

ANEXO 1

INFORME DEL CENTRO DE SIMULACIÓN (SIDMAR)

Operational simulation of docking and undocking in the New container Terminal at RODMAN (PIMPSA)

Prepared by: SIDMAR technical team

Operational simulation of docking and undocking in the New container Terminal at RODMAN (PIMPSA)

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Terminal Characteristics :

- The new Terminal will be located at RODMAN port facilities, at Panama canal Pacific entrance west side coastline; aprox. Lat: N09° 57.206' / Long: W079° 34.500'
- Linear Terminal with max. length of 330m and equipped with three (3) pos-panamax Gantry cranes (45m reach extension)

Vessel dimensions expected at the Terminal:

- Container vessel PPMX LOA : 300m; BEAM: 42m; DRAFT: 13.2m
- Container vessel PMX LOA: 295m; BEAM: 32m; DRAFT: 12m
- Container vessel LOA.: 230m; Manga: 27m; Calado: 12m

Scope and objective of simulation (deliverables):

- Confirm that the project layout allows to berth safely a vessel with the following dimensions LOA max.:300m; BEAM: 40m; DRAFT: 13.2m
- Establish the approach apertures required for navigation so as to set out the design parameters for the dredging plan and berth basin
- Set the minimum navigations aids and tugs requirements.

Tugs and vessels dimensions used during simulation:

- Container vessel CNTNR28L LOA máx.: 347m; BEAM: 42m; DRAFT: 15m
- Container vessel CNTNR08L LOA máx.: 285m; BEAM: 40m; DRAFT: 12.7m
- Container vessel CNTNR07L LOA máx.: 294m; BEAM: 32m; DRAFT: 12m
- Container Break bulk CARGO03L LOA máx.: 230m; BEAM: 27m; DRAFT: 12m
- Tug 11 (Voith-schneider) LOA: 28m; BEAM: 10.5m; max. DRAFT: 4.8m max "bollard pull" 50Ton
- Tug 18 (Z-peller)LOA: 27,4m; BEAM: 11.6m; DRAFT: 4.9m max. "bollard pull" 62Ton

Simulation exercises with 360°, 210° and TUG simulators (integrated):

- Simulation exercises were executed with winds ranging parameters from north and south quadrants and 10 to 30 knots intensity; night and poor visibility (rain) and low and high tide scenarios:
 - Docking and undocking maneuvers with tugs assistances and normal traffic density

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Limitations:

- Vessels simulation models used were adjusted to the expected vessel that will call the Project.
- Depth parameters were adjusted (when needed) to keep a safe 10% Under Keel Clearance (UKC) relative to vessel draft.

Observations:

- The docking and undocking maneuvers to the project Terminal have no major difficulties and variations compare to actual and similar maneuvers to and from RODMAN piers, under fair weather conditions.
- A dredge limit area of the Project must guarantee the safe navigation UKC parameters of 10% at any tide status.
- Actual projects structures (Gantry cranes, containers stacking, vessel superstructures, etc.) close to west limit area of the project should not interfere with line of sight the Pacific Entrance leading (range) lights.
- The maneuvers have no major interfere with the largest vessel allowed to dock at RODMAN Pier 1N.
- Assistance of at least two omni directional tugs with min. 50tons bollard pull is necessary.
- The max. Project vessel LOA max.:300m; BEAM: 40m; DRAFT: 13.2m can be safely berthed.
- The vessel approaching and departing maneuvers block the main navigation channel approximately 15-20 minutes, similar to the actual RODMAN piers maneuvers.
- During ebbs tide the use of third tug availability should be established to assist the maneuvers.

Recommendations:

- Is recommended to guarantee a minimum 10 to 15% UKC related to the maximum vessel draft that will call the Project Terminal. Including all dredge parameters recommend by PIANC guidelines.
- The Project Terminal operating lights should not interfere with the actual and future Panama Canal aids to navigation.
- Wind sock installation is recommended to provide pilots wind direction and intensity parameters.
- Assistance of two tugs is recommended with omni directional tugs with min. 50tons bollard pull.
- Assistance of third tug is recommended two (2) hours before and after the lowest spring tide (minimum UKC) and/or wind over 20 knots.
- The maneuvers should be limited when wind intensity is over 35 knots.
- Installations of range lights (leading) to the berth approach are recommended.
- The approach maneuvers should be initiated from the Balboa basin turning area.
- The coordination of vessel maneuvers to and from the Project Terminal should be established in advance, and are conditioned to Vessel Traffic System parameters established by the Panama Canal Authority (e.g.: vessels to and from Canal has priority over ports calls).
- Is recommended to install (add) a yellow buoy "A" and "D" and relocate green buoy #21 as shown in the annex to delimited safe navigation waters.
- Is recommended to install working bollards with 30m minimum distance between bollards to assure uniformity distribution of mooring forces between bollards with working angle of 30° - 45° for head and stern lines, and 10°-15° for spring lines.



**Operational simulation of docking and undocking in the
New container Terminal at RODMAN (PIMPASA)**

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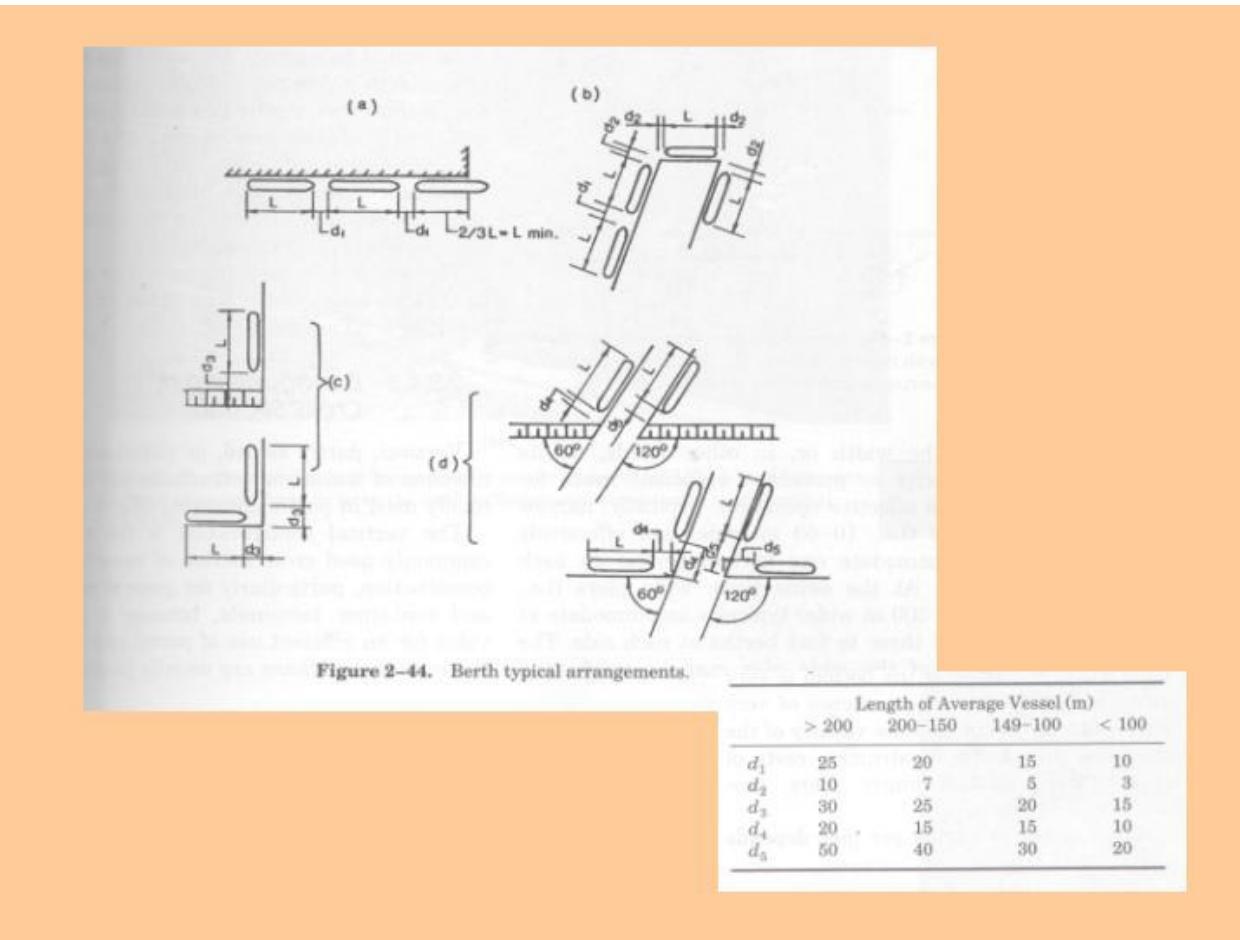
ANNEX A

ANNEX B

ANNEX C

- Exercise # 1
- Exercise # 2
- Exercise # 3
- Exercise # 4
- Exercise # 5
- Exercise # 6
- Exercise # 7
- Exercise # 8
- Exercise # 9
- Exercise # 10

