# Navigation Technology Two Systems used by SF Bar Pilots

#### Portable Pilot Unit for All Pilots

- Used on all piloting assignments
- Relatively light weight and portable
- PPU connects to ship's system
- Pilot relies on navigation data provided by the ship

#### PilotMate System for E-Pilots

- Currently used on Ultra Large Container Vessels (ULCV)
- Ultra-High precision system
- Independent of ship's navigation data







# ULCV Passage Feasibility and Assessment for Oakland

New Panamax (NX) and Ultra Large Container Vessel (ULCV) Passage Feasibility & Assessment Prepared for The Port of Oakland



SFBP participated in a study with the Port of Oakland to determine if ULCV class vessels could safely call on the port

Extensive simulations and review determined the following recommendations:

- Utilize Precision Docking Systems
- Assign an E-Pilot
- Additional operational guidelines



#### **E-Pilot**

The E-Pilot is a second pilot assigned to the vessel to assist the Primary Pilot with maneuvering a ULCV class vessel in and out Oakland

During the movement of the vessel the E-Pilot provides the Primary Pilot with navigational data from the PilotMate Precision Docking System including, (but not limited to) course, speed, position, rate of turn, set and drift as well as predictions of the ship's path



# PilotMate Precision Docking System



**Operates completely independent of ship's navigation system** 

PilotMate provides the pilot with:

- Sub-Meter position accuracy
- Precise speed in all directions
- Stable heading and orientation
- Rate of turn and predicted path
- Distance to obstructions



# PilotMate System Cost

Current PilotMate equipment in use:

- \$72,000 equipment
- \$3,000 \$6,000 annual maintenance and updates
- 2 to 3 years remaining service life

**Next Generation Precision Docking System:** 

- \$100,000 \$200,000 equipment
- Similar estimated annual maintenance and update expense
- 5 years service life



# Portable Pilot Unit California Regulatory Requirements

California Code of Regulations, <u>Title 7, Section 219 (y)</u> requires S.F. Bar Pilots to be equipped with a PPU unless its carriage creates an unacceptable safety hazard.

The PPU must have the ability to display electronic charts, position, heading and other navigational information provided by a ship's pilot plug.





# Portable Pilot Unit (PPU)

- A portable computer system that a pilot brings onboard a vessel to use as a decision-support tool for navigating in confined waters
- Interfaced to ship's positioning sensors such as GPS/DGPS and using an electronic chart display, it shows the vessel's position and movement in real-time
- PPU's provide information about the location/movement of other vessels via an Automated Identification System (AIS) interface



# **Standard PPU Limitations**

- The PPU is reliant on vessel's pilot plug data only. This data is not always accurate
- Pilot does not know the position quality, GPS smoothing rate, or antenna offset configuration of ship he/she is piloting
- The AIS pilot plug may not provide accurate Rate of Turn (ROT) data for advanced PPU software to provide the pilot with an accurate display of vessel predicted path



# Common AIS Pilot Plug Errors: Ship data is not always accurate data

The AIS Pilot Plug provides the PPU with position and dimensions of the vessel, as well as the configuration of the GPS receiver

Vessels data may have incorrect dimensions and configuration which give the pilot false vessel positions





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### Common AIS Pilot Plug Errors: GPS Smoothing

Ship's GPS sensors apply a method of averaging to the course and speed data (Smoothing) supplied to the pilot's PPU

Incorrect smoothing intervals can generate false vessel path predictions





### Common AIS Pilot Plug Limitations: Rate of Turn (ROT) Data







No ROT data from AIS Pilot Plug

Precision ROT data with 30 second predicted path display









# NavSim Argus

# Next Generation Enhanced PPU Components

- Laptop or Tablet with PPU software
  - Configured to work with independent sensors
  - Utilizes only heading and other vessel AIS data from ship's pilot plug
- Precision, lightweight portable Differential GPS (DGPS)
  - Independent of ship's GPS
  - Pilot calculates proper antenna offsets
  - Proper data smoothing rate for use while piloting
- Rate of Turn Generator (ROTG)
  - Solid state, precision device that provides the PPU with instant, accurate Rate of Turn (ROT) data for vessel path prediction



# Next generation PPU benefits

#### Increased Safety due to:

- Independent precision GPS receiver
- Pilot control of correct GPS configuration
- Accurate Rate of Turn data
- Enhanced restricted visibility navigation with predicted vessel path

