



## Cyber-MAR Vessel Pilot

# Vessel Pilot Walkthrough

5<sup>th</sup> May 2022

## Stage 1 – Downloading and Propagation of Attack

- Maintaining Maritime Systems
  - 3<sup>rd</sup> party service company
  - Receives the malicious email
  - Clicks the link and downloads the firmware
- Transferring the firmware to the ship
  - On board scanner will not pick up malware
- Good security practices throughout

# Vessel Pilot Walkthrough – Stage 1

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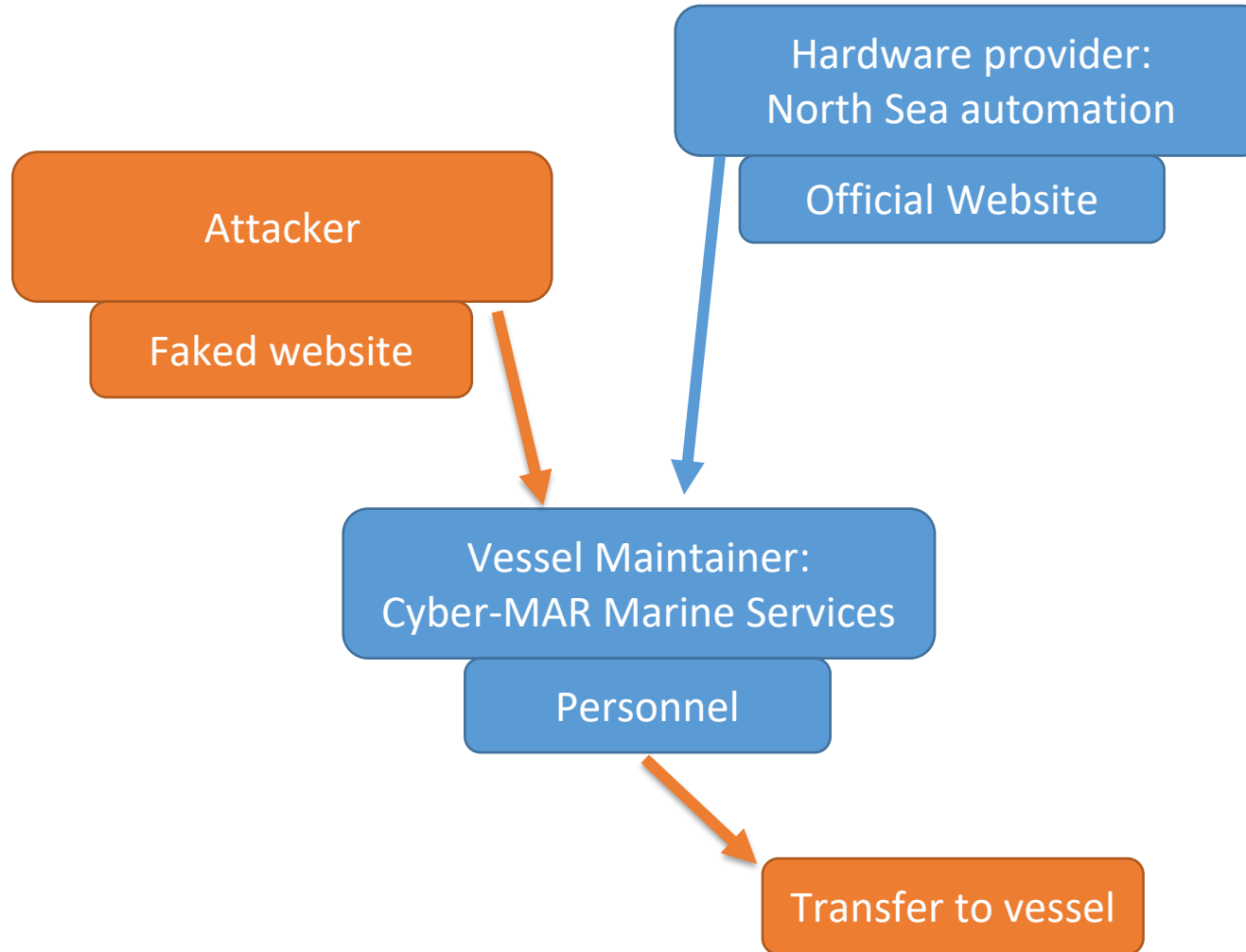
## Reconnaissance & Weaponisation:

- Finding a compromise vector and implementing the malicious firmware
- Identifying the human target
- Website cloning, look-alike domain, email lookalike

## Attack stage 1:

- Piggyback on real vulnerability notification:
  - Malicious email
- Link to website clone
- Malicious firmware download
- Transfer to USB storage for installation

# Vessel Pilot Walkthrough – Stage 1



## Stage 2 – Initiating the Attack on Vessel

- Installing malicious firmware (on propulsion and/or rudder control systems)
- Rudder control system malfunction (incorrect data)
- During Initiation of attack – there is a difference in expected and actual rudder angles
- Demonstrate the final outcome of the attack

## Vessel operations when entering Port

- Normal ship entry
- Altered path ship entry

## Stage 3 – Responding to the Attack

- Crew response to the attack
  - Low response time
  - Natural geography
  - Tugs etc.
- Impact of the attack
  - Vessel blocking PoV entrance
  - Difficult salvage operation (Estimated duration of this 3 – 7 days)
- From simulation with crews the best result is still a glancing blow with the port wall, so almost unavoidable.