ANNEX A



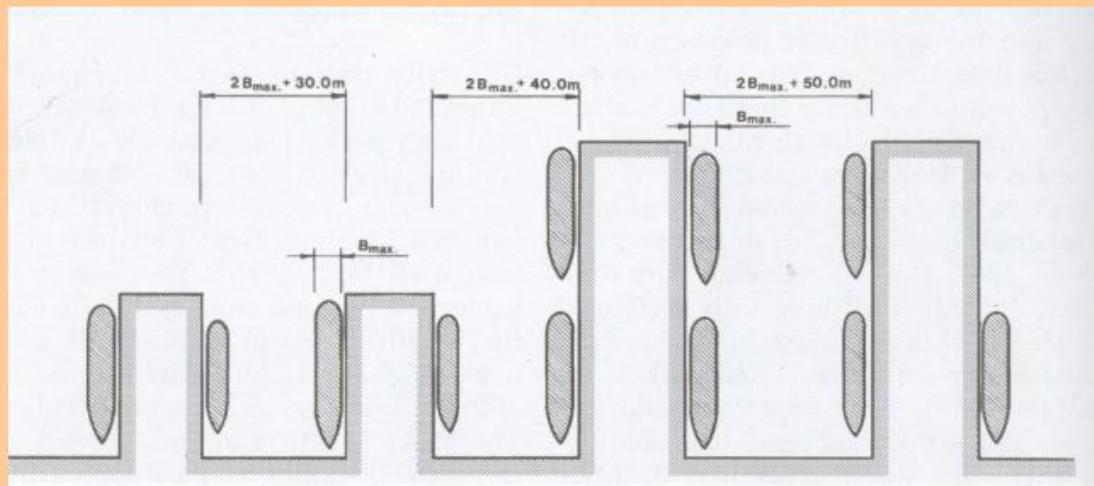


Figure 2-30. Width of port basin between piers.

Table 3-5. Number of simultaneously working bollards (n_B)

| Length of Ship (m) | Minimum Distance Between Bollards (m) | n_B |
|--------------------|---------------------------------------|-------|
| ≤ 50 | 20 | 2 |
| 150 | 25 | 4 |
| 250 | 30 | 6 |
| ≥ 300 | 30 | 8 |

The magnitude of mooring force per bollard, and its vertical and longitudinal components, can be obtained by the following equations (see Fig. 3-13):

$$Q_B = \frac{N_B}{\sin \alpha \cos \beta} \quad (3-26)$$

$$V_B = Q_B \sin \beta \quad (3-27)$$

$$T_B = Q_B \cos \alpha \cos \beta \quad (3-28)$$

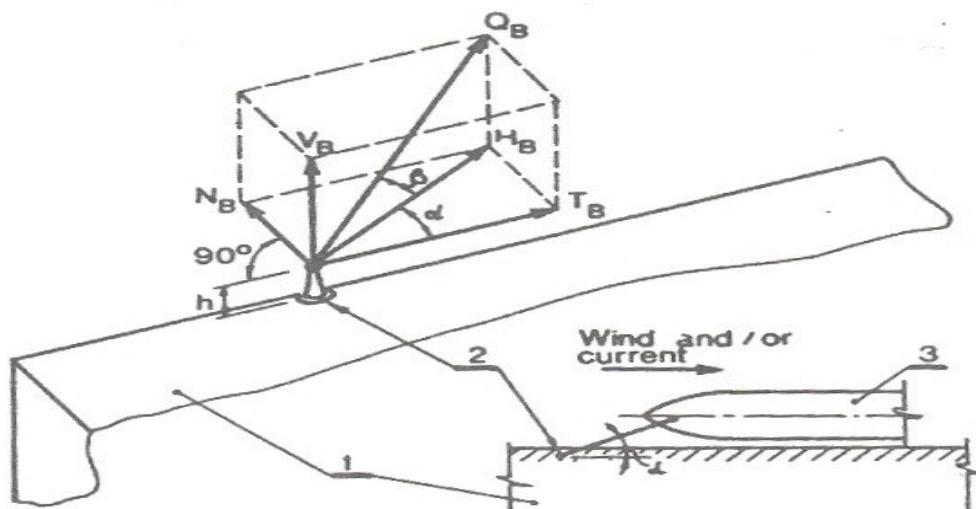


Figure 3-13. Mooring forces.

Table 3-6. Values of α and β in Eqs. (3-36)–(3-28)

| Vessel Type | Bollard Location | α | β | |
|------------------|-------------------------|----------|--------------|---------------------------|
| | | | Laden Vessel | Vessel in Light Condition |
| Seagoing | At the quay edge | 30° | 20° | 40° |
| | Second line of bollards | 40° | 10° | 20° |
| Riverboats | | | | |
| Passenger vessel | At the quay edge | 0°–45° | –30° | 30° |
| Cargo vessel | At the quay edge | 0°–30° | –30° | 30° |

Table 3-7. Mooring forces Q_B generated by seagoing vessels

| Vessel Displacement (tonnes) | Line Pull (kN) | Vessel Displacement (tonnes) | Line Pull (kN) |
|------------------------------|----------------|------------------------------|----------------|
| 2,000 | 100 | 100,000 | 1,000 |
| 10,000 | 300 | 200,000 | 1,500 |
| 20,000 | 600 | > 200,000 | 2,000 |
| 50,000 | 800 | — | — |

Table 3-8. Typical values of Q_B transmitted by inland waterway ship mooring lines to bollards (kN)

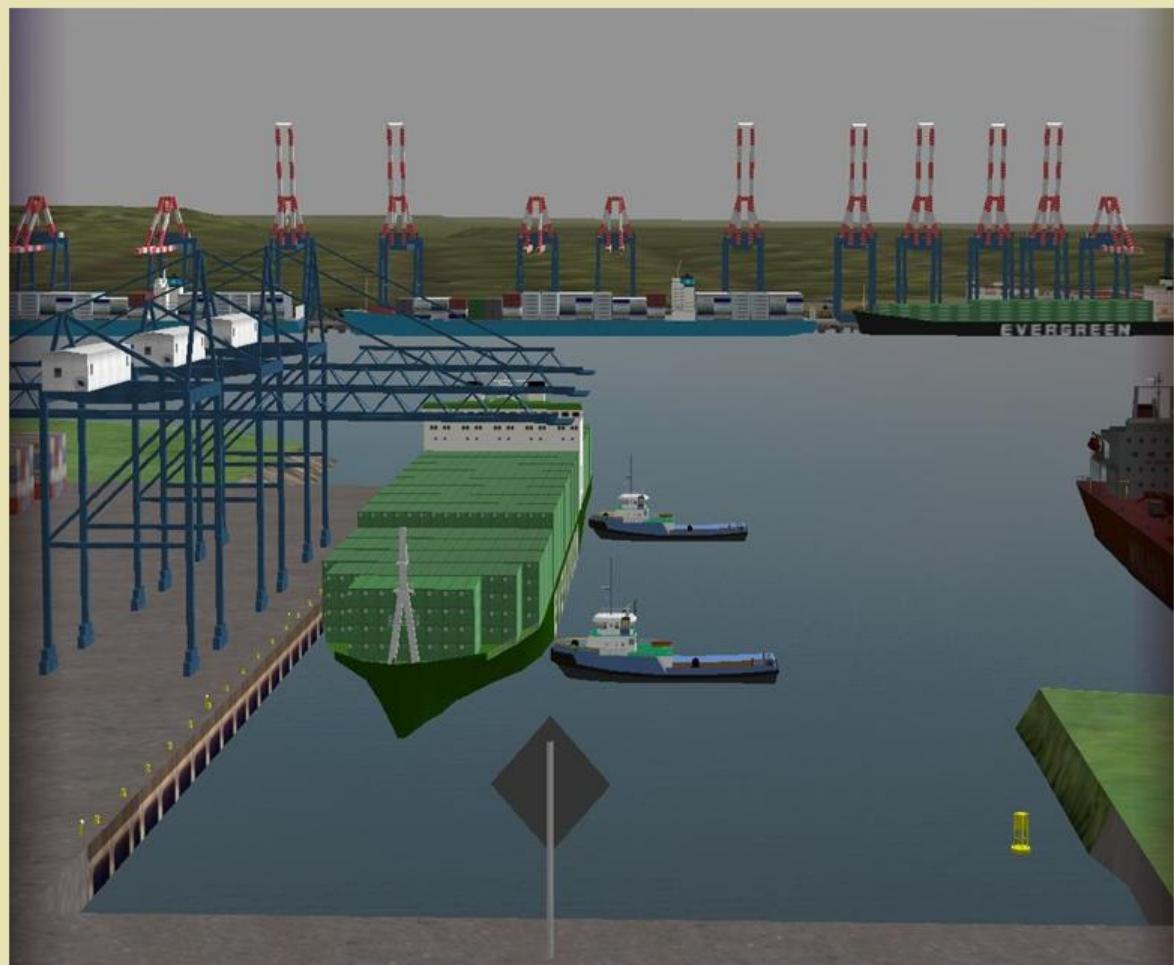
| Vessel Type | Maximum Displacement (tonnes) | | | | | | | | | | | |
|---|-------------------------------|-----|-------|-------|-------|-------|---------|--------|--------|---------|---------|-----------|
| | ≤ 100 | 500 | 1,000 | 2,000 | 3,000 | 5,000 | 10,000 | 20,000 | 50,000 | 100,000 | 200,000 | ≥ 200,000 |
| Passenger and mixed cargo/ passenger ship | 50 | 100 | 150 | 200 | 250 | — | — | — | — | — | — | — |
| Cargo ship | 30 | 50 | 100 | 130 | 150 | 200 | 250–300 | 600 | 800 | 1,000 | 1,500 | 2,000 |

