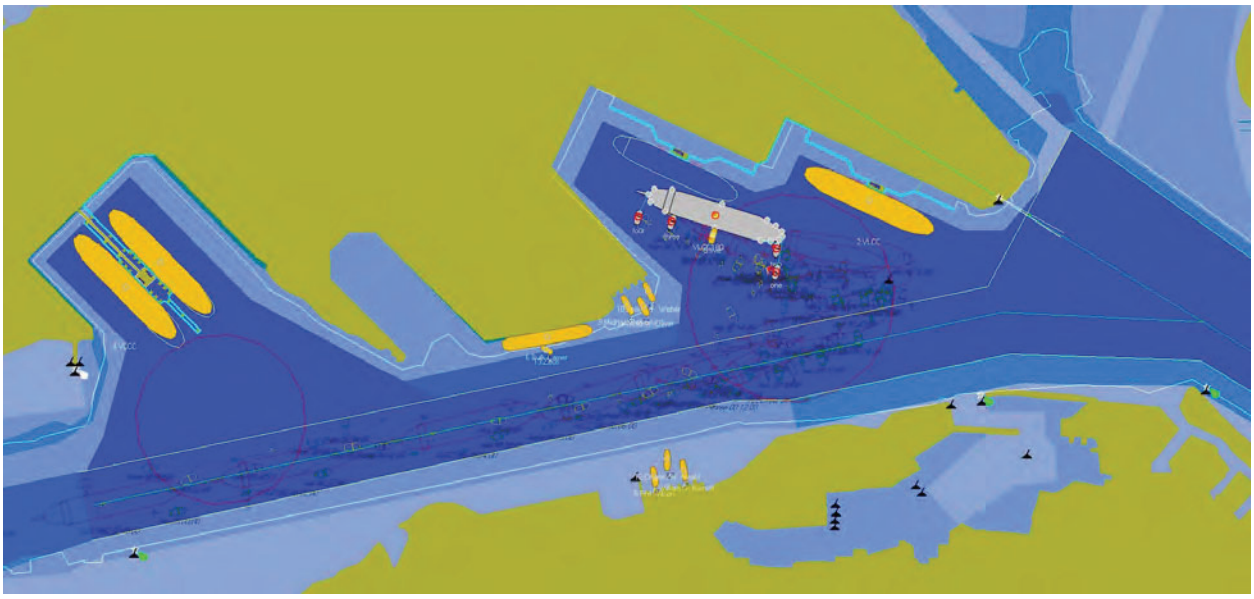
Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: S Med Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 4 tugs - 2 tandem on the bow, 2 tandem on the sternTug 2 tripped but was able to recover and get in front of the ship jrivera: Good tug power, good room, overall successful.

Run 32

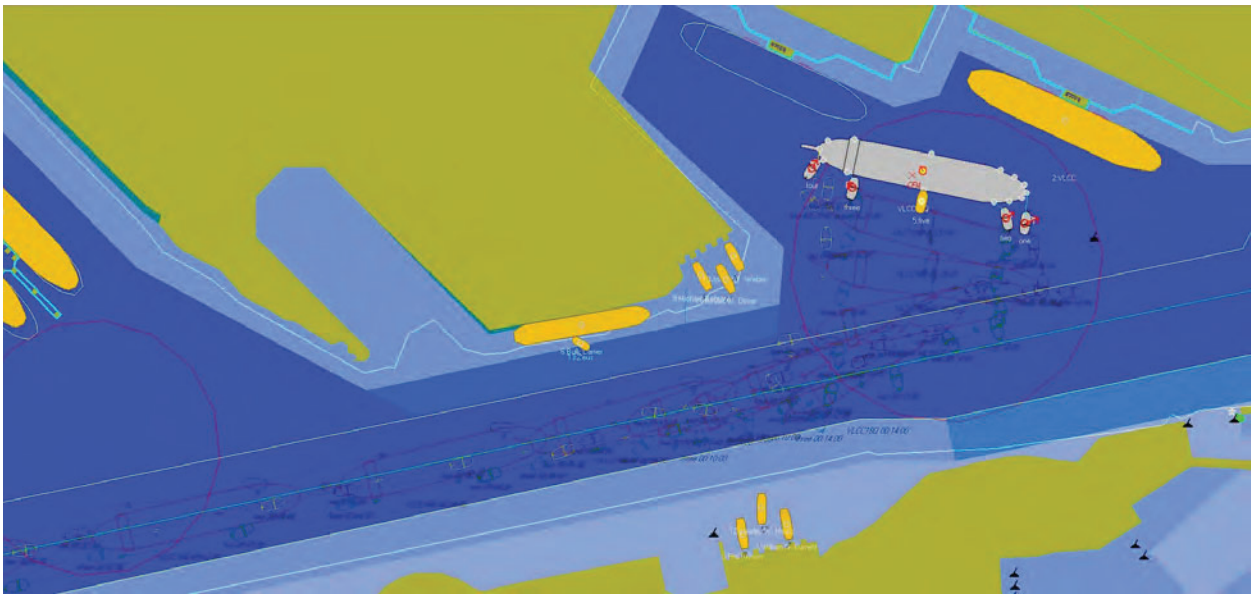
Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: N/A jrivera: Easy run. Nothing out of the ordinary.

Run 33

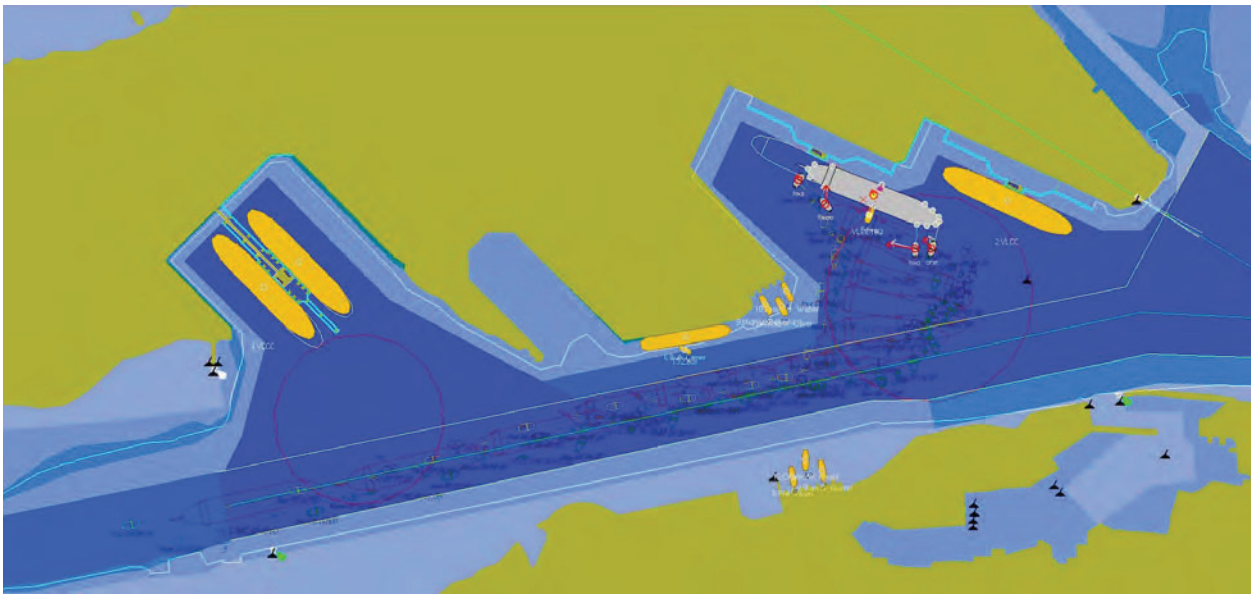
Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: No additional comments jrivera: Center-lead forward tug was used to slow vessel by pushing into bow stem. Maneuver worked well.

Run 34

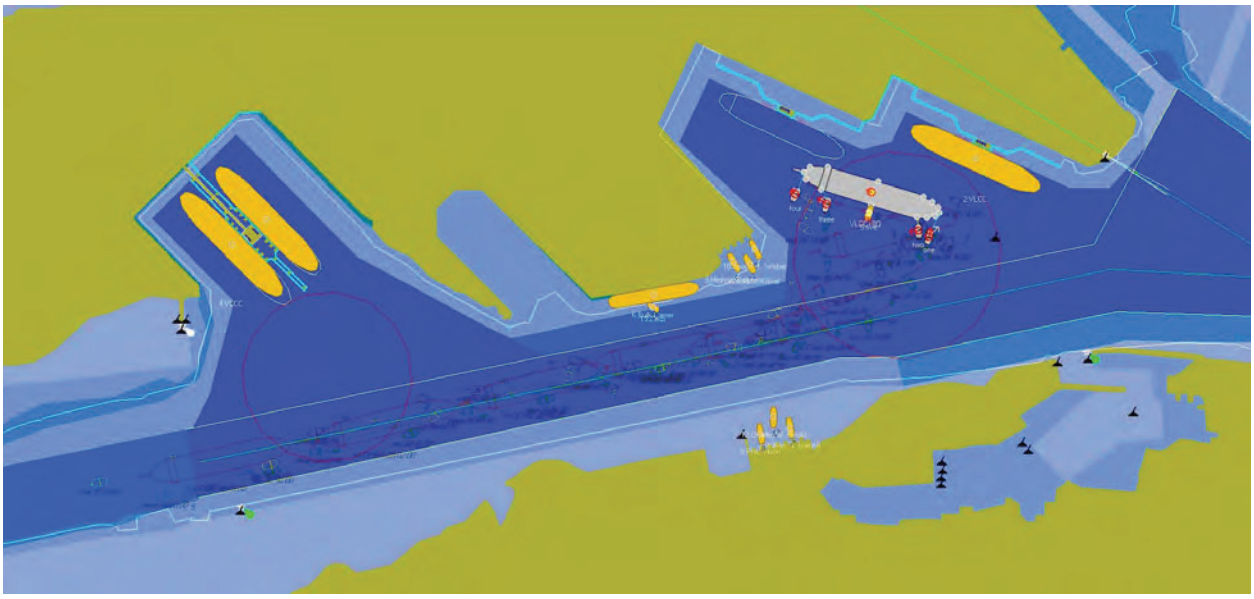
Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Straight forward run jrivera: All good

Run 35

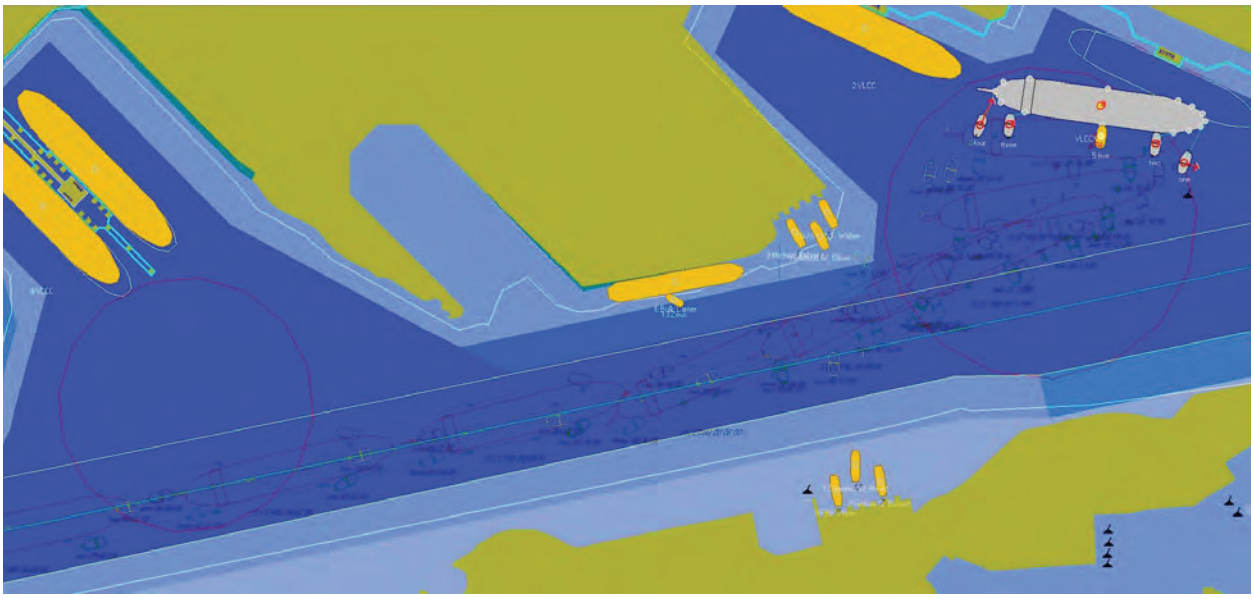
Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments: changed from flood to ebb at last minute



Question	Answers
Did this run contain an emergency?	**jrivera: No** **kjones: No**
What was the status of the run?	jrivera: Successful kjones: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: All good kjones: No additional comments.

Run 36

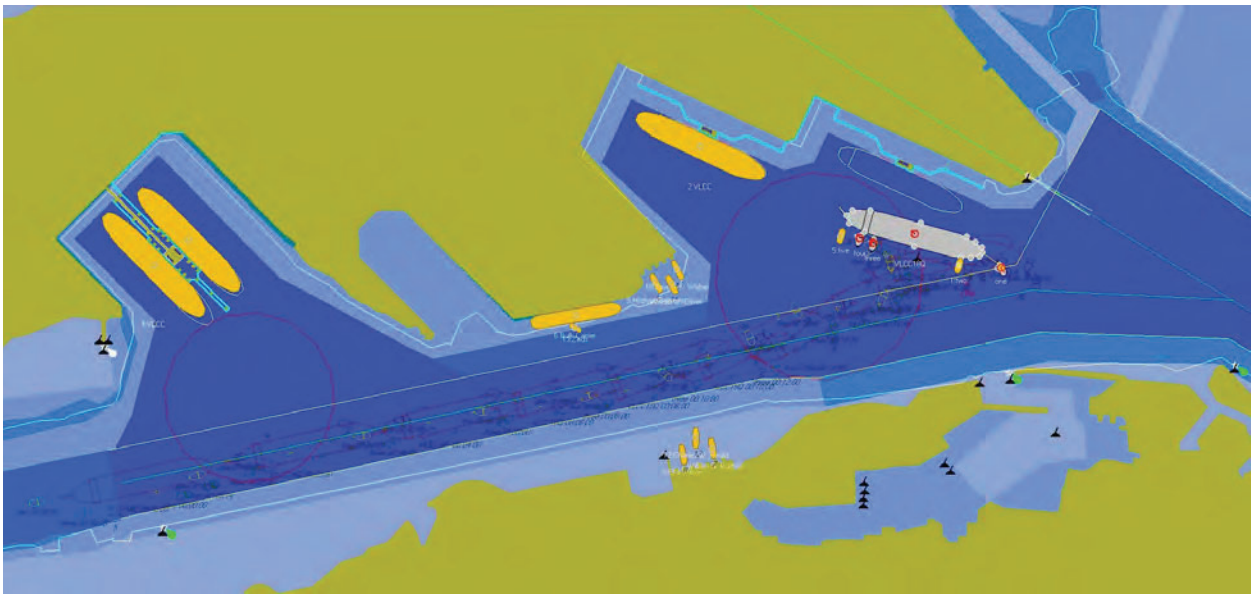
Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 1 robot tug jrivera: Good to go

Run 37

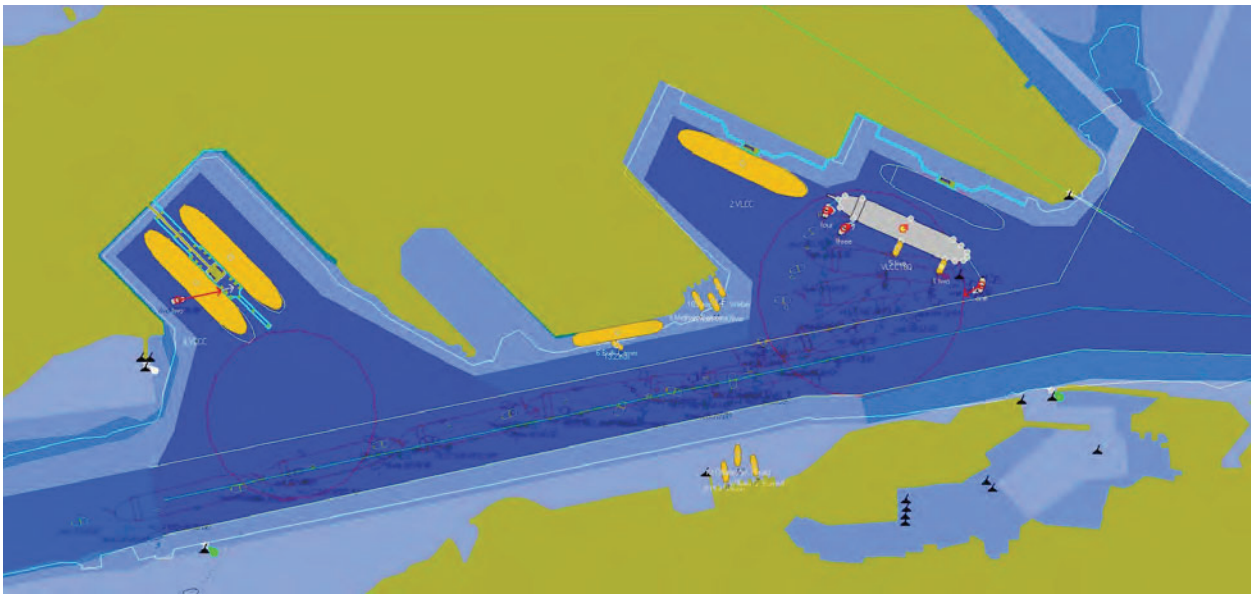
Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: Yes** **jrivera: Yes**
What type of emergency was it? Please type in the answer.	kjones: 2 emergencies 1) Ship rudder jammed hard to port2) Tug 4's lines parted jrivera: Rudder failure hard to port and tug broke a line.
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Two robot tugs - tugs 2 and 5. Tug 5 took center lead aft when tug 4's lines parted. jrivera: Pilot was able to overcome the failures with reserve tug power.

Run 38

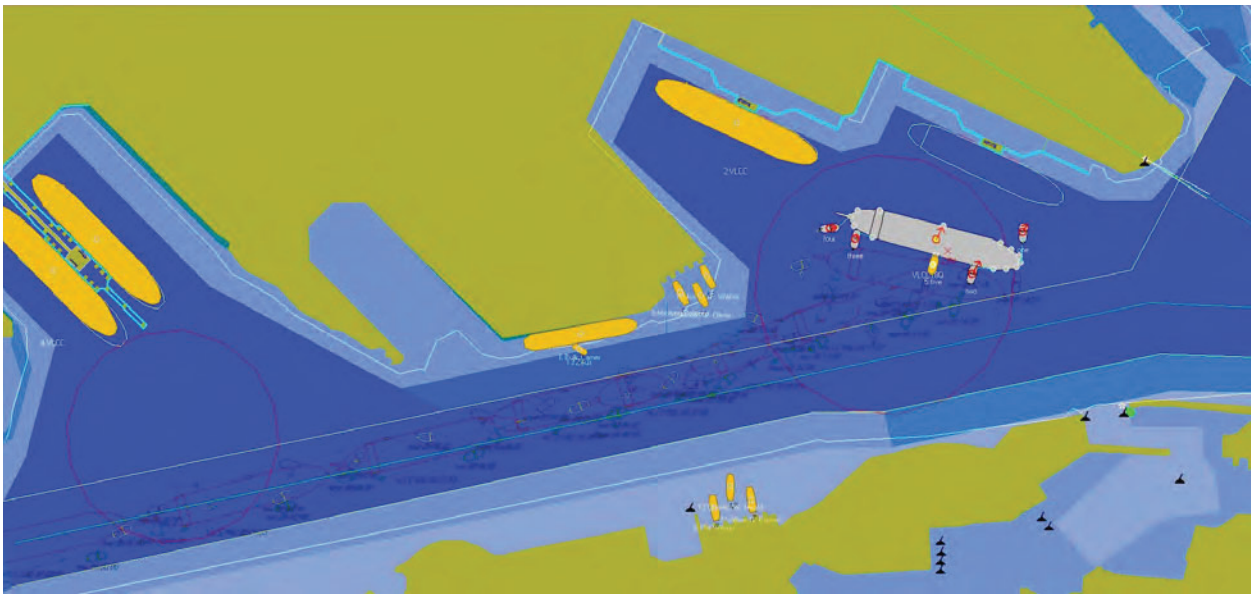
Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: Yes** **jrivera: Yes**
What type of emergency was it? Please type in the answer.	kjones: Ship lost the engine. jrivera: Ship lost engine
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Two robot tugs, tugs 2 and 5. jrivera: 4 tugs used

Run 39

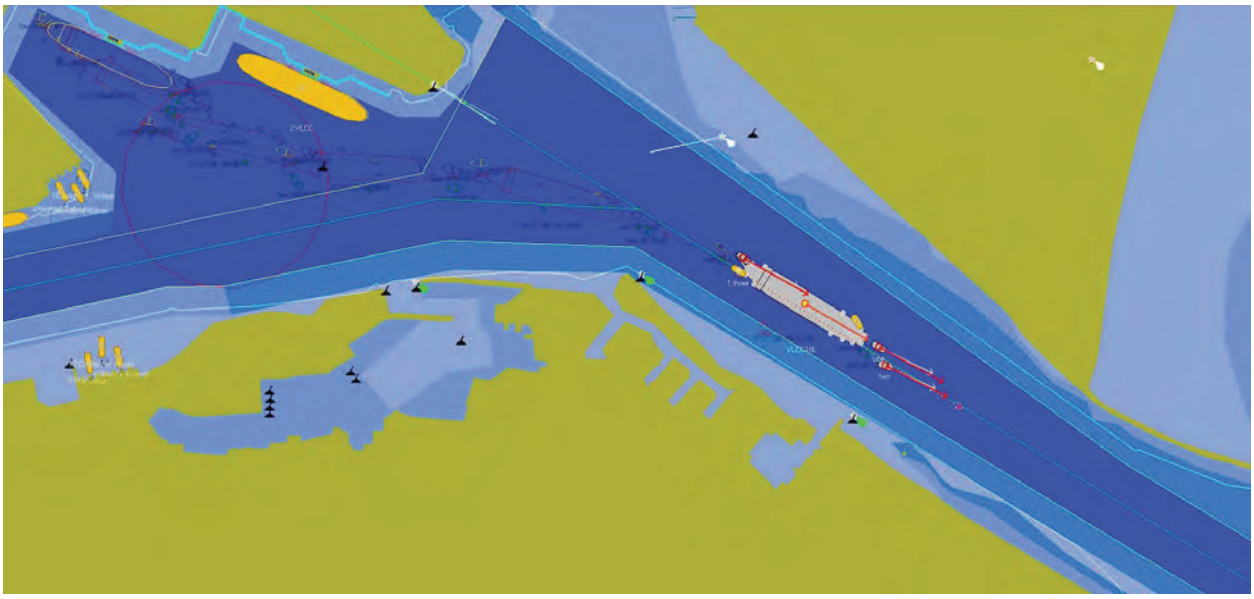
Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N High Ebb Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Swapped the current file after the run started. Current was corrected for the high ebb. jrivera: All good

Run 40

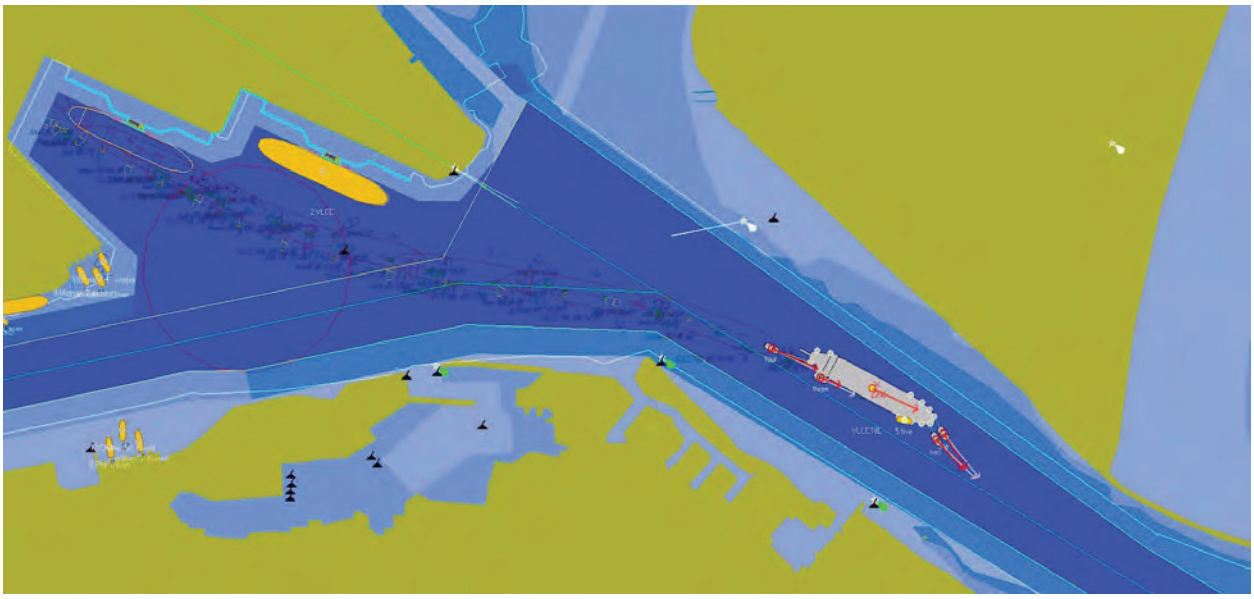
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**jrivera: No**
What was the status of the run?	jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	jrivera: All good

Run 41

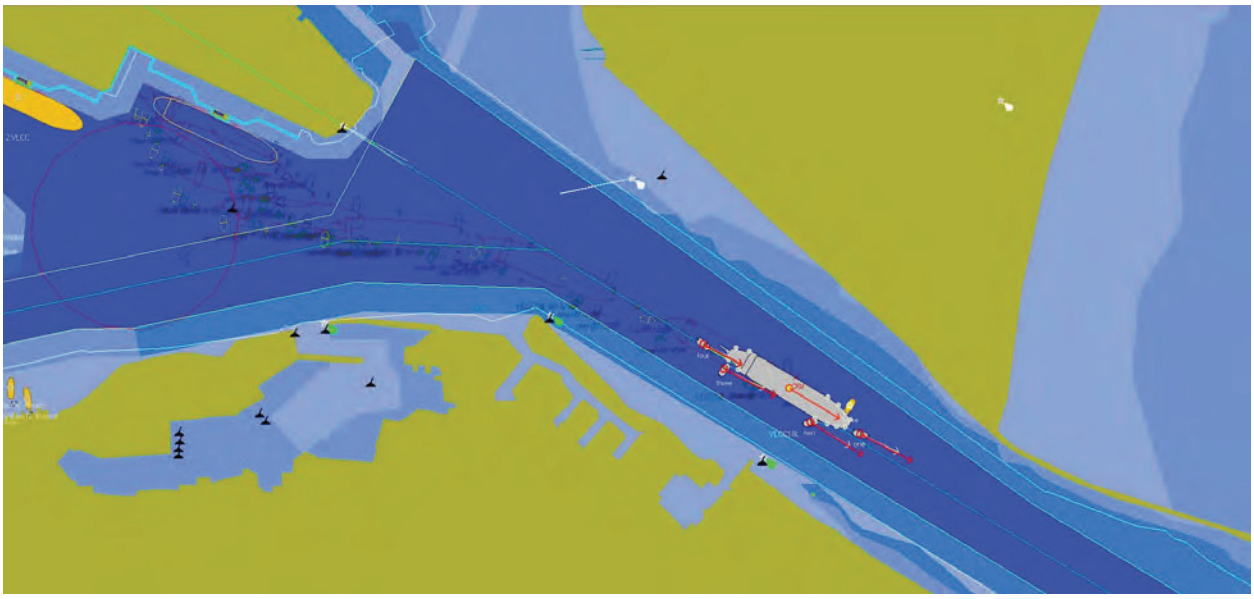
Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: None jrivera: All good. Nothing out of the ordinary

Run 42

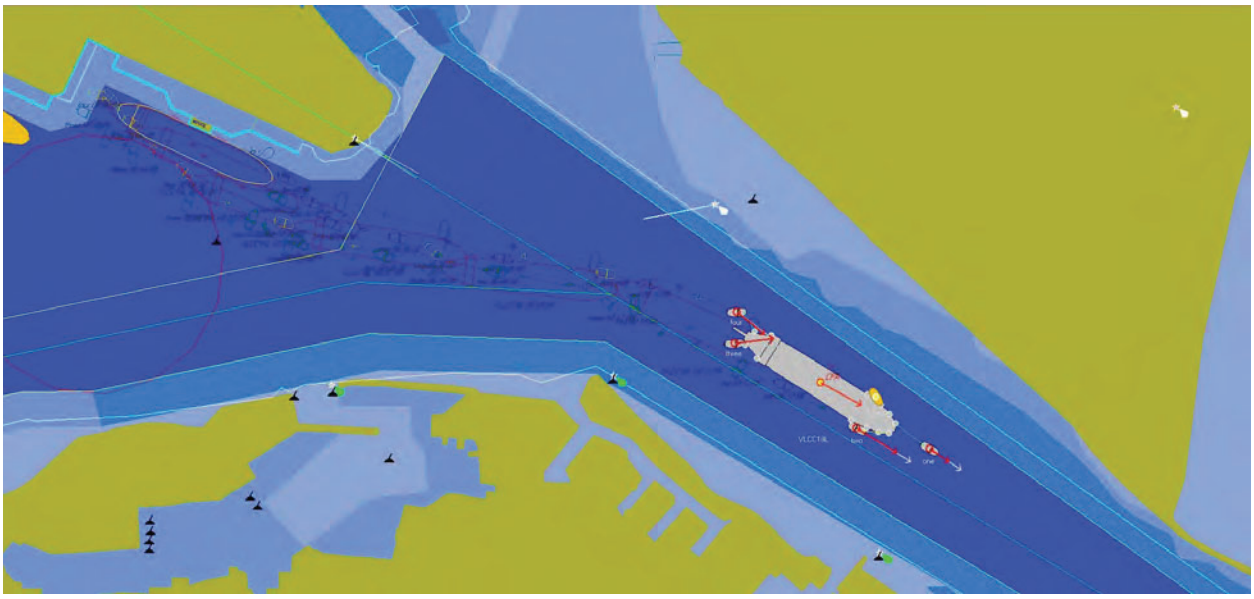
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Had to do a reboot. After reboot, the run ran fine. jrivera: Run was good.

Run 43

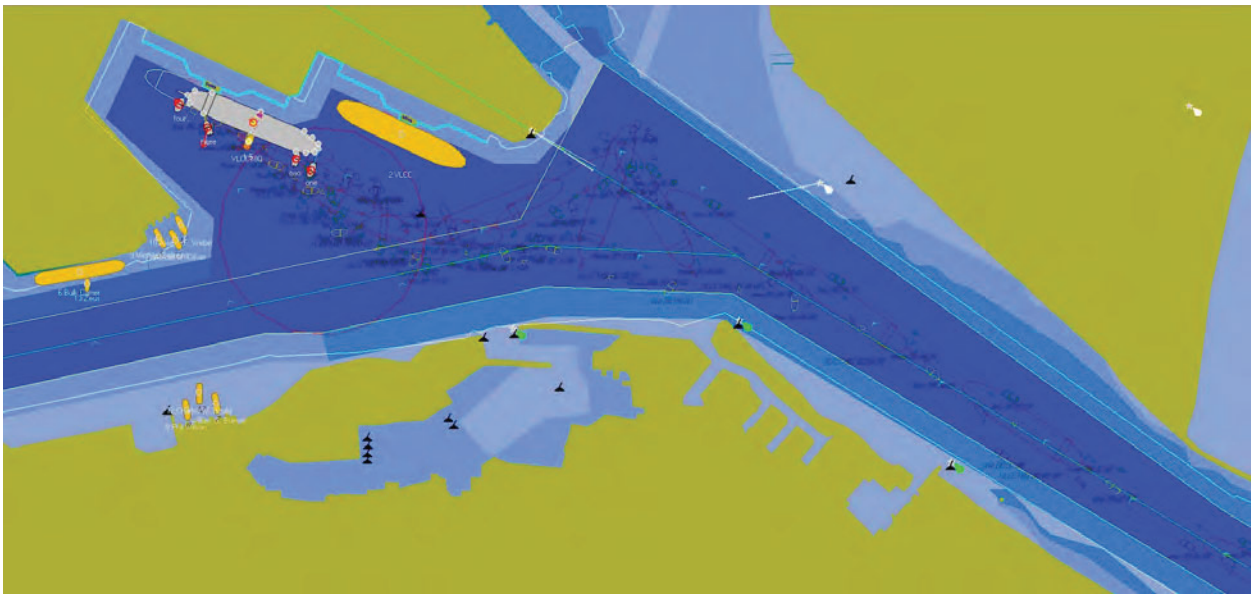
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: One robot tug; all good. jrivera: all good at 74'

Run 7.2

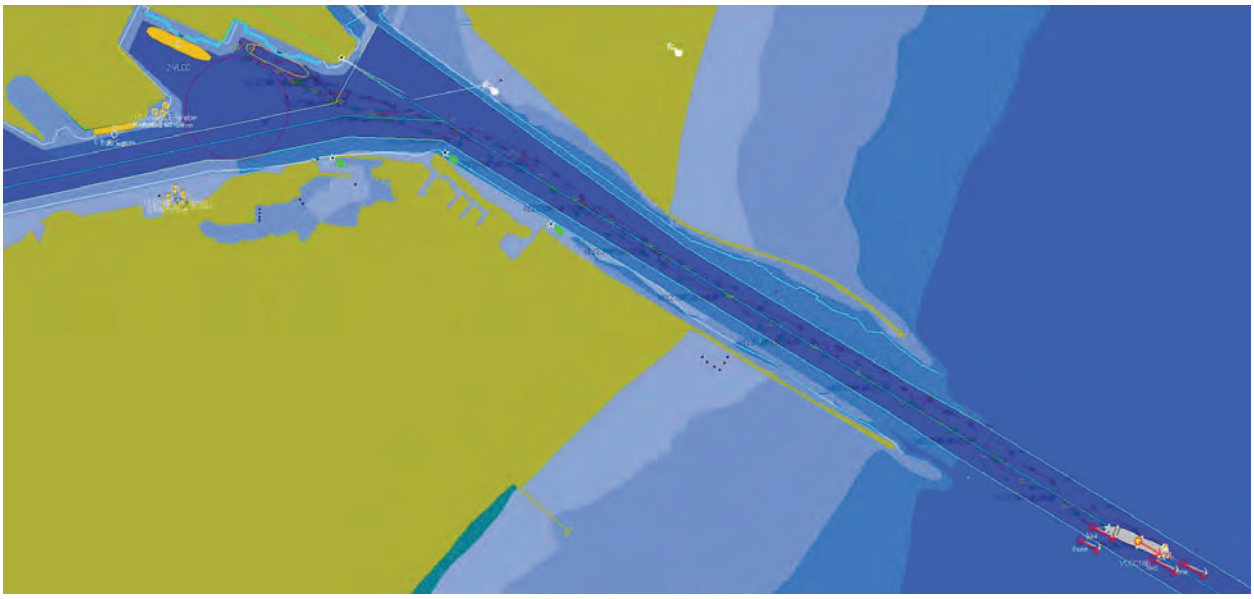
Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: Had to change swell for inside harbor. Robot tug started port bow 2, inline 3/4. Then slow towards, slid back to stay port quarter, shifted to stbd midships, minimum towards. jrivera: Commands executed with ease, nothing out of the ordinary. Whole maneuver was under control.

Run 28.2

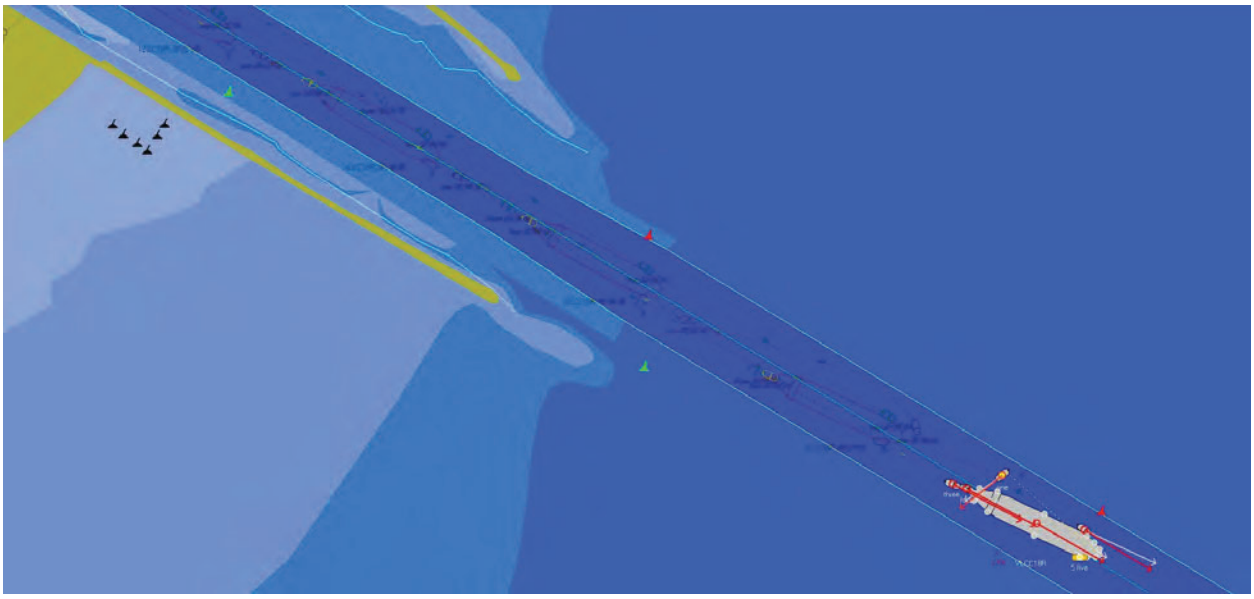
Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: 1 robot tug. On the matrix, the run stops at the jetties but in real simulator time, we ran past the jetties. jrivera: Tugs operated as necessary and everything worked out.