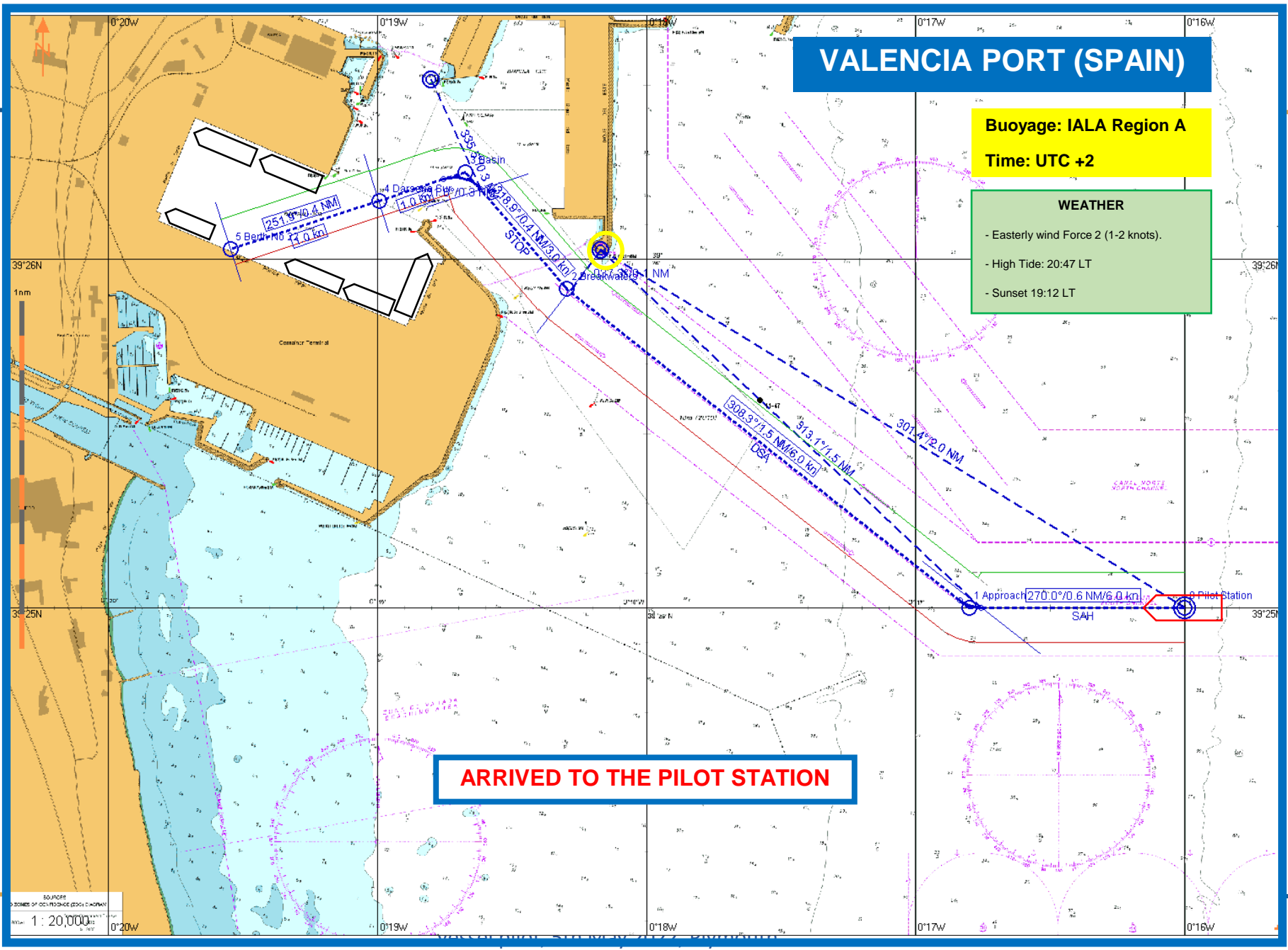
## Normal Ship Entry at Valencia

# VALENCIA PORT (SPAIN)

**Buoyage: IALA Region A**  
**Time: UTC +2**

**WEATHER**

- Easterly wind Force 2 (1-2 knots).
- High Tide: 20:47 LT
- Sunset 19:12 LT



**ARRIVED TO THE PILOT STATION**

SOURCE:  
COAST GUARD (CGO) CHARTS  
Scale: 1:20,000



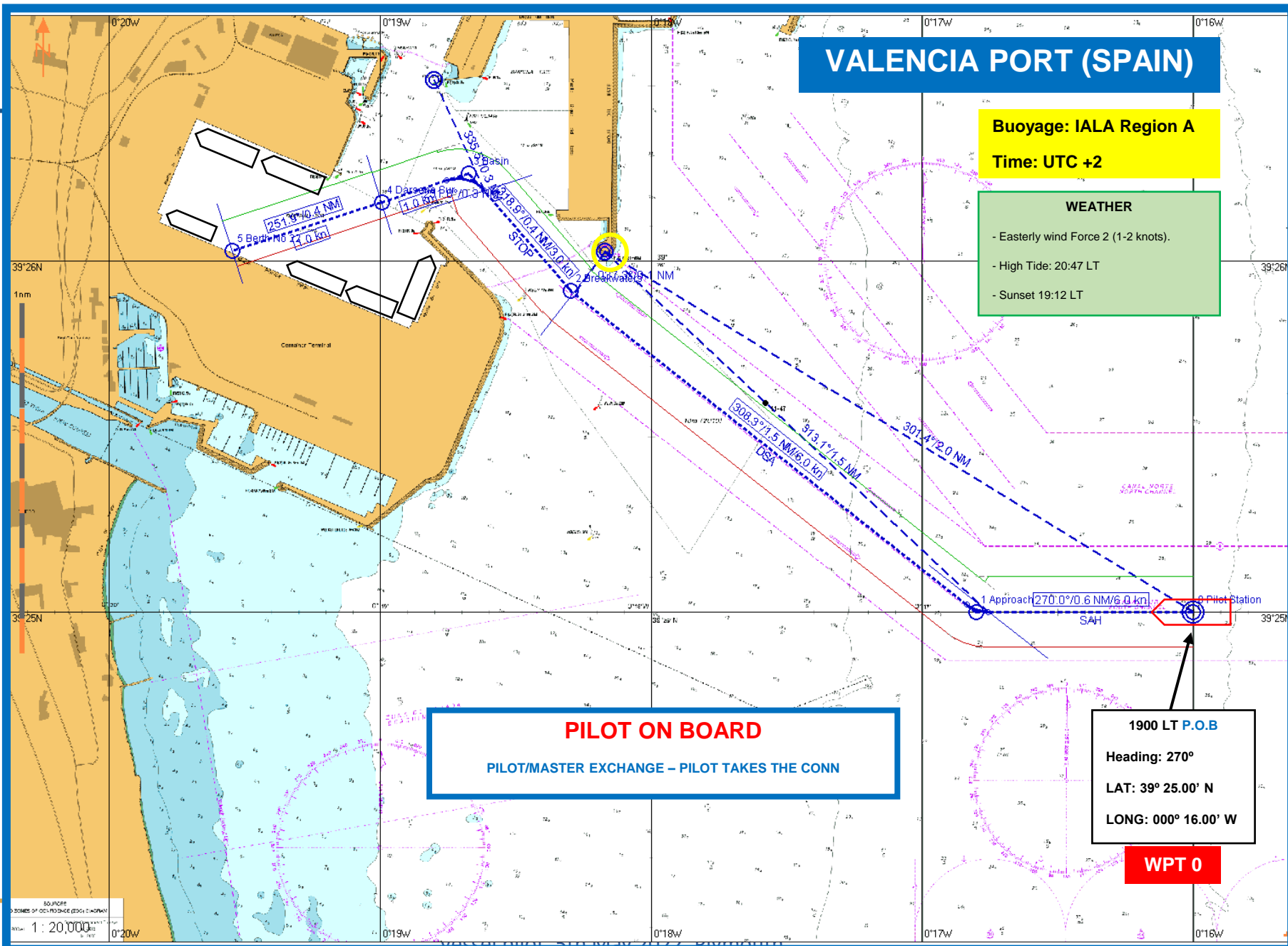


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**PILOT ON BOARD**  
 PILOT/MASTER EXCHANGE – PILOT TAKES THE CONN

**1900 LT P.O.B**  
 Heading: 270°  
 LAT: 39° 25.00' N  
 LONG: 000° 16.00' W

**WPT 0**

SOURCE:  
 CHARTS OF COAST AND GEOD. SURVEY  
 Scale: 1 : 20,000

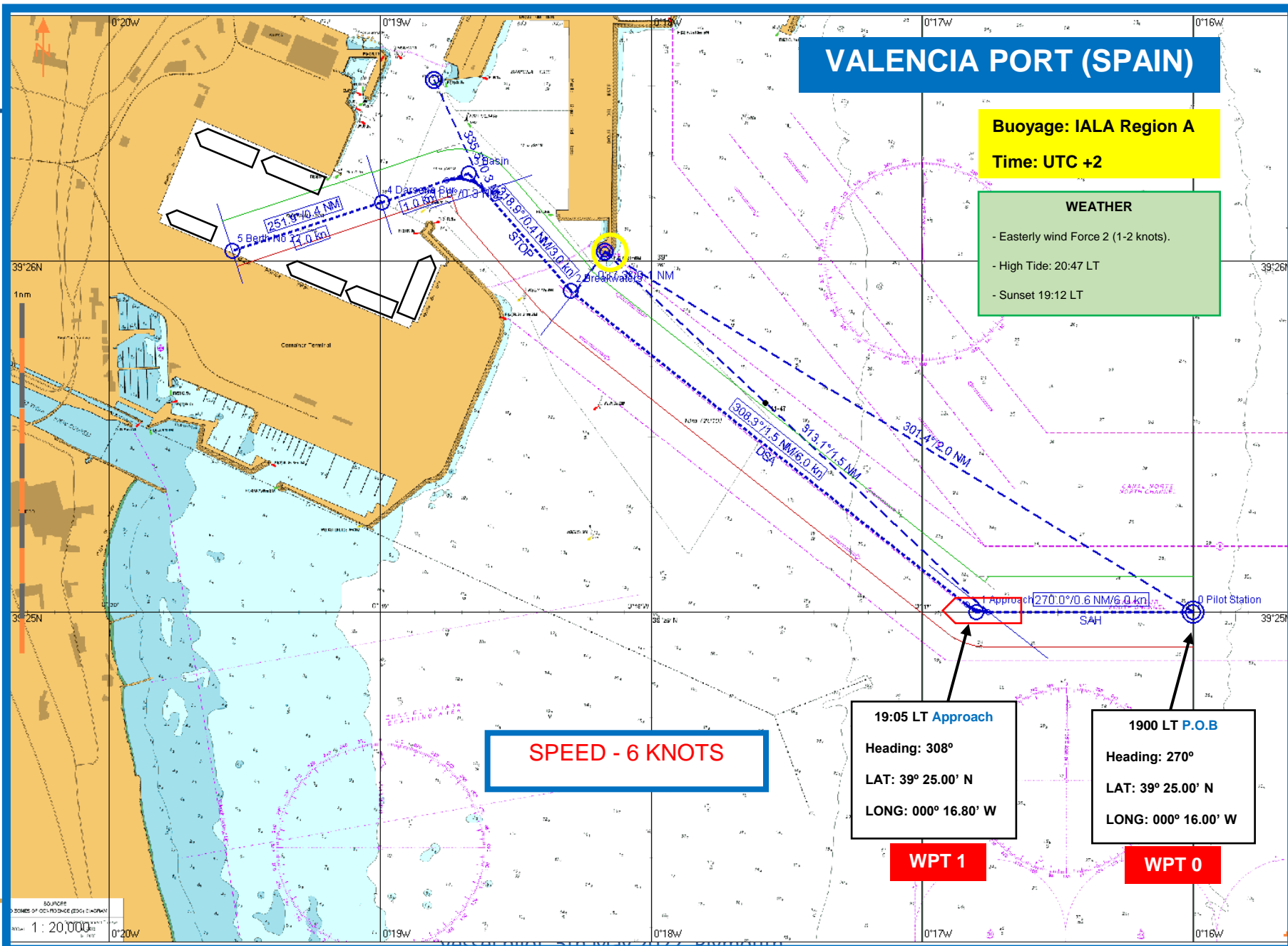


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**Buoyage: IALA Region A**  
**Time: UTC +2**

**WEATHER**

- Easterly wind Force 2 (1-2 knots).
- High Tide: 20:47 LT
- Sunset 19:12 LT



**SPEED - 6 KNOTS**

**19:05 LT Approach**  
 Heading: 308°  
 LAT: 39° 25.00' N  
 LONG: 000° 16.80' W

**WPT 1**

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**Buoyage: IALA Region A**  
**Time: UTC +2**