ANNEX B



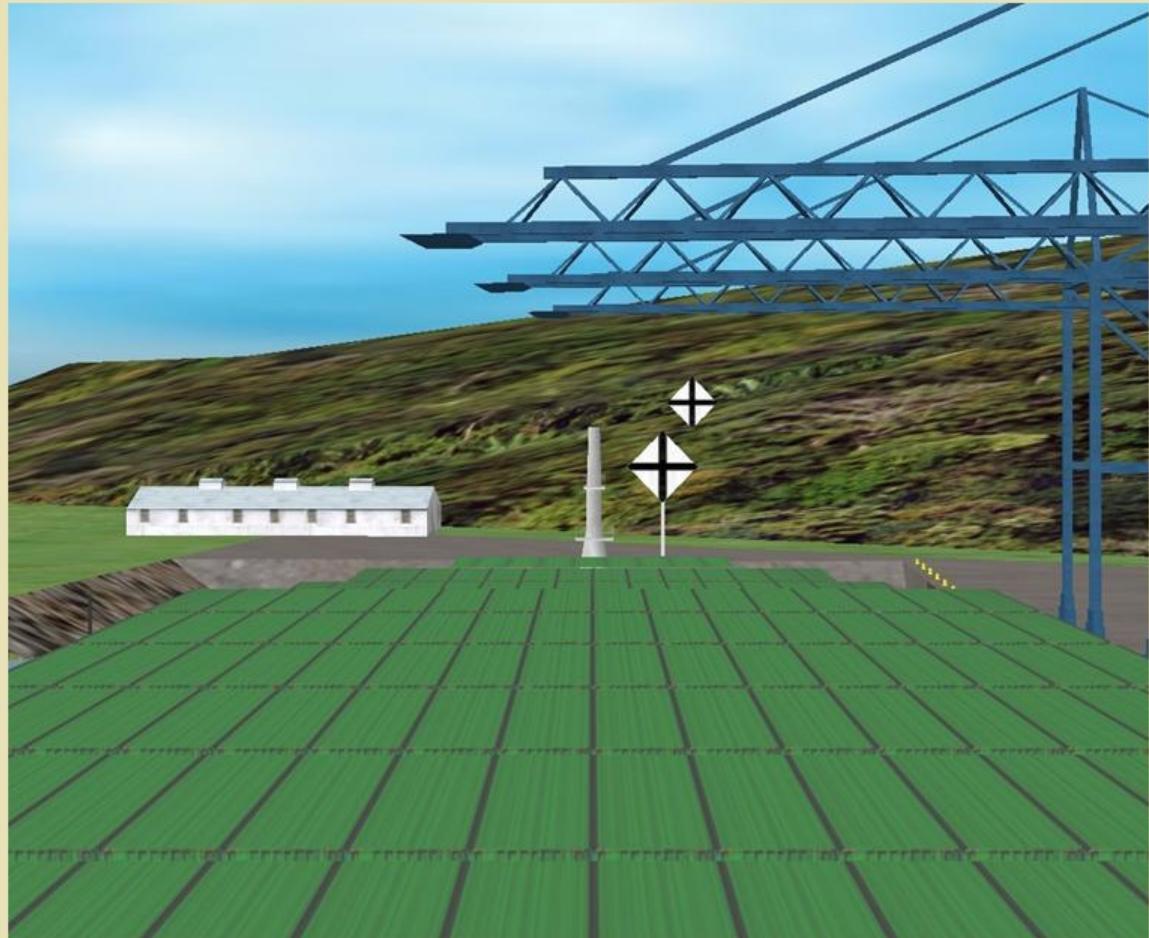
**PSA Container Terminal
RODMAN**

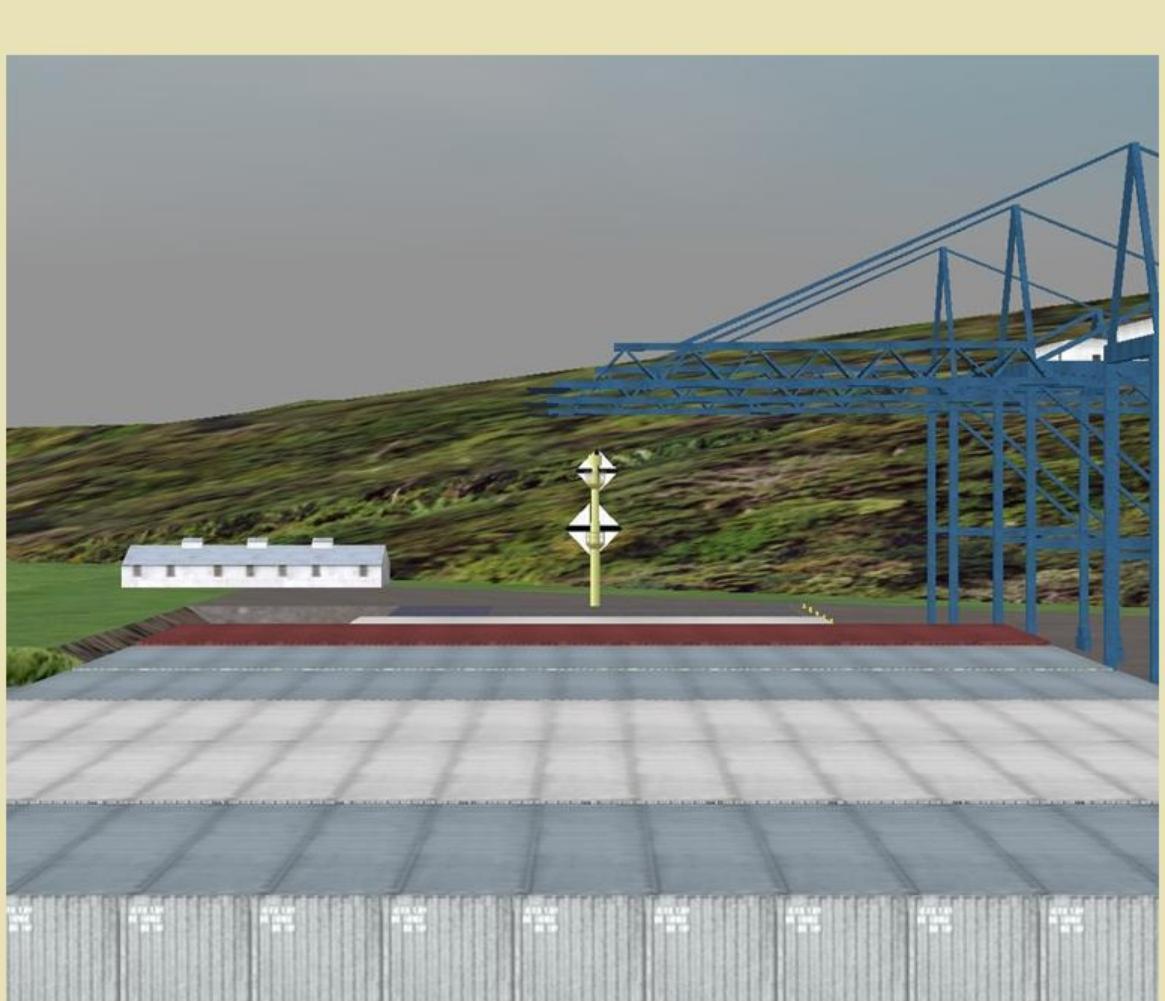




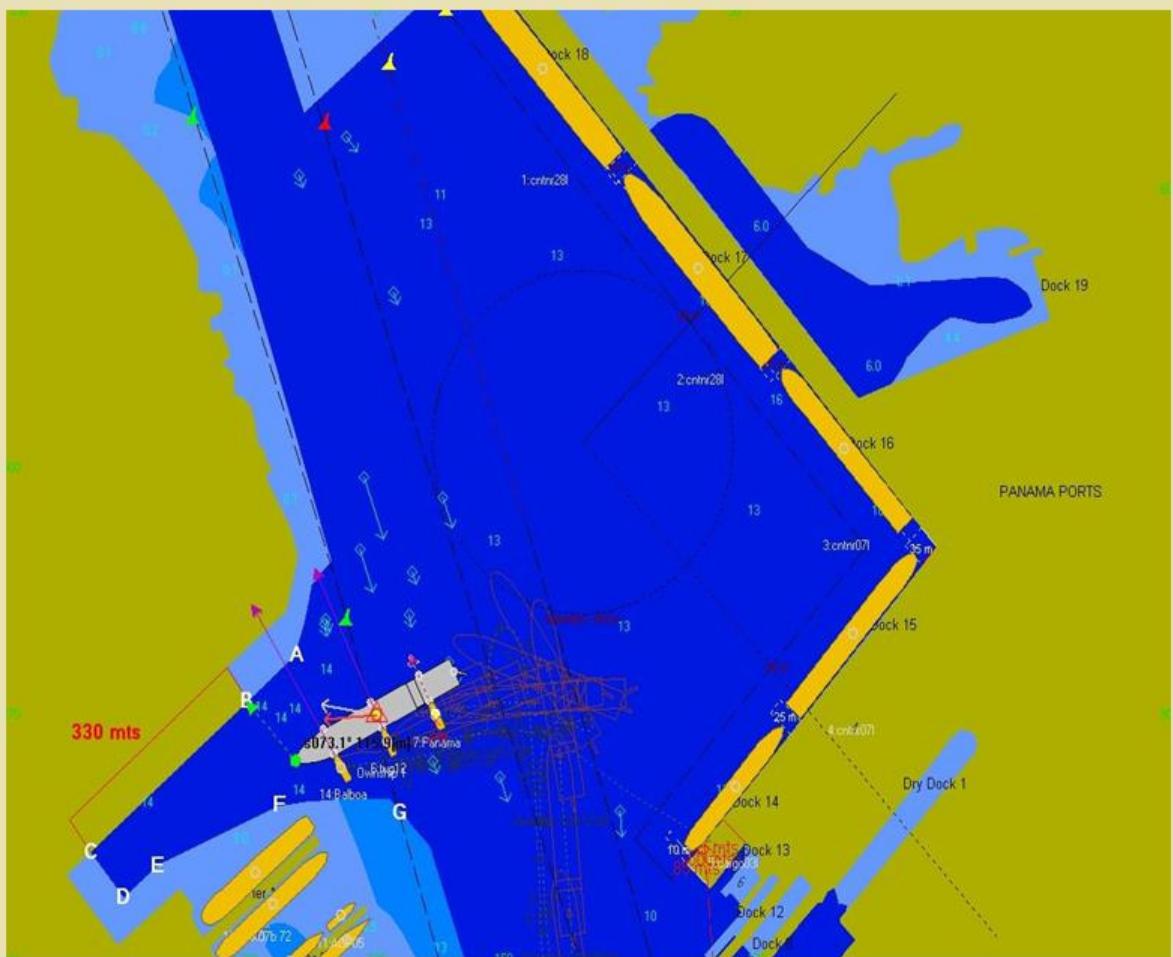


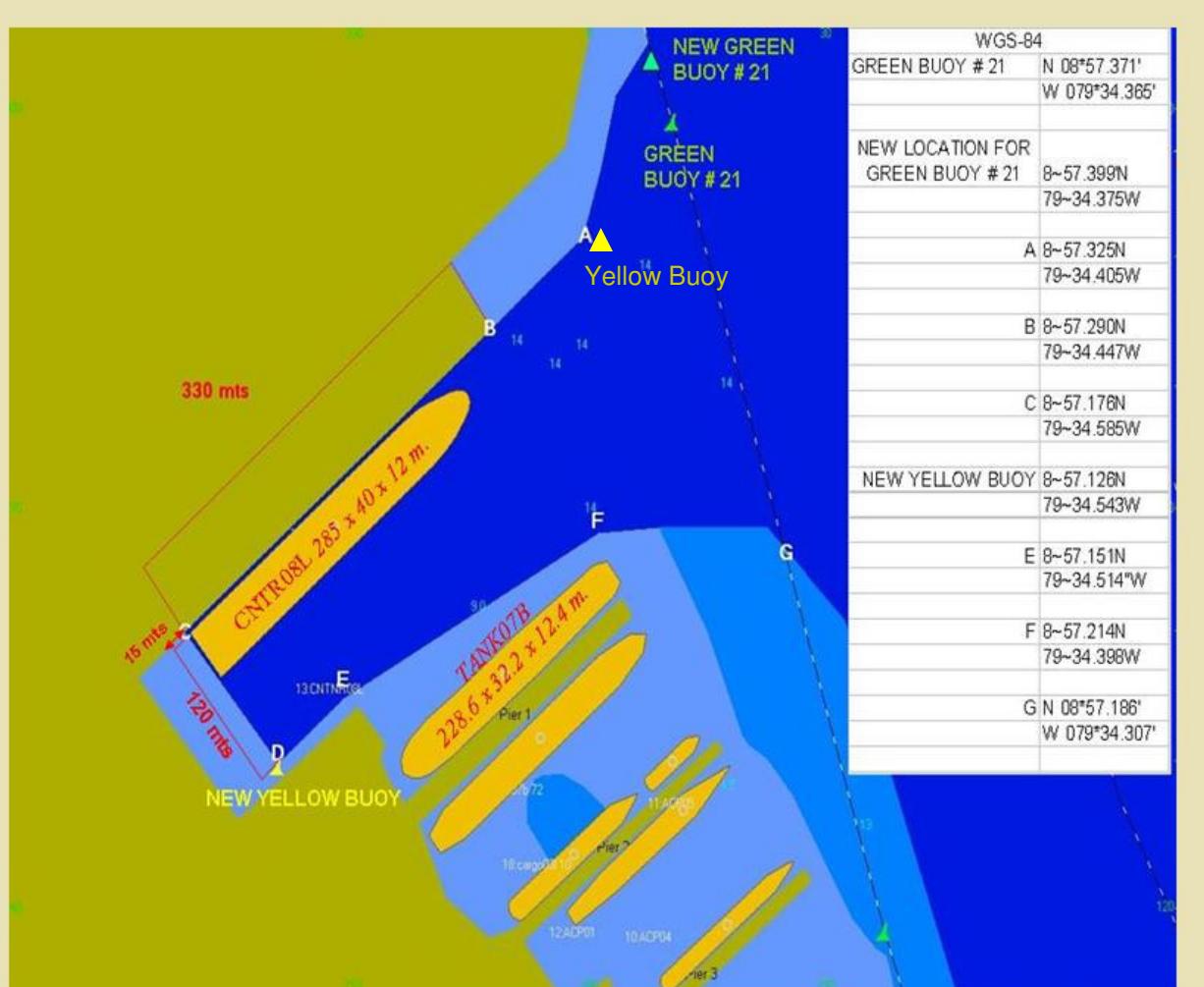