Run 44

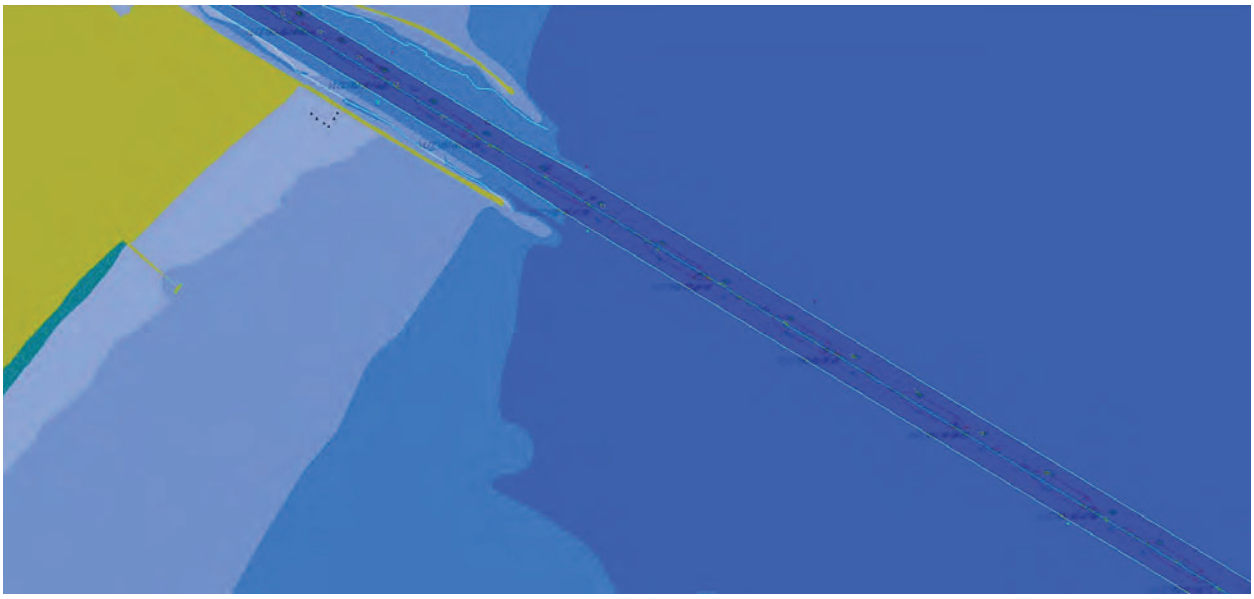
Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: - Offshore Wind and Current: S High Comments:



Question	Answers
Did this run contain an emergency?	**kjones: No** **jrivera: No**
What was the status of the run?	kjones: Successful jrivera: Successful
Please add additional notes about the run that may be important to the study's recommendation.	kjones: All good, no robot tug commands given jrivera: All good

Run 1

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: N Medium Comments:

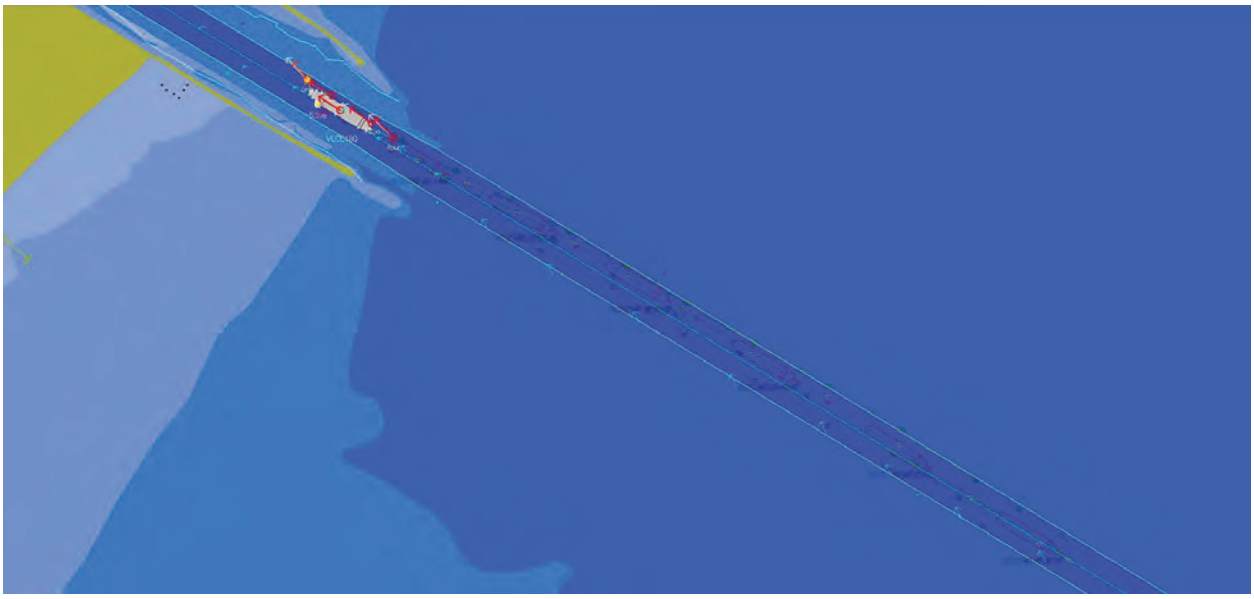


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: On full ahead making 11 kts, we had no issues crossing in. When we started slowing down inside the jetties, the tugs were able to help steer the ship.

Run 2

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: N High Comments:

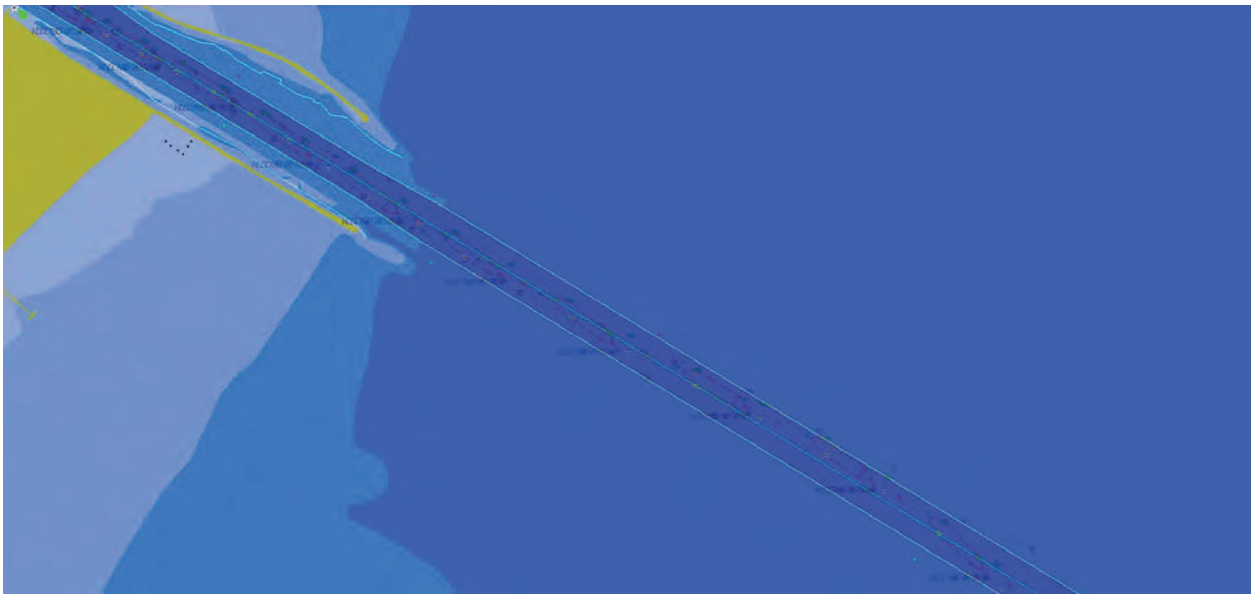


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful
Additional comments:	hpilot2: The exercise was very realistic the way the ship reacted to the elements.

Run 3

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: S Medium Comments:

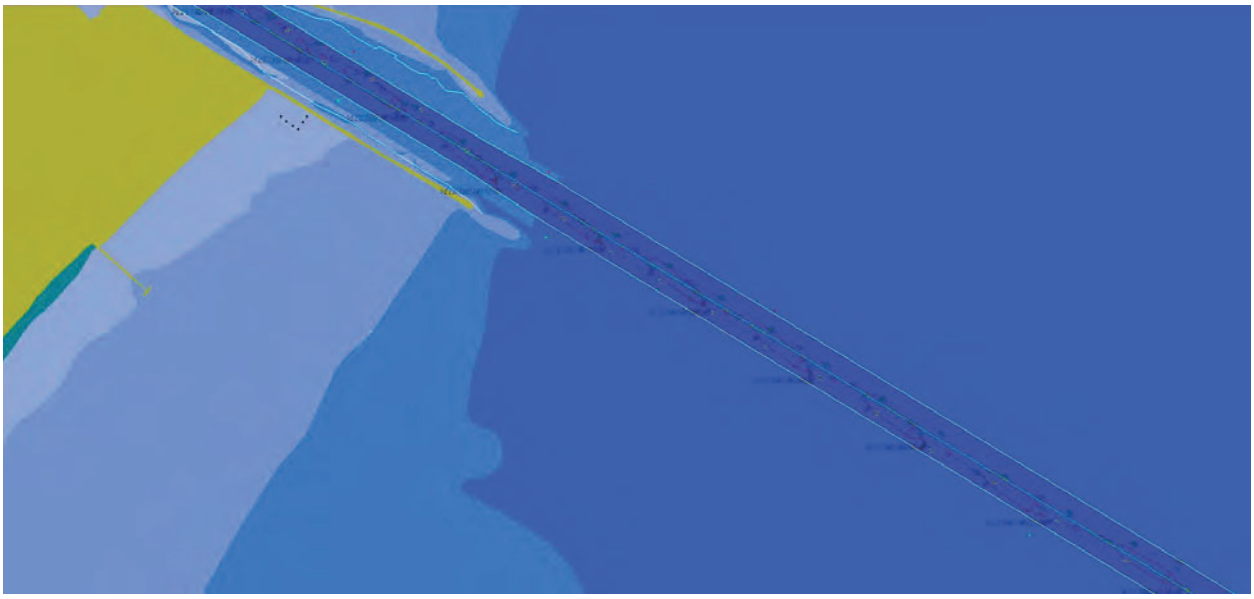


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 3 Average: 3.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: unsuccessful
Additional comments:	hpilot1: I had problems with the sog display It went from 2kts to stern way in a second

Run 4

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: - Offshore Wind and Current: S High Comments:

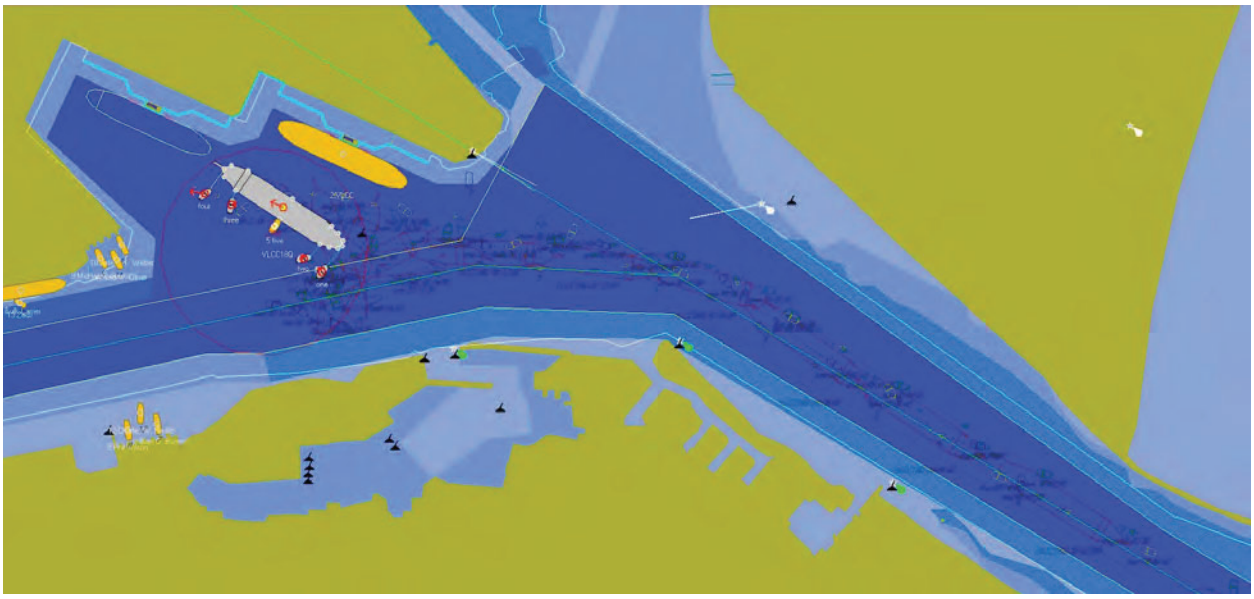


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful
If the run was not successful, please explain why.	hpilot2: Good run. Environment factor appeared true to life. Ship and tug compliment was able to adequately over come set

Run 5

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

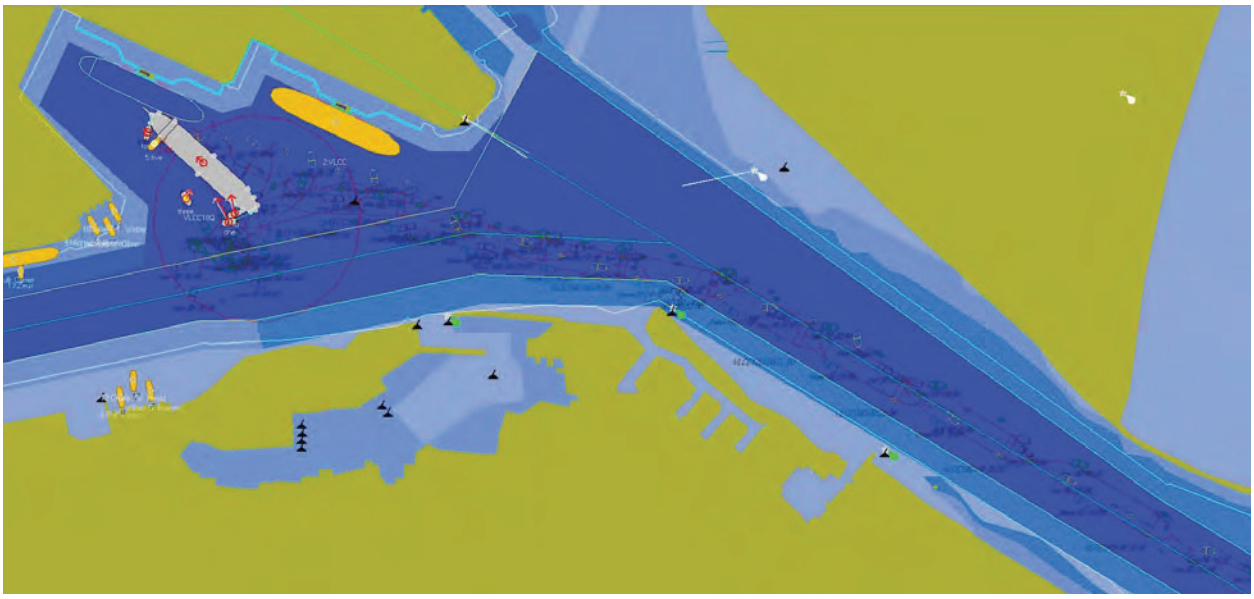


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot3: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot3: successful

Run 6

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

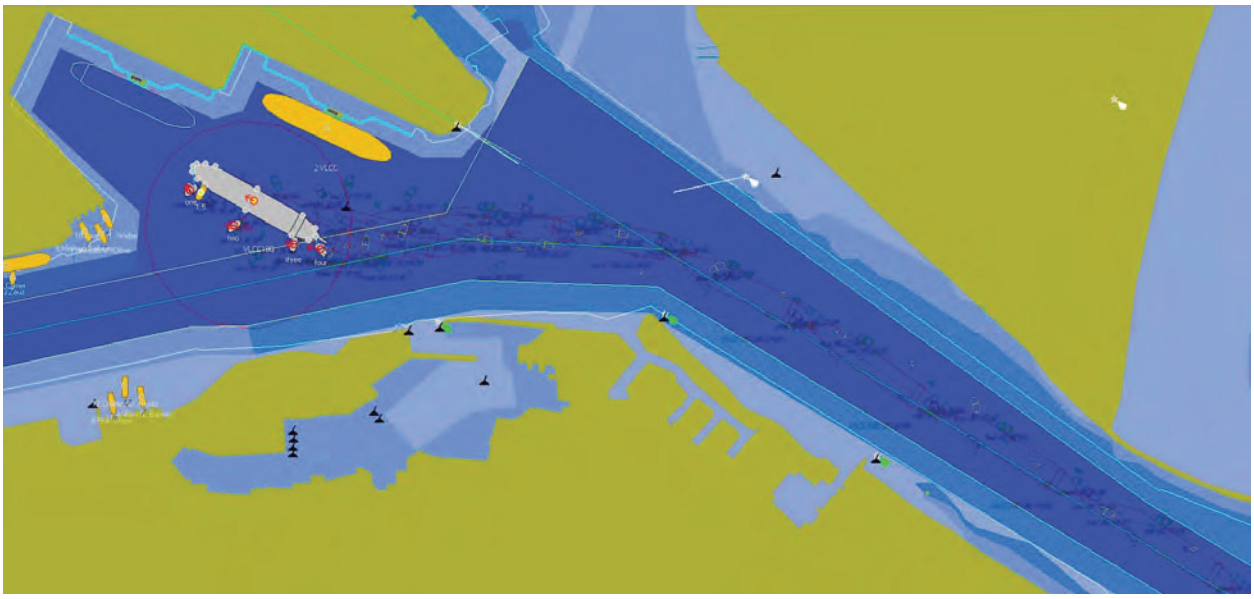


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: I have no doubt that with 5 120T Rotor tugs we will have no issues controlling these VLCC's.

Run 8

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

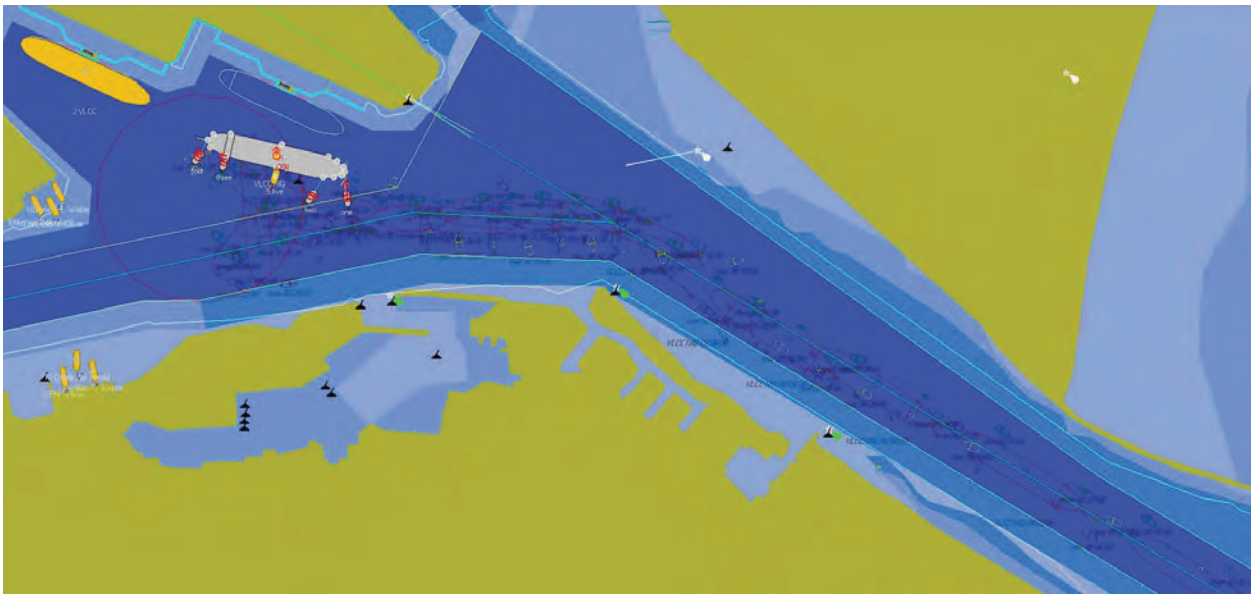


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 3 Average: 3.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful
If the run was not successful, please explain why.	hpilot2: Tugs were able to effectively maneuver the ship to a safe berth after engine failure

Run 9

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

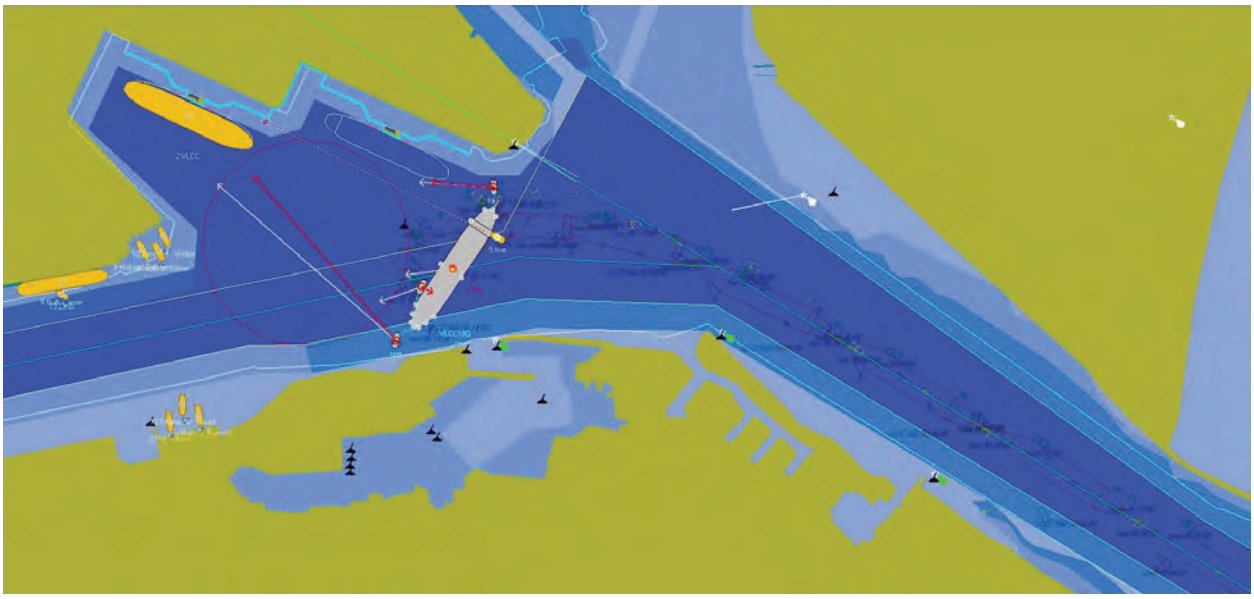


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: There's plenty of room. Tugs are very adequateTurning on left wheel when the east dock is free is much safer, I feel very comfortable with this maneuver.

Run 10

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

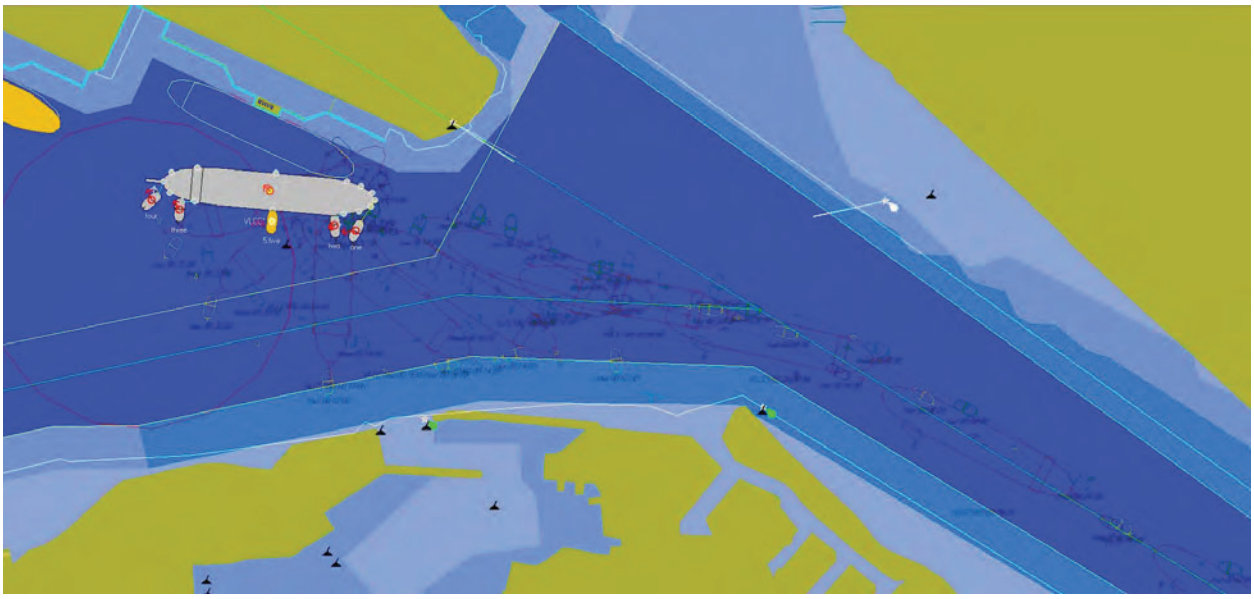


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 3** **Average: 3.0**
If the channel configuration was inadequate in any way, please explain why.	hpilot3: Not enough room for something to fail or go wrong
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 2 Average: 2.0
If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.	hpilot3: To much current to turn that draft.
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate.	hpilot3: 3 Average: 3.0

Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	
If the tug configuration was not adequate, please explain why.	hpilot3: Was barely enough. Was not enough after loosing 2 tugs.
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot3: 1 Average: 1.0
If not safe, please explain why.	hpilot3: Not safe when you lose 2 tugs
Run was _____ based on run parameters	hpilot3: unsuccessful
Additional comments:	hpilot3: lost 2 tugs and current was to strong.

Run 11

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

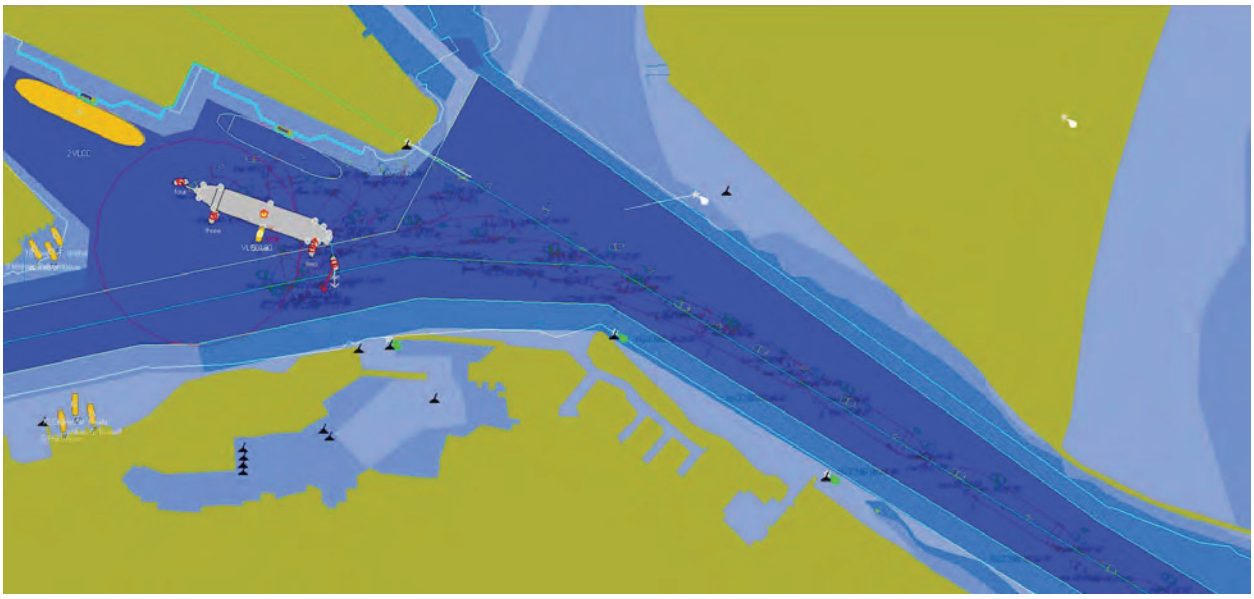


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 3 Average: 3.0
If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.	hpilot3: Currents did not effect the ship as I would expect in real life. At least for first half of maneuver 120 tugs are far superior to 90 ton tugs. They allow more safe control
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the	hpilot3: 5 Average: 5.0

job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	
If the tug configuration was not adequate, please explain why.	hpilot3: 120 tugs make this maneuver possible
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot3: 3 Average: 3.0
Run was _____ based on run parameters	hpilot3: successful
Additional comments:	hpilot3: I don't believe this is possible with 90 ton tugs

Run 12

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

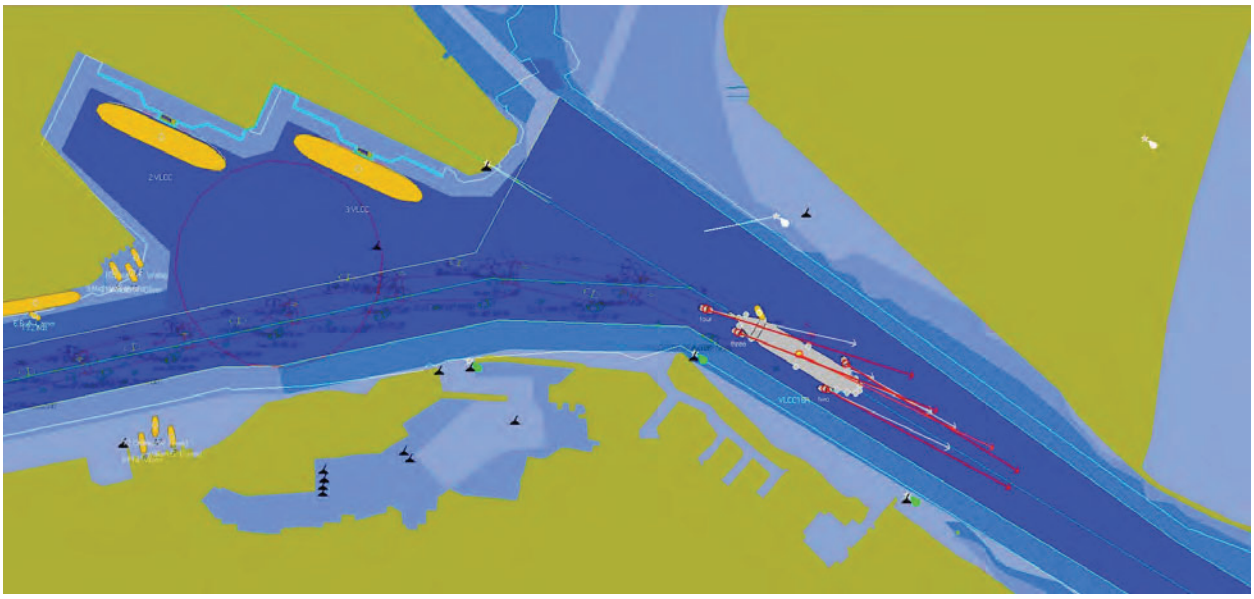


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: A very safe maneuver. We had a misunderstanding on the contour of the draft line, but the ship was always in good water. I felt very comfortable with the maneuver.

Run 13

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

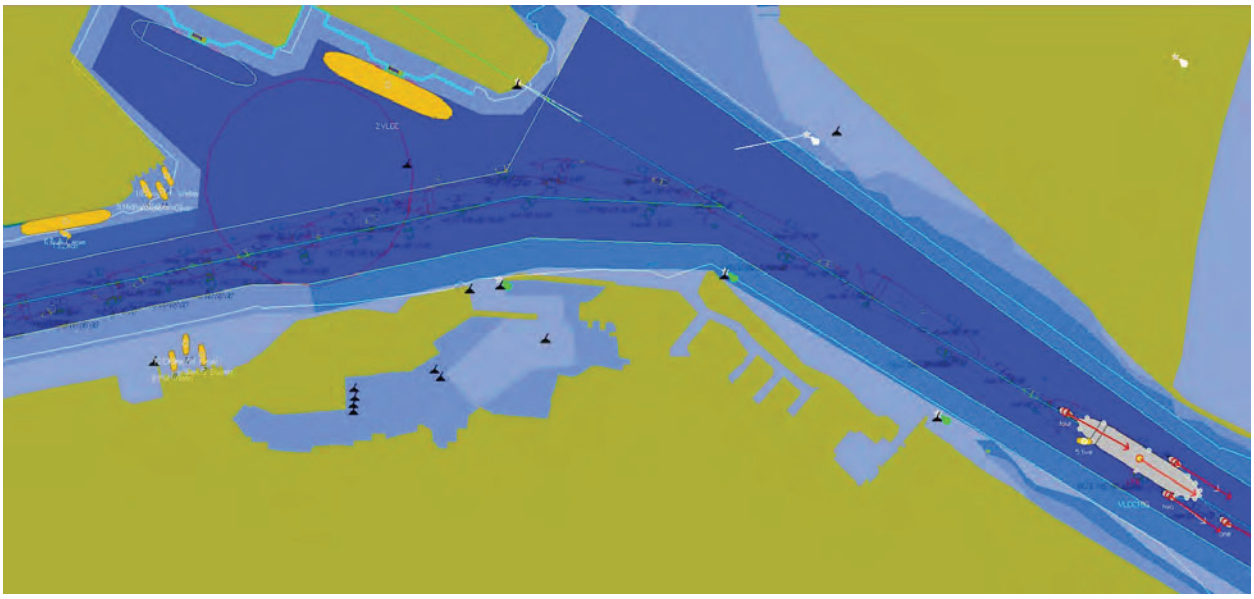


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.	hpilot4: 2 knot Lidia Anne ebb is extreme conditions for 68' draft. Even with the 120's and five of them.
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 4 Average: 4.0

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot4: 2 Average: 2.0
If not safe, please explain why.	hpilot4: Strong currents and these drafts are a tough combination less current or less draft allow for more margin of safety.
Run was _____ based on run parameters	hpilot4: successful

Run 14

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

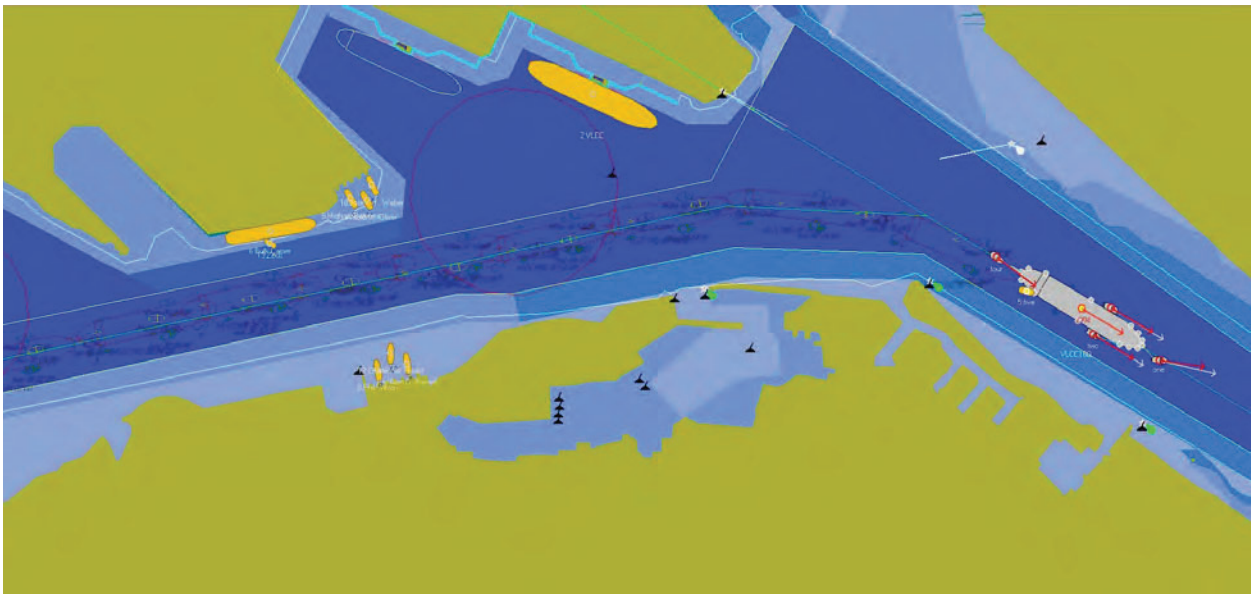


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful

Run 15

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

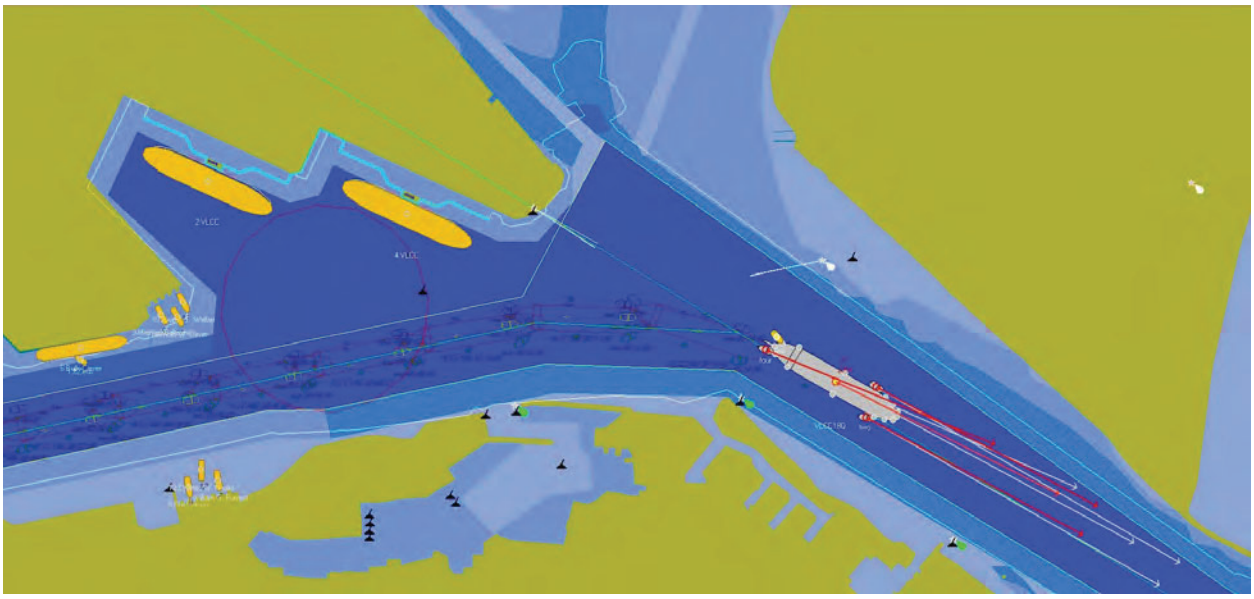


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot3: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot3: successful

Run 16

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

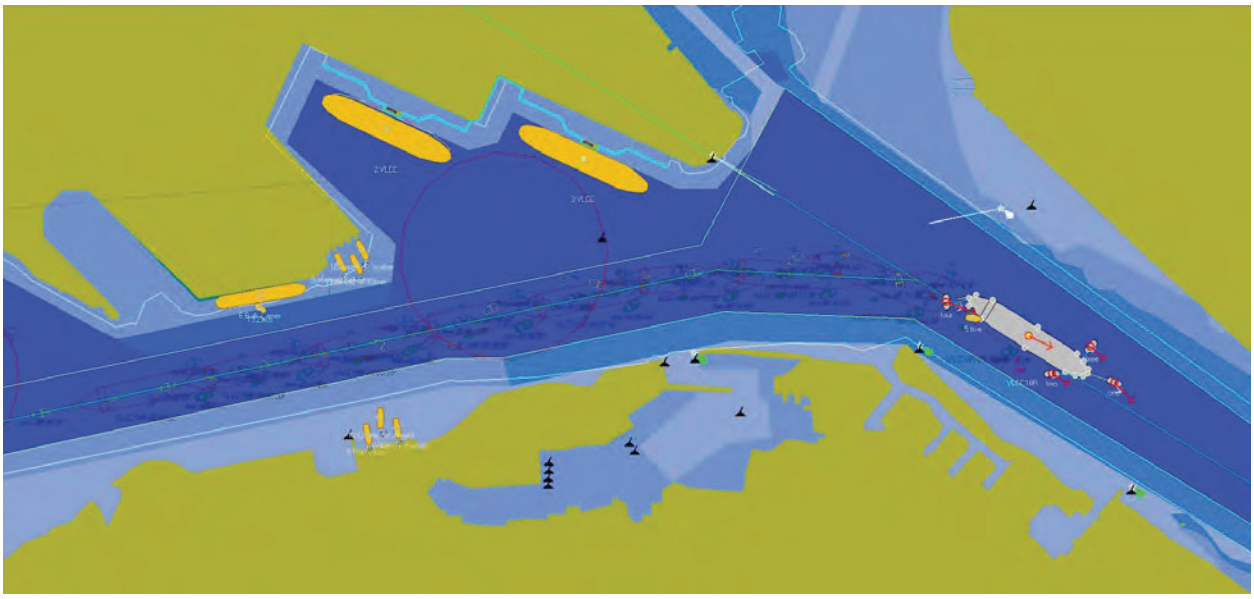


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: I did not notice much difference in this 52' load than what i am used to handling with the 45' loads. I did not need to use the tugs to make the turn because everything went right.