**WEATHER**

- Easterly wind Force 2 (1-2 knots).
- High Tide: 20:47 LT
- Sunset 19:12 LT

**2 Tugs attached before brake water**

Total Bollard Pull:

- FORWARD: 70t bollard pull - Llevant (Voith tractor)
- AFT: 55t bollard pull - Furia (Voith tractor)

**SPEED - 6 KNOTS**

**19:05 LT Approach**

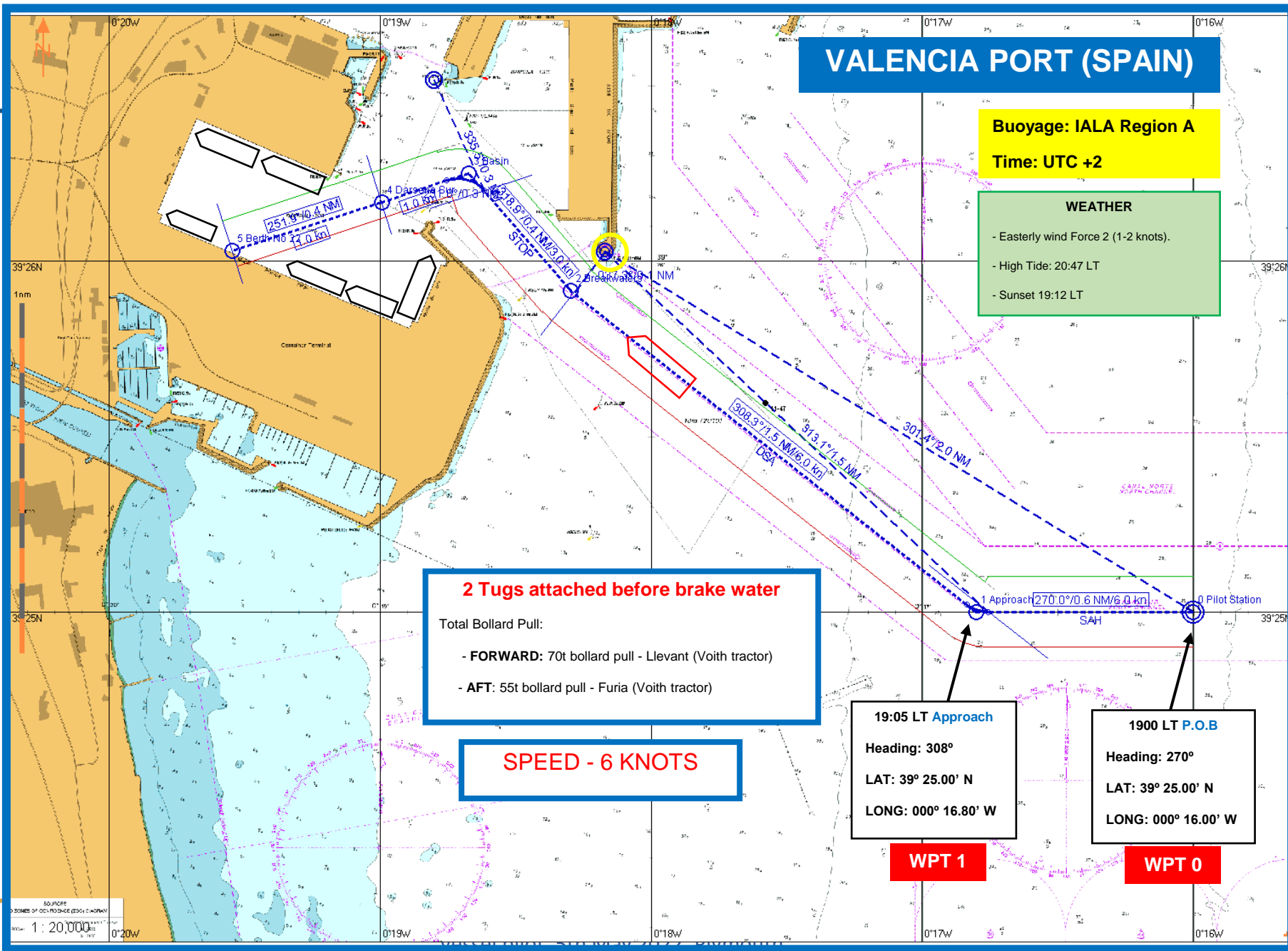
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**WPT 1**

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Heading: 270°  
 LAT: 39° 25.00' N  
 LONG: 000° 16.00' W

**WPT 0**



SOURCE:  
 CHARTS OF COAST AND GEOD. CONTROL  
 Scale: 1 : 20,000



# VALENCIA PORT (SPAIN)

**Buoyage: IALA Region A**  
**Time: UTC +2**

**WEATHER**

- Easterly wind Force 2 (1-2 knots).
- High Tide: 20:47 LT
- Sunset 19:12 LT

**NOTES**

- Engine stopped
- Speed 5.5 knots
- Tugs attached

**19:20 LT B/W**  
**Heading: 319°**  
**LAT: 39° 25.92' N**  
**LONG: 000° 18.30' W**

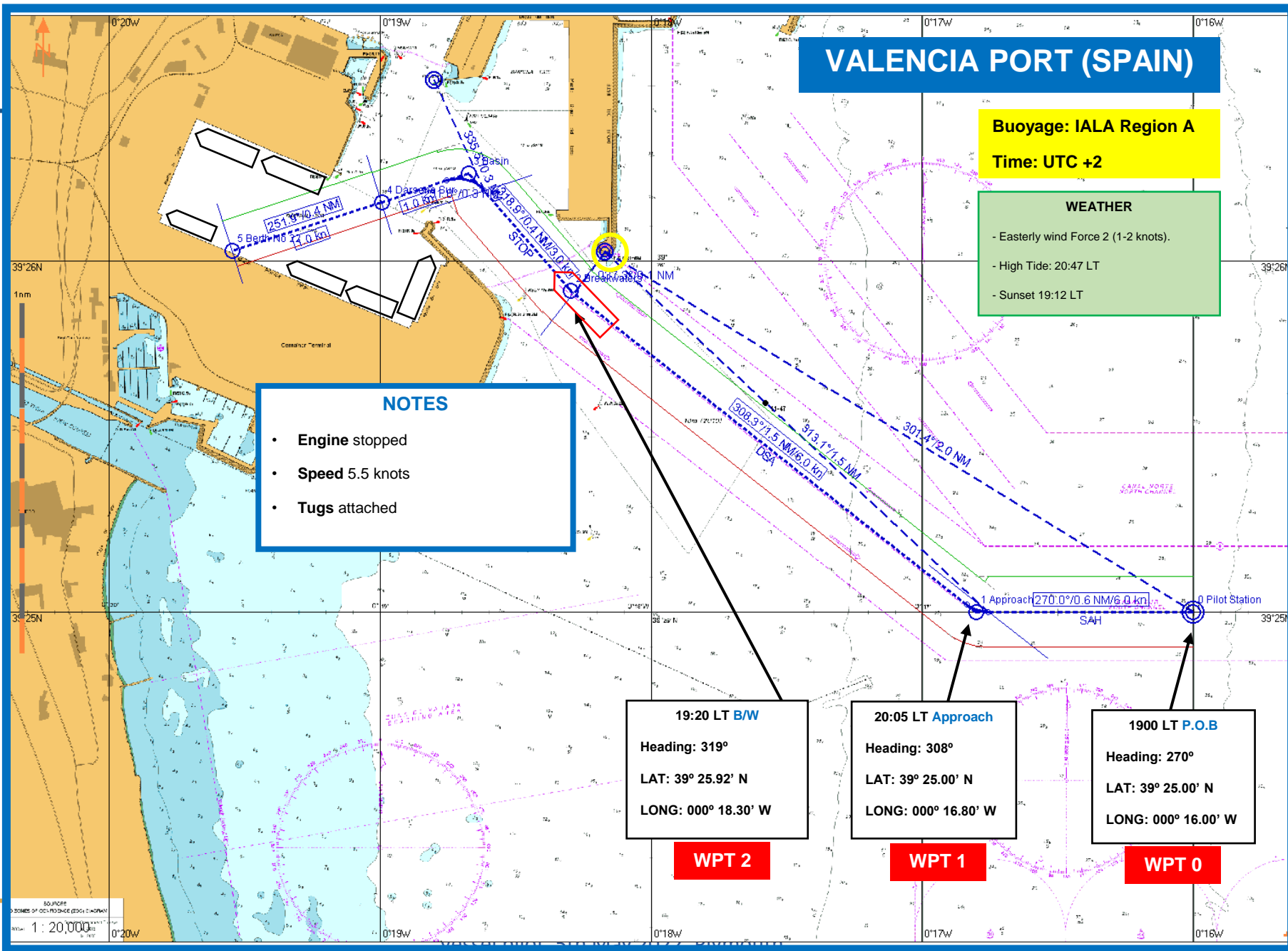
**WPT 2**

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**WPT 1**

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**Heading: 270°**  
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**WPT 0**