ANNEX C

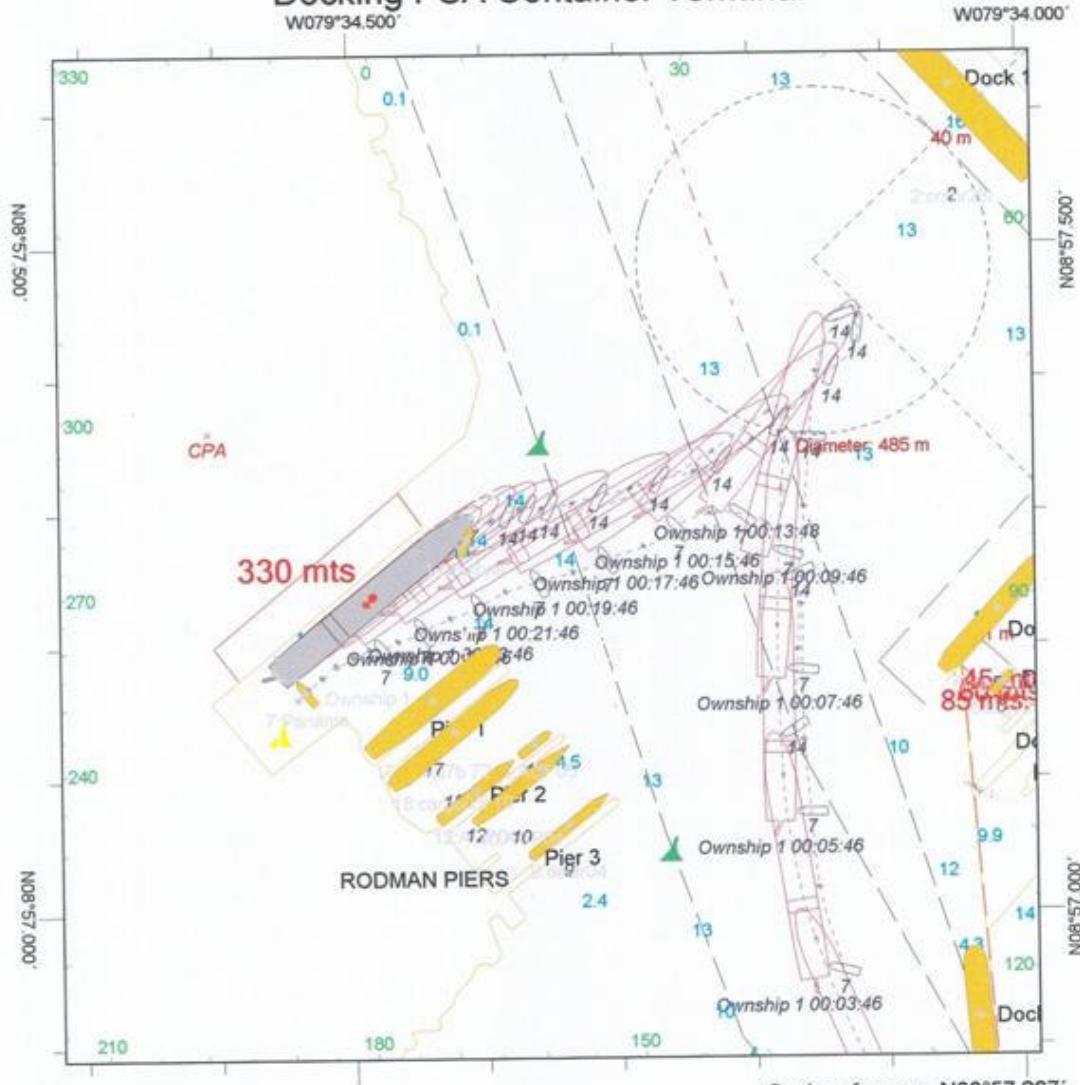
Norcontrol Polaris, Real date: 5/8/2007

Real time: 11:29:33 AM

Exercise: Rodman-070417-1653

Exercise # 1

Docking PSA Container Terminal

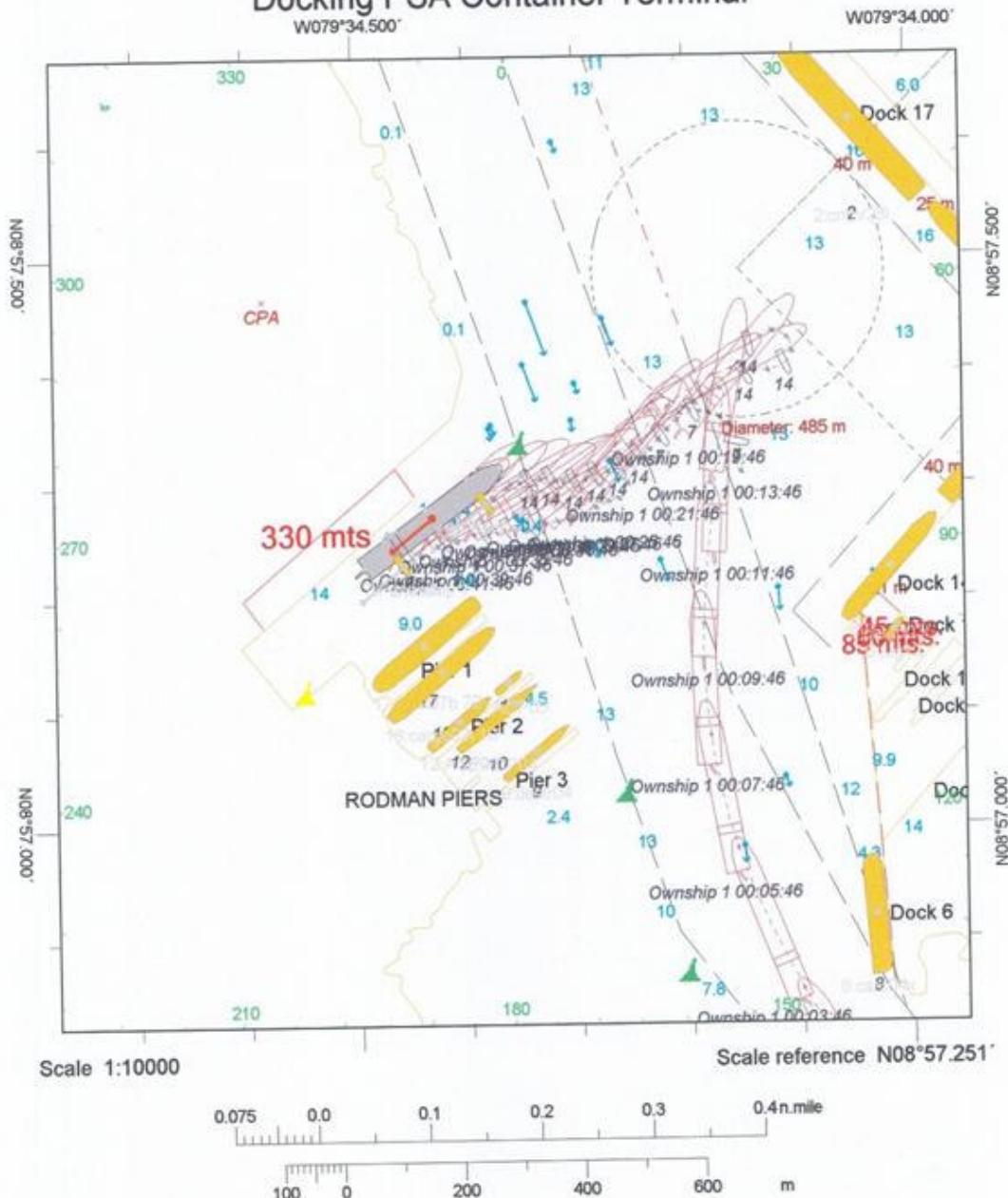