Run 18

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

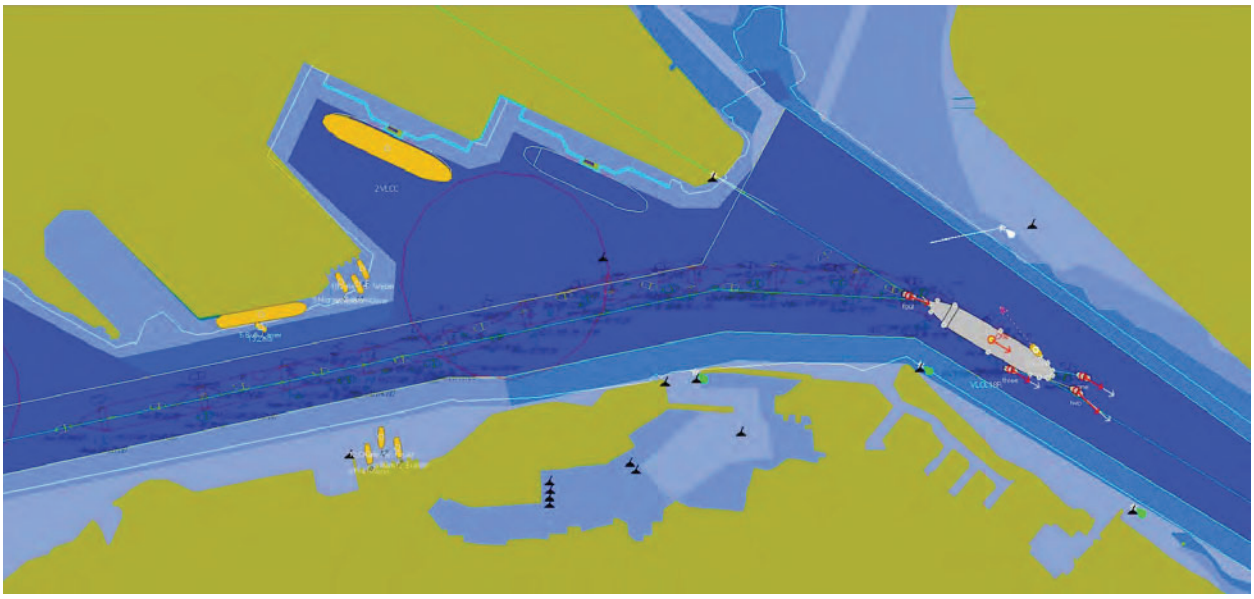


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful

Run 19

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

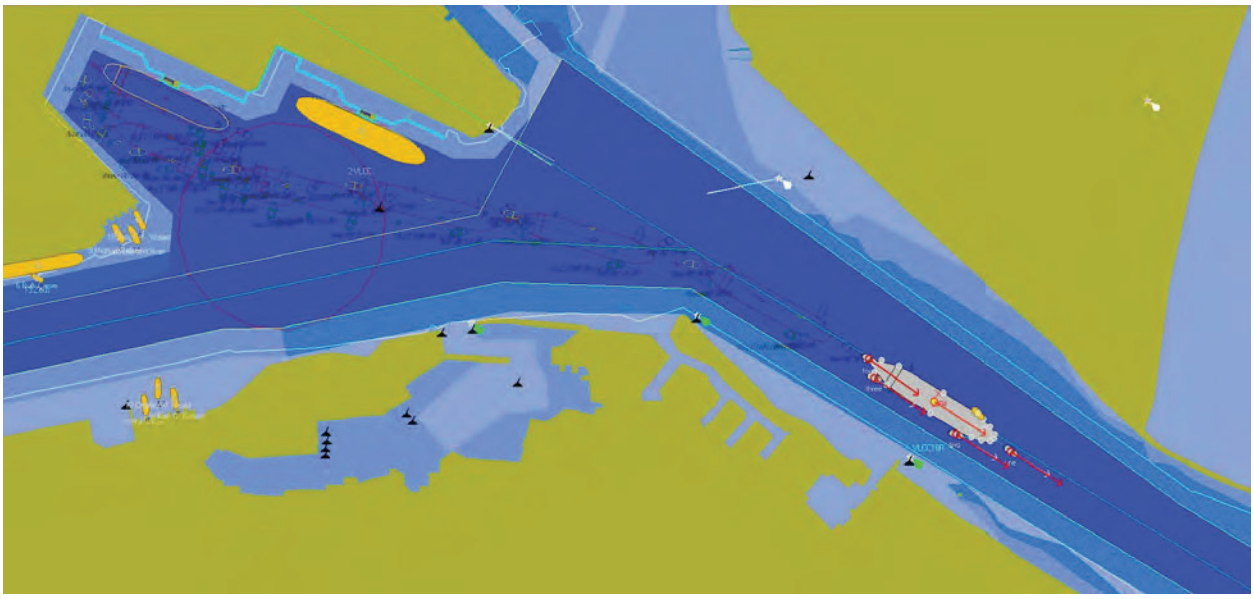


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
If the tug configuration was not adequate, please explain why.	hpilot4: 120's are a must for 68' and a 3 knot transit.

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot4: 4 Average: 4.0
Run was _____ based on run parameters	hpilot4: successful

Run 21

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

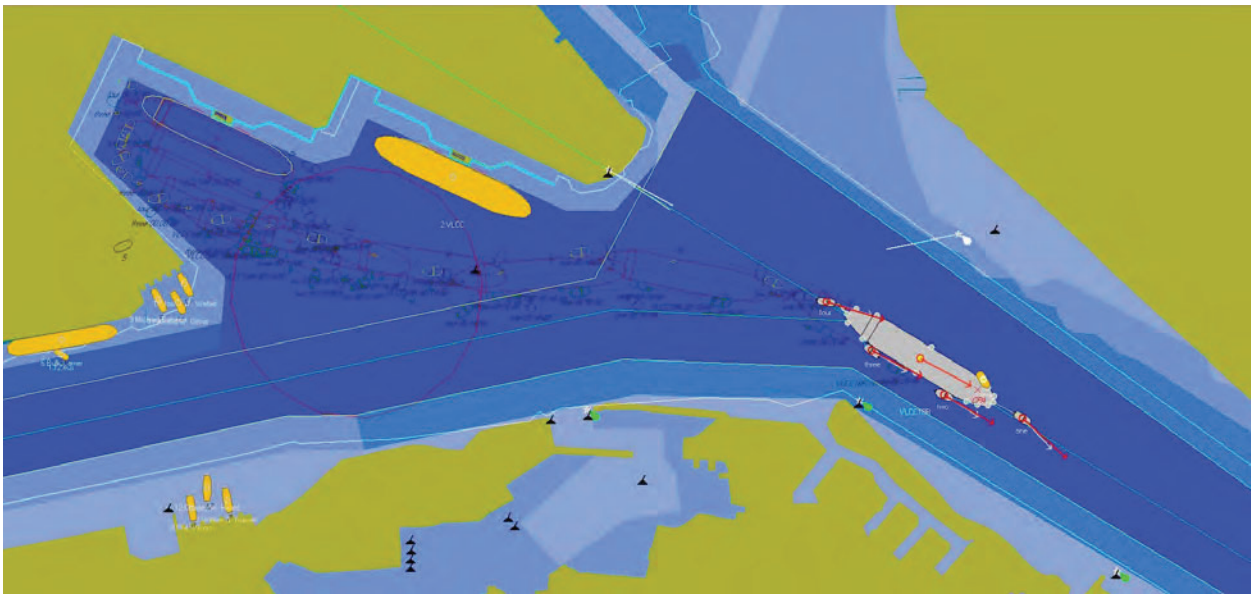


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot4: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot4: successful

Run 22

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



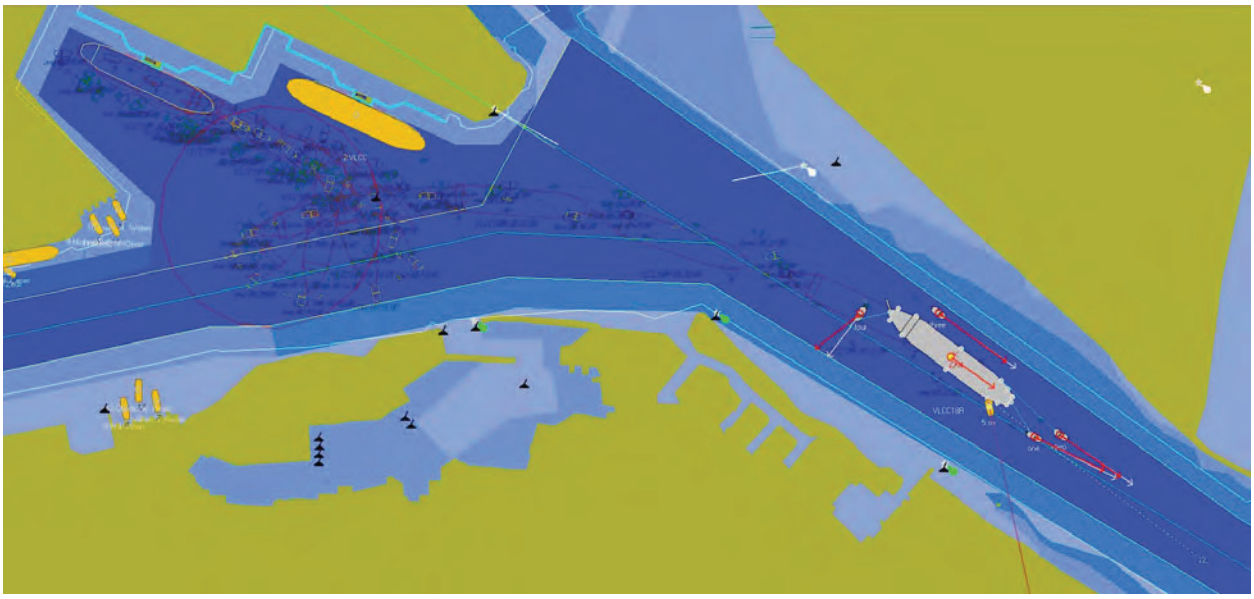
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 3** **Average: 3.0**
If the channel configuration was inadequate in any way, please explain why.	hpilot4: Without the 120 tugs there will need to be more room to accommodate to currents
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0

Pilot Report

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot4: 3 Average: 3.0
If not safe, please explain why.	hpilot4: Any V is always a challenge !,!
Run was _____ based on run parameters	hpilot4: successful

Run 23

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments: Head-in with 6 tugs

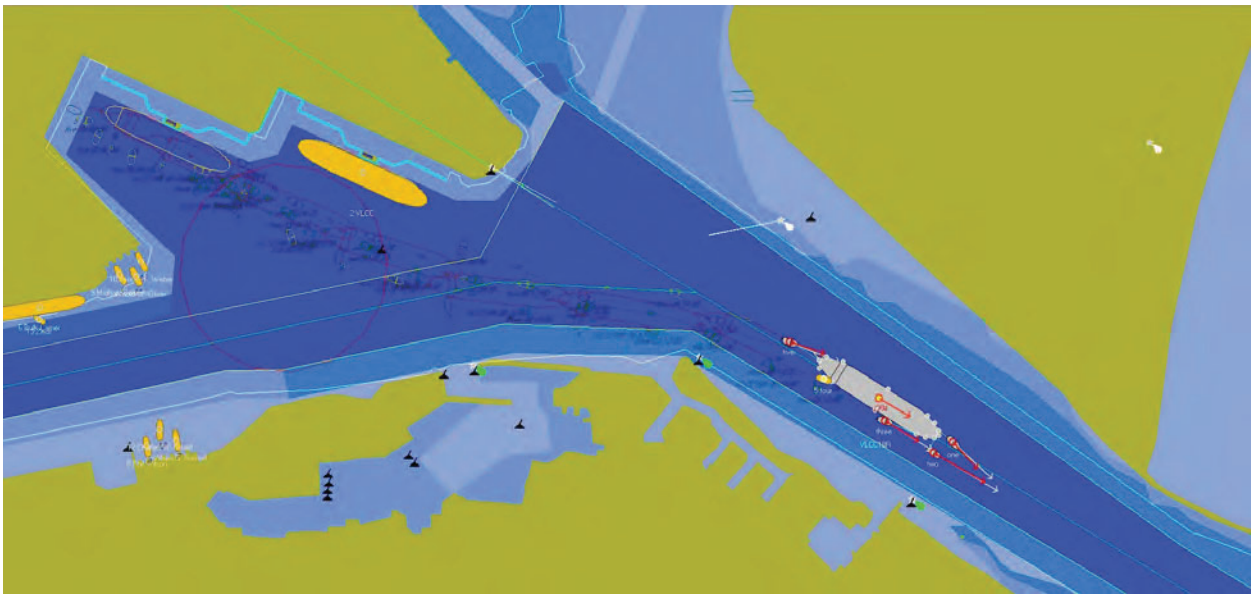


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful
Additional comments:	hpilot2: I would have expected more current effect when ship was perpendicular to channel. Unrealistically difficult to complete turn around cline point due to current models

Run 24

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

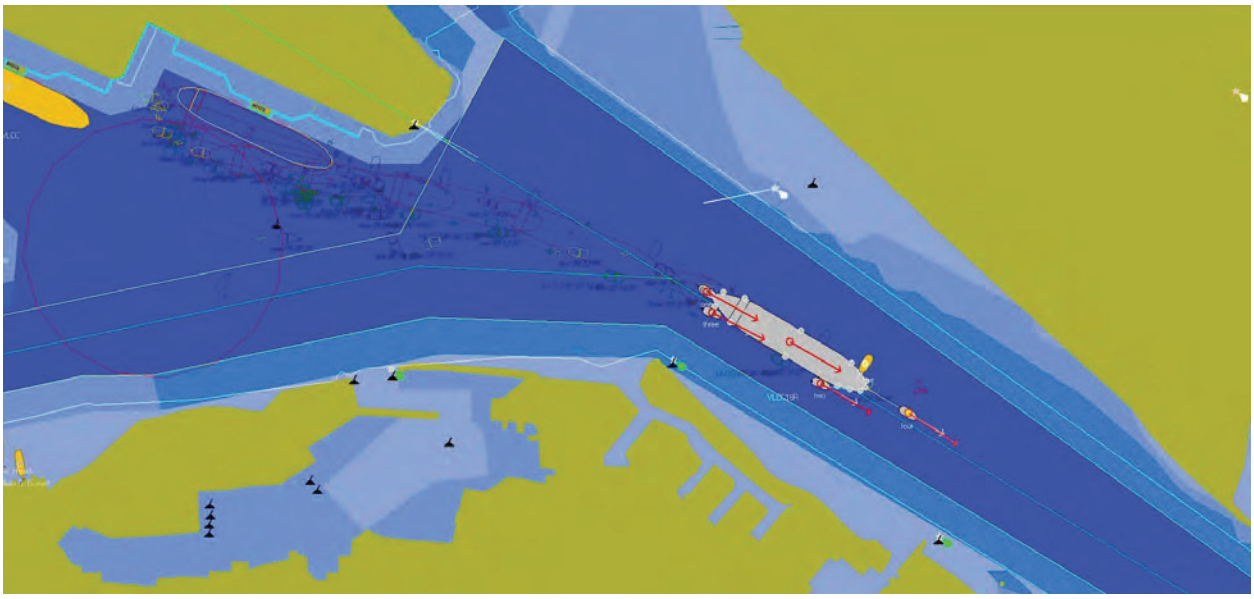


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful

Run 25

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

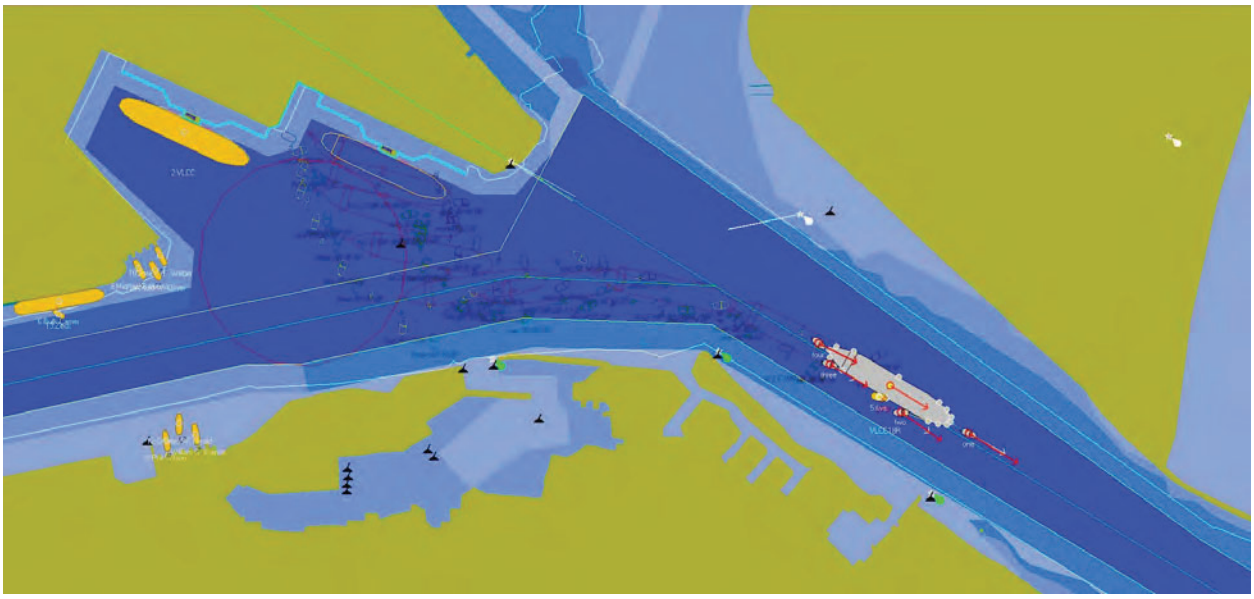


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: With these light environmental conditions and having 5 120 Ton tugs, this maneuver can be done very safely.

Run 26

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

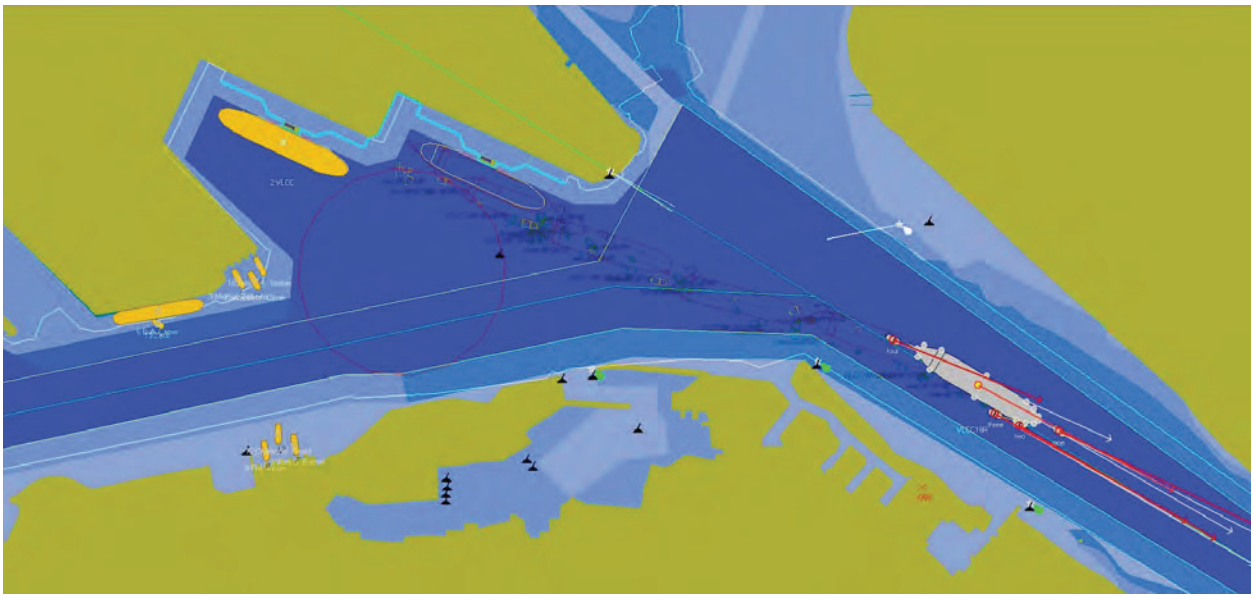


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot3: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot3: successful
Additional comments:	hpilot3: Very safe maneuver with these tugs

Run 27

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

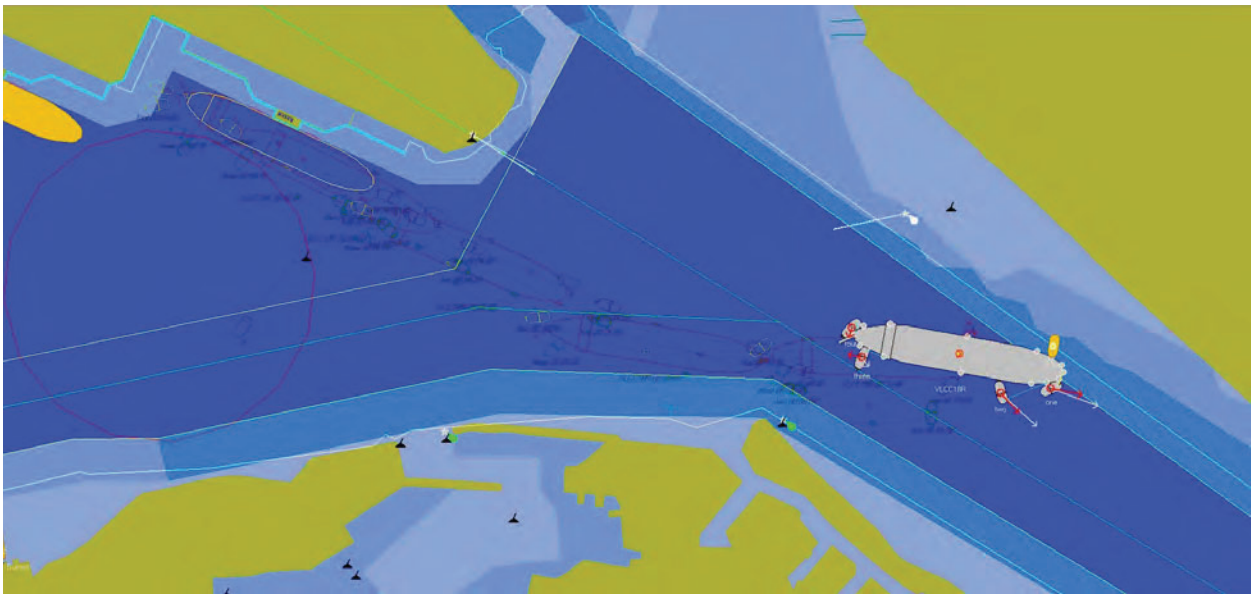


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 4 Average: 4.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot3: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot3: successful

Run 28

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

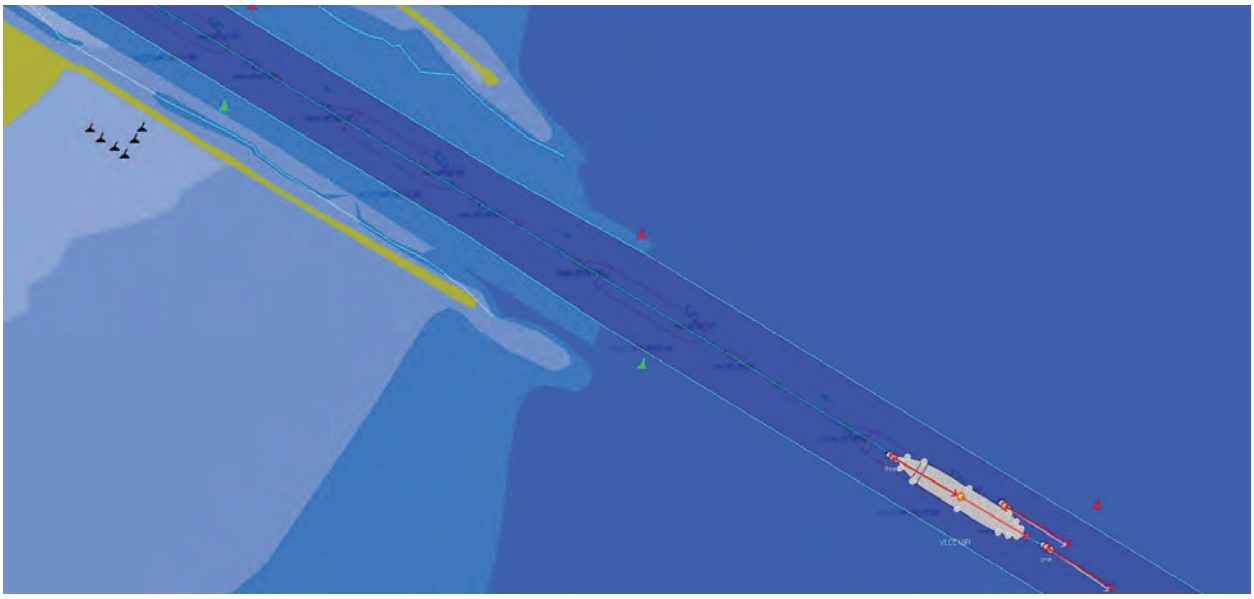


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 1 Average: 1.0
If any of the environmental forces (wind, wave, current) exceeded operational limitations, please explain what could be changed to safely execute the maneuver.	hpilot2: Felt current on port bow was more than anticipated.
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 4 Average: 4.0

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot2: 1 Average: 1.0
If not safe, please explain why.	hpilot2: I question the characteristics of the felt current. The inbound set was extreme however the current did not effect the heading/ steering until the ship was almost fully in the channel. Indications of a strong flood would have been felt prior to the full effect of the flood on the ship that we experienced in the channel.
Run was _____ based on run parameters	hpilot2: unsuccessful
If the run was not successful, please explain why.	hpilot2: See above

Run 30

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: N High Comments:

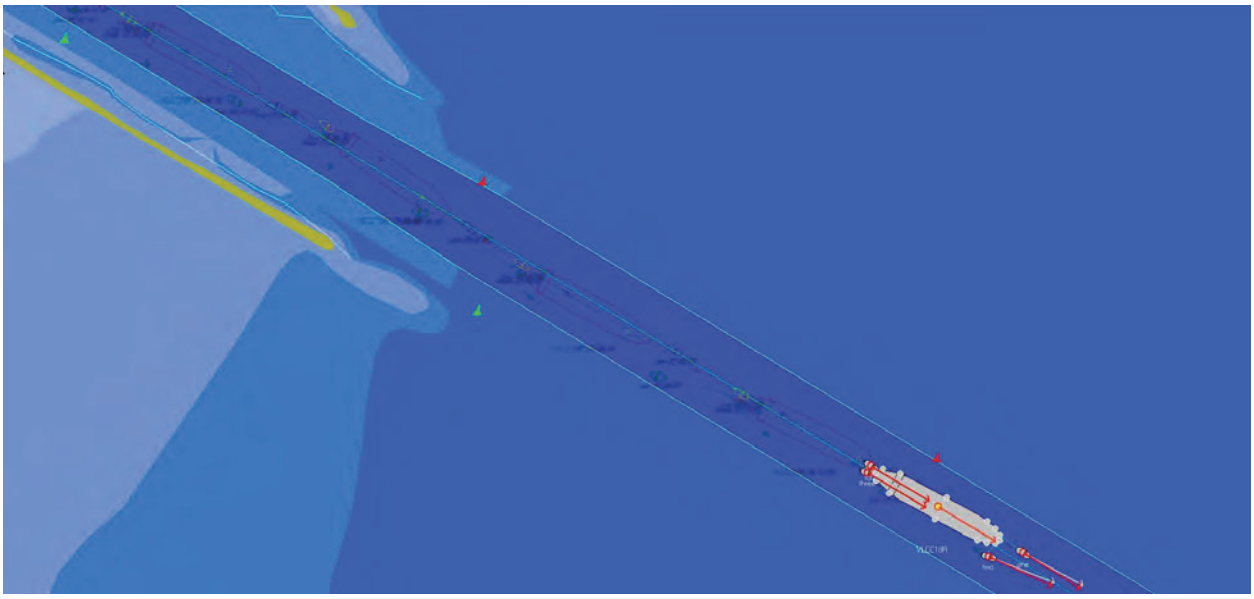


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot4: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot4: successful
Additional comments:	hpilot4: Very safe maneuver with these tugs

Run 31

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: S High Comments:

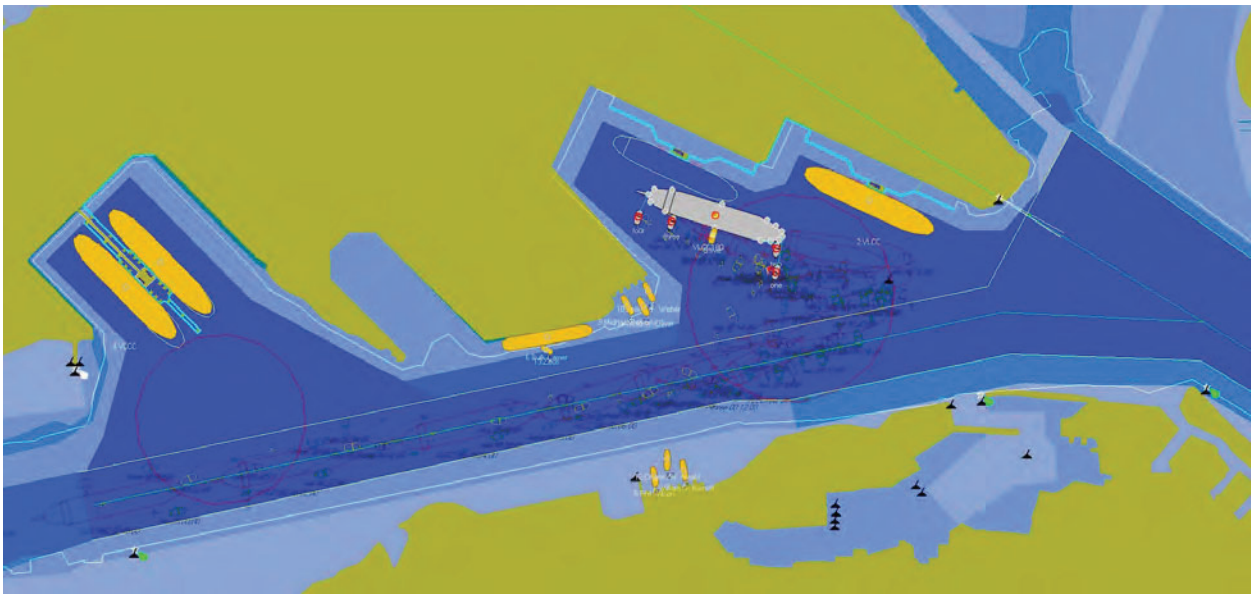


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot4: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot4: successful
Additional comments:	hpilot4: With the tug bollard pull availability and number of tugs the stress factor during the maneuvers at task was greatly reduced. When a pilot has the assets to overcome environmental challenges it improves the comfort zone for the pilot and builds the confidence to complete the manuver at task successfully.

Run 32

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

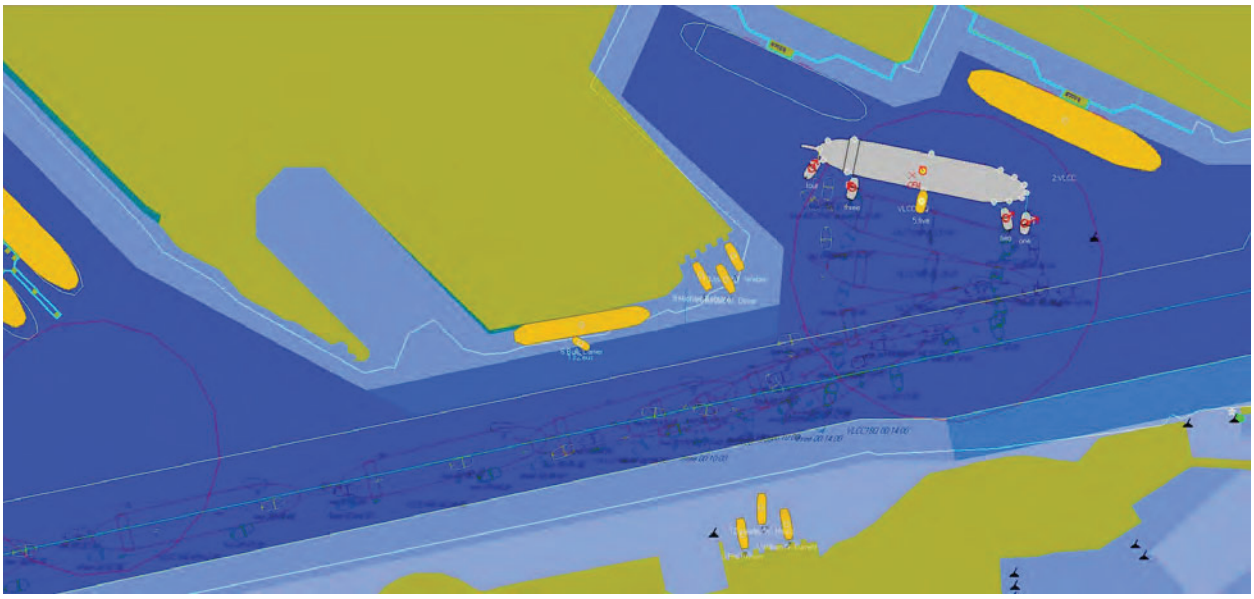


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot1: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: These are the tugs that are needed for this maneuver, anything less would jeopardize the safety of the vessel.