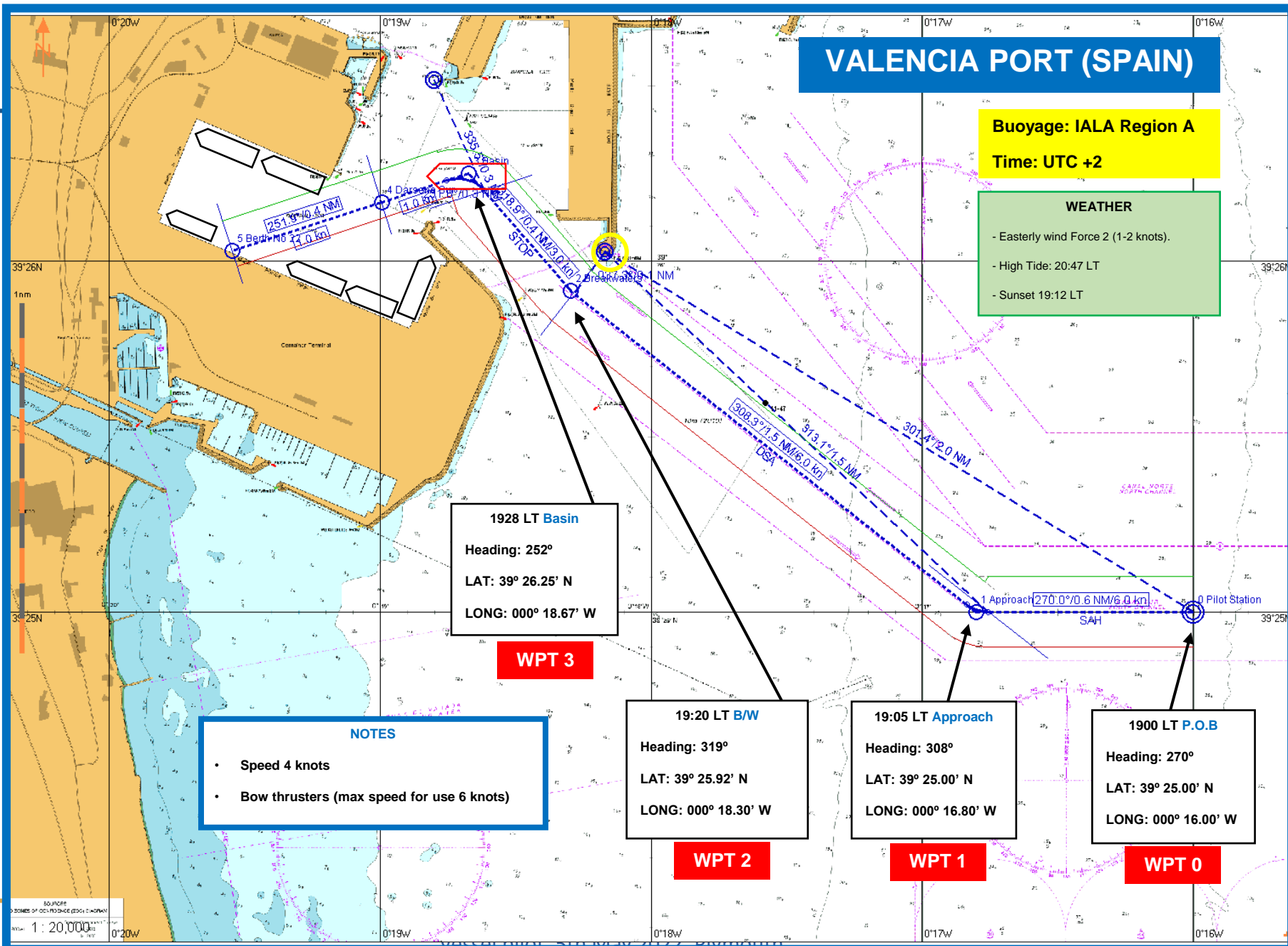


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**Time: UTC +2**

**WEATHER**

- Easterly wind Force 2 (1-2 knots).
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**1928 LT Basin**  
 Heading: 252°  
 LAT: 39° 26.25' N  
 LONG: 000° 18.67' W

**WPT 3**

**NOTES**

- Speed 4 knots
- Bow thrusters (max speed for use 6 knots)

**19:20 LT B/W**  
 Heading: 319°  
 LAT: 39° 25.92' N  
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**WPT 2**

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**WPT 0**

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**19:47 LT Darsena Sur**  
 Heading: 252°  
 LAT: 39° 26.17' N  
 LONG: 000° 18.99' W

**WPT 4**

**19:28 LT Basin**  
 Heading: 252°  
 LAT: 39° 26.25' N  
 LONG: 000° 18.67' W

**WPT 3**

**NOTES**  
 Speed 2 knots

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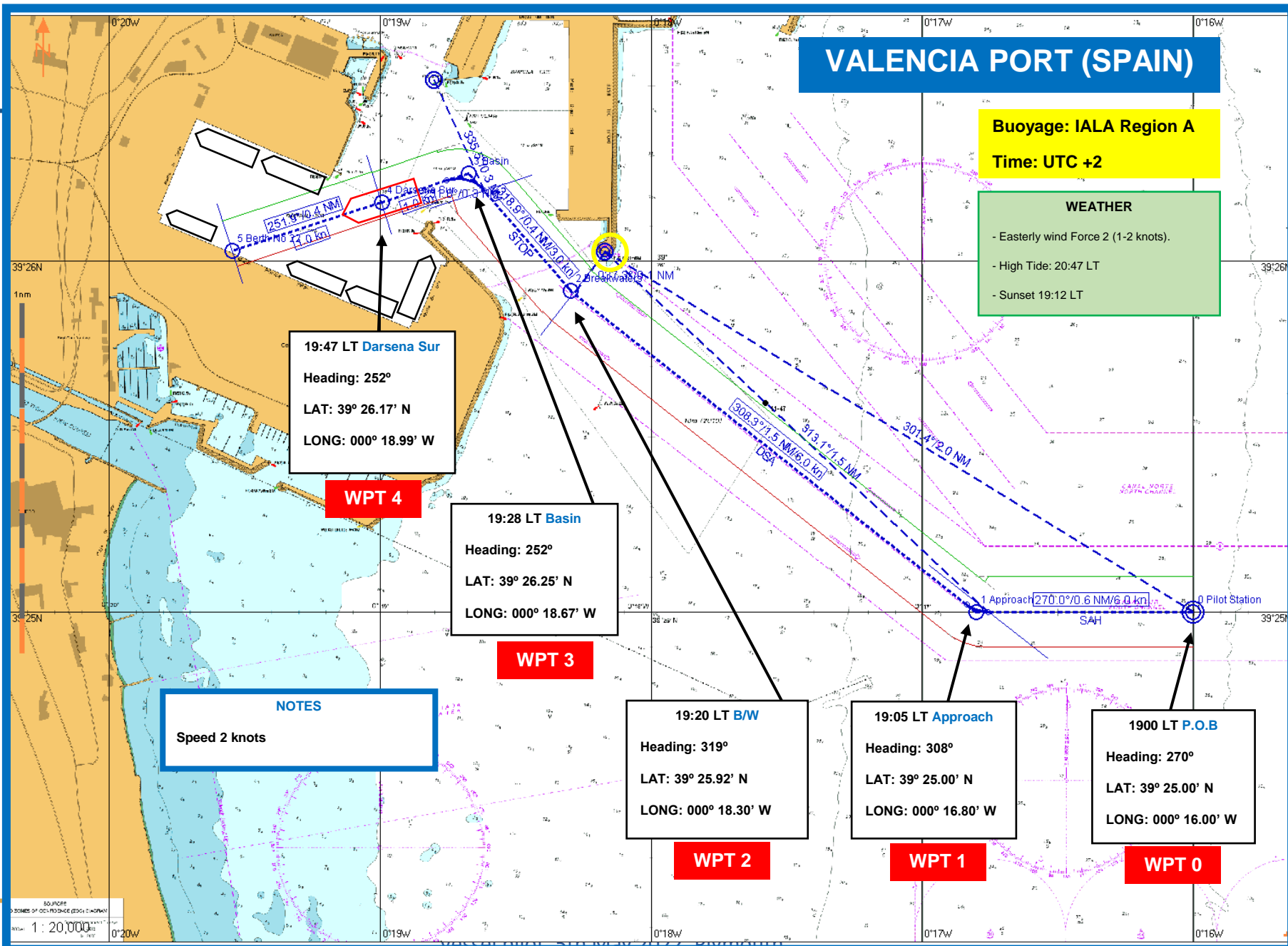
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**WPT 0**



SOURCE: CHARTS OF COAST AND GEOD. SURVEY  
 Scale: 1:20,000



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**20:14 LT FWE**  
 Heading: 294°  
 LAT: 39° 26.03' N  
 LONG: 000° 19.55' W