Comments: UKC 2.5mts, 10knots north, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 2 tugs 50t BP

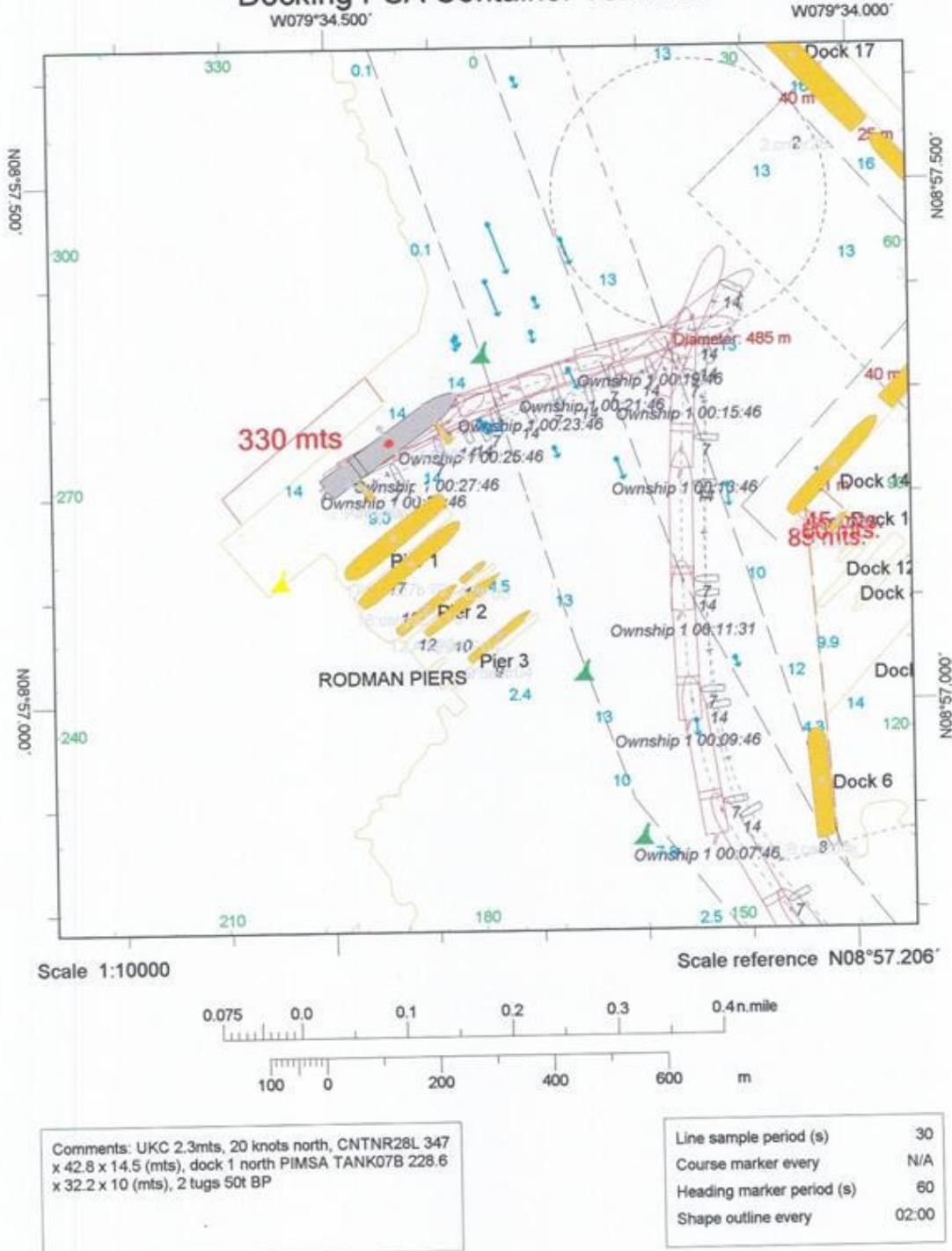
| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exercise # 2