Run 33

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

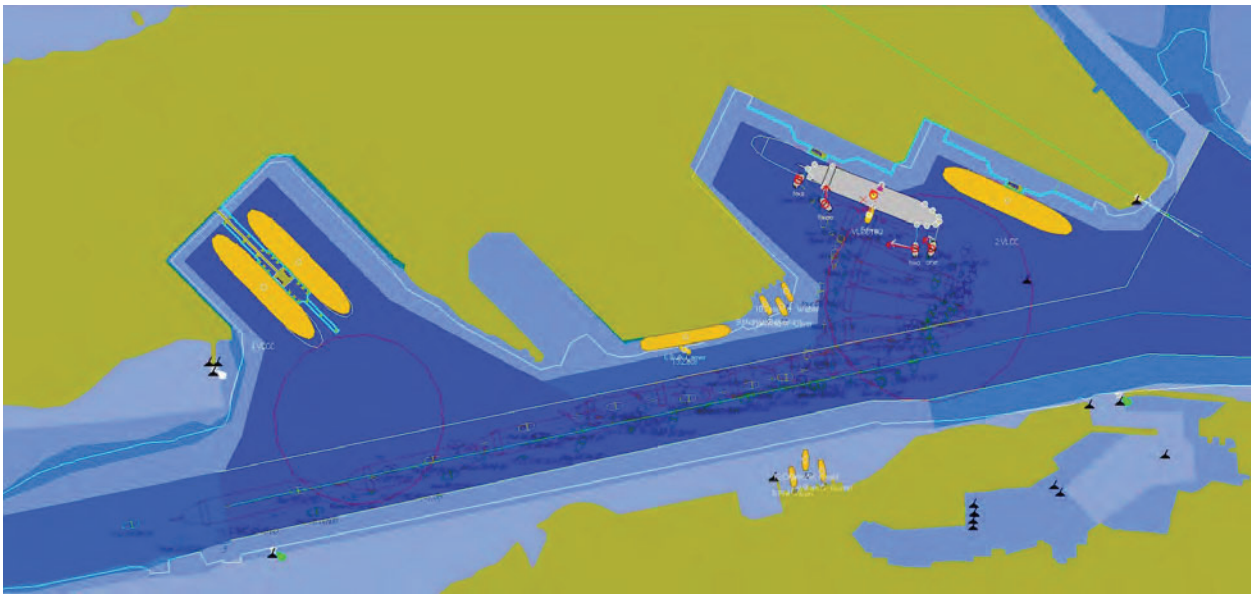


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot4: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot4: successful
Additional comments:	hpilot4: Strong ebb north wind 120's. I felt comfortable and also felt like I had some extra power (margin of safety) with the 120's. 👍

Run 34

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

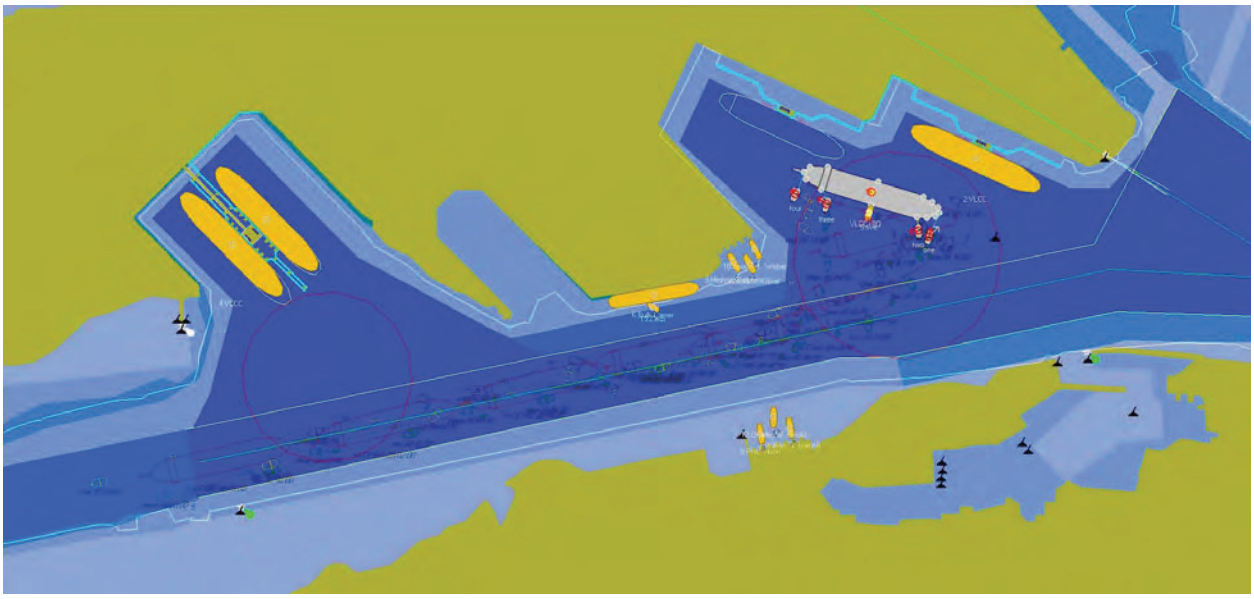


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
If not safe, please explain why.	hpilot2: you have to stay on top of it. The tide can take it away from you if you don't stay focused.
Run was _____ based on run parameters	hpilot2: successful
Additional comments:	hpilot2: tug power and ship power was adequate to overcome environmental conditions.

Run 35

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 H Ebb High Offshore Wind and Current: - Comments:

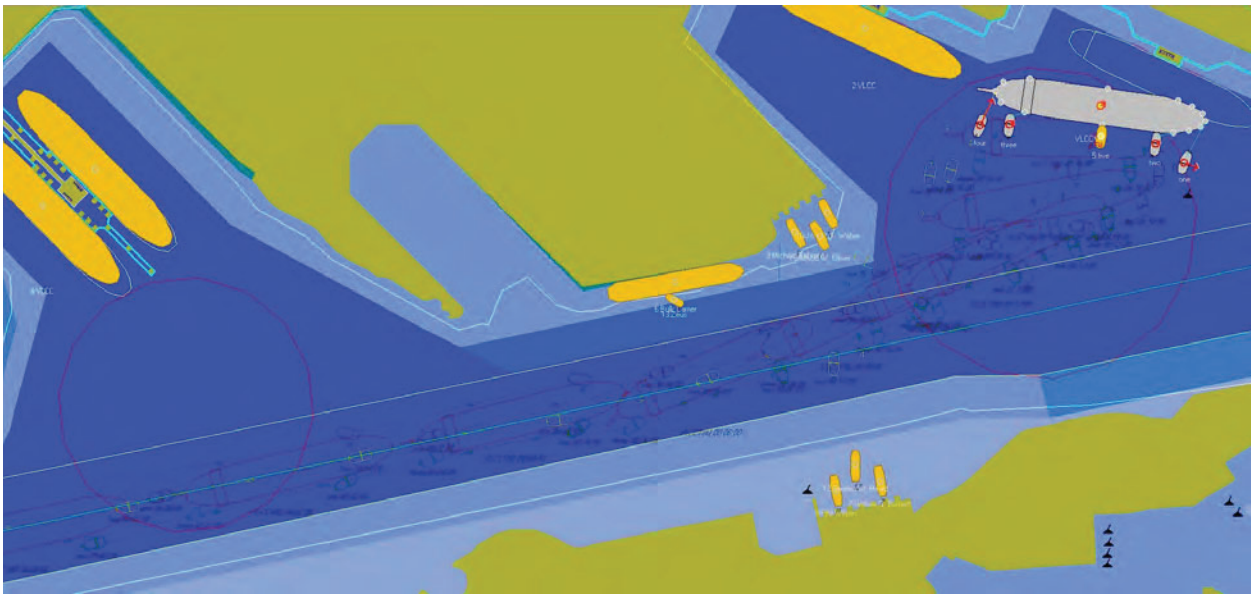


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot2: successful
Additional comments:	hpilot2: Tugs very effective. Flood current is very favorable for this maneuver.

Run 36

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

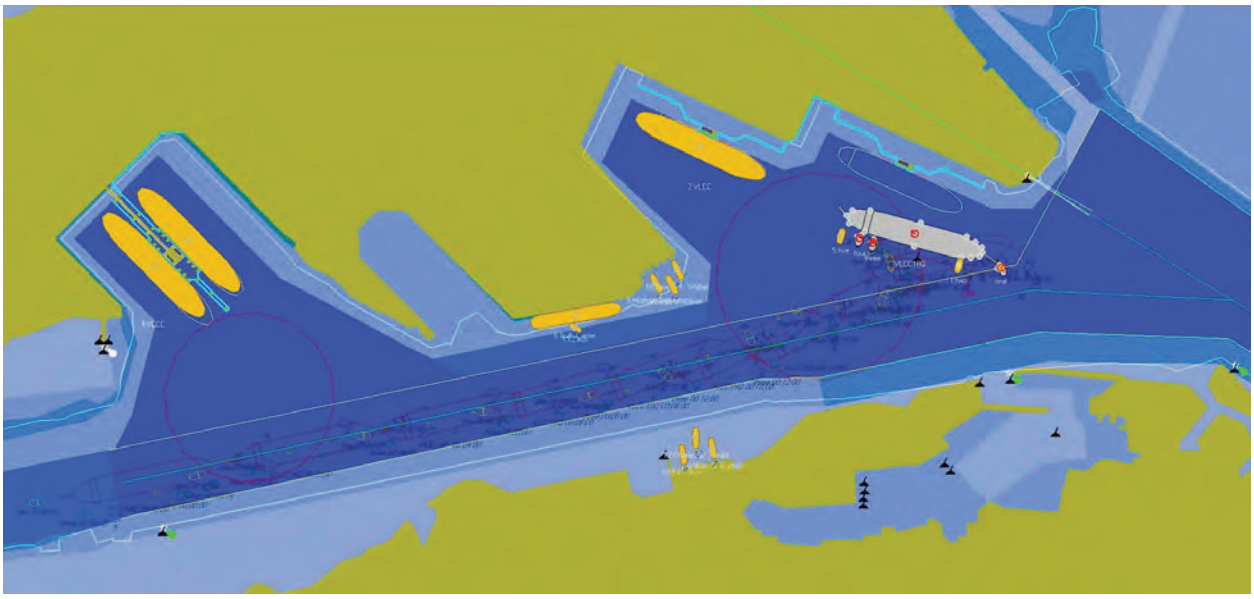


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**admin: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	admin: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	admin: 5 Average: 5.0
If the tug configuration was not adequate, please explain why.	admin: 120 ton tugs made this maneuver safe with ample margins for safety.

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	admin: 5 Average: 5.0
Run was _____ based on run parameters	admin: successful
Additional comments:	admin: 120 ton tugs have made these runs safe and manageable. Significant difference from 90 ton.

Run 37

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:

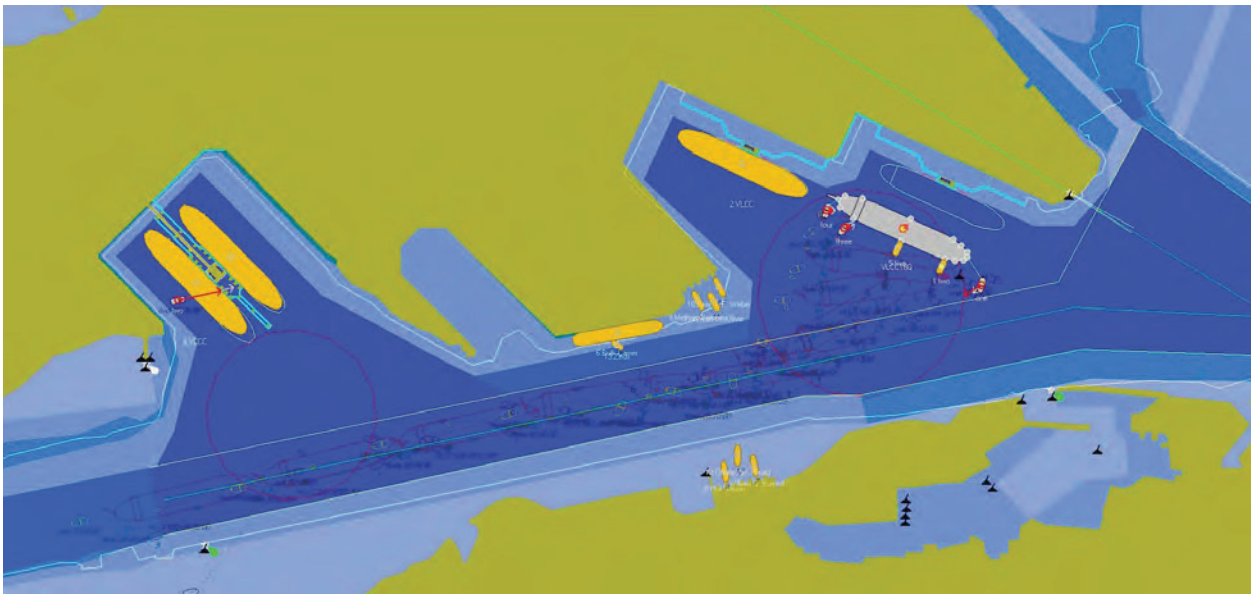


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot2: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
If not safe, please explain why.	hpilot2: Several failures including ships rudder & broken tug line. Adequate number of tugs and horsepower of tugs to over come failures.
Run was _____ based on run parameters	hpilot2: successful

Run 38

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:

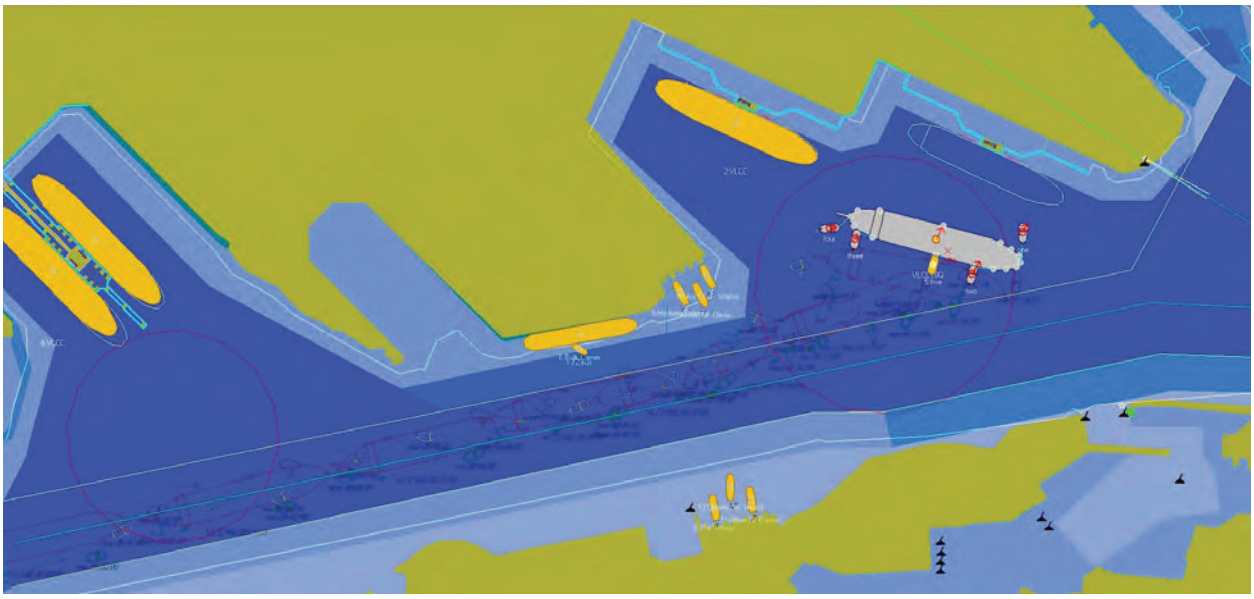


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot4: 5 Average: 5.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot4: successful
Additional comments:	hpilot4: Even though we lost the engines on a partially loaded VLCC, these tugs were able to dock it without a problemA very safe maneuver with these tugs

Run 39

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 Ebb High Offshore Wind and Current: - Comments: changed from flood to ebb at last minute

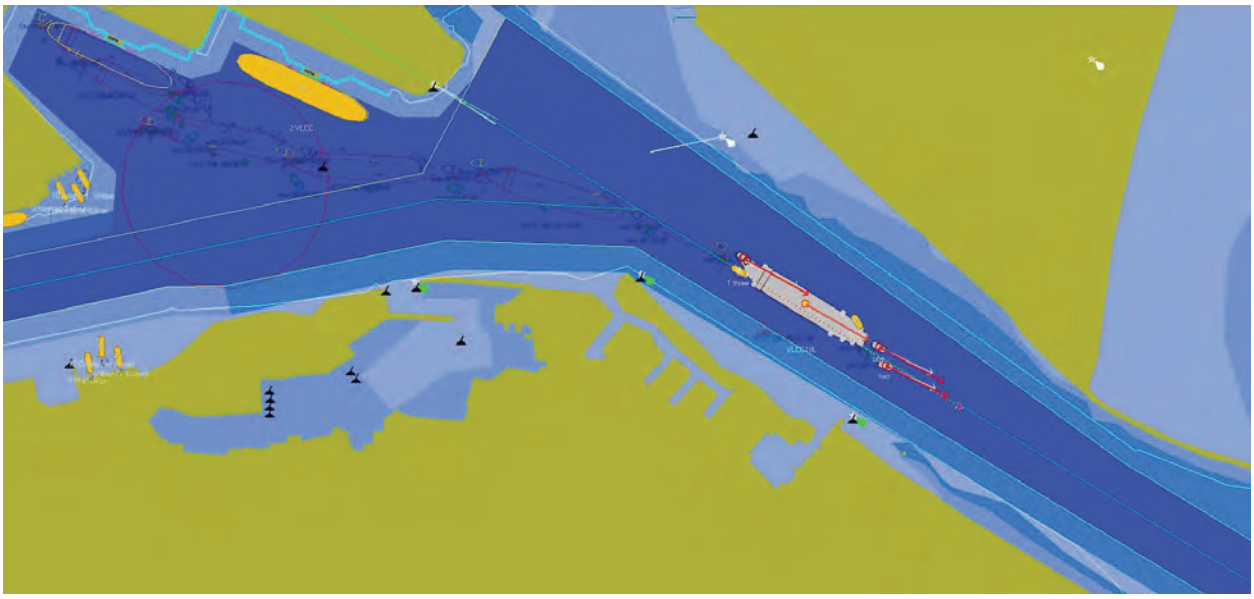


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
If the tug configuration was not adequate, please explain why.	hpilot3: 120 Ton tugs are what makes this possible

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot3: 4 Average: 4.0
If not safe, please explain why.	hpilot3: In real life I believe there will be tide restrictions.
Run was _____ based on run parameters	hpilot3: successful

Run 40

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:

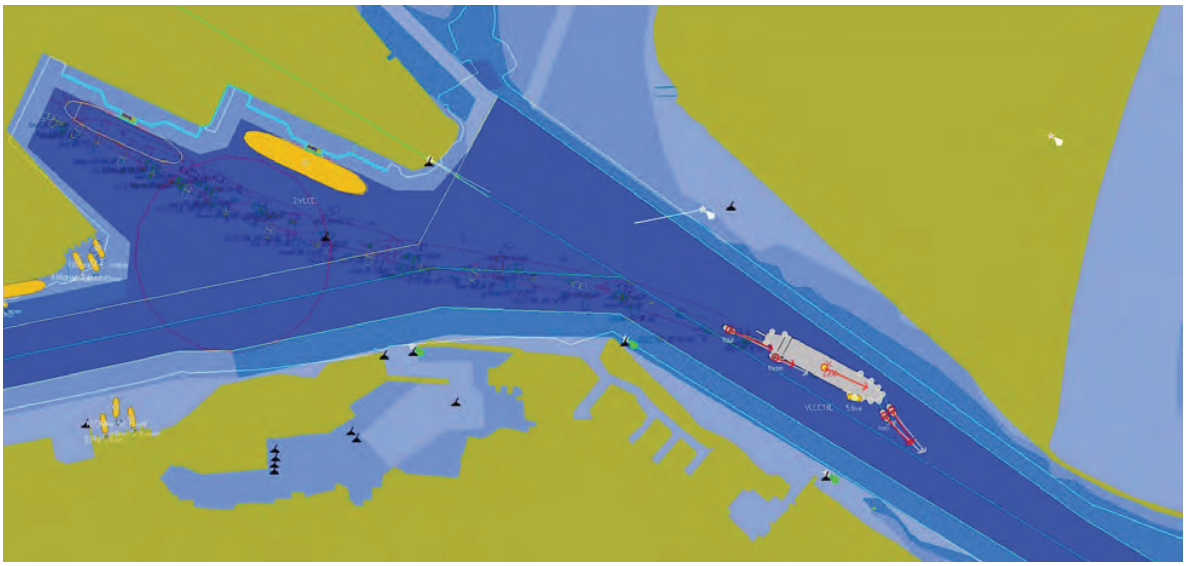


Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely	hpilot3: 4 Average: 4.0

unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	
Run was _____ based on run parameters	hpilot3: successful

Run 41

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



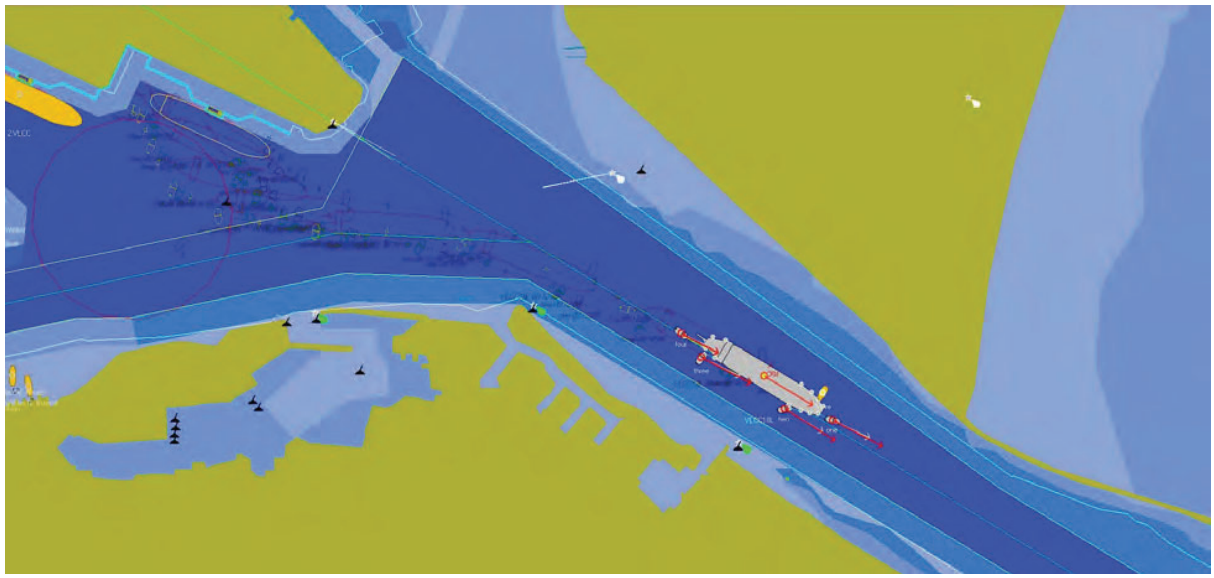
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 4 Average: 4.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot4: 4 Average: 4.0

Pilot Report

Run was _____ based on run parameters	hpilot4: successful

Run 42

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



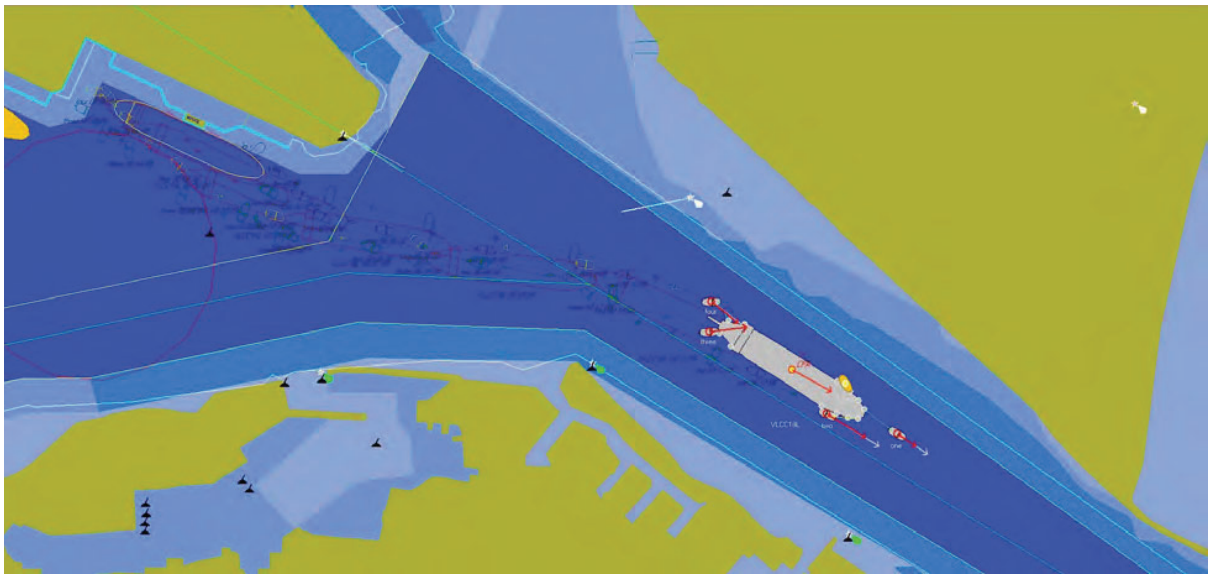
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot4: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot4: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot4: 5 Average: 5.0

Pilot Report

Run was _____ based on run parameters	hpilot4: successful
Additional comments:	hpilot4: This maneuver was very safe with these tugs

Run 43

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



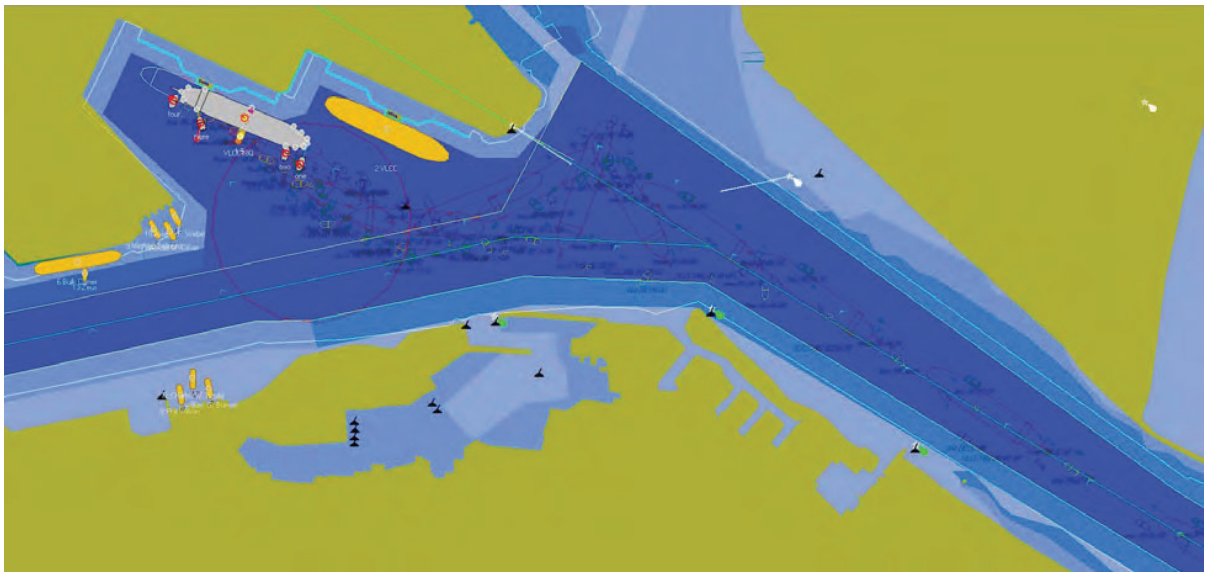
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot1: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot1: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot1: 4 Average: 4.0

Pilot Report

Run was _____ based on run parameters	hpilot1: successful
Additional comments:	hpilot1: At 72' draft and any current, it will be very difficult to control these VLCCs. 5 120 Ton tugs will be vital to these movements.

Run 7.2

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



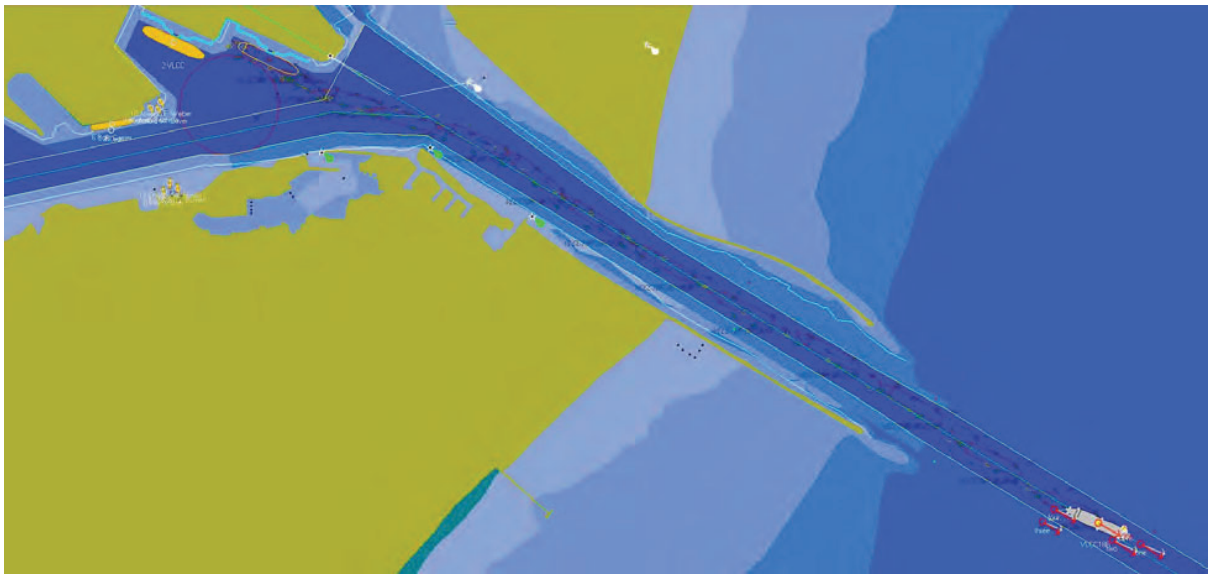
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 4** **Average: 4.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot2: 4 Average: 4.0

Pilot Report

Run was _____ based on run parameters	hpilot2: successful

Run 28.2

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



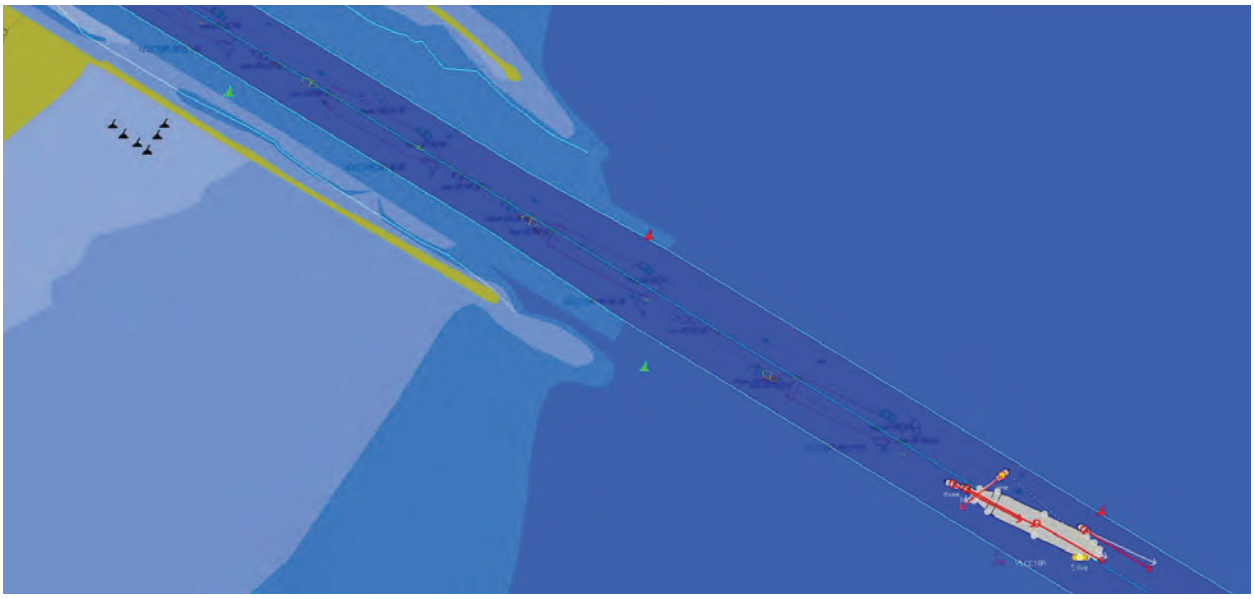
Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot2: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot2: 3 Average: 3.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot2: 4 Average: 4.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot2: 4 Average: 4.0

Pilot Report

Run was _____ based on run parameters	hpilot2: successful
Additional comments:	hpilot2: Current effect around cline point felt unnatural. I believe I should have been able to turn the ship in to the current with more ease than was observed once the starboard quarter was around the point

Run 44

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: - Offshore Wind and Current: S High Comments:



Question	Answers
The CHANNEL CONFIGURATION (slope, width, depth profile, and layout) was sufficient and adequate. 1 being the channel is inadequate and 5 being the channel is adequate.	**hpilot3: 5** **Average: 5.0**
Commands were executed and resulted in desired outcome within a reasonable timeframe. Please consider the current, wind, wave (ENVIRONMENTAL FORCES) and their effects on the vessels involved as well as the tug configuration. Please rate based on wind, current, and wave effect on the vessel models – 5 being the channel is adequate and 1 being the channel is inadequate.	hpilot3: 5 Average: 5.0
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	hpilot3: 5 Average: 5.0
If the tug configuration was not adequate, please explain why.	hpilot3: 120 ton tugs are adequate for this maneuver

Pilot Report

The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	hpilot3: 4 Average: 4.0
Run was _____ based on run parameters	hpilot3: successful

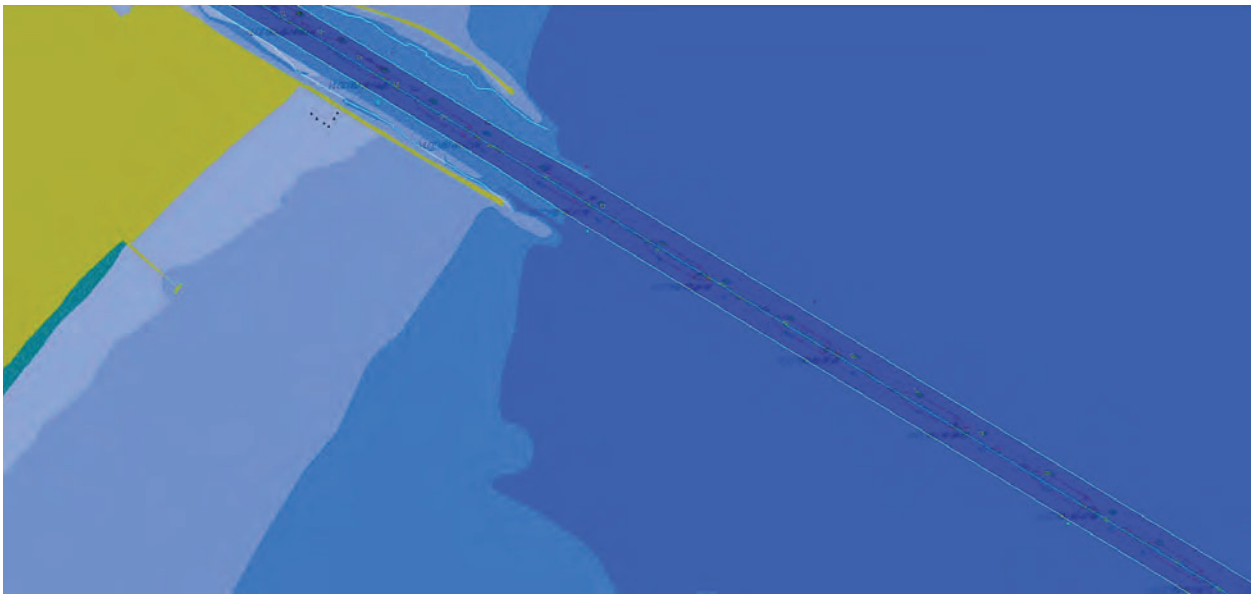
General Run Comments

General Study Comments

Question	Answers

Run #1

Location: Sea Destination: Jetties Dredge Plan: 81 Ship Draft: 52' Inland Wind and Current: Offshore Wind and Current: N Med Comments:



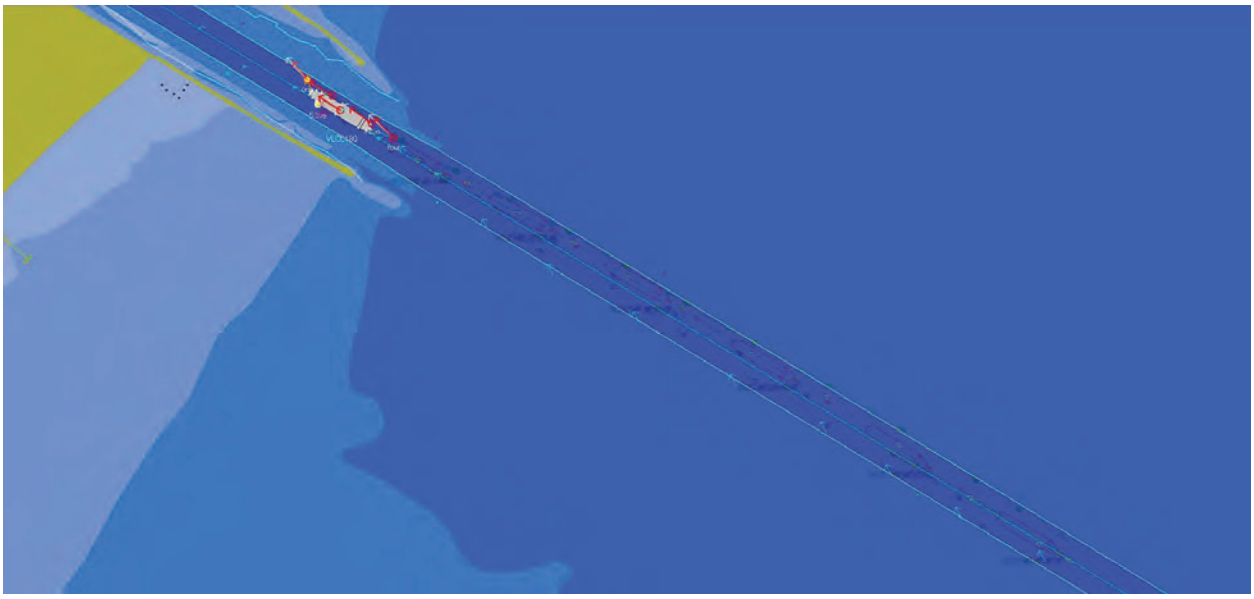
Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Starboard B2 tug2: Center lead front tug3: Port B1 tug1: Center lead aft rtug5: Starboard quarter
Tug location - End:	tug4: Starboard B2 tug2: Center lead front tug3: Starboard midship tug1: Center lead aft rtug5: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug2: 5 tug3: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug3: No tug1: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug3: 5 tug1: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 tug3: 5 tug1: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug3: n tug1: n rtug5: n
If Yes, please explain why	tug4: Easy run. Tug not used much power tug2: No issues tug3: Successful run tug1: No rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug3: n tug1: n rtug5: n
Run was _____ based on run parameters	tug4: successful tug2: successful

	tug3: successful tug1: successful rtug5: successful
Additional Comments:	rtug5: Ship gave tug minimum commands

Run #2

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: Offshore Wind and Current: N High Comments:



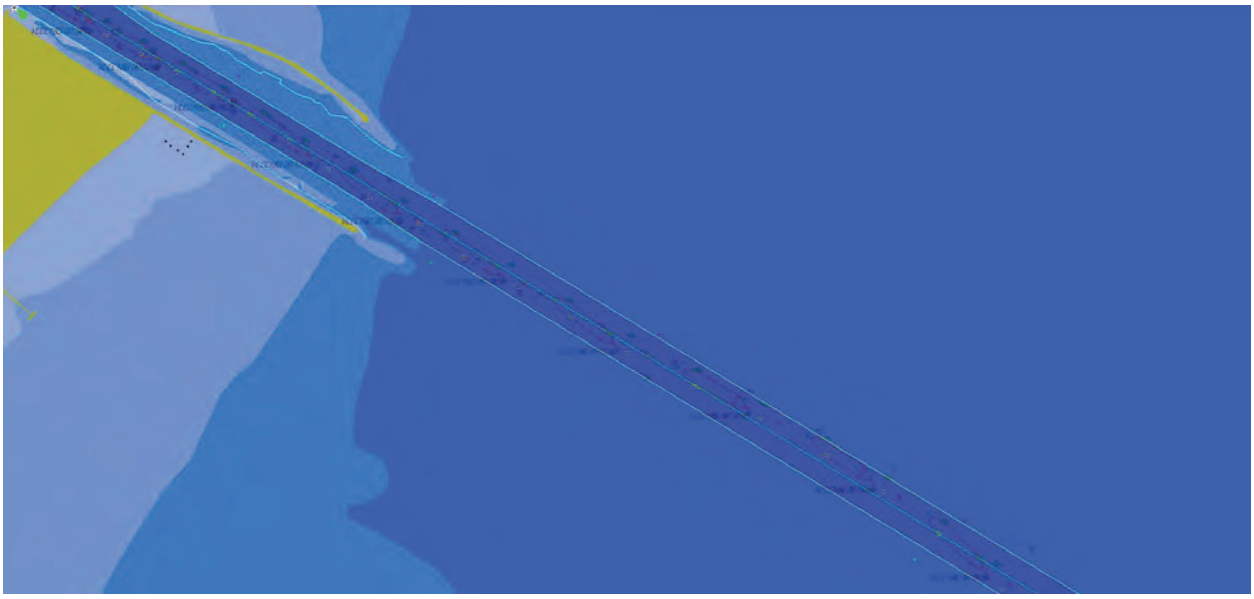
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Starboard B1 tug2: Starboard quarter tug1: Center lead front rtug5: Port B2 tug4: Center lead aft
Tug location - End:	tug3: Starboard B1 tug2: Starboard quarter tug1: Center lead front rtug5: Port B2 tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug2: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No tug1: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n rtug5: n tug4: n
If Yes, please explain why	tug3: No issues tug4: All maneuvers safe. No commands given. Escorting off the stern tethered.
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: y tug1: n rtug5: n tug4: n
Run was _____ based on run parameters	tug3: successful tug2: successful tug1: successful rtug5: successful

	tug4: successful
Additional Comments:	tug4: Had to run full to catch the ship. After making fast, no commands given. Safe maneuver

Run #3

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: Offshore Wind and Current: S Med Comments:



Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Starboard quarter tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft
Tug location - End:	tug2: Starboard quarter tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug3: 5 tug1: 5 tug4: 2 Average: 4.2

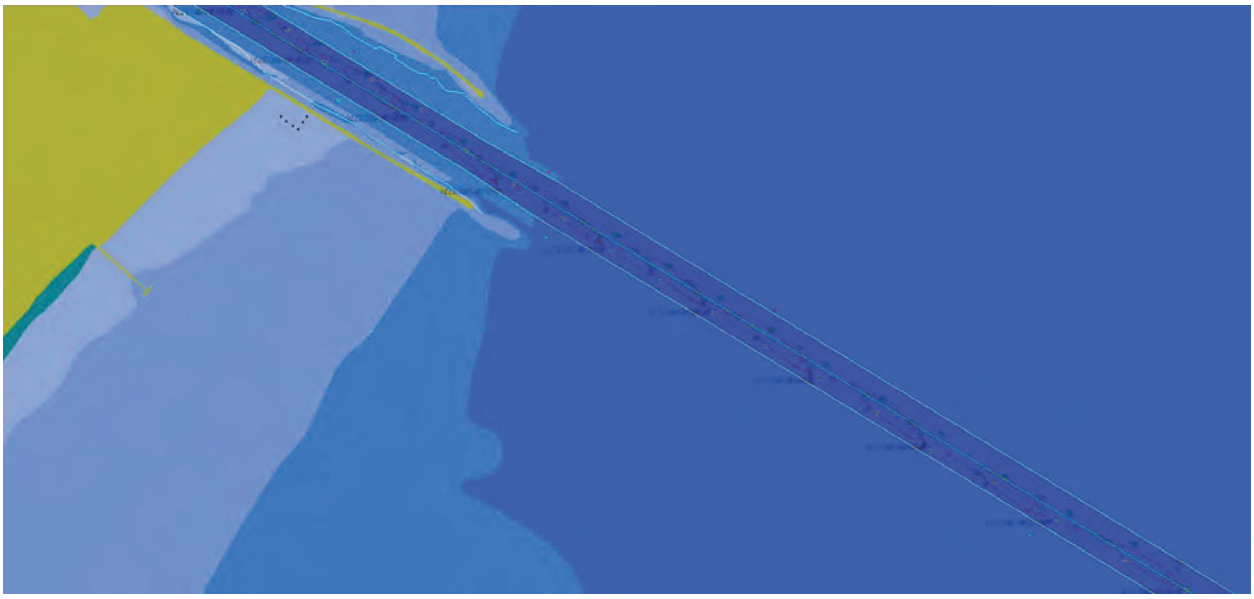
If the maneuvering room was not adequate, please explain why.	tug4: Tight tolerance on port quarter. Ship ran aground
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug1: No tug4: No
If any of the environmental forces caused vessel operational limits to be exceeded, please explain why, and if the forces prevented you from performing any specific maneuver, what occurred.	tug4: All environmental forces felt correct
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug3: 4 tug1: 5 tug4: 5 Average: 4.8
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 3 tug3: 4 tug1: 4 tug4: 2 Average: 3.2
If not safe, please explain why.	tug4: Ship got too close to Turtle cove and ran aground
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: y tug3: n tug1: y tug4: n
If Yes, please explain why	tug2: With the sea state off shore and ships speed was difficult to keep the tug along side tug3: Due to the sea state I was full ahead trying to keep my line slack but never could keep it at 0 tons until we got inside the jetties tug1: Environmentals added time taken to get into position tug4: All commands given were executed

Tug Report

Did you feel that you were asked to operate at max power for an extended period of time?	tug2: y tug3: n tug1: n tug4: n
Run was _____ based on run parameters	tug2: successful tug3: successful tug1: successful tug4: unsuccessful
If the run was not successful, please explain why.	tug4: Ran aground

Run #4

Location: Sea Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: Offshore Wind and Current: S High Comments:



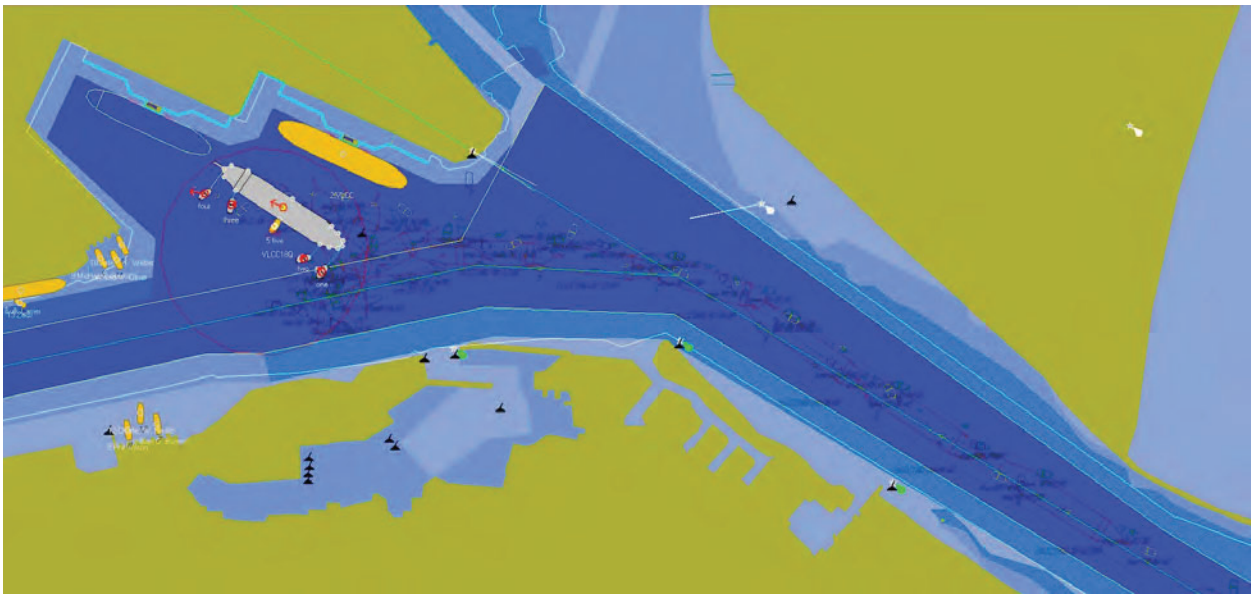
Question	Answers
Tug Type:	**tug4: Rotor 120** **tug1: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120**
Tug Location - Beginning:	tug4: Starboard B2 tug1: Center lead aft tug2: Center lead front tug3: Starboard quarter
Tug location - End:	tug4: Starboard B2 tug1: Center lead aft tug2: Center lead front tug3: Port quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 5 tug1: 5 tug2: 5 tug3: 5 Average: 5.0

Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug1: No tug2: No tug3: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug1: 5 tug2: 5 tug3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug1: 5 tug2: 5 tug3: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug1: n tug2: n tug3: n
If Yes, please explain why	tug4: Good run inbound. Safe maneuver. tug1: No tug2: No issues tug3: Successful run
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug1: n tug2: n tug3: n
Run was _____ based on run parameters	tug4: successful tug1: successful tug2: successful tug3: successful

Run #5

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**rtug5: Robot Rotor 120** **tug2: Rotor 120** **tug4: Rotor 120** **tug1: Rotor 120** **tug3: Rotor 120**
Tug Location - Beginning:	rtug5: Port B2 tug2: Center lead front tug4: Starboard B2 tug1: Center lead aft tug3: Starboard quarter
Tug location - End:	rtug5: Starboard midship tug2: Center lead front tug4: Starboard B2 tug1: Center lead aft tug3: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	rtug5: 5 tug2: 5 tug4: 5

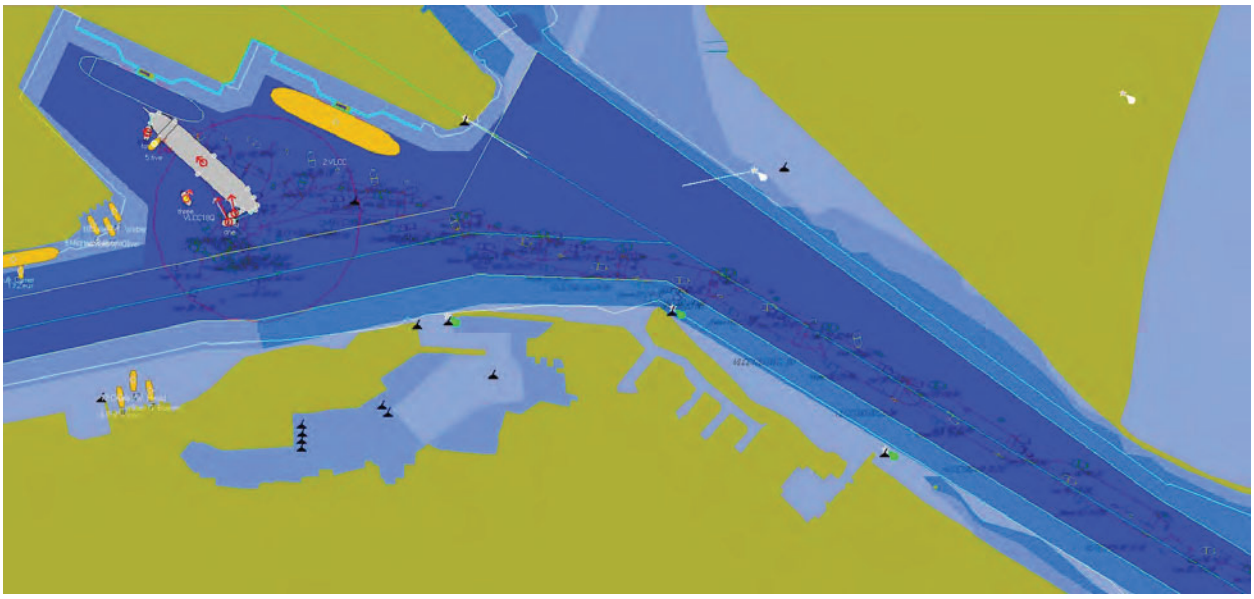
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 tug3: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	rtug5: No tug2: No tug4: No tug1: No tug3: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	rtug5: 5 tug2: 5 tug4: 5 tug1: 5 tug3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	rtug5: 5 tug2: 5 tug4: 5 tug1: 5 tug3: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	rtug5: n tug2: n tug4: n tug1: n tug3: n
If Yes, please explain why	rtug5: A tug2: No issues tug4: Safe maneuver. Short bursts of full power, but reduced again quickly. Overall safe run. tug1: No tug3: Successful run
Did you feel that you were asked to operate at max power for an extended period of time?	rtug5: n tug2: n tug4: n tug1: n tug3: n

Tug Report

Run was _____ based on run parameters	rtug5: successful tug2: successful tug4: successful tug1: successful tug3: successful

Run #6

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



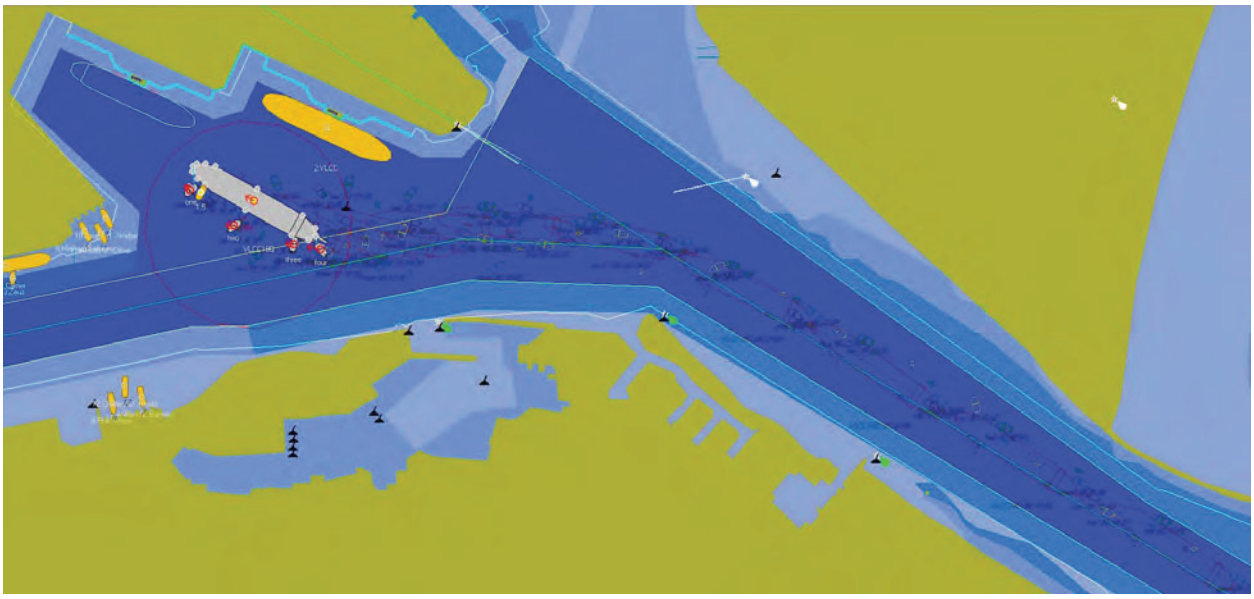
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug3: Port B1 tug1: Center lead aft rtug5: Starboard quarter tug4: Starboard B2
Tug location - End:	tug2: Center lead front tug3: Starboard midship tug1: Center lead aft rtug5: Starboard quarter tug4: Starboard B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug2: 5 tug3: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug1: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug3: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug3: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug3: n tug1: n rtug5: n tug4: n
If Yes, please explain why	tug2: No issues tug3: Very successful run tug1: No rtug5: A tug4: Safe run. Did not use tug for extended periods
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug3: n tug1: n rtug5: n tug4: n
Run was _____ based on run parameters	tug2: successful tug3: successful

	tug1: successful rtug5: successful tug4: successful
Additional Comments:	rtug5: Minimum tug commands issued.

Run #8

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:

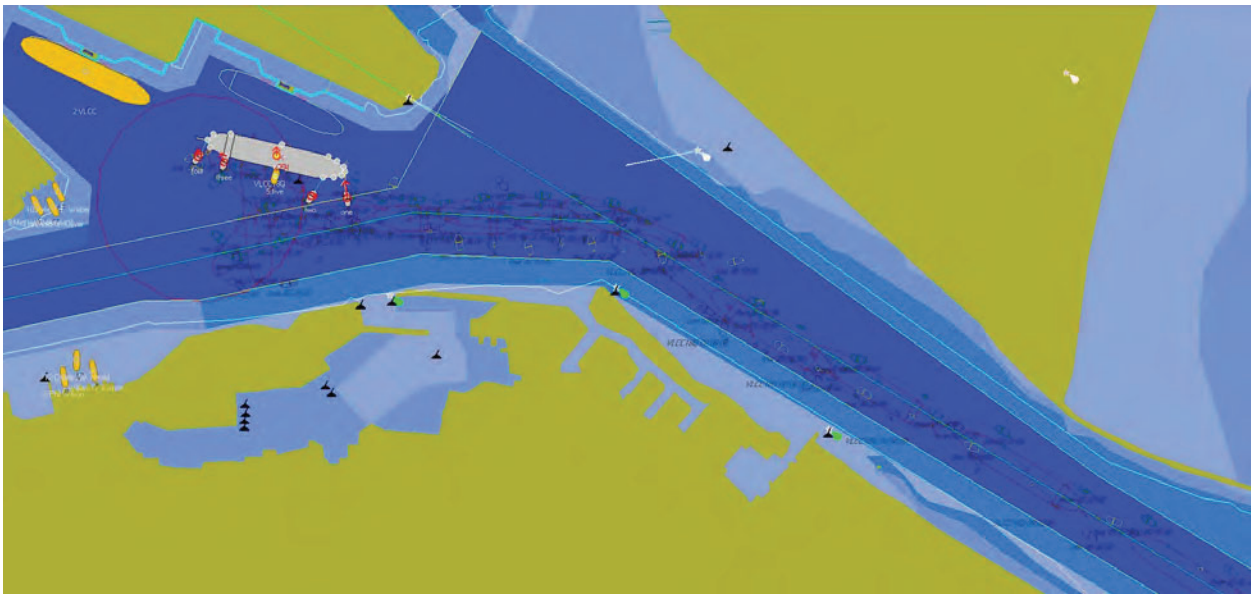


Question	Answers
Tug Type:	**tug3: Rotor 120** **tug1: Rotor 120** **tug2: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Starboard quarter tug1: Center lead aft tug2: Center lead front tug4: Starboard B2
Tug location - End:	tug3: Port quarter tug1: Center lead aft tug2: Center lead front tug4: Port midship
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 5 tug1: 5 tug2: 5 tug4: 5 Average: 5.0

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug1: No tug2: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug1: 5 tug2: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug1: 5 tug2: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug1: n tug2: n tug4: n
If Yes, please explain why	tug3: Run was successful tug1: No tug2: No issues tug4: Emergency maneuver. Ship lost power. Tug started assisting on starboard bow then shifted to port midship. Safe run, tugs able to overcome engine failure on ship.
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug1: n tug2: n tug4: n
Run was _____ based on run parameters	tug3: successful tug1: successful tug2: successful tug4: successful

Run #9

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug3: Rotor 120** **tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug1: Center lead front tug3: Starboard B1 tug2: Starboard quarter rtug5: Port B2 tug4: Center lead aft
Tug location - End:	tug1: Center lead front tug3: Starboard B1 tug2: Starboard quarter rtug5: Starboard midship tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 tug3: 5 tug2: 5

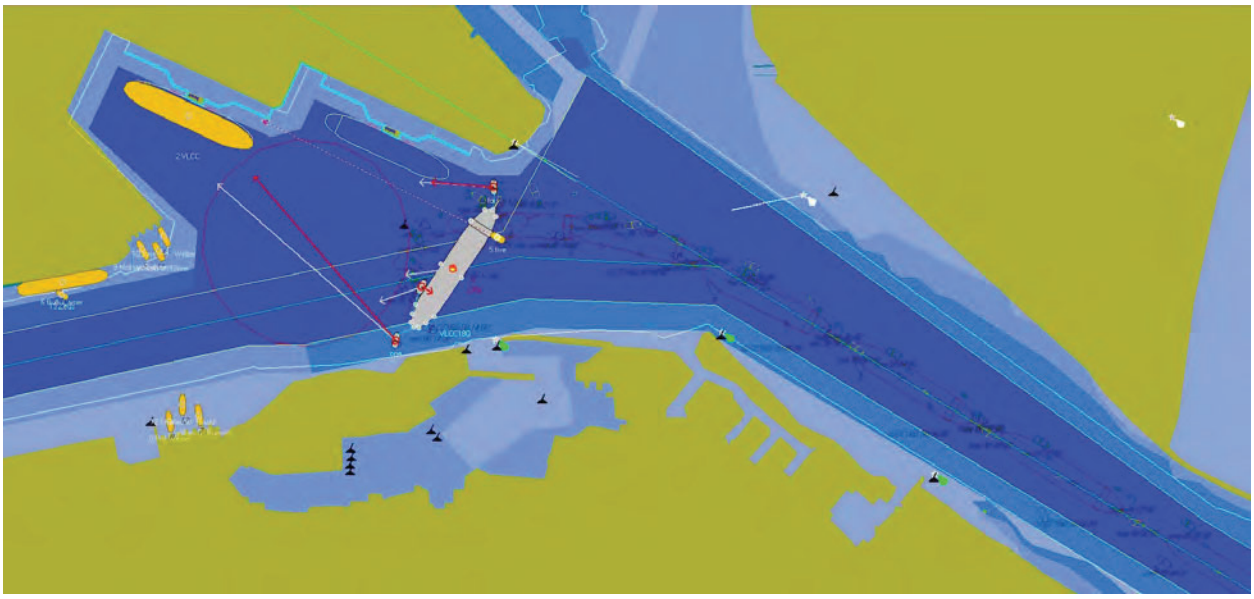
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug3: No tug2: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug3: 5 tug2: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug3: 5 tug2: 5 rtug5: 4 tug4: 5 Average: 4.8
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug3: n tug2: y rtug5: n tug4: n
If Yes, please explain why	tug1: No tug3: I had no difficulty on the starboard bow and did not push for any extended amount of time tug2: Evolution went smoothly with out issue rtug5: Good run tug4: All commands executed easily.
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug3: n tug2: n rtug5: n tug4: n

Tug Report

Run was _____ based on run parameters	tug1: successful tug3: successful tug2: successful rtug5: successful tug4: successful

Run #10

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



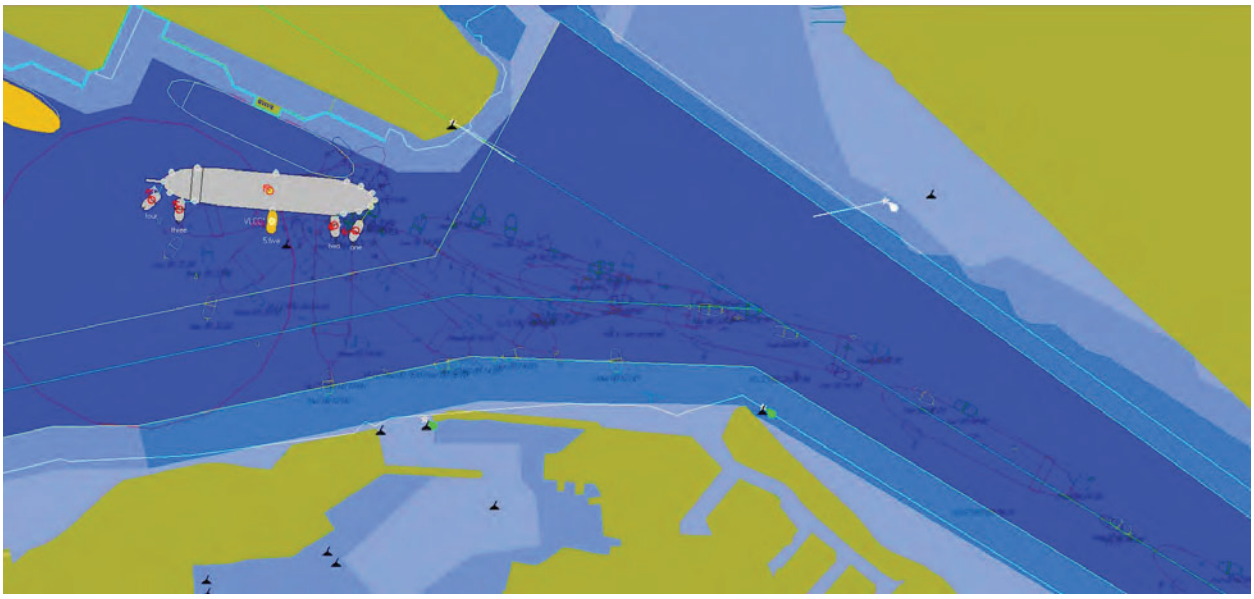
Question	Answers
Tug Type:	**tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front rtug5: Port B2 tug1: Center lead aft tug4: Starboard B2
Tug location - End:	tug2: Center lead front rtug5: Starboard quarter tug1: Center lead aft tug4: Starboard B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 4 rtug5: 5 tug1: 5 tug4: 5 Average: 4.8

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No rtug5: No tug1: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 3 rtug5: 5 tug1: 3 tug4: 5 Average: 4.0
If the tug configuration was not adequate, please explain why.	tug2: Two tugs lost power and working lines so we were down to 3 tugs
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 3 rtug5: 5 tug1: 3 tug4: 3 Average: 3.5
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n rtug5: n tug1: n tug4: n
If Yes, please explain why	tug2: N/a rtug5: A tug1: No tug4: Ship grounded after multiple tug failures.
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n rtug5: n tug1: n tug4: n
Run was _____ based on run parameters	tug2: successful rtug5: unsuccessful tug1: unsuccessful tug4: unsuccessful

If the run was not successful, please explain why.	rtug5: Ship Grounded tug1: Too many failures tug4: Ship grounded after multiple tug failures. Unable to overcome the current forces.
Additional Comments:	rtug5: This was an emergency situation. Tug three parted line and sank. Tug two had a black out condition. The ship ran aground after that.

Run #11

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**rtug5: Robot Rotor 120** **tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	rtug5: Port B2 tug3: Starboard quarter tug2: Center lead front tug1: Center lead aft tug4: Starboard B2
Tug location - End:	rtug5: Starboard midship tug3: Starboard quarter tug2: Center lead front tug1: Center lead aft tug4: Starboard B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	rtug5: 5 tug3: 5 tug2: 5

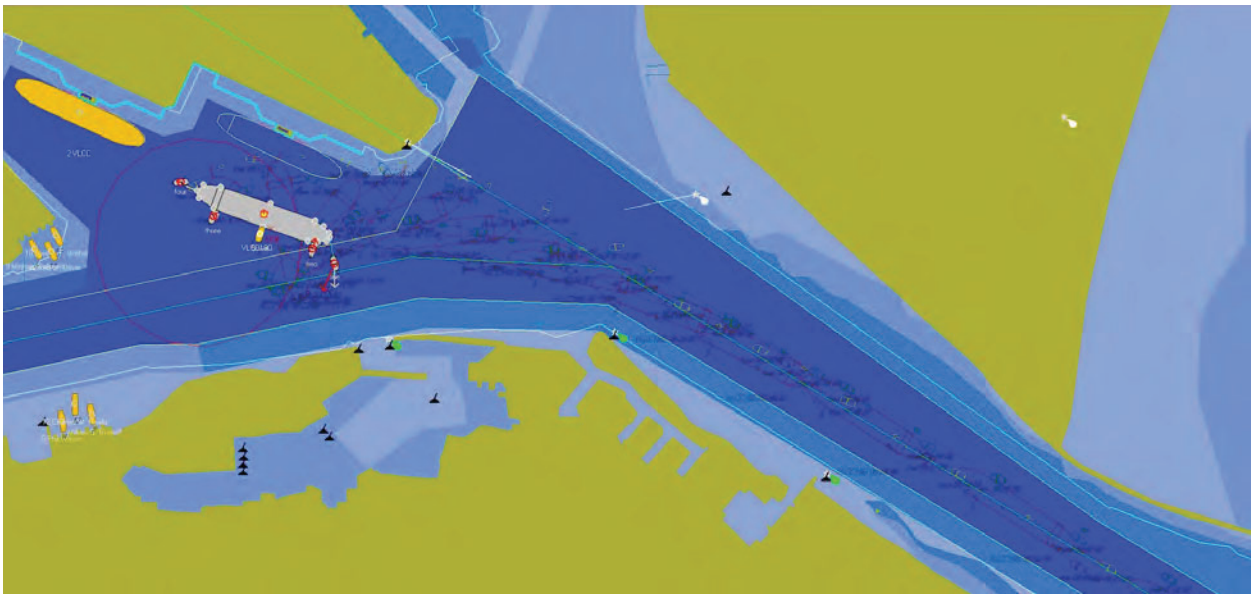
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	rtug5: No tug3: No tug2: No tug1: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	rtug5: 5 tug3: 5 tug2: 5 tug1: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	rtug5: 5 tug3: 5 tug2: 5 tug1: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	rtug5: n tug3: n tug2: n tug1: n tug4: n
If Yes, please explain why	rtug5: A tug3: Run was successful tug2: No issues tug1: No tug4: Overall safe maneuver. Tugs had vessel under control at all times.
Did you feel that you were asked to operate at max power for an extended period of time?	rtug5: n tug3: n tug2: n tug1: n tug4: n

Tug Report

Run was _____ based on run parameters	rtug5: successful tug3: successful tug2: successful tug1: successful tug4: successful

Run #12

Location: Jetties Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



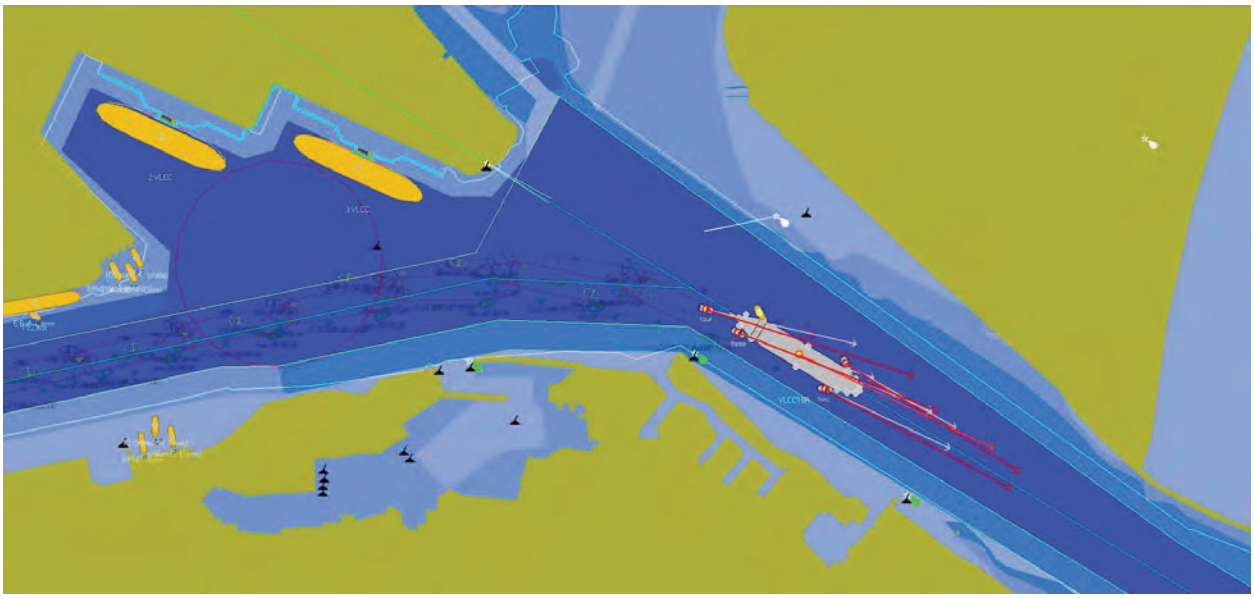
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug3: Starboard B1 tug2: Starboard quarter tug1: Center lead front tug4: Center lead aft rtug5: Port B2
Tug location - End:	tug3: Starboard B1 tug2: Starboard quarter tug1: Center lead front tug4: Center lead aft rtug5: Starboard midship
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug2: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 3 rtug5: 5 Average: 4.6
If the maneuvering room was not adequate, please explain why.	tug4: I miscalculated the depth contour and bumped bottom. Did not stop and exercise completed successfully.
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No tug1: No tug4: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 tug4: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 4 tug1: 5 tug4: 5 rtug5: 5 Average: 4.8
If not safe, please explain why.	tug4: Tug captain error. Misjudged depth contour and bumped bottom.
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n tug4: n rtug5: n
If Yes, please explain why	tug4: All commands executed successfully and easily.
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: n tug1: n tug4: n

	rtug5: n
Run was _____ based on run parameters	tug3: successful tug2: successful tug1: successful tug4: successful rtug5: successful
Additional Comments:	rtug5: Was running free alongside in the beginning.