**WPT 5**

**19:47 LT Darsena Sur**  
 Heading: 252°  
 LAT: 39° 26.17' N  
 LONG: 000° 18.99' W

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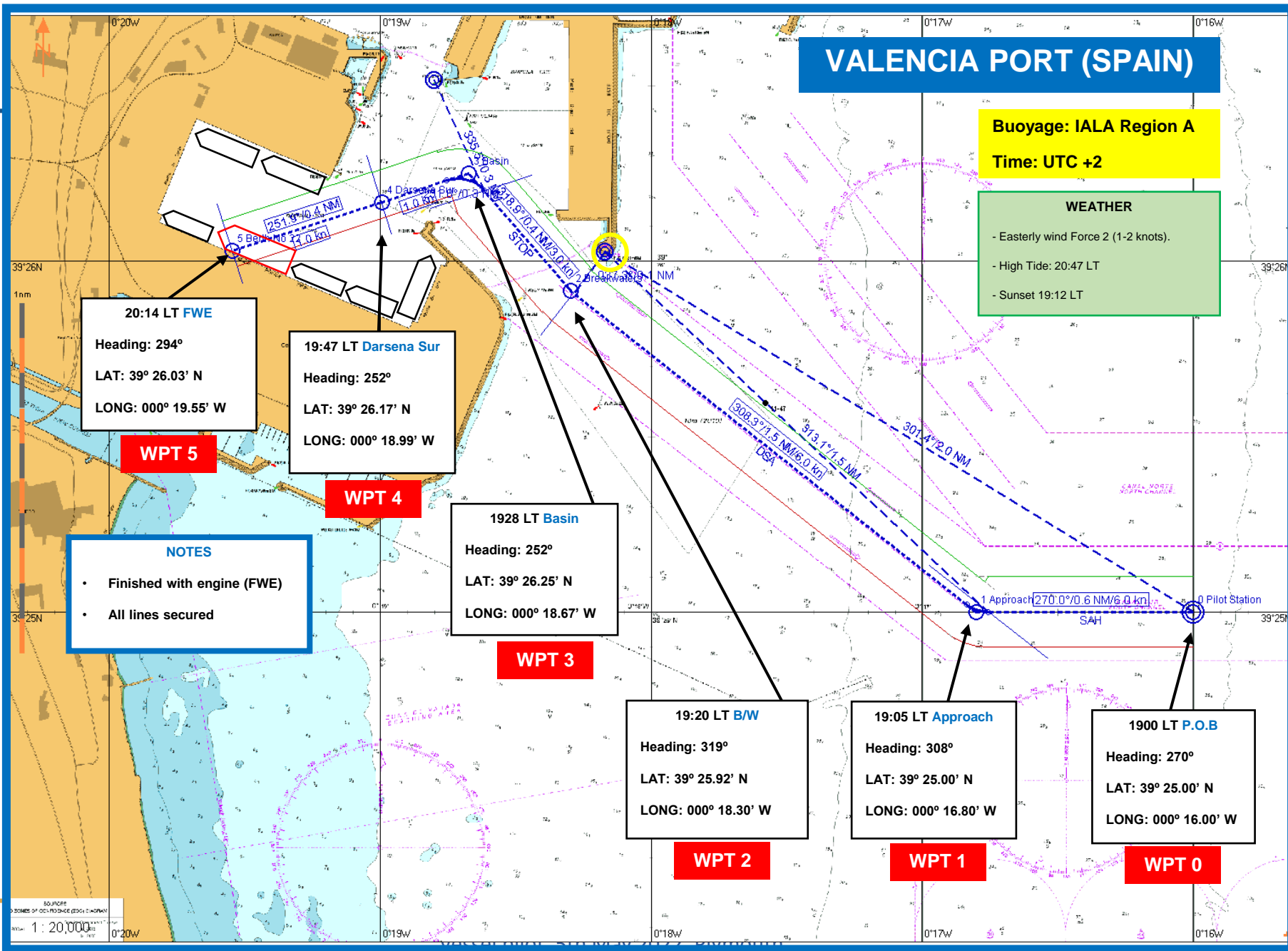
**WPT 1**

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 Heading: 270°  
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**WPT 0**