Docking PSA Container Terminal

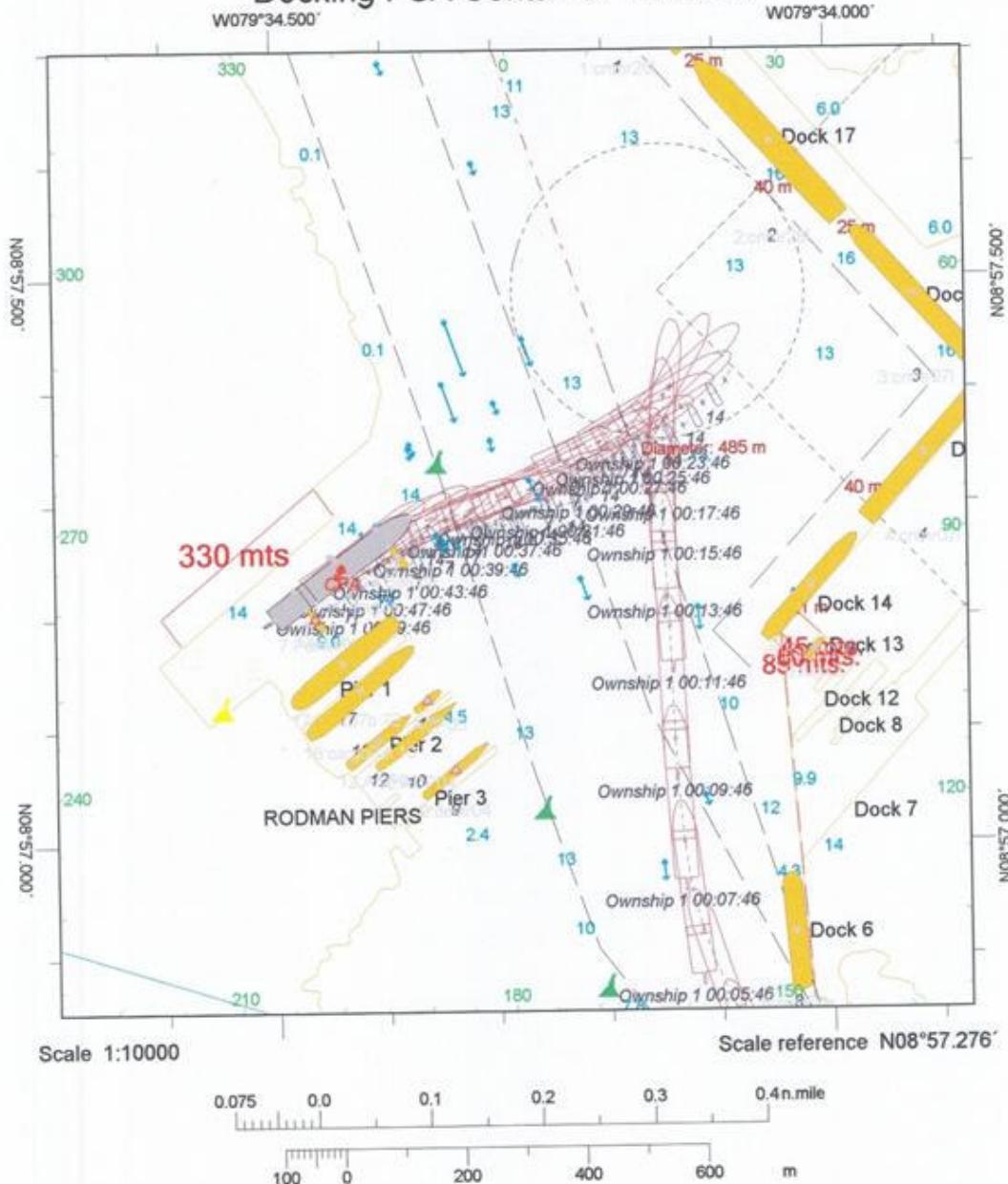


Exercise # 3



Exercise # 4

Docking PSA Container Terminal

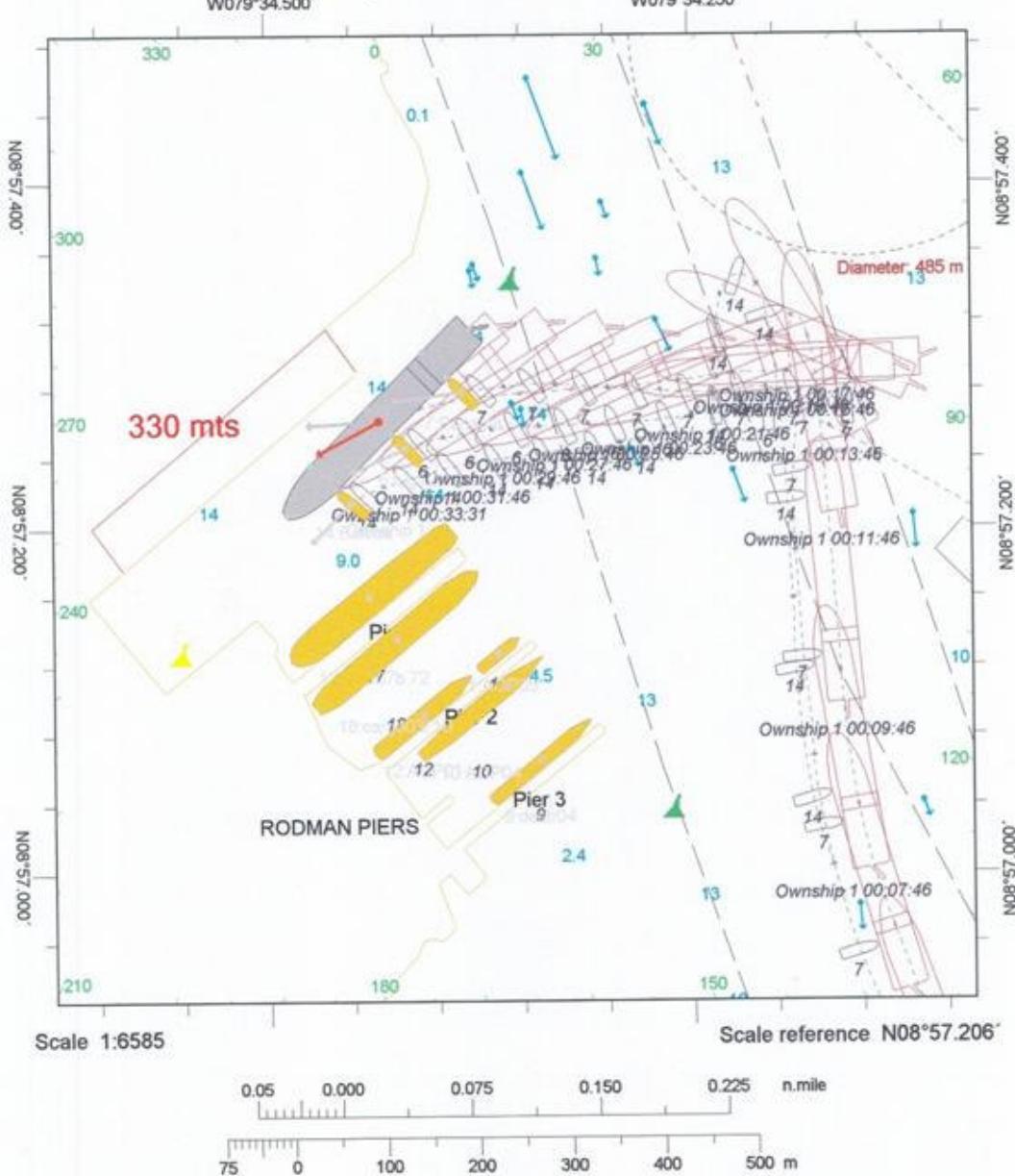


Comments: UKC 1.3mts, 30 knots north, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 3 tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exercise # 5