Run #13

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



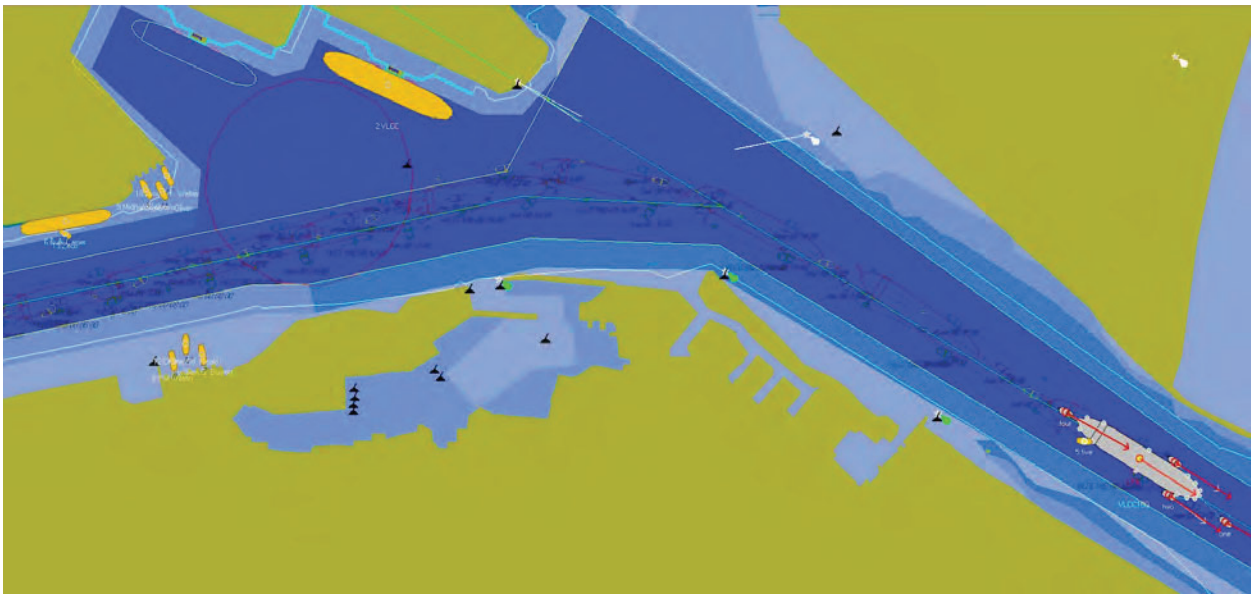
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug2: Port B1 tug1: Center lead aft tug4: Starboard B2 rtug5: Port quarter
Tug location - End:	tug2: Port B1 tug1: Center lead aft tug4: Starboard B2 rtug5: Port quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug1: 5 tug4: 5 rtug5: 5 Average: 5.0

Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug1: No tug4: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug1: 5 tug4: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug1: 5 tug4: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug1: n tug4: n rtug5: n
If Yes, please explain why	tug2: No issues tug1: No tug4: Maneuver went well. Tugs assisted as directed. rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug1: n tug4: n rtug5: n
Run was _____ based on run parameters	tug2: successful tug1: successful tug4: successful rtug5: successful
Additional Comments:	rtug5: No commands given from ship

Run #14

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**rtug5: Robot Rotor 120** **tug1: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	rtug5: Starboard quarter tug1: Center lead front tug2: Port B1 tug3: Starboard B1 tug4: Center lead aft
Tug location - End:	rtug5: Starboard quarter tug1: Center lead front tug2: Port B1 tug3: Starboard B1 tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	rtug5: 5 tug1: 5 tug2: 5

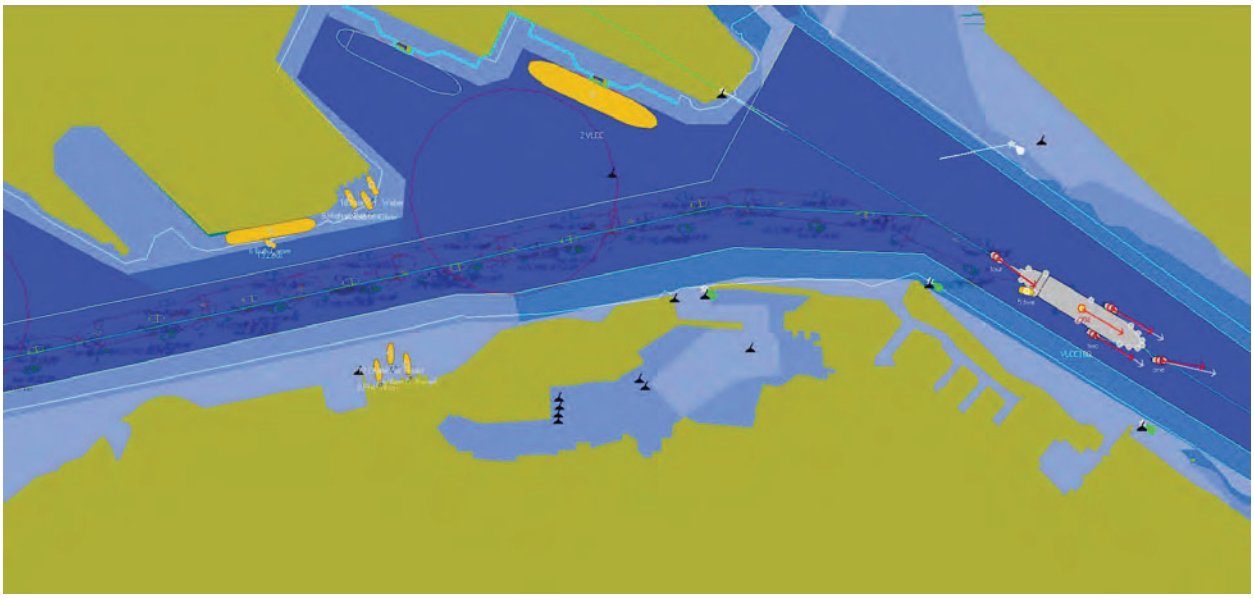
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	rtug5: No tug1: No tug2: No tug3: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	rtug5: 5 tug1: 5 tug2: 5 tug3: 5 tug4: 5 Average: 5.0
If the tug configuration was not adequate, please explain why.	tug4: Tug was very effective for indirect steering
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	rtug5: 5 tug1: 5 tug2: 5 tug3: 4 tug4: 5 Average: 4.8
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	rtug5: n tug1: n tug2: n tug3: n tug4: n
If Yes, please explain why	tug3: There was a few times that I was pushing full to hold that bow up tug4: Tug maneuvered well. Short bursts of power were given for steerage. As soon as tug delivered the force, the pilot asked to reduce
Did you feel that you were asked to operate at max power for an extended period of time?	rtug5: n tug1: n tug2: n tug3: n tug4: n

Tug Report

Run was _____ based on run parameters	rtug5: successful tug1: successful tug2: successful tug3: successful tug4: successful

Run #15

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



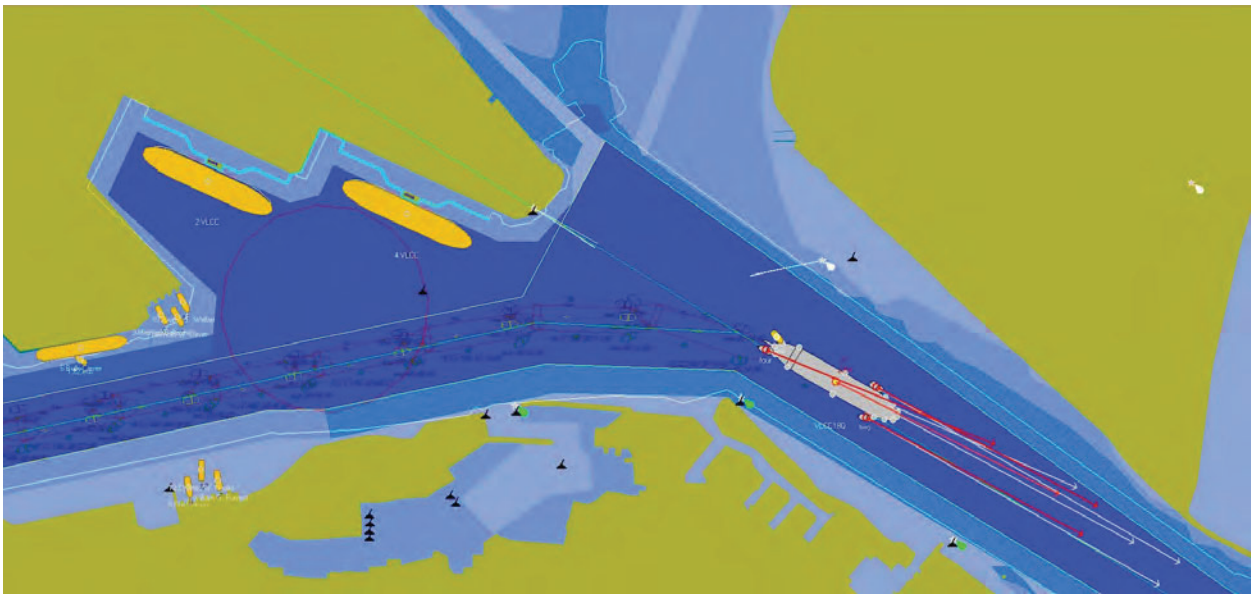
Question	Answers
Tug Type:	**tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120**
Tug Location - Beginning:	tug1: Center lead front rtug5: Starboard quarter tug4: Center lead aft tug2: Port B1 tug3: Starboard B1
Tug location - End:	tug1: Center lead front rtug5: Starboard quarter tug4: Center lead aft tug2: Port B1 tug3: Starboard B1
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 rtug5: 5 tug4: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug3: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No rtug5: No tug4: Yes tug2: No tug3: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 rtug5: 5 tug4: 5 tug2: 5 tug3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 rtug5: 5 tug4: 5 tug2: 5 tug3: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n rtug5: n tug4: n tug2: n tug3: n
If Yes, please explain why	tug1: No rtug5: A tug4: Easy maneuver. No tugs used tug2: Evolution went smoothly with minimal tug usage tug3: No issues
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n rtug5: n tug4: n tug2: n tug3: n
Run was _____ based on run parameters	tug1: successful rtug5: successful

	tug4: successful tug2: successful tug3: successful
Additional Comments:	rtug5: No commands given to me tug3: Very minimal tug use on the stud bow tug

Run #16

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



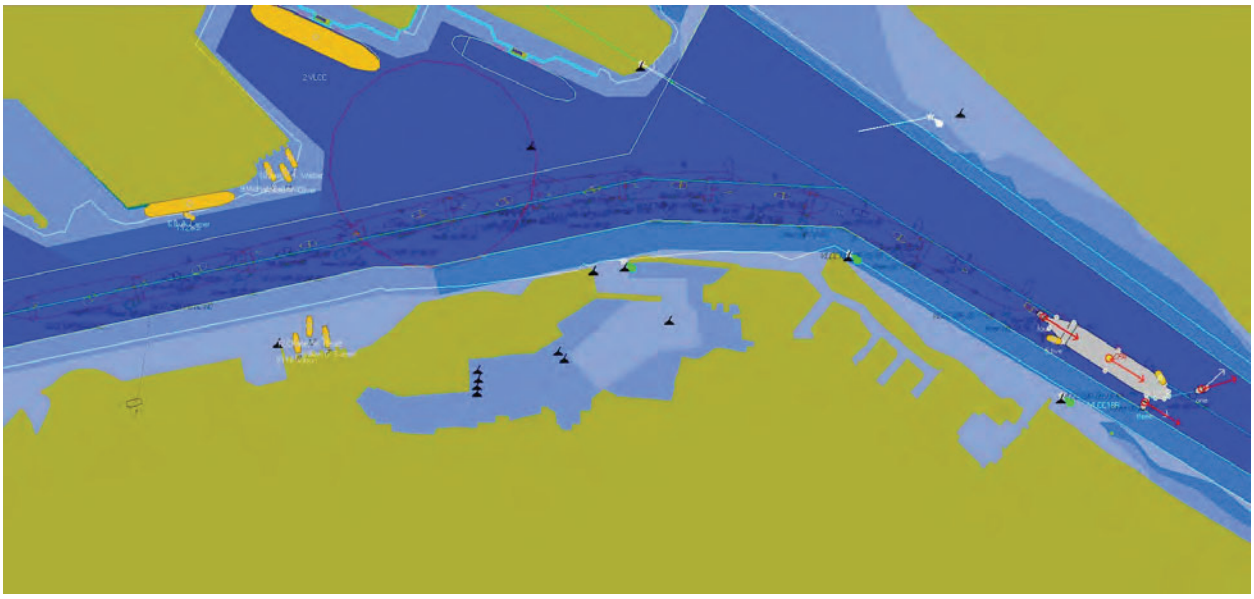
Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Starboard B2 tug2: Port B1 tug1: Starboard quarter rtug5: Port quarter
Tug location - End:	tug4: Starboard B2 tug2: Port B1 tug1: Starboard quarter rtug5: Port quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0

Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug1: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug1: n rtug5: n
If Yes, please explain why	tug4: No commands tug2: Never had to work the tugNo issues tug1: No rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug1: n rtug5: n
Run was _____ based on run parameters	tug4: successful tug2: successful tug1: successful rtug5: successful
Additional Comments:	rtug5: No tug assistance

Run #17

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug2: Robot Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug2: Port B1 rtug5: Starboard quarter
Tug location - End:	tug4: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug2: Port B1 rtug5: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug2: 5 tug1: 5

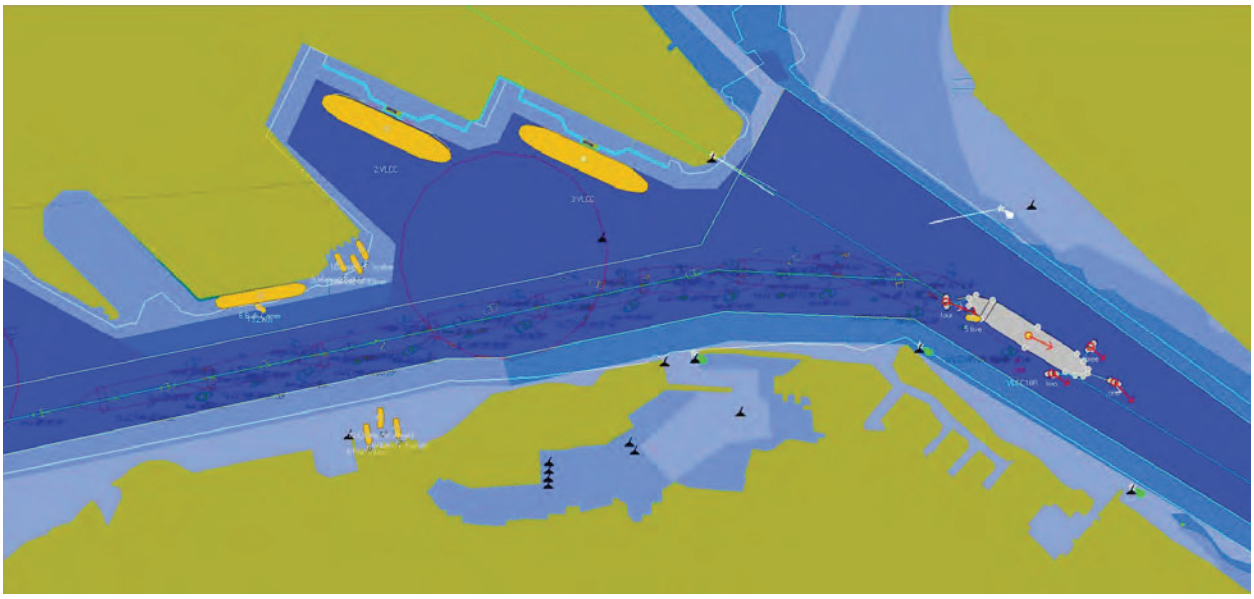
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug2: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug1: No rtug2: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug1: 5 rtug2: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 tug1: 5 rtug2: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug1: n rtug2: n rtug5: n
If Yes, please explain why	tug4: Loss of power on ship. Dead tow to berth. No issues. Tugs were able to overcome ship failure with ease. tug2: No issues tug1: No rtug2: A rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug1: n rtug2: n rtug5: n

Tug Report

Run was _____ based on run parameters	tug4: successful tug2: successful tug1: successful rtug2: successful rtug5: successful
Additional Comments:	rtug2: Emergency situation, ship lost power headed outbound for sea rtug5: Emergency situation, ship lost power headed out to sea

Run #18

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120** **tug3: Rotor 120**
Tug Location - Beginning:	tug1: Center lead aft tug2: Center lead front rtug5: Starboard quarter tug4: Starboard B2 tug3: Port B1
Tug location - End:	tug1: Center lead aft tug2: Center lead front rtug5: Starboard quarter tug4: Starboard B2 tug3: Port B1
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 tug2: 5 rtug5: 5

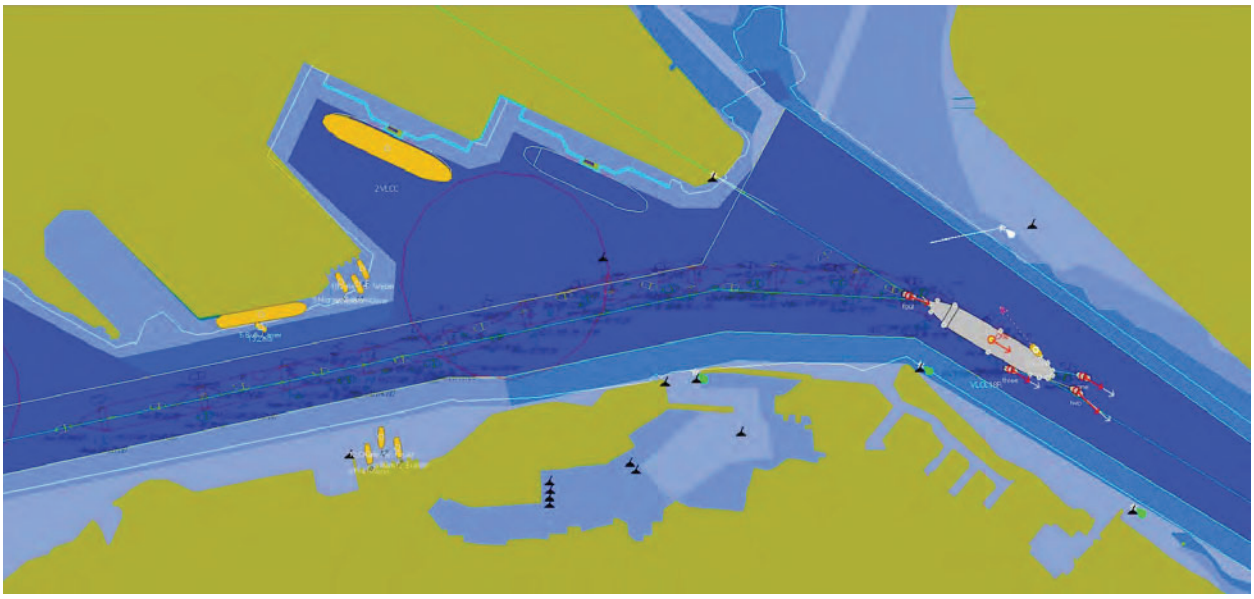
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 5 tug3: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug2: No rtug5: No tug4: No tug3: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug2: 5 rtug5: 5 tug4: 5 tug3: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug2: 5 rtug5: 5 tug4: 5 tug3: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug2: n rtug5: n tug4: n tug3: n
If Yes, please explain why	tug1: No tug2: No issues rtug5: A tug4: Rudder failure. Tugs were able to overcome ship failure and tow ship out safely. tug3: Successful run
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug2: n rtug5: n tug4: n tug3: n

Tug Report

Run was _____ based on run parameters	tug1: successful tug2: successful rtug5: successful tug4: successful tug3: successful
Additional Comments:	rtug5: No commands given to tug

Run #19

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug3: Rotor 120** **tug2: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug1: Center lead aft rtug5: Port B2 tug3: Starboard B2 tug2: Center lead front tug4: Center lead front
Tug location - End:	tug1: Center lead aft rtug5: Port B2 tug3: Starboard B2 tug2: Center lead front tug4: Center lead front
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 rtug5: 5 tug3: 5

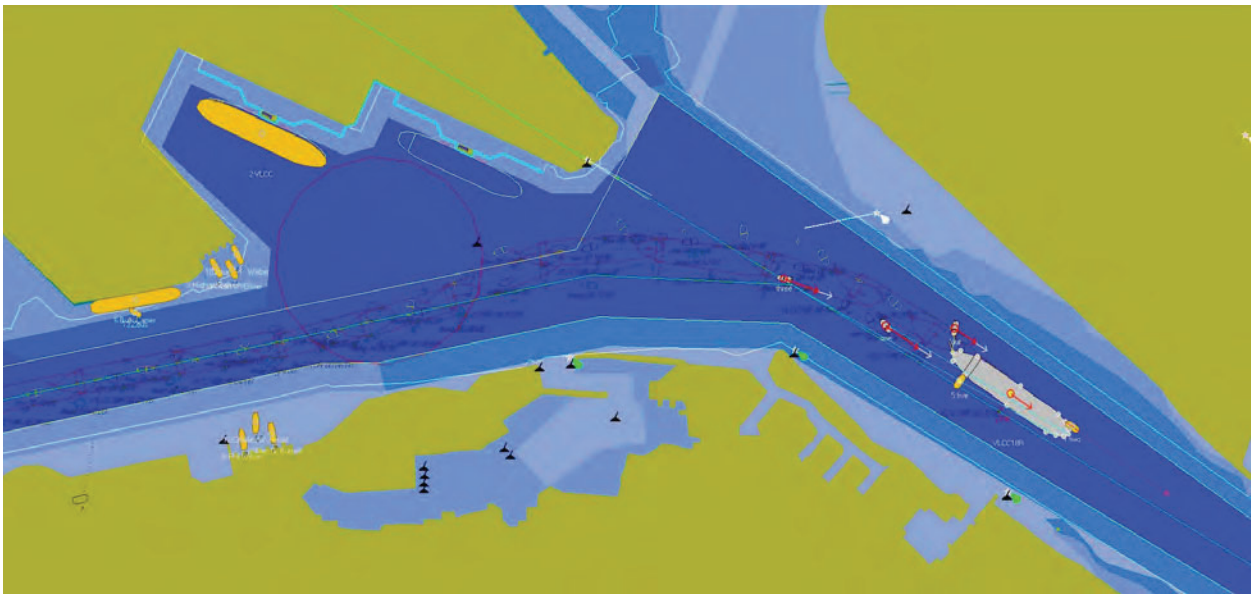
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No rtug5: No tug3: No tug2: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 rtug5: 5 tug3: 5 tug2: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 rtug5: 5 tug3: 5 tug2: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n rtug5: n tug3: n tug2: n tug4: n
If Yes, please explain why	tug1: No rtug5: A tug3: Successful run tug2: No issues tug4: Simple maneuver on the bow. Used both tugs in tandem. Worked very well.
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n rtug5: n tug3: n tug2: n tug4: n

Tug Report

Run was _____ based on run parameters	tug1: successful rtug5: successful tug3: successful tug2: successful tug4: successful

Run #20

Location: Ferries Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug2: Rotor 120** **tug4: Rotor 120** **rtug2: Robot Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug1: Center lead aft tug2: Center lead front tug4: Starboard B2 rtug2: Port B1 rtug5: Starboard quarter
Tug location - End:	tug1: Center lead aft tug2: Center lead front tug4: Starboard B2 rtug2: Port B1 rtug5: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 tug2: 5 tug4: 5

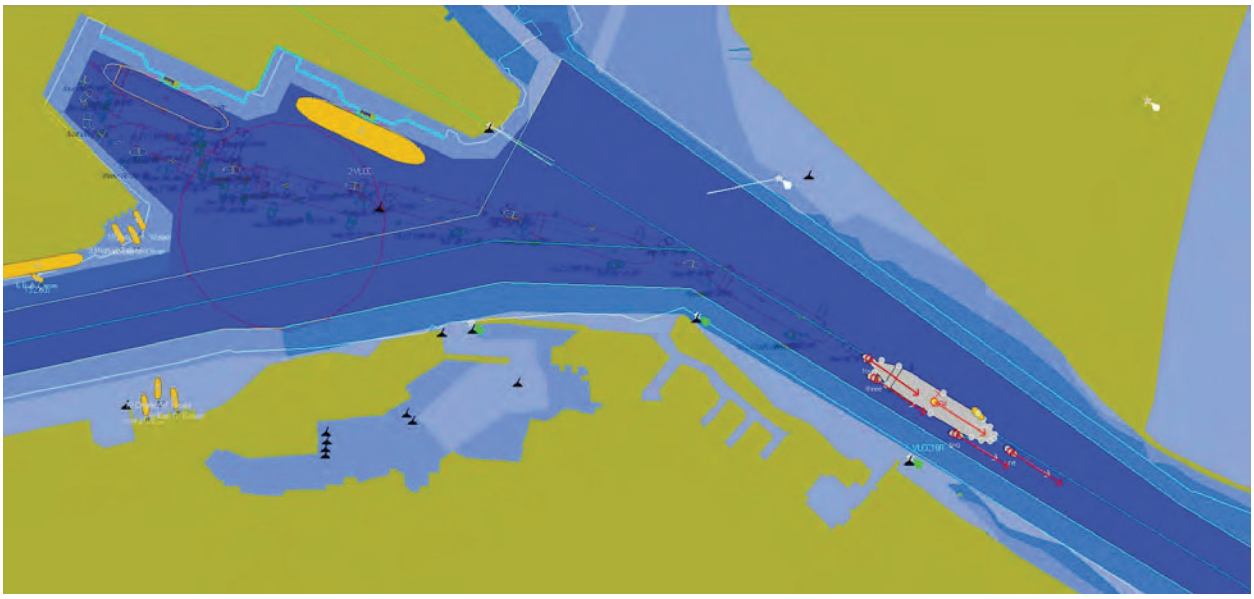
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug2: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug2: No tug4: No rtug2: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug2: 5 tug4: 5 rtug2: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug2: 5 tug4: 5 rtug2: 4 rtug5: 4 Average: 4.6
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug2: n tug4: n rtug2: n rtug5: n
If Yes, please explain why	tug1: No tug2: No issues tug4: Ship lost rudder use and locked hard to port. Tug power was sufficient to successfully tow ship out with locked rudder rtug2: A rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug2: n tug4: y rtug2: n rtug5: n

Tug Report

Run was _____ based on run parameters	tug1: successful tug2: successful tug4: successful rtug2: successful rtug5: successful
Additional Comments:	rtug2: Emergency rudder failure on ship rtug5: Rudder on ship locked hard port, emergency situation

Run #21

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



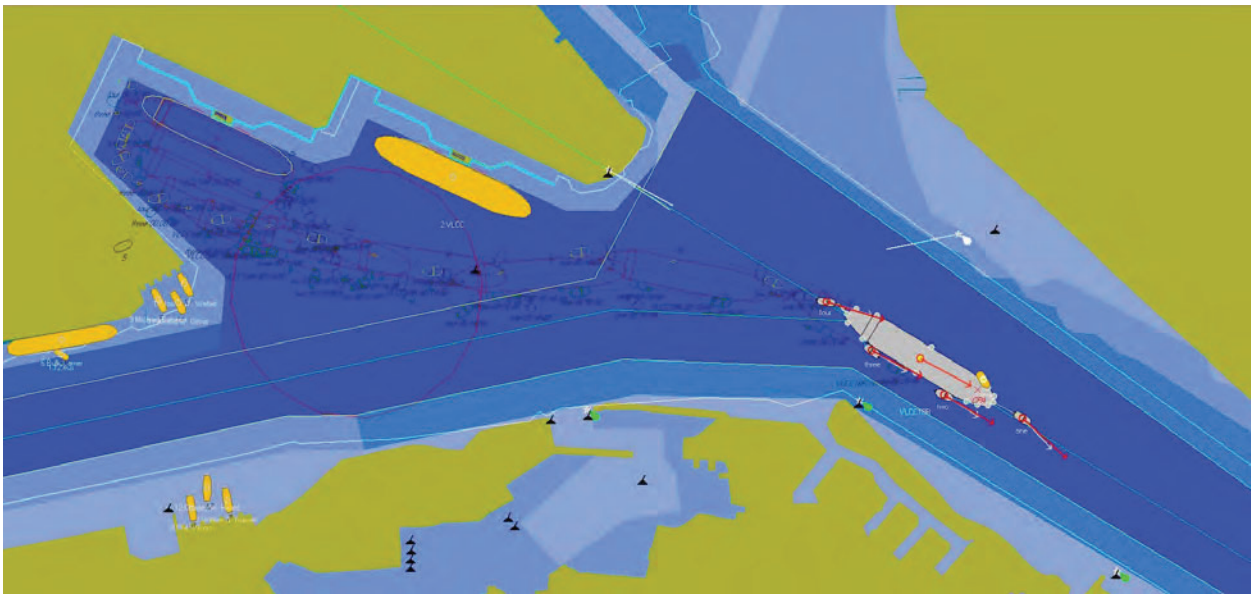
Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **rtug5: Robot Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	tug4: Starboard quarter tug2: Center lead front tug3: Center lead aft rtug5: Port B2 tug1: Starboard B1
Tug location - End:	tug4: Starboard quarter tug2: Center lead front tug3: Center lead aft rtug5: Port B2 tug1: Starboard B1
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug2: 5 tug3: 4

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 4 tug1: 5 Average: 4.6
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug3: No rtug5: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug3: 5 rtug5: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 tug3: 5 rtug5: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug3: n rtug5: n tug1: n
If Yes, please explain why	tug4: Smooth run. tug2: No issues tug3: Successful run rtug5: A tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug3: n rtug5: n tug1: n
Run was _____ based on run parameters	tug4: successful tug2: successful

	tug3: successful rtug5: successful tug1: successful

Run #22

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **tug3: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Starboard B2 tug2: Center lead front tug1: Center lead aft tug3: Starboard quarter rtug5: Starboard midship
Tug location - End:	tug4: Starboard B2 tug2: Center lead front tug1: Center lead aft tug3: Starboard quarter rtug5: Port B1
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug2: 5 tug1: 5

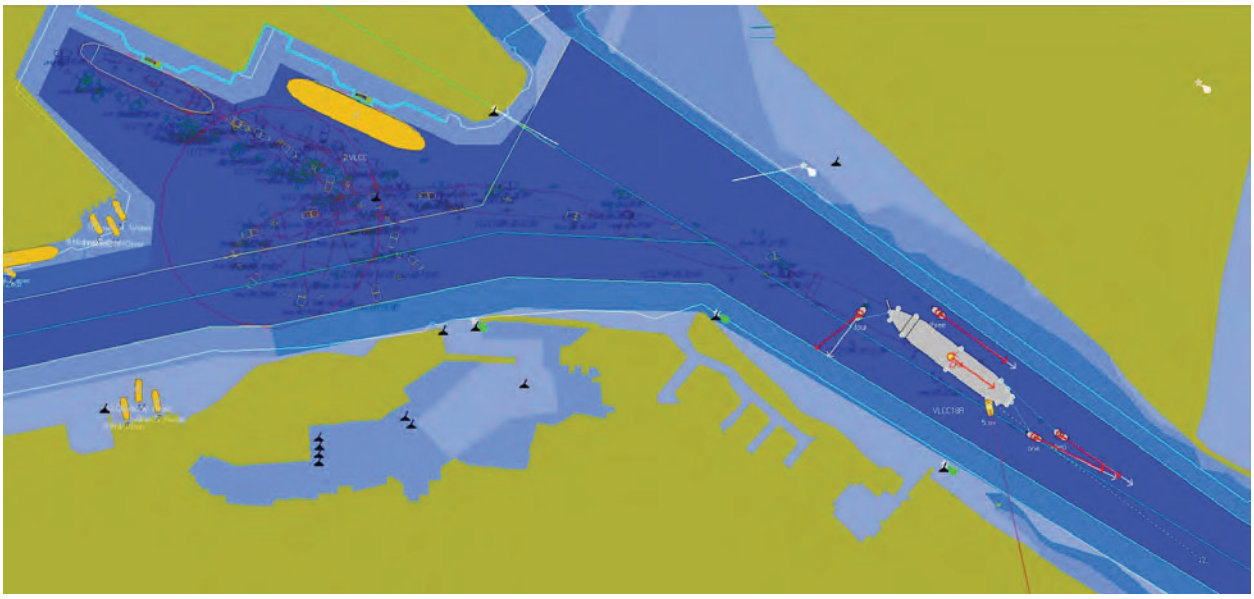
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 3 rtug5: 5 Average: 4.6
If the maneuvering room was not adequate, please explain why.	tug3: Got tight on starboard quarter for tug 3
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug1: No tug3: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug1: 5 tug3: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 tug1: 5 tug3: 4 rtug5: 5 Average: 4.8
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug1: n tug3: n rtug5: n
If Yes, please explain why	tug4: Overall safe run tug2: No issues tug1: No tug3: Successful run rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug1: n tug3: n rtug5: n

Tug Report

Run was _____ based on run parameters	tug4: successful tug2: successful tug1: successful tug3: successful rtug5: successful
Additional Comments:	rtug5: Went from midship to port bow immediately. Moved again to stab bow, then back to port bow 1

Run #23

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments: Head-in with 6 tugs



Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **rtug2: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Port B1 tug3: Port quarter tug1: Center lead aft rtug5: Port midship rtug2: Starboard B2 tug4: Center lead front
Tug location - End:	tug2: Port B1 tug3: Port quarter tug1: Center lead aft rtug5: Starboard quarter rtug2: Starboard B2 tug4: Center lead front

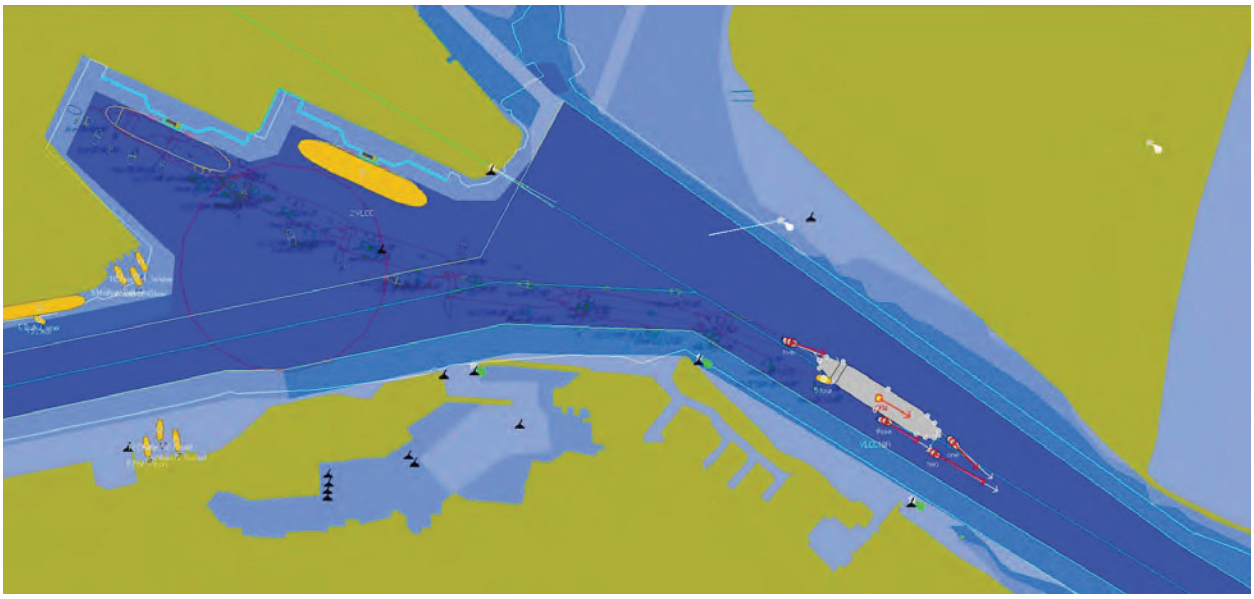
Tug Report

I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug3: 5 tug1: 5 rtug5: 5 rtug2: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug1: No rtug5: No rtug2: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug3: 5 tug1: 5 rtug5: 5 rtug2: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug3: 5 tug1: 5 rtug5: 5 rtug2: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug3: n tug1: n rtug5: n rtug2: n tug4: n
If Yes, please explain why	tug2: No issues tug3: Successful run tug1: No rtug5: A rtug2: A tug4: Turned loaded ship that was head into HI west and then towed offshore.

Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug3: n tug1: n rtug5: n rtug2: n tug4: y
Run was _____ based on run parameters	tug2: successful tug3: successful tug1: successful rtug5: successful rtug2: successful tug4: successful

Run #24

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



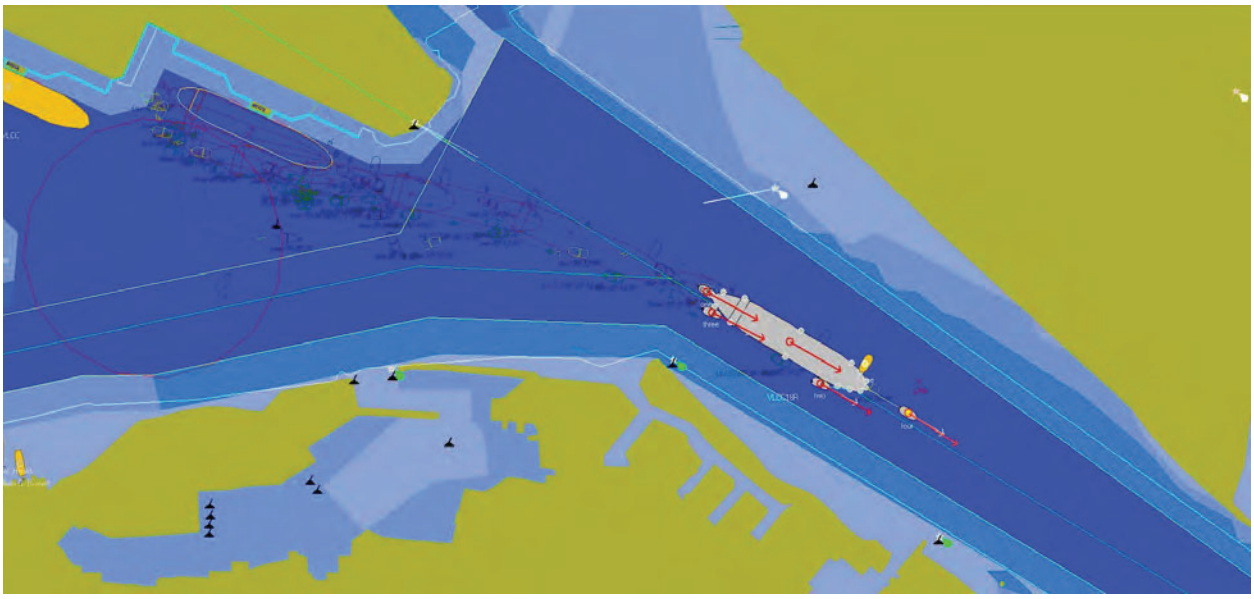
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Center lead aft tug2: Center lead front tug1: Starboard B1 rtug5: Starboard quarter tug4: Starboard B3
Tug location - End:	tug3: Center lead aft tug2: Center lead front tug1: Starboard B1 rtug5: Starboard quarter tug4: Starboard B3
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug2: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 3 tug4: 5 Average: 4.6
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No tug1: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 5 tug1: 5 rtug5: 3 tug4: 4 Average: 4.4
If not safe, please explain why.	tug4: Got close to Cline's Point, but in good water all the time
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n rtug5: n tug4: n
If Yes, please explain why	tug3: Successful run tug2: No issues tug1: No rtug5: A tug4: Close with Cline's Point, but stayed in good water.
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: n tug1: n rtug5: n

	tug4: n
Run was _____ based on run parameters	tug3: successful tug2: successful tug1: successful rtug5: successful tug4: successful
Additional Comments:	rtug5: Came close to harbor Island point. Had a little bit more room to maneuver but not much

Run #25

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Starboard quarter tug2: Starboard B1 tug1: Center lead aft rtug5: Port B1 tug4: Center lead front
Tug location - End:	tug3: Starboard quarter tug2: Starboard B1 tug1: Center lead front rtug5: Port B1 tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug2: 5 tug1: 5

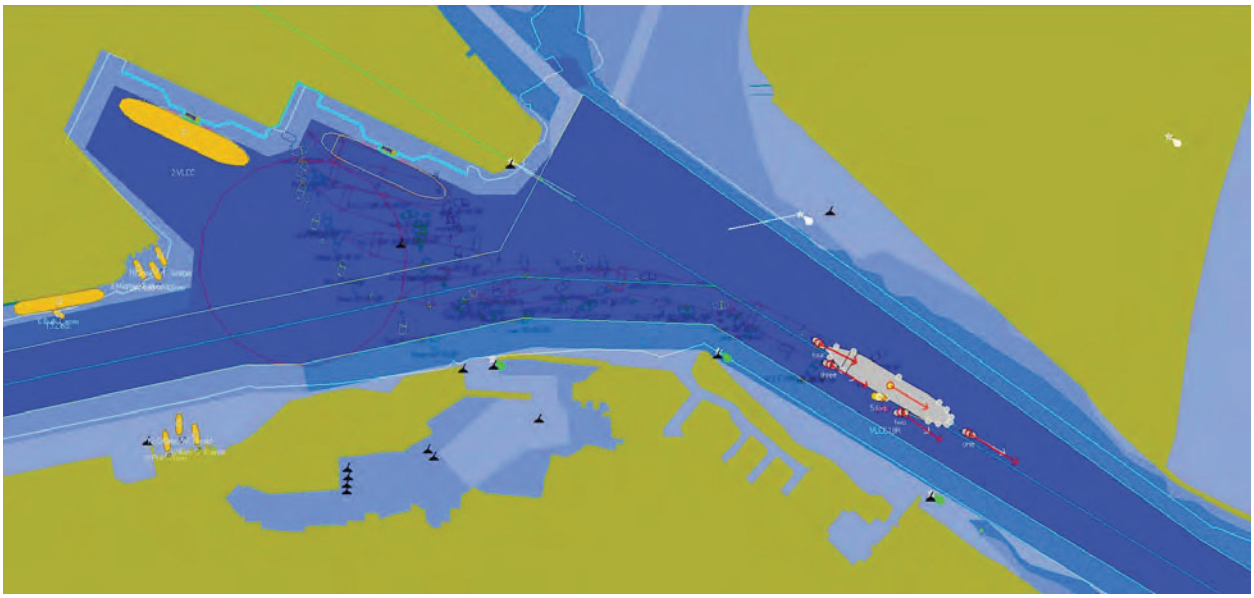
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No tug1: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n rtug5: n tug4: n
If Yes, please explain why	tug3: Successful run tug2: No issues. Never did any work with the tug tug1: No rtug5: A tug4: Tug winch failure. Swapped from pulling center lead forward to pushing center lead aft. All went well
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: n tug1: n rtug5: n tug4: n

Tug Report

Run was _____ based on run parameters	tug3: successful tug2: successful tug1: successful rtug5: successful tug4: successful

Run #26

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:NOTE: Tug 1 mistakenly put center lead forward when he should have been on stbd bow



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug3: Rotor 120** **tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug1: Center lead front tug3: Center lead aft tug2: Center lead front rtug5: Port B2 tug4: Starboard quarter
Tug location - End:	tug1: Center lead front tug3: Center lead aft tug2: Center lead front rtug5: Starboard midship tug4: Starboard quarter

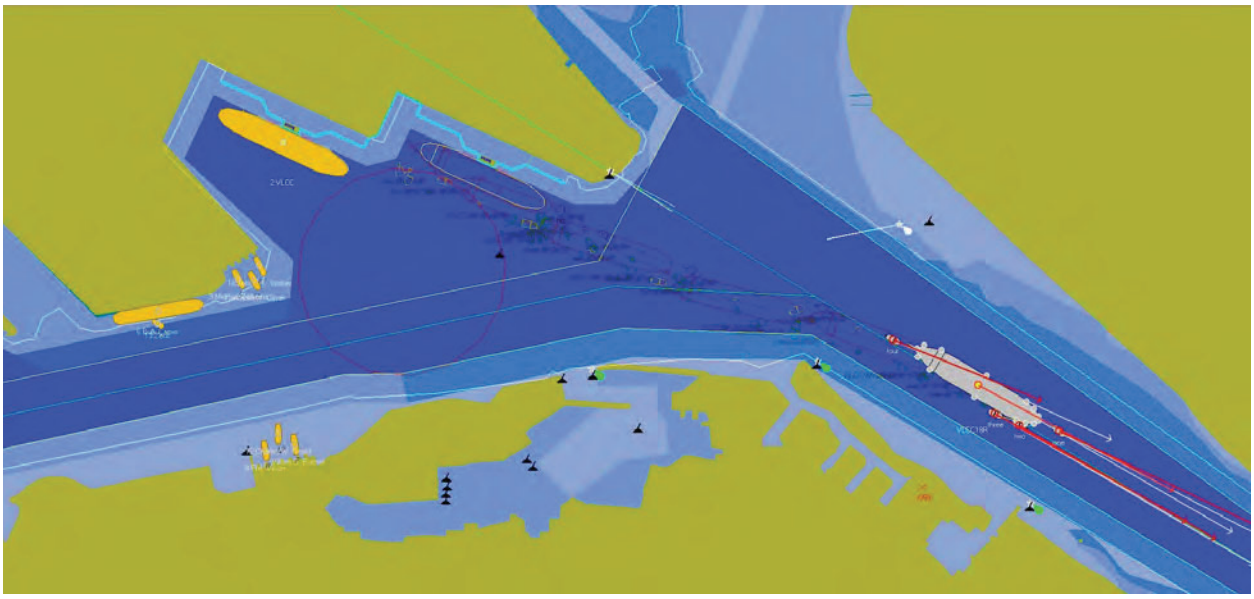
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 tug3: 5 tug2: 5 rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug3: No tug2: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug3: 5 tug2: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug3: 5 tug2: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug3: n tug2: n rtug5: n tug4: n
If Yes, please explain why	tug1: No tug3: Run was smooth tug2: No issues rtug5: A tug4: Easy run
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug3: n tug2: n rtug5: n tug4: n

Tug Report

Run was _____ based on run parameters	tug1: successful tug3: successful tug2: successful rtug5: successful tug4: successful

Run #27

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug3: Rotor 120** **tug1: Rotor 120** **tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Center lead front tug1: Center lead front tug2: Starboard B1 rtug5: Starboard quarter tug4: Center lead aft
Tug location - End:	tug3: Center lead front tug1: Center lead front tug2: Starboard B1 rtug5: Port B1 tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 4 tug1: 5 tug2: 5

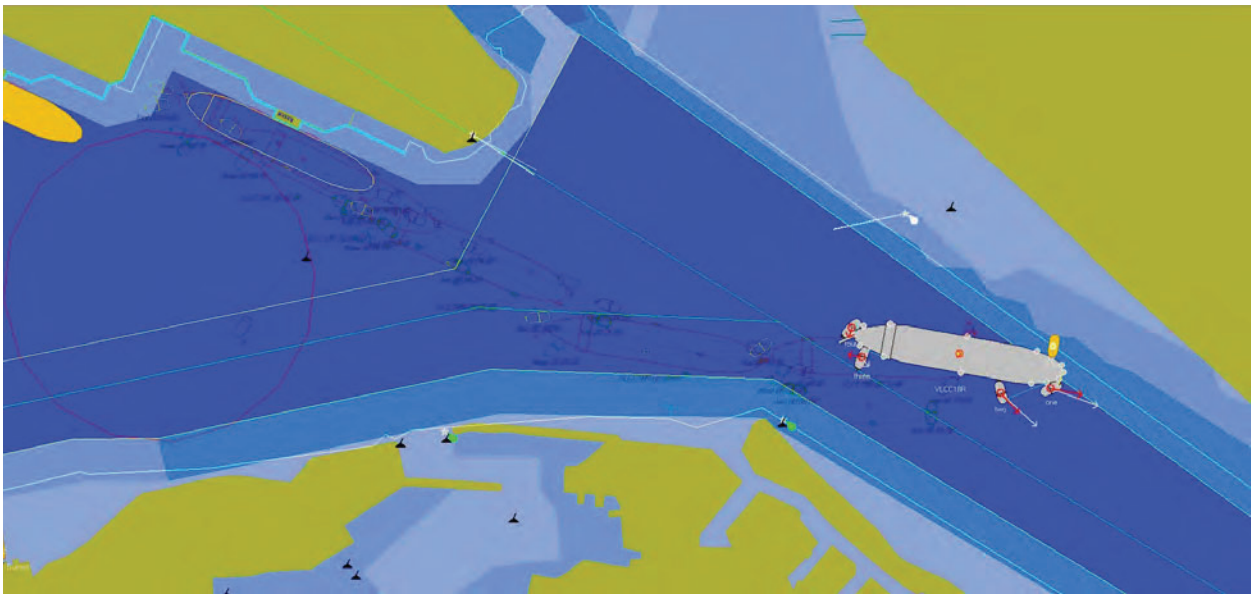
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 4.8
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug1: No tug2: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 4 tug1: 5 tug2: 5 rtug5: 5 tug4: 5 Average: 4.8
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 4 tug1: 5 tug2: 5 rtug5: 4 tug4: 5 Average: 4.6
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug1: n tug2: n rtug5: n tug4: n
If Yes, please explain why	tug3: No issues tug1: No tug2: Run went smoothly rtug5: A tug4: Tugs were able overcome the current effects and assist the vessel around the turn
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug1: n tug2: n rtug5: n tug4: n

Tug Report

Run was _____ based on run parameters	tug3: successful tug1: successful tug2: successful rtug5: successful tug4: successful
Additional Comments:	rtug5: Shadowed ship after released from stern

Run #28

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



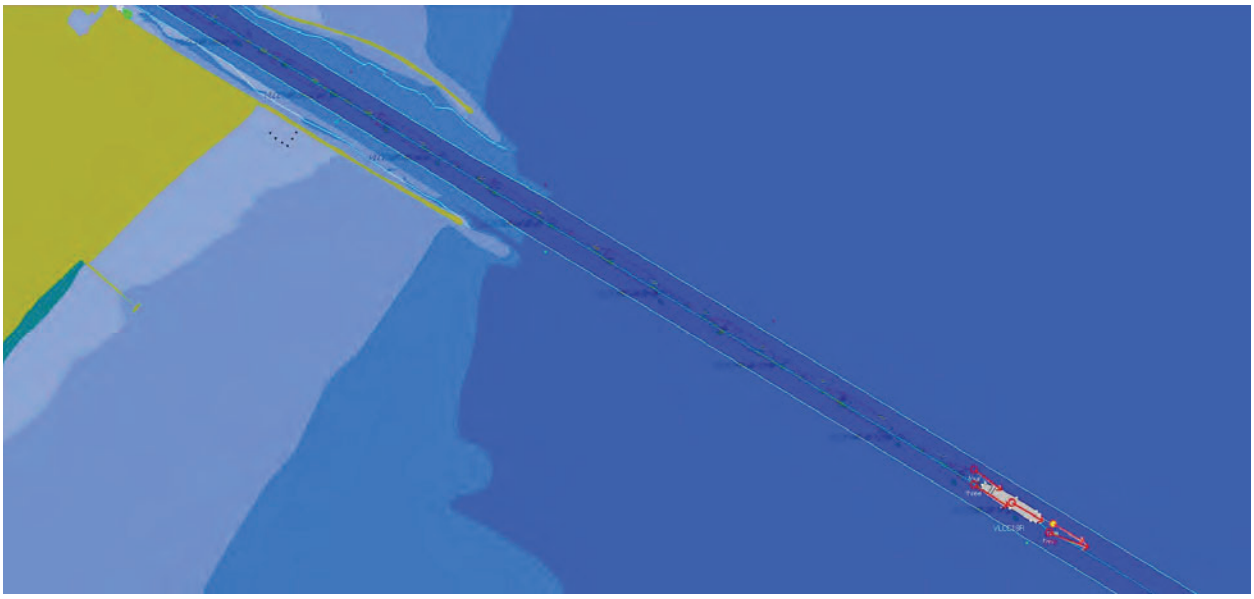
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug3: Starboard quarter tug1: Center lead aft rtug5: Port B1 tug4: Starboard B2
Tug location - End:	tug2: Center lead front tug3: Starboard quarter tug1: Center lead aft rtug5: Port B1 tug4: Starboard B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug2: 3 tug3: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 1 tug4: 3 Average: 3.4
If the maneuvering room was not adequate, please explain why.	rtug5: Ship ran aground tug4: Very close to Cline Point.
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug1: Yes rtug5: No tug4: Yes
If any of the environmental forces caused vessel operational limits to be exceeded, please explain why, and if the forces prevented you from performing any specific maneuver, what occurred.	tug4: The ship was overcome by the current force. Too much hull exposed to current broadside.
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 3 tug3: 5 tug1: 3 rtug5: 3 tug4: 3 Average: 3.4
If the tug configuration was not adequate, please explain why.	tug4: Tugs could not overcome the current effects.
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 3 tug3: 4 tug1: 1 rtug5: 1 tug4: 2 Average: 2.2
If not safe, please explain why.	rtug5: Tug was run aground tug4: Ship ran aground
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug3: n tug1: n rtug5: n tug4: n

If Yes, please explain why	tug2: I was not able to hold my 90 while pulling full to starboard and got tripped tug3: I felt comfortable on the quarter tug1: No rtug5: A tug4: Tug 1 ran into tug 2 when trying to pull ship to starboard.
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: y tug3: n tug1: n rtug5: n tug4: y
Run was _____ based on run parameters	tug2: unsuccessful tug3: unsuccessful tug1: unsuccessful rtug5: unsuccessful tug4: unsuccessful
If the run was not successful, please explain why.	tug3: Ship ran aground rtug5: Ship missed turn and ran aground on St Joe Island

Run #29

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: N Medium Comments: No robot tug

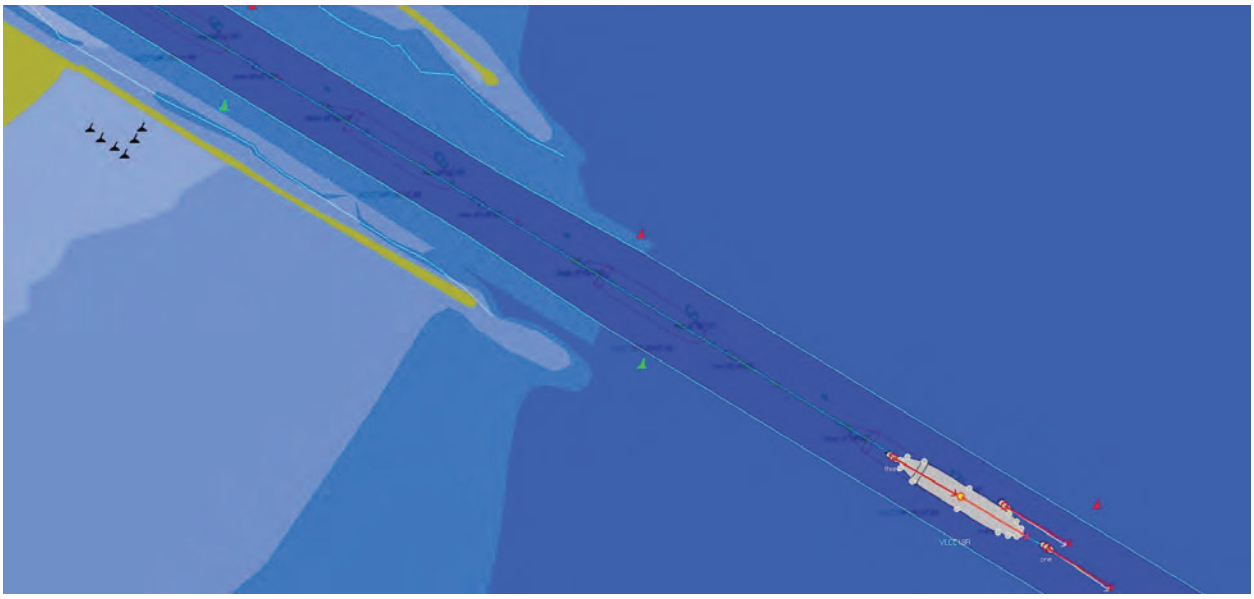


Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug4: Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug3: Starboard quarter tug4: Starboard B1 tug1: Port transom
Tug location - End:	tug2: Center lead front tug3: Starboard quarter tug4: Starboard B1 tug1: Port transom
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug3: 5 tug4: 5 tug1: 5 Average: 5.0

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug4: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug3: 5 tug4: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug3: 5 tug4: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug3: n tug4: n tug1: n
If Yes, please explain why	tug2: No issues tug3: Run was successful tug4: Escorted off bow to starboard of center lead. Towed vessel out. All worked well. tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug3: n tug4: n tug1: n
Run was _____ based on run parameters	tug2: successful tug3: successful tug4: successful tug1: successful

Run #30

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: N High Comments:

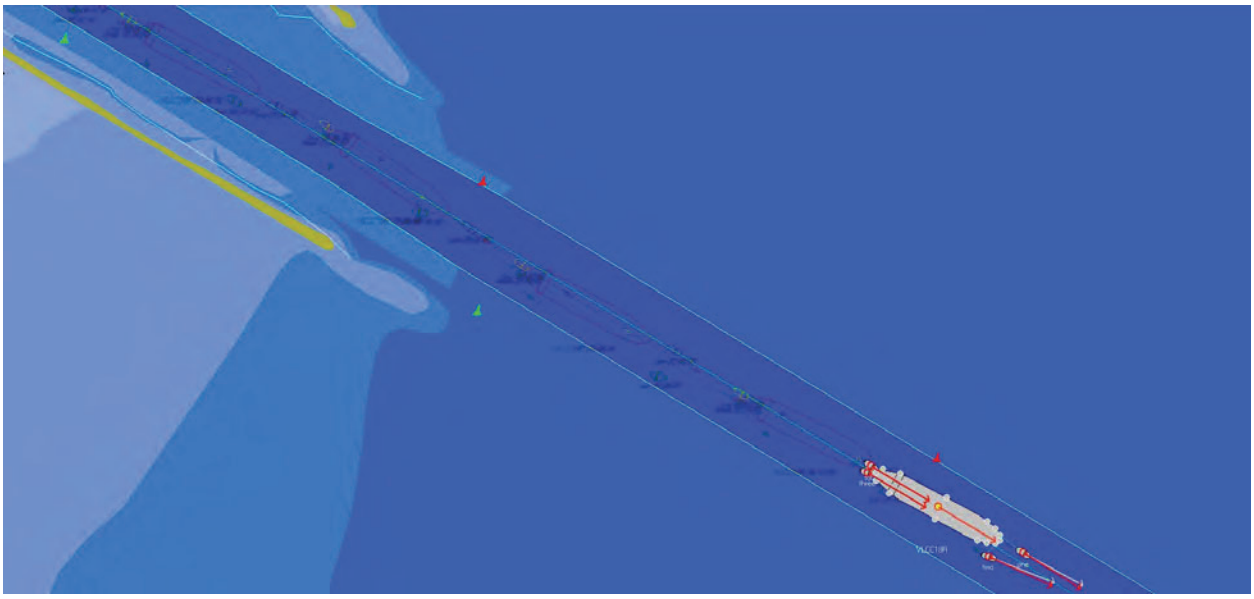


Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Rotor 120** **tug1: Robot Rotor 120**
Tug Location - Beginning:	tug3: Center lead aft tug2: Center lead front tug1: Center lead front
Tug location - End:	tug3: Center lead aft tug2: Center lead front tug1: Center lead front
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 5 tug2: 5 tug1: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No

	tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n
If Yes, please explain why	tug3: Run was successful tug2: No issues tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: n tug1: n
Run was _____ based on run parameters	tug3: successful tug2: successful tug1: successful

Run #31

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: - Offshore Wind and Current: S High Comments:



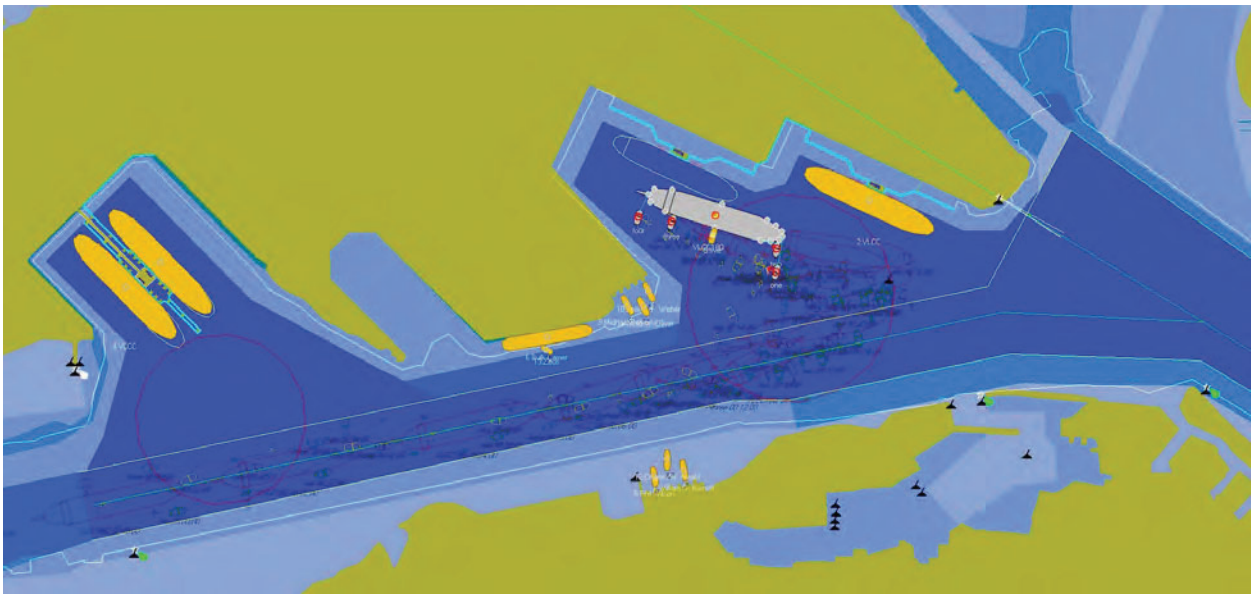
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug3: Starboard quarter tug1: Center lead front tug4: Port quarter
Tug location - End:	tug2: Center lead front tug3: Starboard quarter tug1: Center lead front tug4: Port quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug3: 5 tug1: 5 tug4: 5 Average: 5.0

Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug3: No tug1: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug3: 5 tug1: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug3: 5 tug1: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug3: n tug1: n tug4: n
If Yes, please explain why	tug2: No issues tug3: Run was successful tug1: No tug4: Pushing on transom on the way out to assist in increasing speed. Overall safe maneuver.
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug3: n tug1: n tug4: n
Run was _____ based on run parameters	tug2: successful tug3: successful tug1: successful tug4: successful

Run #32

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**rtug5: Robot Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **tug4: Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	rtug5: Port B2 tug2: Starboard quarter tug3: Starboard B1 tug4: Center lead aft tug1: Center lead front
Tug location - End:	rtug5: Starboard midship tug2: Starboard quarter tug3: Starboard B1 tug4: Center lead aft tug1: Center lead front
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	rtug5: 5 tug2: 5 tug3: 5

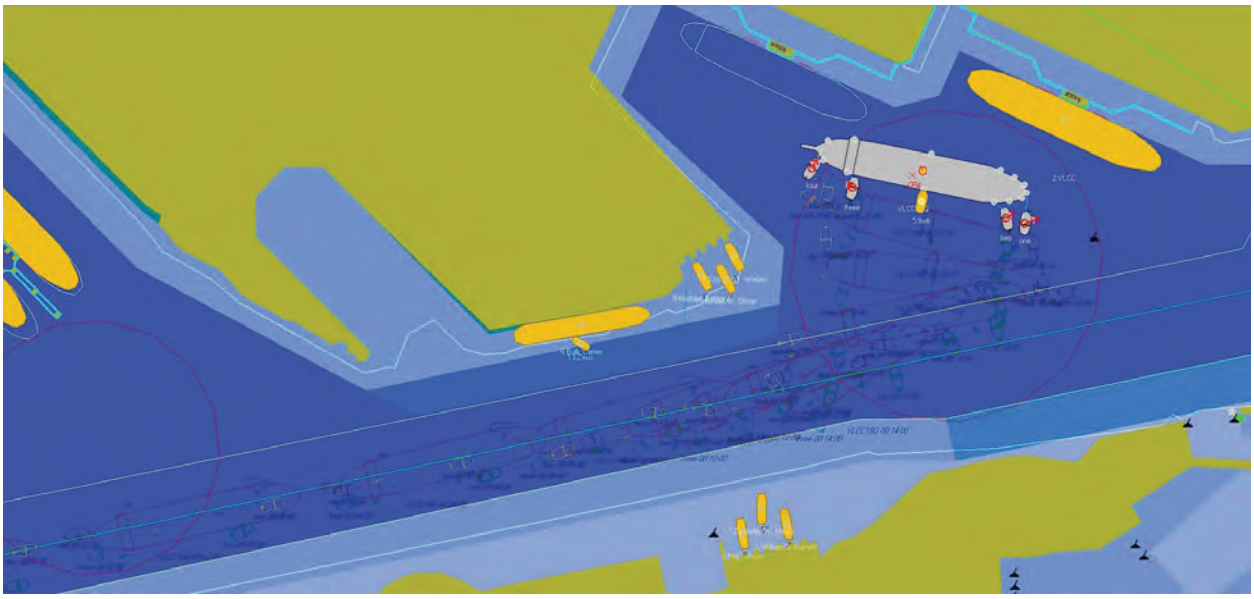
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 5 tug1: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	rtug5: No tug2: No tug3: No tug4: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	rtug5: 5 tug2: 5 tug3: 5 tug4: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	rtug5: 5 tug2: 5 tug3: 5 tug4: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	rtug5: n tug2: n tug3: n tug4: y tug1: n
If Yes, please explain why	rtug5: No tug2: Evolution went smoothly tug3: No issues tug4: Commands executed without much effort. Tug behaved well tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	rtug5: n tug2: n tug3: y tug4: n tug1: n

Tug Report

Run was _____ based on run parameters	rtug5: successful tug2: successful tug3: successful tug4: successful tug1: successful
Additional Comments:	tug3: There was a period where I had to push for an extended amount of time on full ahead. Other then that it was a easy maneuver

Run #33

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug3: Rotor 120** **tug4: Rotor 120** **rtug5: Robot Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	tug3: Starboard quarter tug4: Center lead front rtug5: Port B2 tug2: Starboard B1 tug1: Center lead aft
Tug location - End:	tug3: Starboard quarter tug4: Center lead front rtug5: Starboard midship tug2: Starboard B1 tug1: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug4: 5 rtug5: 5

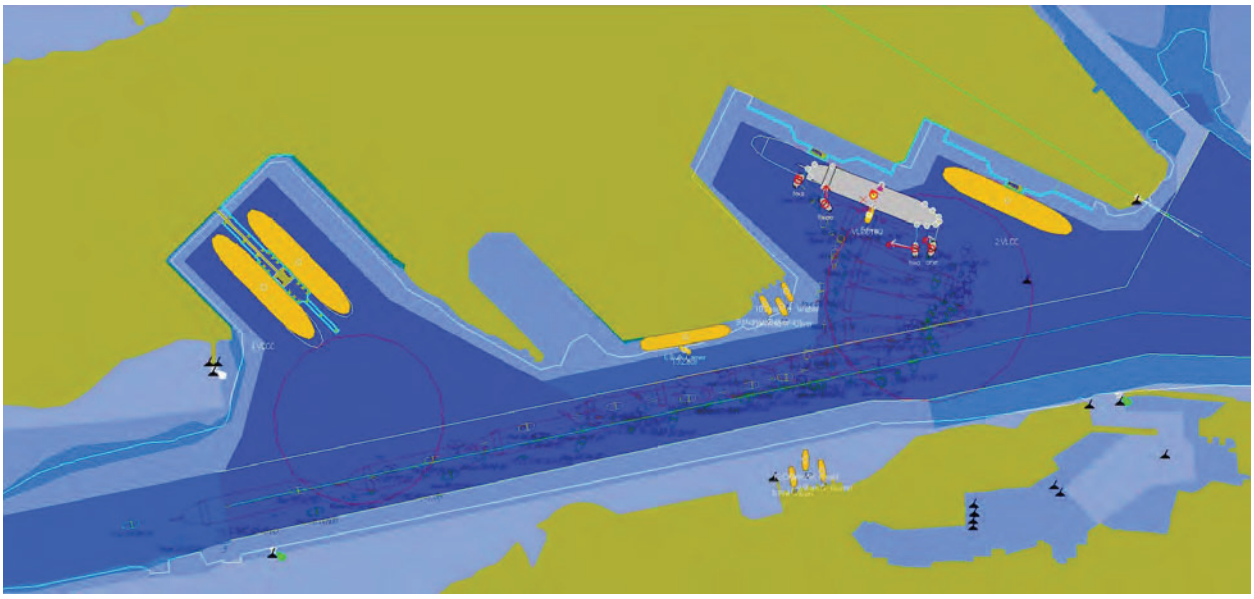
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug2: 5 tug1: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug4: No rtug5: No tug2: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug4: 5 rtug5: 5 tug2: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug4: 5 rtug5: 5 tug2: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug4: n rtug5: n tug2: n tug1: n
If Yes, please explain why	tug3: Successful run tug4: Good run. Used tug pushing into bow stem to slow down the ship. Simple maneuver. rtug5: A tug2: No issues tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug4: n rtug5: n tug2: n tug1: n

Tug Report

Run was _____ based on run parameters	tug3: successful tug4: successful rtug5: successful tug2: successful tug1: successful

Run #34

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



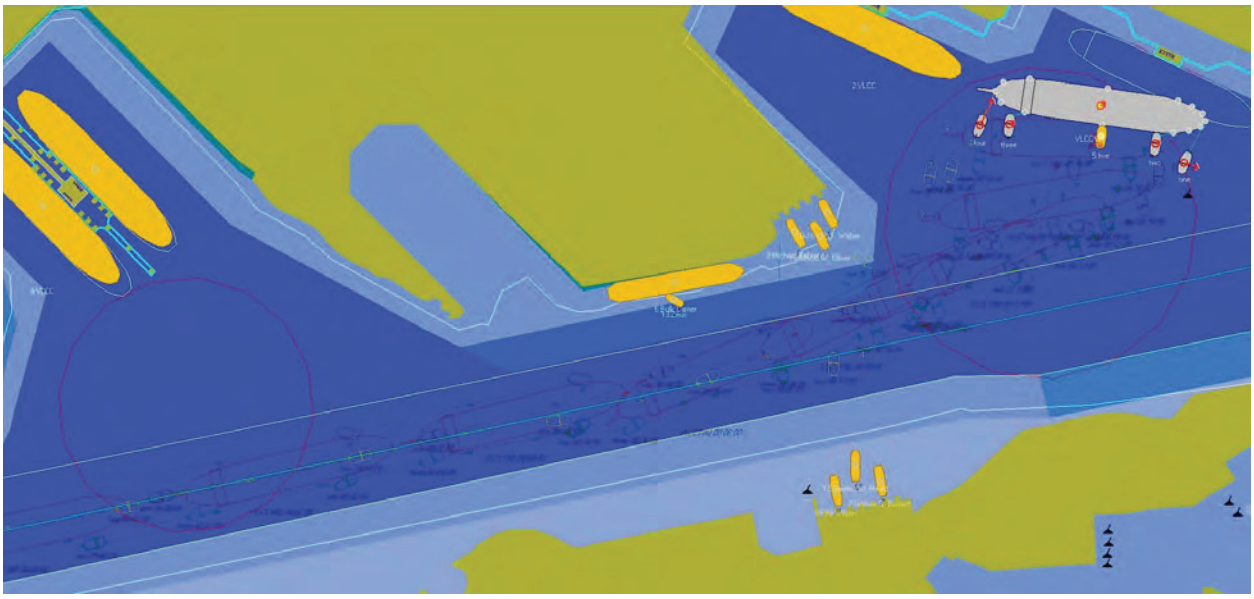
Question	Answers
Tug Type:	**rtug5: Robot Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	rtug5: Port B2 tug2: Starboard quarter tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft
Tug location - End:	rtug5: Starboard midship tug2: Starboard quarter tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	rtug5: 5 tug2: 5 tug3: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	rtug5: No tug2: No tug3: No tug1: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	rtug5: 5 tug2: 5 tug3: 5 tug1: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	rtug5: 5 tug2: 5 tug3: 5 tug1: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	rtug5: n tug2: n tug3: n tug1: n tug4: n
If Yes, please explain why	rtug5: A tug2: Evolution was successful tug3: No issues tug1: No tug4: aa
Did you feel that you were asked to operate at max power for an extended period of time?	rtug5: n tug2: n tug3: y tug1: n tug4: n
Run was _____ based on run parameters	rtug5: successful tug2: successful

	tug3: successful tug1: successful tug4: successful
Additional Comments:	tug3: There was a couple different times I pushed full power to get the ship into the basin and then start backing down while on the starboard bow tug4: misunderstood a pilot command and went opposite direction. Not withstanding the correction was made and the maneuver was successful. Mistake was easily overcome.