**NOTES**

- Finished with engine (FWE)
- All lines secured



## Ship Entry at Valencia with cyber-attack

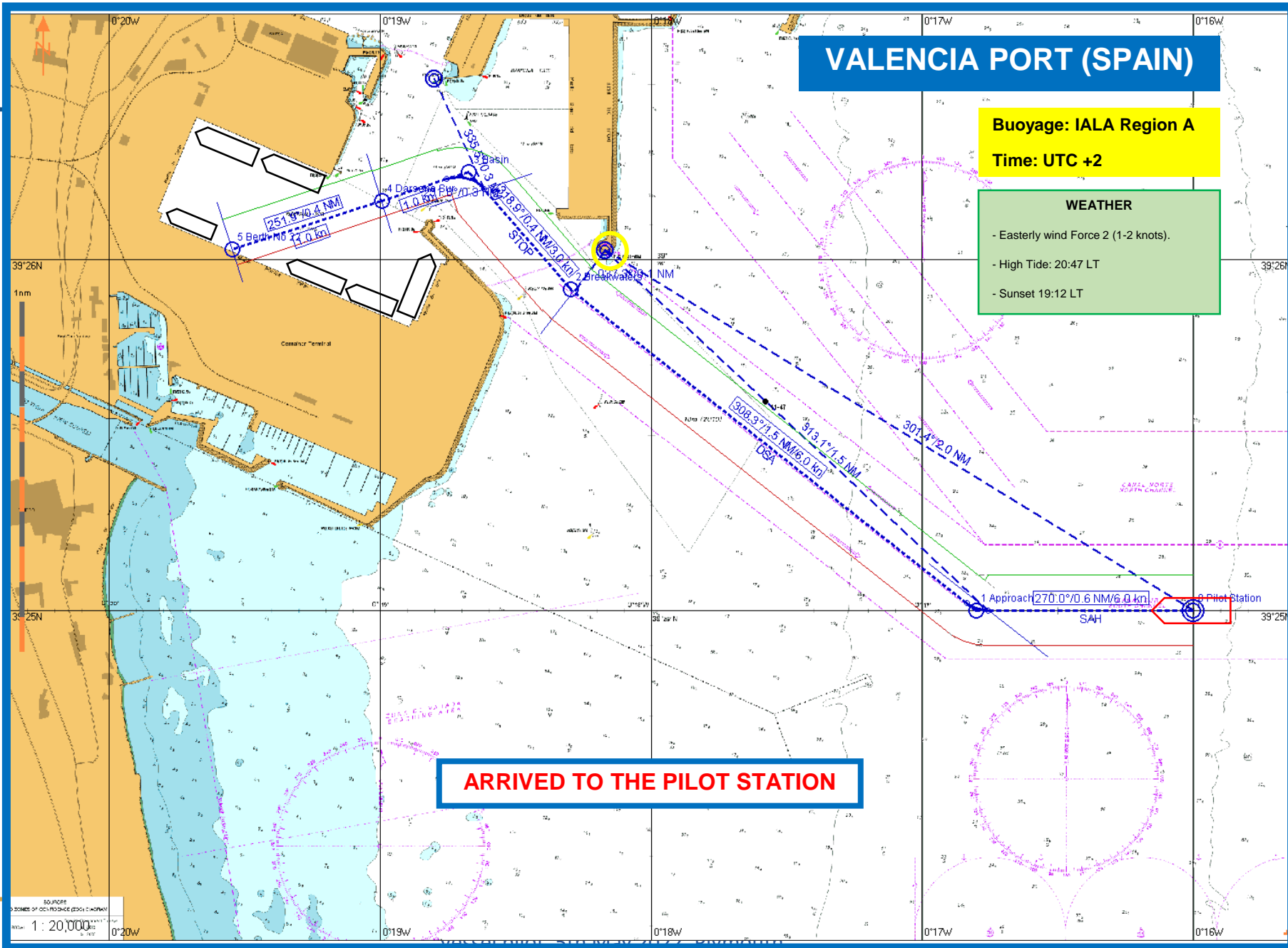


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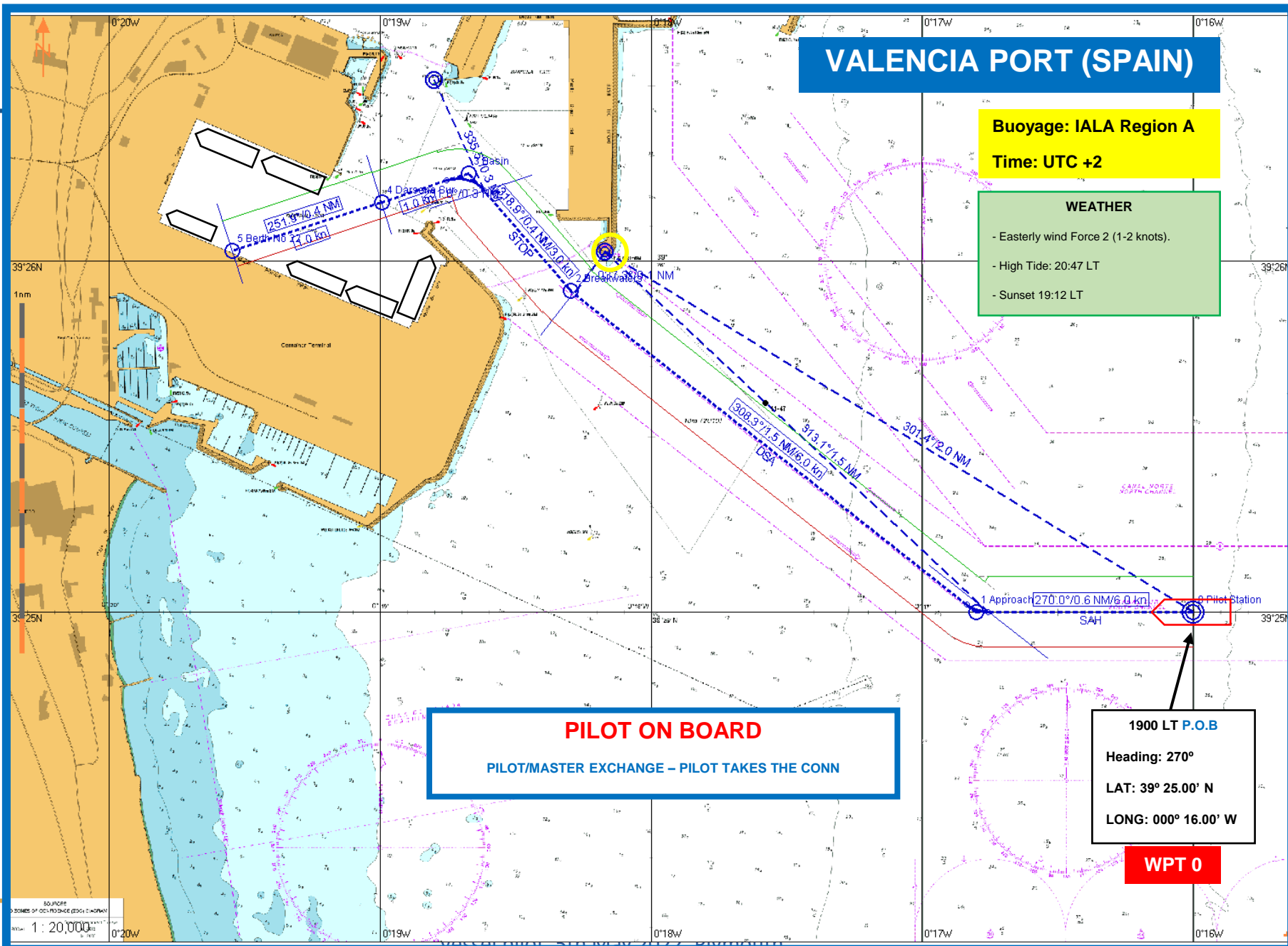


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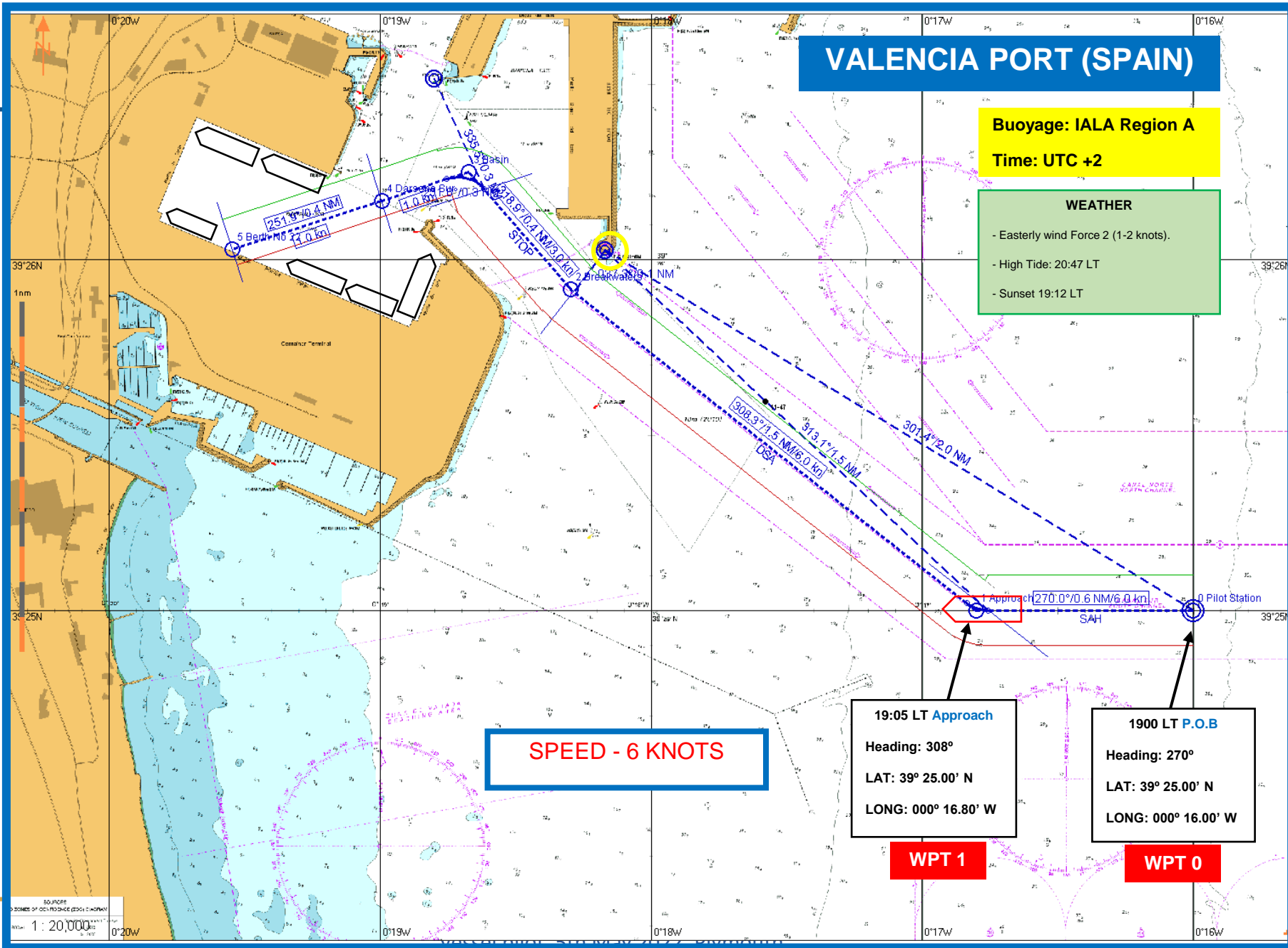
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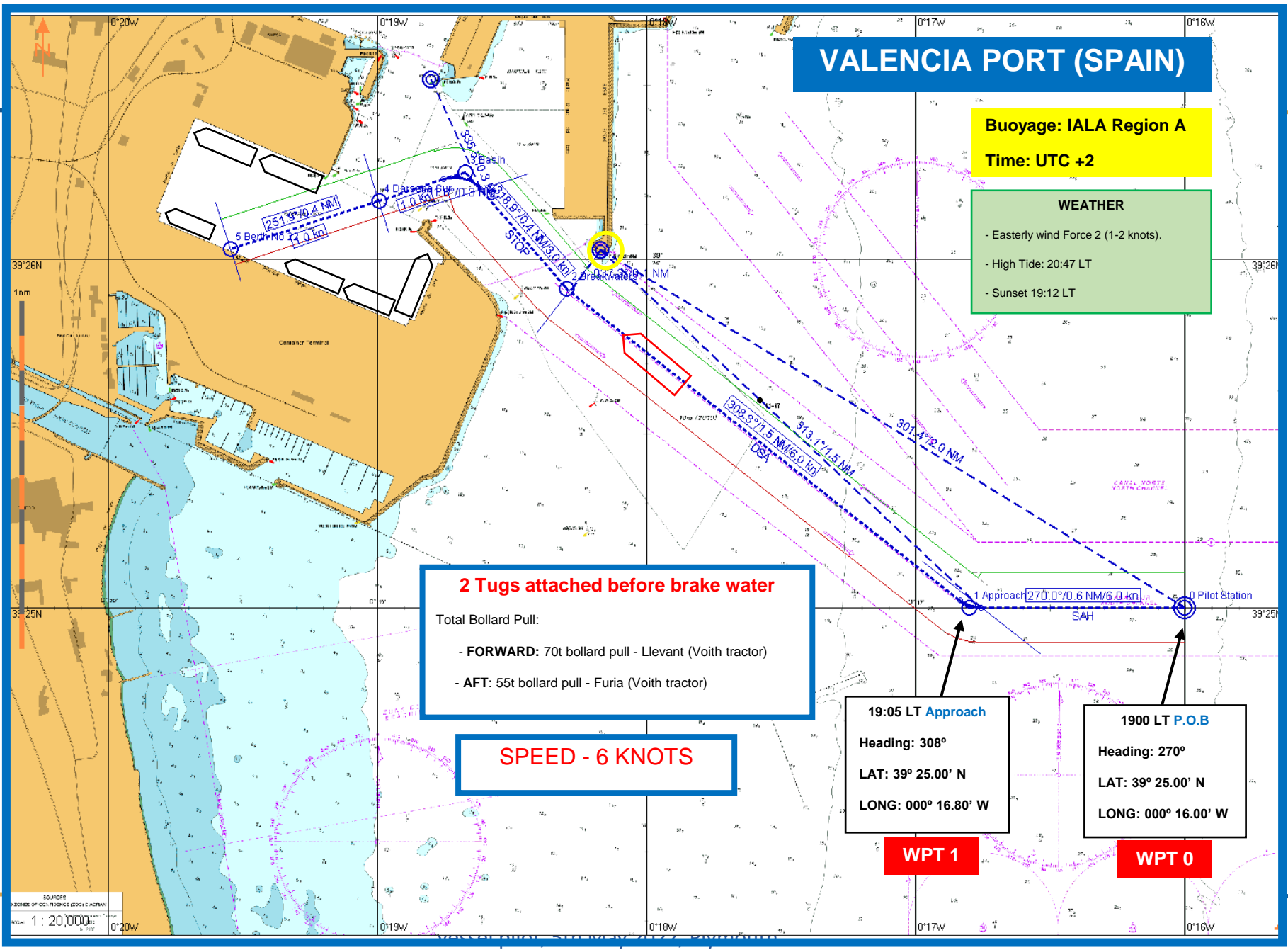
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**Attack location:**  
 Rudder: Hard to port  
 Engine: Full ahead