Docking PSA Container Terminal

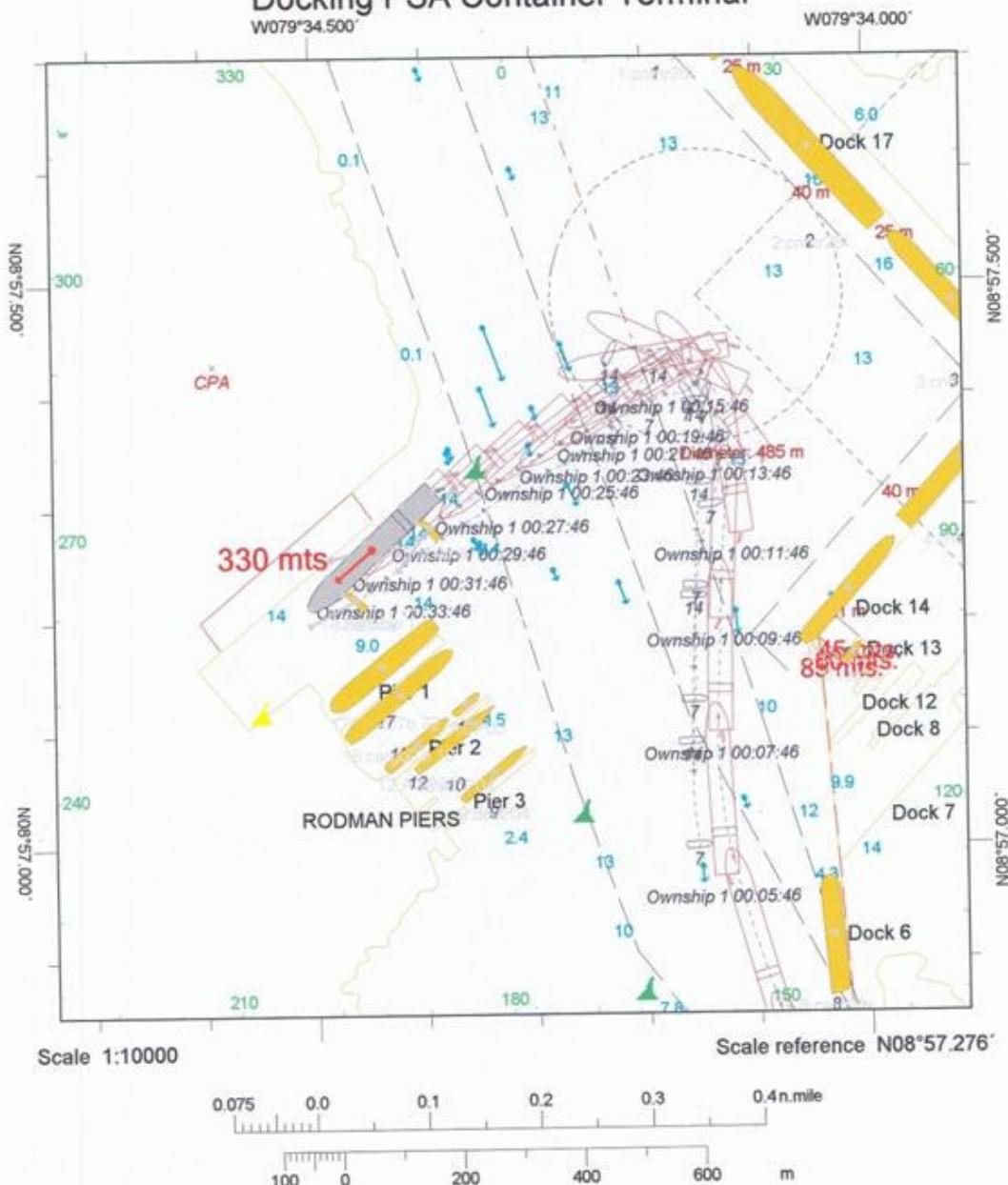


Comments: UKC 1.5mts, 20knots north, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 3tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exercise # 6

Docking PSA Container Terminal

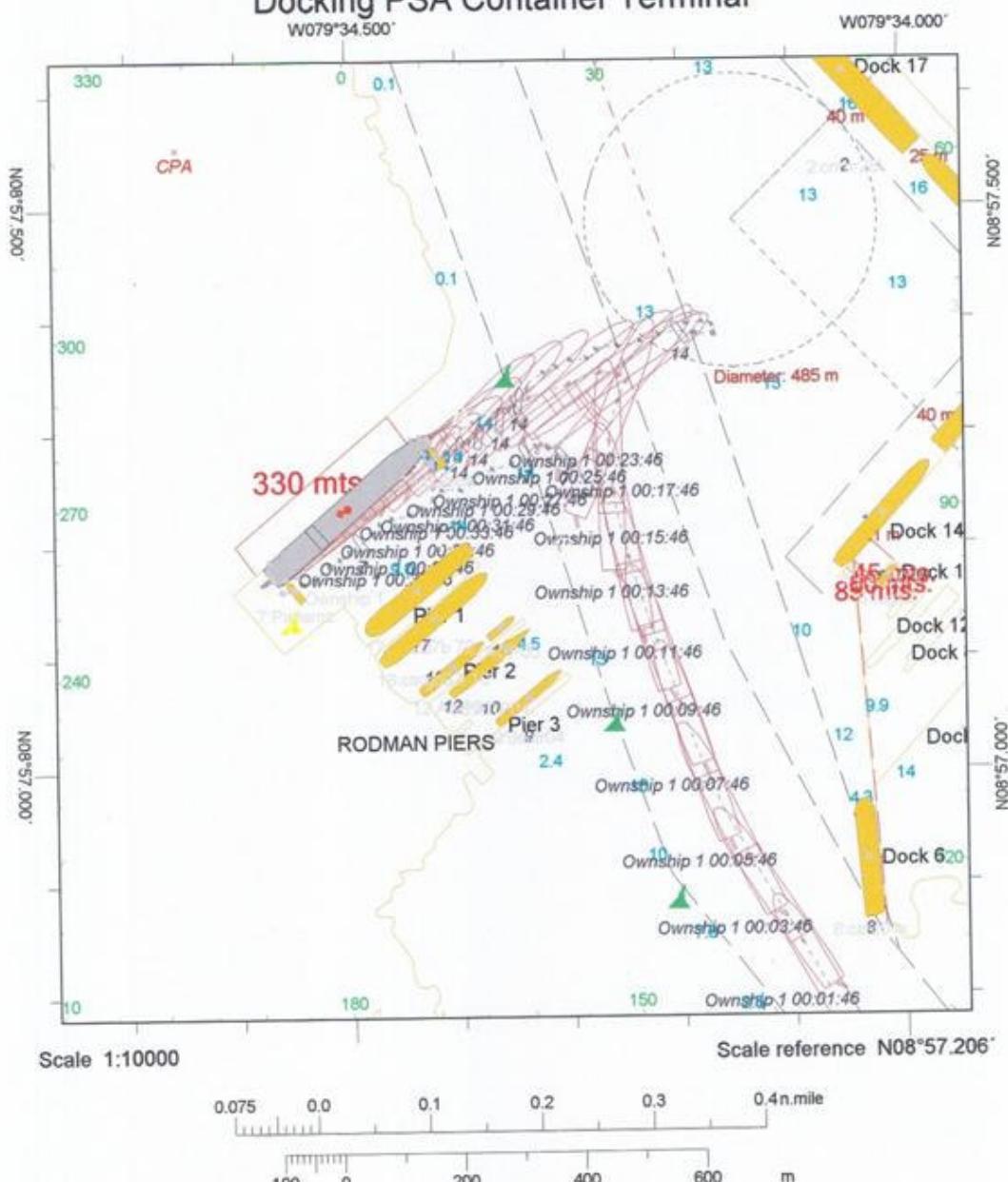


Comments: UKC 2.8mts, 15knots north, CNTNR08L
285x 40 x 12.7 (mts), dock 1 north PIMSA TANK07B
228.6 x 32.2 x 10 (mts), 3tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exercise # 7

Docking PSA Container Terminal

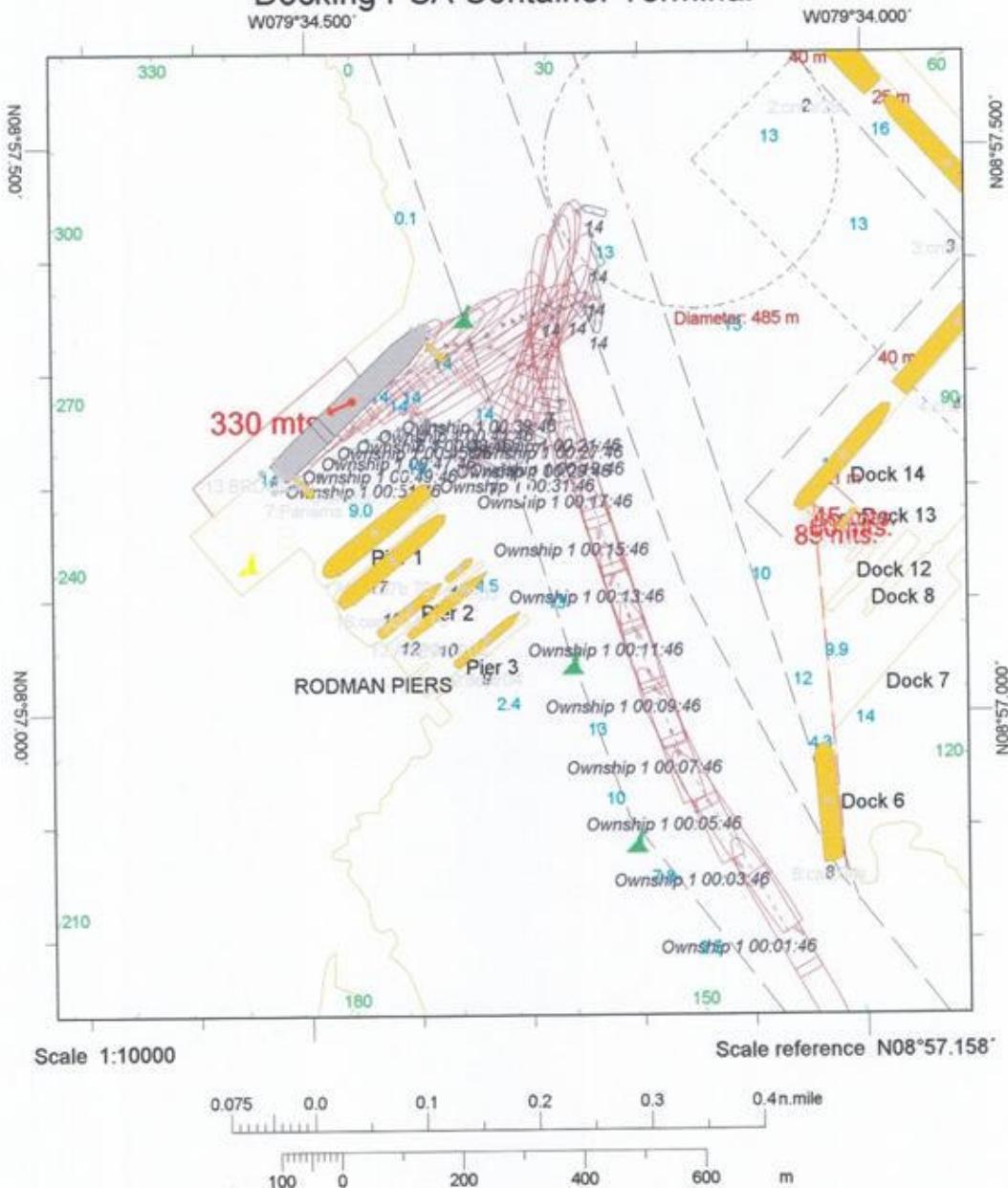


Comments: UKC 2.5mts, 10knots south, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 2 tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exercise # 8