Run #36

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



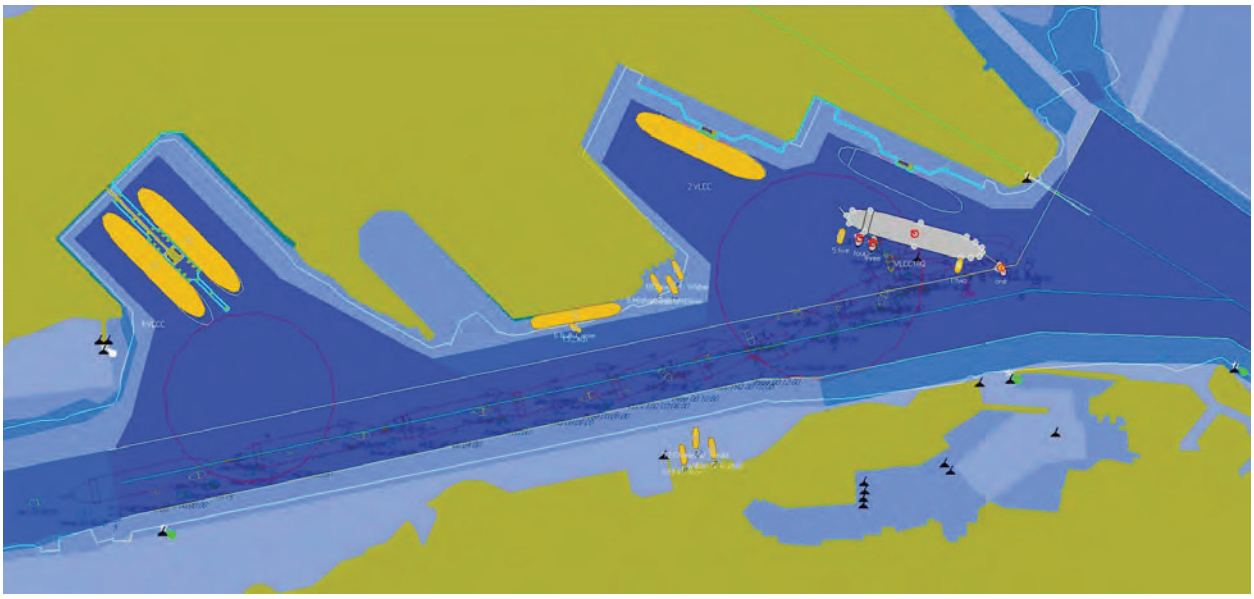
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug4: Rotor 120** **tug3: Rotor 120** **rtug5: Robot Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug4: Starboard B2 tug3: Starboard quarter rtug5: Port B2 tug1: Center lead aft
Tug location - End:	tug2: Center lead front tug4: Starboard B2 tug3: Starboard quarter rtug5: Starboard midship tug1: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug2: 5 tug4: 5 tug3: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug1: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug4: No tug3: No rtug5: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug4: 5 tug3: 5 rtug5: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug4: 5 tug3: 5 rtug5: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug4: n tug3: n rtug5: n tug1: n
If Yes, please explain why	tug2: No issues tug4: Overall safe run tug3: Very successful run rtug5: A tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug4: y tug3: n rtug5: n tug1: n
Run was _____ based on run parameters	tug2: successful tug4: successful

	tug3: successful rtug5: successful tug1: successful

Run #37

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug2: Rotor 120** **rtug2: Robot Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug1: Center lead aft tug2: Center lead front rtug2: Starboard B2 rtug5: Port B2
Tug location - End:	tug1: Starboard quarter tug2: Center lead front rtug2: Starboard B2 rtug5: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 tug2: 5 rtug2: 5 rtug5: 5 Average: 5.0

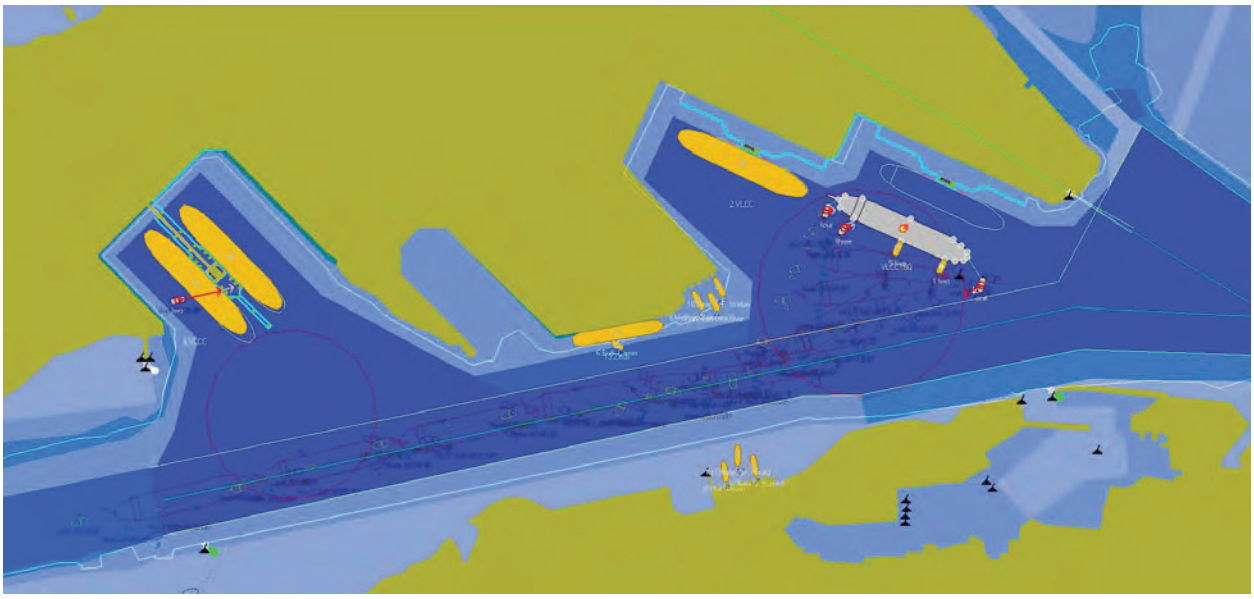
Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug2: No rtug2: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug2: 5 rtug2: 5 rtug5: 4 Average: 4.8
If the tug configuration was not adequate, please explain why.	tug2: Even with rudder failure on the simulation all tugs were being utilized and no incidents
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug2: 5 rtug2: 4 rtug5: 4 Average: 4.5
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug2: n rtug2: n rtug5: y
If Yes, please explain why	tug1: No tug2: No issues rtug2: A rtug5: Tug 4 got in the way on stern could not get on a 45 for a good bit of time.
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug2: n rtug2: n rtug5: n
Run was _____ based on run parameters	tug1: successful tug2: successful rtug2: successful rtug5: successful

Additional Comments:	rtug2: This was an emergency situation. Ships rudder was locked hard port rtug5: This was an emergency situation. Ship rudder locked hard port and tug 4 parted a line.

Run #38

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug2: Robot Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug2: Starboard B2 rtug5: Port B2
Tug location - End:	tug4: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug2: Starboard B2 rtug5: Starboard midship
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug2: 5 tug1: 5

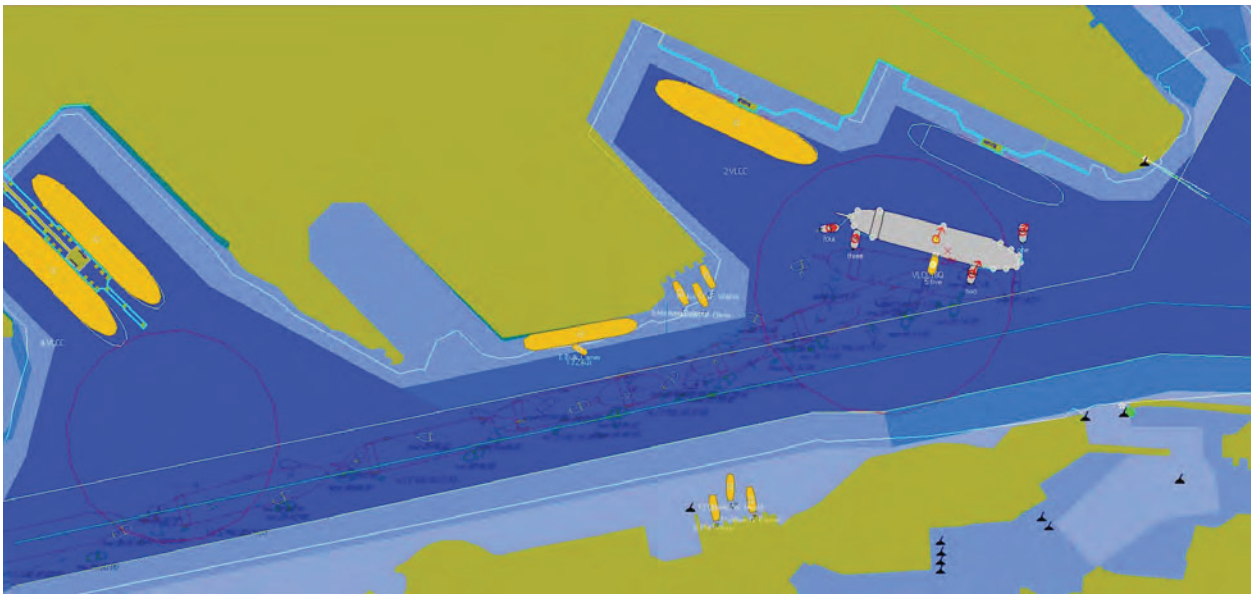
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug2: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No tug1: No rtug2: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 tug1: 5 rtug2: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 4 tug2: 5 tug1: 5 rtug2: 5 rtug5: 4 Average: 4.6
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n tug1: n rtug2: n rtug5: n
If Yes, please explain why	tug4: Ship lost rudder. Was able to overcome failure with tug use. Safe maneuver overall tug2: No issues tug1: No rtug2: A rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n tug1: n rtug2: n rtug5: n

Tug Report

Run was _____ based on run parameters	tug4: successful tug2: successful tug1: successful rtug2: successful rtug5: successful
Additional Comments:	rtug2: It was an emergency. Ship lost engines. rtug5: Ship had engine failure. Emergency situation

Run #39

Location: Ingleside Destination: HI E Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



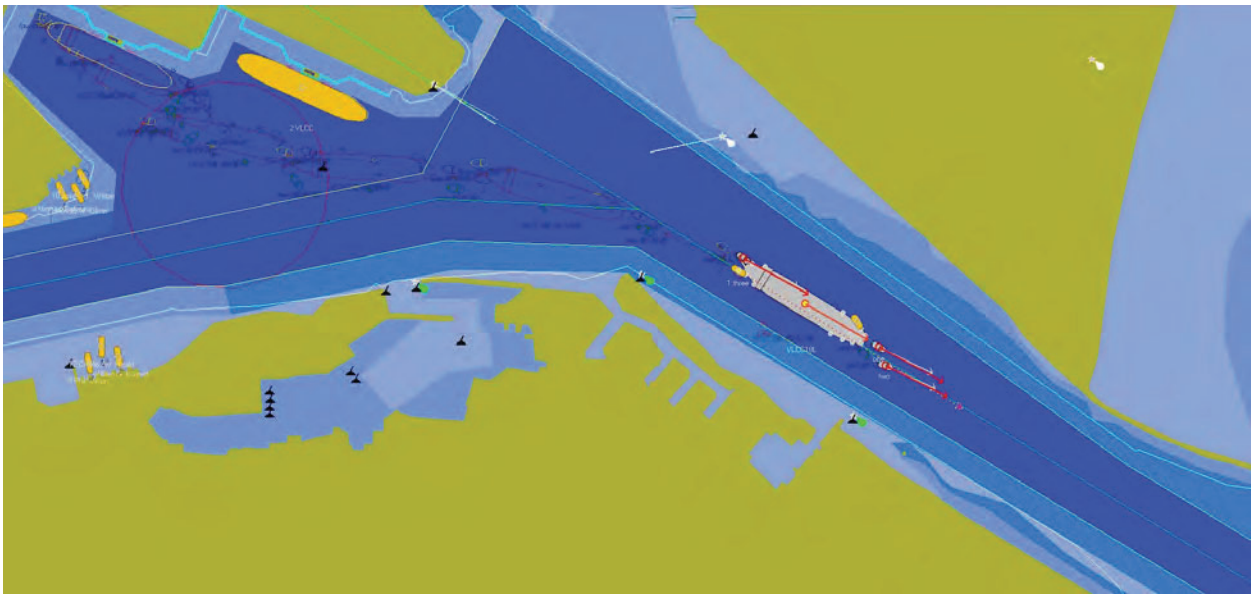
Question	Answers
Tug Type:	**tug4: Rotor 120** **tug3: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug4: Center lead front tug3: Starboard quarter tug2: Starboard B1 tug1: Center lead aft rtug5: Port B2
Tug location - End:	tug4: Center lead front tug3: Starboard quarter tug2: Starboard B1 tug1: Center lead aft rtug5: Starboard midship
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug4: 5 tug3: 5 tug2: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug3: No tug2: No tug1: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug3: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug3: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug3: n tug2: n tug1: n rtug5: n
If Yes, please explain why	tug4: Easy run tug3: Successful run tug2: No issues tug1: No rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug3: n tug2: n tug1: n rtug5: n
Run was _____ based on run parameters	tug4: successful tug3: successful

	tug2: successful tug1: successful rtug5: successful

Run #40

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb Medium Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug2: Rotor 120** **tug4: Rotor 120** **rtug2: Robot Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug1: Port transom tug2: Center lead front tug4: Starboard B1 rtug2: Starboard transom rtug5: Port B1
Tug location - End:	tug1: Port transom tug2: Center lead front tug4: Starboard B1 rtug2: Starboard transom rtug5: Port B1
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 tug2: 5 tug4: 5

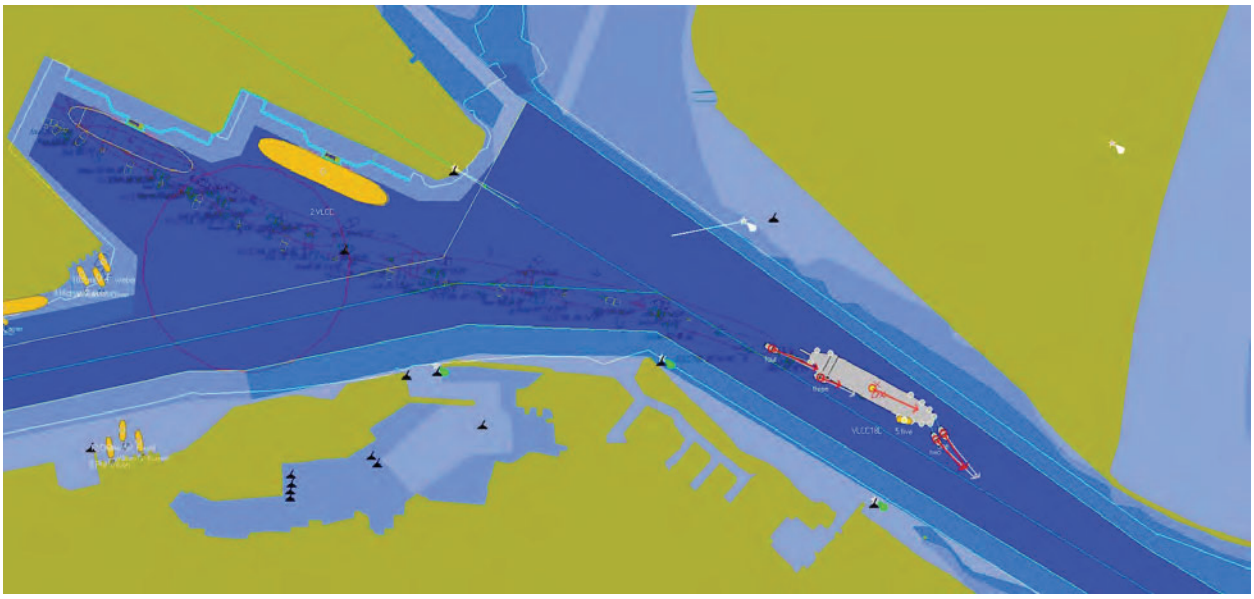
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug2: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug2: No tug4: No rtug2: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug2: 5 tug4: 5 rtug2: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug2: 5 tug4: 5 rtug2: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug2: n tug4: n rtug2: n rtug5: n
If Yes, please explain why	tug1: No tug2: No issues tug4: Smooth maneuver. Towed ship outbound. rtug2: A rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug2: n tug4: n rtug2: n rtug5: n
Run was _____ based on run parameters	tug1: successful tug2: successful

Tug Report

	tug4: successful rtug2: successful rtug5: successful
Additional Comments:	rtug2: The tug number for this was not tug 2, it was tug 3

Run #41

Location: HI W Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug3: Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug1: Starboard B1 rtug5: Starboard B2 tug3: Starboard quarter tug4: Starboard quarter
Tug location - End:	tug2: Center lead front tug1: Center lead front rtug5: Starboard B2 tug3: Starboard quarter tug4: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug2: 5 tug1: 5 rtug5: 5

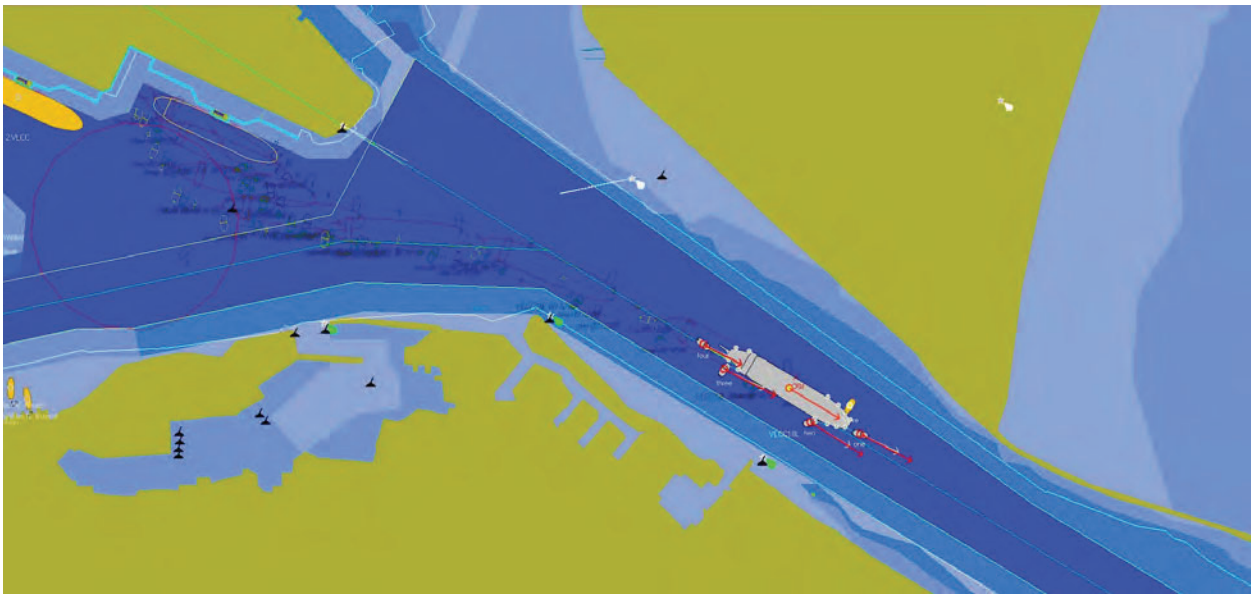
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug1: No rtug5: No tug3: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug1: 5 rtug5: 5 tug3: 4 tug4: 4 Average: 4.6
If the tug configuration was not adequate, please explain why.	tug3: Need to have one tug center line aft tug4: Same as previous run
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug1: 5 rtug5: 4 tug3: 5 tug4: 4 Average: 4.6
If not safe, please explain why.	tug4: Same as previous run. Close to tug 4, but no issues
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug1: n rtug5: n tug3: n tug4: n
If Yes, please explain why	tug2: No issues tug1: No rtug5: A tug3: Run was successful tug4: Close to tug 4 due to ship construction, but no issue.

Tug Report

Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug1: n rtug5: n tug3: n tug4: n
Run was _____ based on run parameters	tug2: successful tug1: successful rtug5: successful tug3: successful tug4: successful

Run #42

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 N Ebb High Offshore Wind and Current: - Comments:



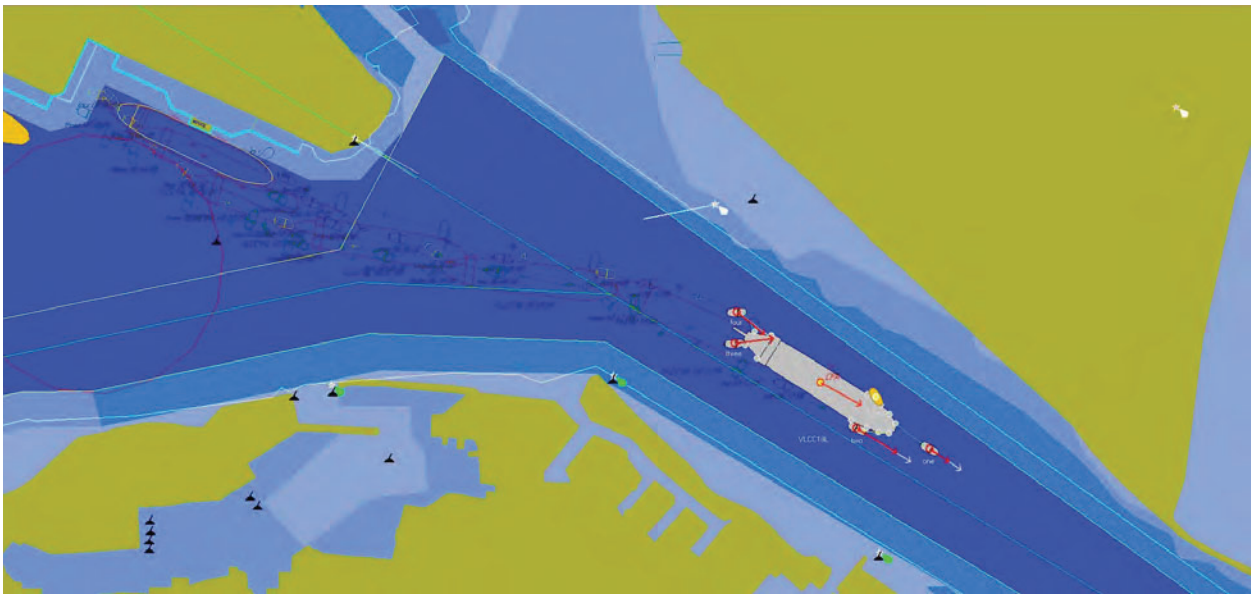
Question	Answers
Tug Type:	**tug2: Rotor 120** **tug1: Rotor 120** **tug3: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug2: Center lead front tug1: Starboard B1 tug3: Starboard quarter rtug5: Port B1 tug4: Starboard quarter
Tug location - End:	tug2: Center lead front tug1: Starboard B1 tug3: Starboard quarter rtug5: Port B1 tug4: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug2: 5 tug1: 5 tug3: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug2: No tug1: No tug3: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug2: 5 tug1: 5 tug3: 3 rtug5: 5 tug4: 4 Average: 4.4
If the tug configuration was not adequate, please explain why.	tug3: I feel tug 4 should have been made up center line aft tug4: Tug was close to tug 4 due to mooring points on ship. Had to operate backward to stay out of the way of tug4
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug2: 5 tug1: 5 tug3: 4 rtug5: 4 tug4: 4 Average: 4.4
If not safe, please explain why.	tug4: Tight with tug 4 but run was succesful
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug2: n tug1: n tug3: n rtug5: n tug4: n
If Yes, please explain why	tug2: No issues tug1: No tug3: Run was good starboard quarter tug number 4 should be made up centerline aft rtug5: A

	tug4: Overall safe maneuver, not a lot of power used.
Did you feel that you were asked to operate at max power for an extended period of time?	tug2: n tug1: n tug3: n rtug5: n tug4: n
Run was _____ based on run parameters	tug2: successful tug1: successful tug3: successful rtug5: successful tug4: successful

Run #43

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



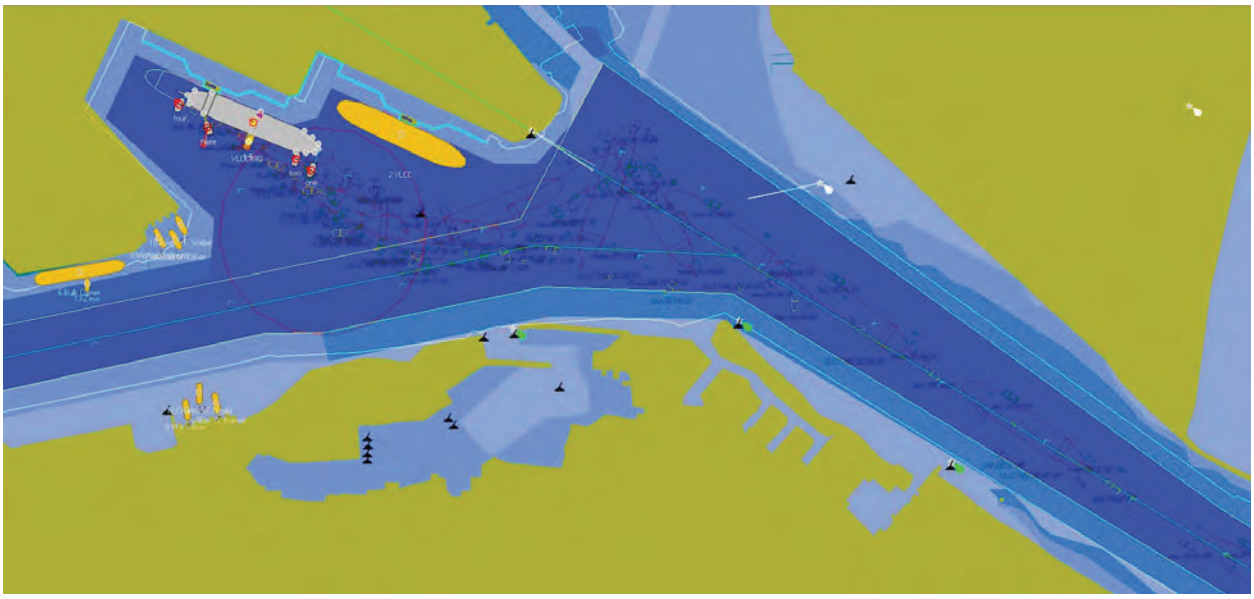
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug4: Rotor 120** **tug2: Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120**
Tug Location - Beginning:	tug3: Starboard quarter tug4: Port B1 tug2: Center lead front tug1: Port transom rtug5: Port B2
Tug location - End:	tug3: Starboard quarter tug4: Port B1 tug2: Center lead front tug1: Port transom rtug5: Port B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug4: 5 tug2: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug1: 5 rtug5: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug4: No tug2: No tug1: No rtug5: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug4: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug4: 5 tug2: 5 tug1: 5 rtug5: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug4: n tug2: n tug1: n rtug5: n
If Yes, please explain why	tug3: Successful run tug4: All good tug2: No issues tug1: No rtug5: A
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug4: n tug2: n tug1: n rtug5: n
Run was _____ based on run parameters	tug3: successful tug4: successful

	tug2: successful tug1: successful rtug5: successful
Additional Comments:	rtug5: Minimum tug commands

Run #7.2

Location: Jetties Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood Medium Offshore Wind and Current: - Comments:



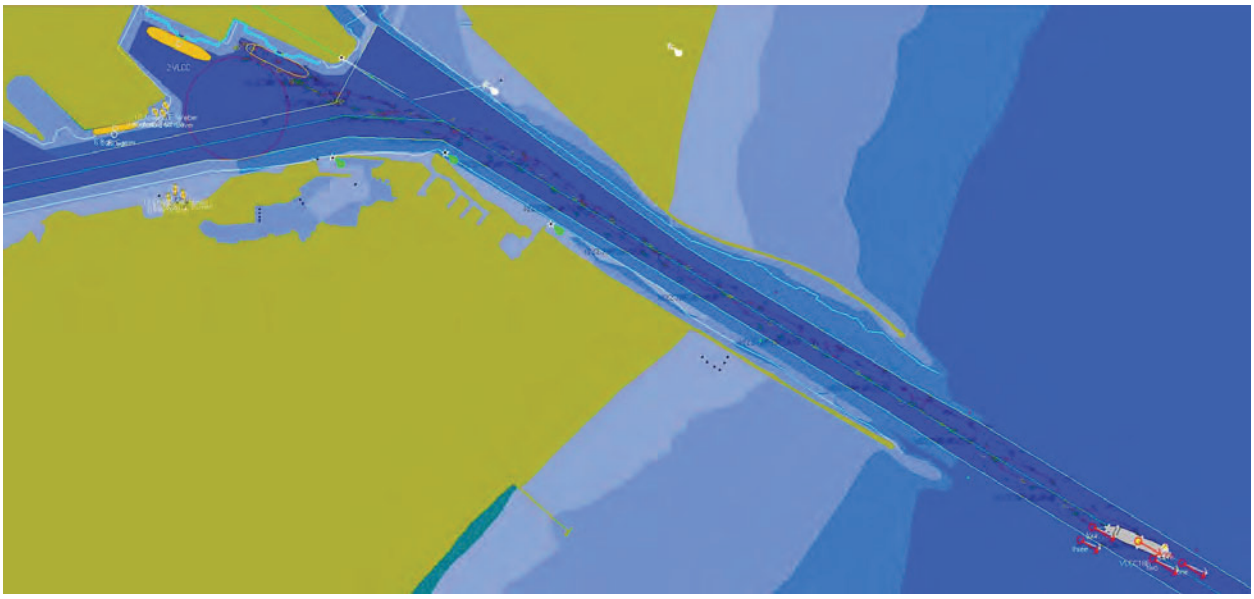
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug1: Rotor 120** **tug4: Rotor 120** **tug2: Rotor 120**
Tug Location - Beginning:	tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft tug2: Starboard quarter
Tug location - End:	tug3: Starboard B1 tug1: Center lead front tug4: Center lead aft tug2: Starboard quarter
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug3: 5 tug1: 5 tug4: 5 tug2: 5 Average: 5.0

Tug Report

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug1: No tug4: No tug2: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug1: 5 tug4: 5 tug2: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug1: 5 tug4: 5 tug2: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug1: n tug4: n tug2: n
If Yes, please explain why	tug3: No difficulty tug1: Na tug4: No tug2: The evolution was smooth and successful
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug1: n tug4: n tug2: n
Run was _____ based on run parameters	tug3: successful tug1: successful tug4: successful tug2: successful
Additional Comments:	tug4: Run was very comfortable. Commands executed with ease. Not stressful at all.

Run #28.2

Location: HI E Destination: Jetties Dredge Plan: 81' Ship Draft: 68' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



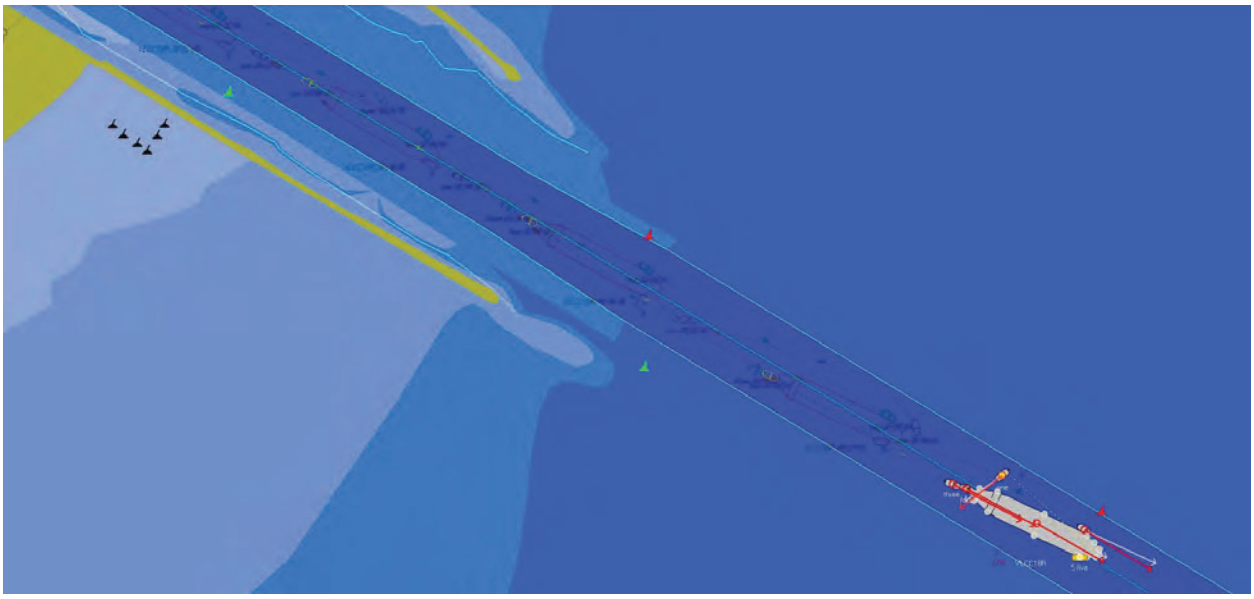
Question	Answers
Tug Type:	**tug3: Rotor 120** **tug2: Robot Rotor 120** **tug1: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug3: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug5: Port B1 tug4: Starboard B2
Tug location - End:	tug3: Starboard quarter tug2: Center lead front tug1: Center lead aft rtug5: Port B1 tug4: Starboard B2
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug3: 5 tug2: 5 tug1: 5

plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug3: No tug2: No tug1: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug3: 5 tug2: 5 tug1: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug3: n tug2: n tug1: n rtug5: n tug4: n
If Yes, please explain why	tug3: Successful run tug2: No issues tug1: No rtug5: A tug4: Overall good maneuver.
Did you feel that you were asked to operate at max power for an extended period of time?	tug3: n tug2: n tug1: n rtug5: n tug4: n
Run was _____ based on run parameters	tug3: successful tug2: successful

	tug1: successful rtug5: successful tug4: successful
Additional Comments:	rtug5: Minimum tug commands given

Run #44

Location: Jetties Destination: Sea Dredge Plan: 81' Ship Draft: 74' Inland Wind and Current: - Offshore Wind and Current: S High Comments:



Question	Answers
Tug Type:	**tug1: Rotor 120** **tug2: Rotor 120** **tug3: Rotor 120** **rtug5: Robot Rotor 120** **tug4: Rotor 120**
Tug Location - Beginning:	tug1: Center lead aft tug2: Port B1 tug3: Port B1 rtug5: Starboard B1 tug4: Center lead front
Tug location - End:	tug1: Center lead aft tug2: Port B1 tug3: Port B3 rtug5: Starboard B1 tug4: Center lead front
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships,	tug1: 5 tug2: 5 tug3: 5

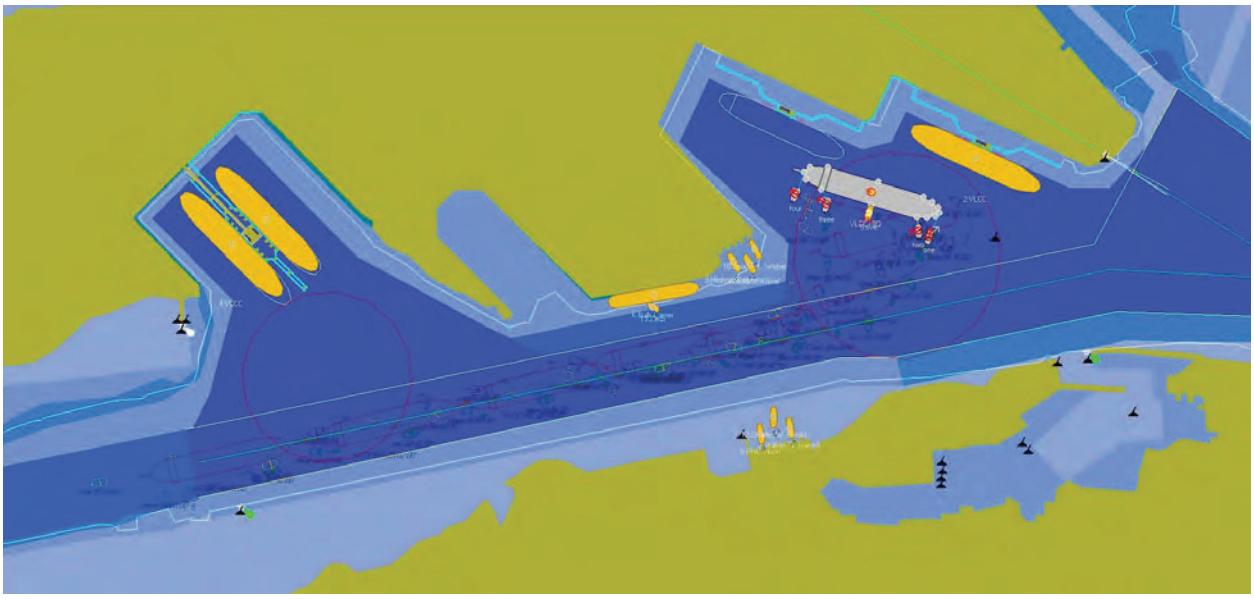
plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	rtug5: 5 tug4: 5 Average: 5.0
If the maneuvering room was not adequate, please explain why.	tug3: No line for tug 3
Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug1: No tug2: No tug3: No rtug5: No tug4: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug1: 5 tug2: 5 tug3: 5 rtug5: 5 tug4: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug1: 5 tug2: 5 tug3: 5 rtug5: 5 tug4: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug1: n tug2: n tug3: n rtug5: n tug4: n
If Yes, please explain why	tug1: No tug2: No issues other then tug 1 not being able to stay out front and getting tripped tug3: Successful run rtug5: A tug4: All went well
Did you feel that you were asked to operate at max power for an extended period of time?	tug1: n tug2: n tug3: n rtug5: n tug4: n

Tug Report

Run was _____ based on run parameters	tug1: successful tug2: successful tug3: successful rtug5: successful tug4: successful
Additional Comments:	rtug5: No commands given

Run #35

Location: Ingleside Destination: HI W Dredge Plan: 81' Ship Draft: 52' Inland Wind and Current: 25 SE Flood High Offshore Wind and Current: - Comments:



Question	Answers
Tug Type:	**tug4: Rotor 120** **tug2: Rotor 120** **rtug5: Robot Rotor 120** **tug1: Rotor 120**
Tug Location - Beginning:	tug4: Center lead front tug2: Starboard B1 rtug5: Port B2 tug1: Center lead aft
Tug location - End:	tug4: Center lead front tug2: Starboard B1 rtug5: Starboard midship tug1: Center lead aft
I had adequate room in the area (CHANNEL CONFIGURATION) to include (channel dimensions, ships, plus other assist tugs). Please rate this statement based on – 1 being you did not have adequate room and 5 being you had adequate room.	tug4: 5 tug2: 5 rtug5: 5 tug1: 5 Average: 5.0

Did the ENVIRONMENTAL FORCES (current, wind, waves) cause operational limits to be exceeded?	tug4: No tug2: No rtug5: No tug1: No
The TUG CONFIGURATION (number of tugs, tug bollard-pull rating, and tug type) was sufficient and adequate. Please rate based on number of tugs used, bollard pull rating, and tug type used vs. what is needed to do the job safely – 1 being the Tug Configuration is inadequate and 5 being the Tug Configuration is adequate.	tug4: 5 tug2: 5 rtug5: 5 tug1: 5 Average: 5.0
The overall safety, stress and difficulty level of this run was: Please rate the based on – 1 being extremely unsafe, stressful, and very difficult and 5 being safest, low stress, and not challenging.	tug4: 5 tug2: 5 rtug5: 5 tug1: 5 Average: 5.0
Were any of the maneuvers or commands given by the pilots difficult relative to the time provided or the environmental conditions simulated? Did you have any trouble getting into position, or staying in shape due to the current, ship's speed, or environmental conditions?	tug4: n tug2: n rtug5: n tug1: n
If Yes, please explain why	tug4: Easy run tug2: No issues rtug5: A tug1: No
Did you feel that you were asked to operate at max power for an extended period of time?	tug4: n tug2: n rtug5: n tug1: n
Run was _____ based on run parameters	tug4: successful tug2: successful rtug5: successful tug1: successful

Appendix I: Simulator Log Files

Please see Appendix I in Appendixes folder. Requires a Kongsberg simulator to utilize.

The Simulator Log Files can be obtained from the USACE, contact Mr. Jayson Hudson at the USACE at (409) 766-3108 or at SWG201900067@usace.army.mil