**Crew actions:**

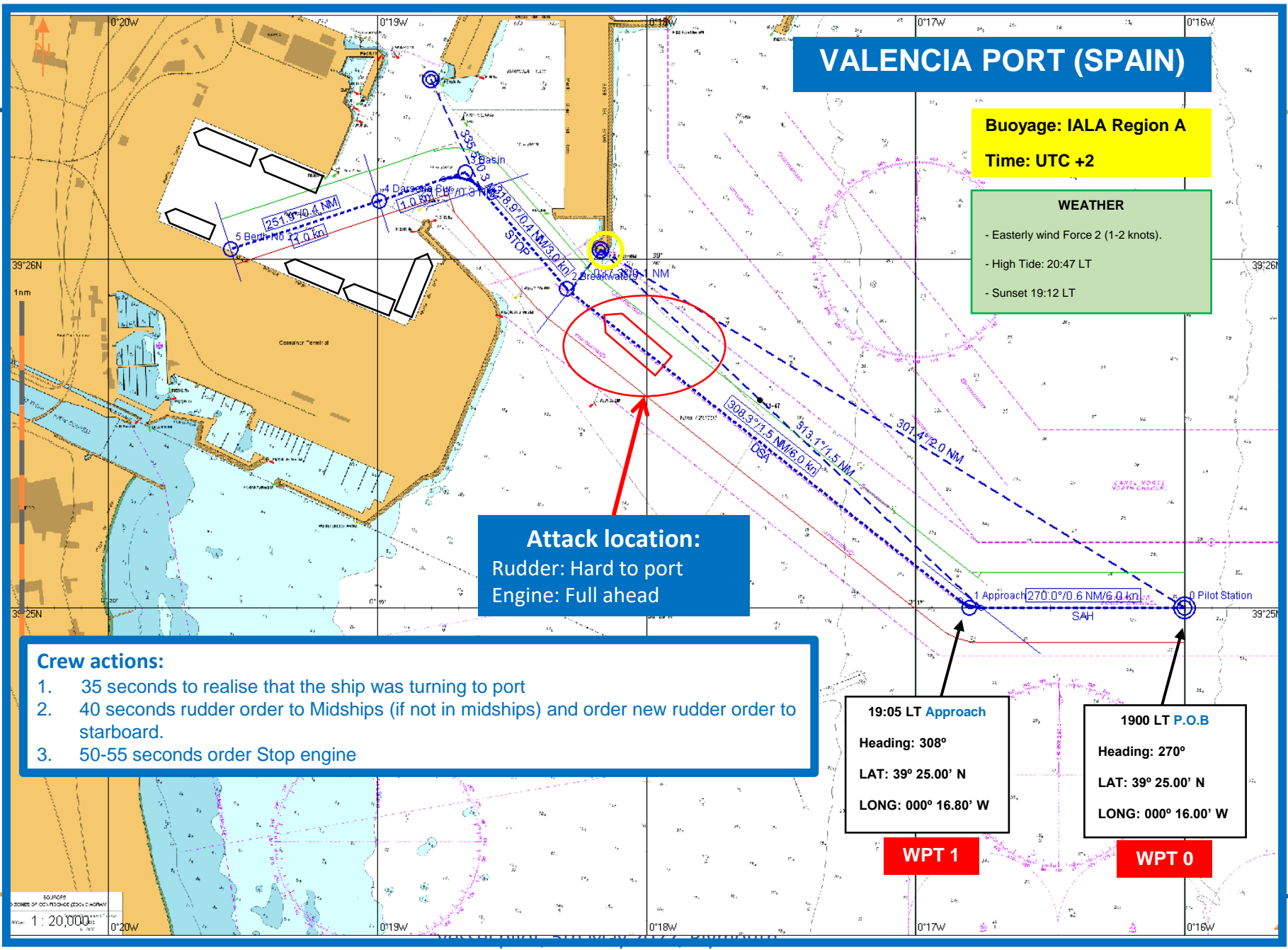
1. 35 seconds to realise that the ship was turning to port
2. 40 seconds rudder order to Midships (if not in midships) and order new rudder order to starboard.
3. 50-55 seconds order Stop engine

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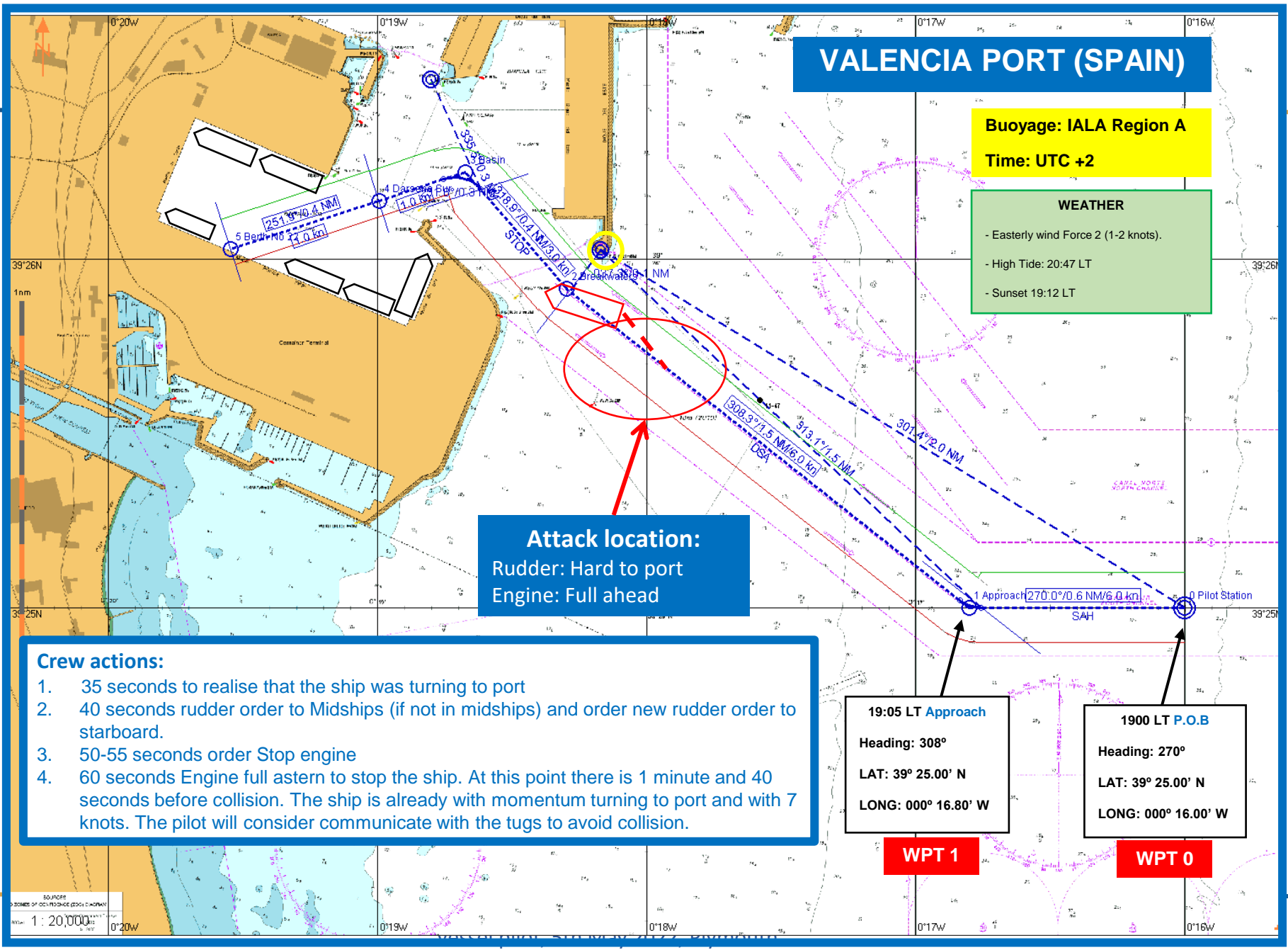
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3. 50-55 seconds order Stop engine
4. 60 seconds Engine full astern to stop the ship. At this point there is 1 minute and 40 seconds before collision. The ship is already with momentum turning to port and with 7 knots. The pilot will consider communicate with the tugs to avoid collision.