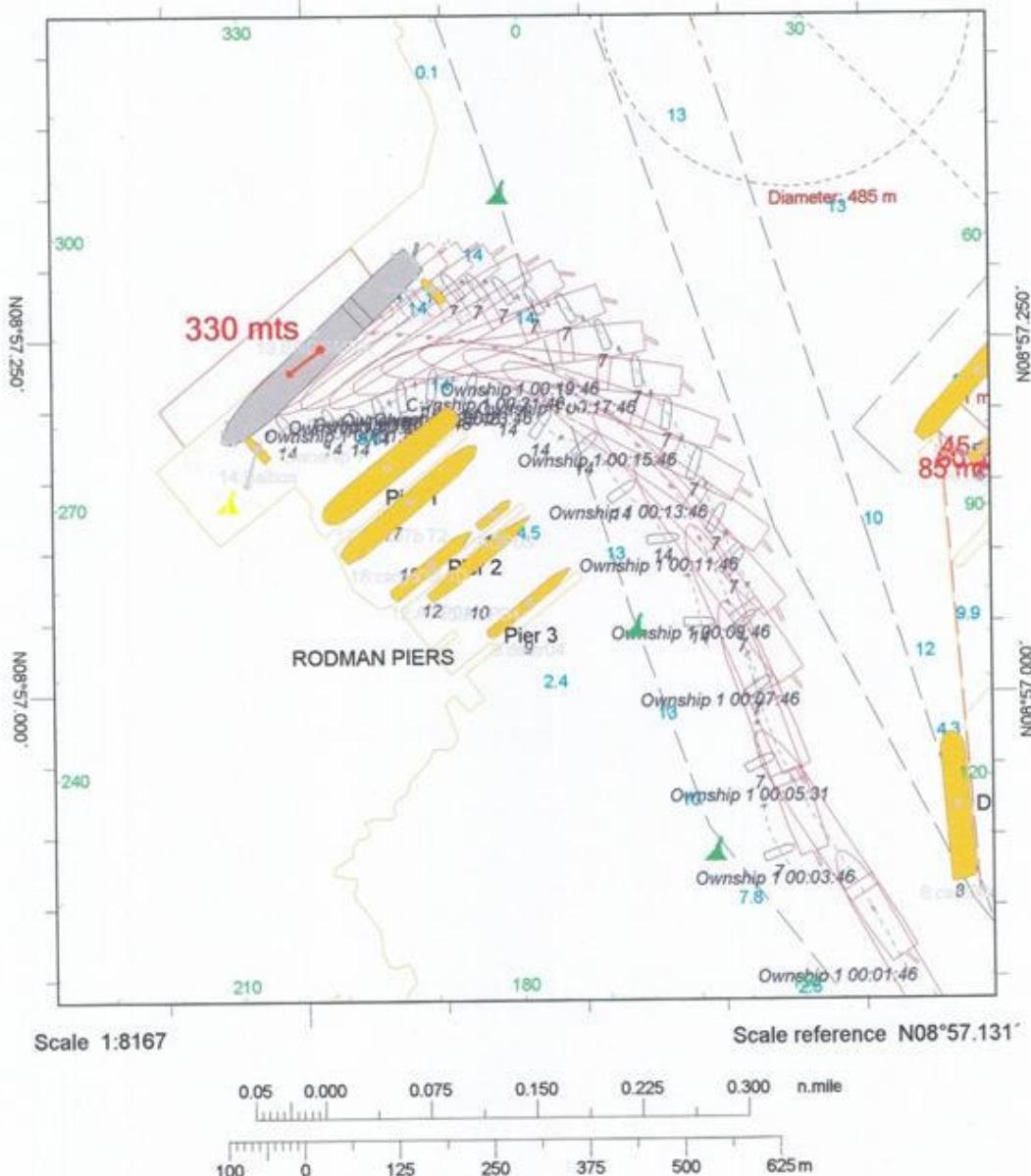
Docking PSA Container Terminal



Exercise # 9

Docking PSA Container Terminal

W079°34.500'



Comments: UKC 2.5mts, 10knots south, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 2 tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Norcontrol Polaris, Real date: 5/8/2007

Real time: 9:32:06 AM

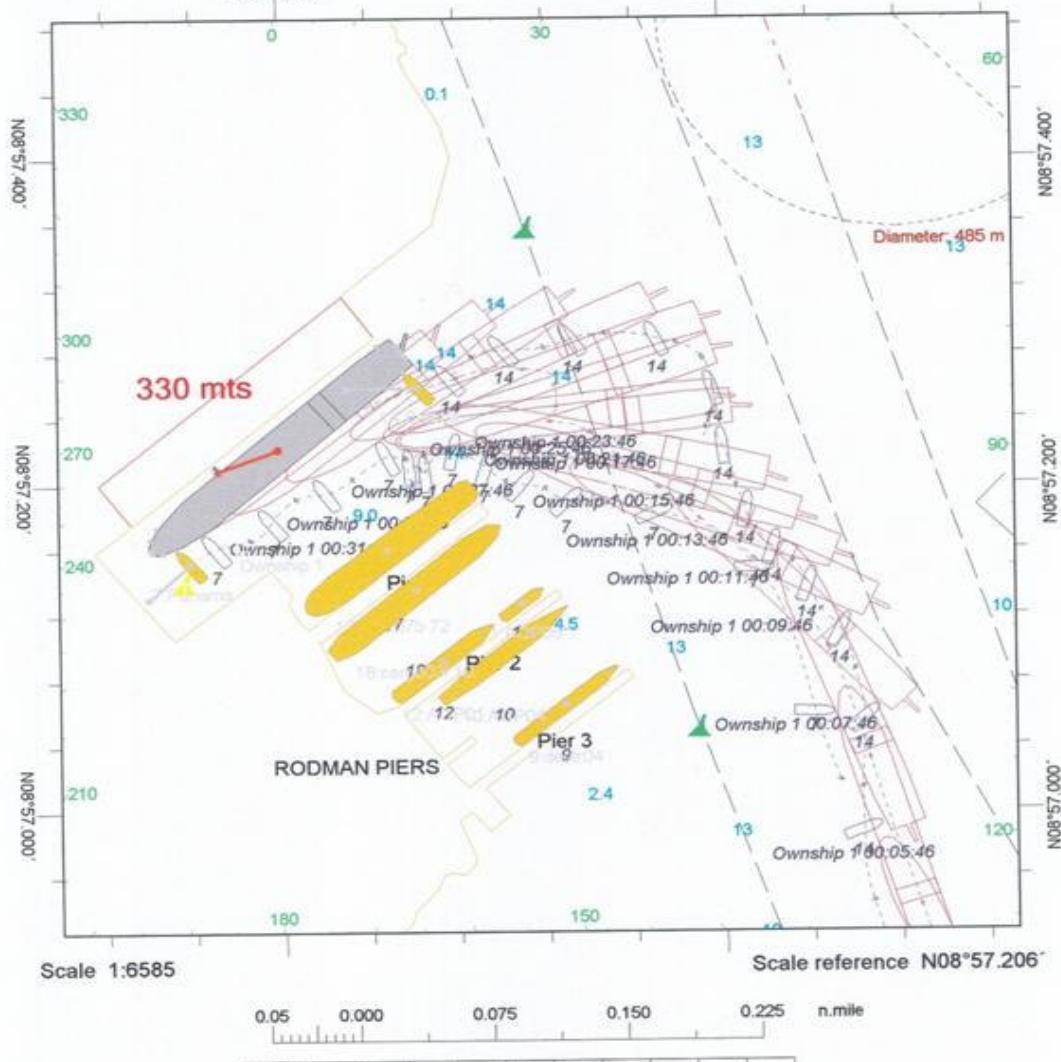
Exercise: Rodman-070507-1433

Exercise # 10

Docking PSA Container Terminal

W079°34.500'

W079°34.250'



Comments: UKC 2.5mts, 10knots north, CNTNR28L 347 x 42.8 x 14.5 (mts), dock 1 north PIMSA TANK07B 228.6 x 32.2 x 10 (mts), 2 tugs 50t BP

| | |
|---------------------------|-------|
| Line sample period (s) | 30 |
| Course marker every | N/A |
| Heading marker period (s) | 60 |
| Shape outline every | 02:00 |

Exc date: 4/10/2007

Exc time (elapsed): 8:32:54 AM (00:32:54)

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