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**Buoyage: IALA Region A**  
**Time: UTC +2**

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**Total time from attack triggered to collision:**  
 2 minutes and 40 seconds

**Attack location:**  
 Rudder: Hard to port  
 Engine: Full ahead

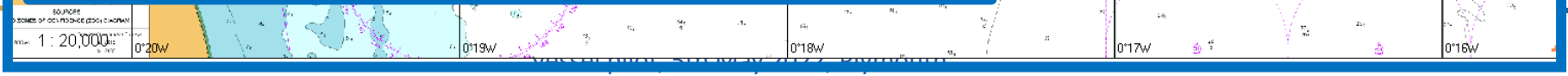
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  5. Consequence according to ships simulator the ship will be grounding head on to the break water rock at the speed of 9 knots.

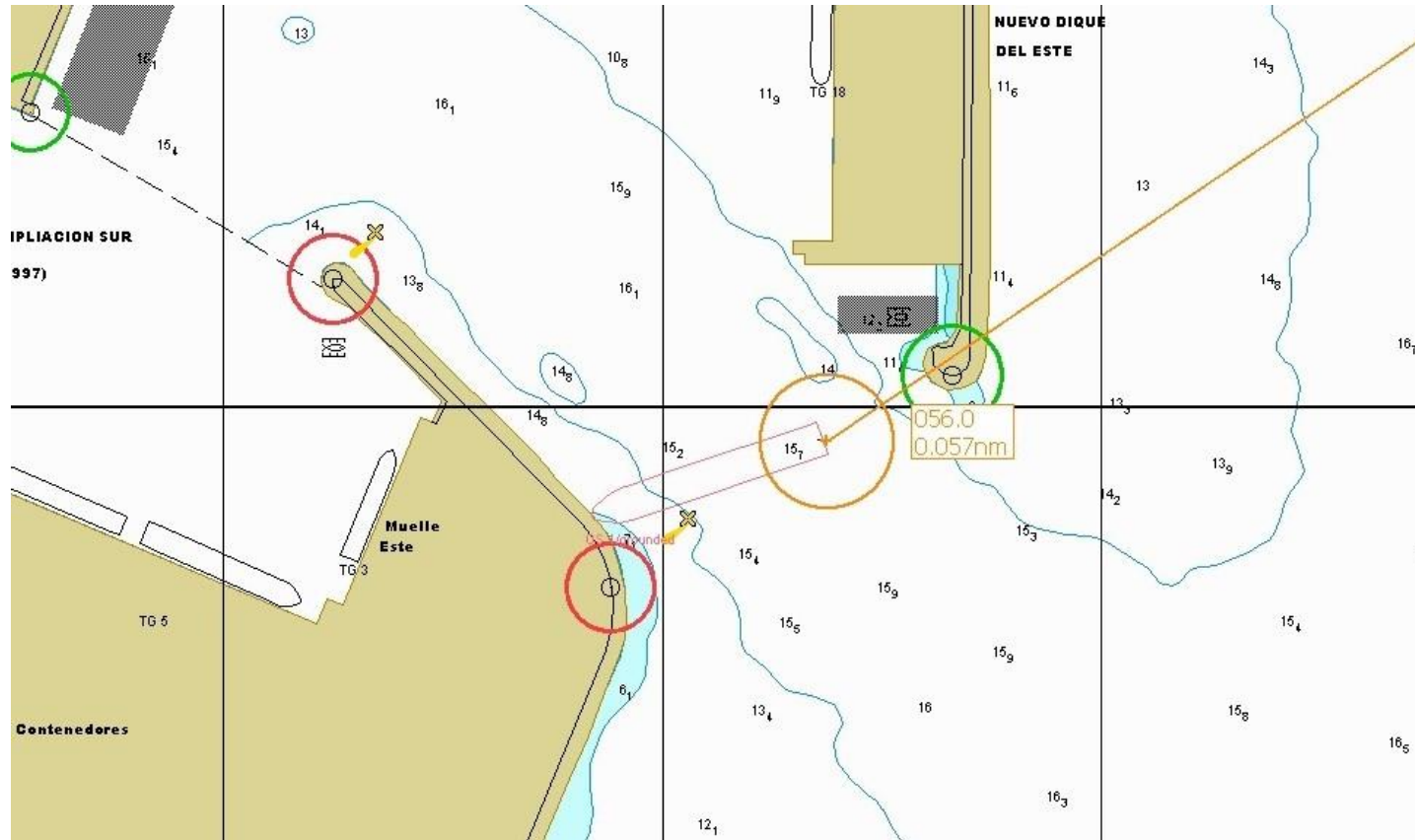
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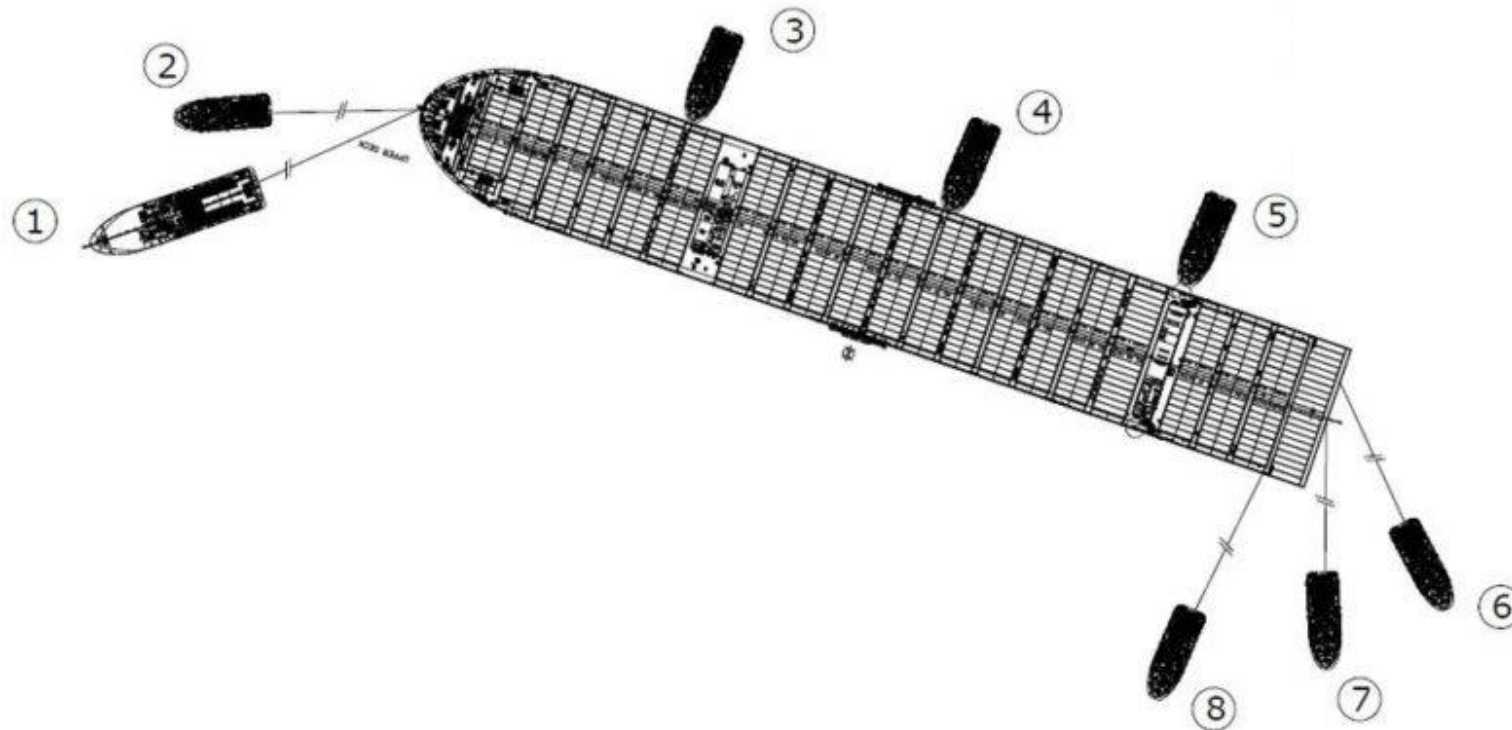




- What tugs could do to avoid collision with break water?
- Vessel blocking the Port of Valencia entrance (100 metres gap)



**Example of similar vessel with tug operations to recover a ship that run's aground "Mumbai Maersk, which ran aground outside Bremerhaven, Germany on 2 February, 2022"**



- Salvage operations estimated duration 3-7 days
- Impact on berthing and unberthing operations



-  [www.Cyber-MAR.eu](http://www.Cyber-MAR.eu)
-  [Cyber\\_MAR](#)
-  [Cyber-MAR EU Project](#)
-  [Cyber-MAR](#)
-  [info@lists.Cyber-MAR.eu](mailto:info@lists.Cyber-MAR.eu)

# THANK YOU FOR YOUR ATTENTION



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