

San Francisco Bay Pilots Navigation Technology Program Status and Update Requirements

Route Piloting PPU System

1. Existing System Technology

- a. Various Windows laptops, some put in service in 2008-2009
- b. Rose Point ECS software
- c. Simple Pilot Plug adapter (cable or wireless) provides vessel data to PPU
 - i. No Rate of Turn Data
 - ii. No independent GPS data
 - iii. No pilot input for own vessel GPS antenna offsets (position of vessel relative to GPS position source)
- d. Many in service since 2008 - 2009. Most laptops currently nearing end of useful life, little or no hardware value

2. Replacement Route Piloting System requirements

- a. Must provide
 - i. Accurate independent GPS position
 - ii. Accurate Rate of Turn data
 - iii. Wireless connection from sensors to pilot display
- b. Sensor Hardware Requirements
 - i. Wireless connection to pilot display
 - ii. Position accuracy: Sub-meter DGPS (SBAS/WAAS or MF beacon)
 - iii. Speed accuracy: 1 cm/second
 - iv. Rate of Turn accuracy: 1 degree/minute
 - v. Improved heading accuracy over own ships heading from pilot plug
 - vi. Seamless integration with Rose Point ECS
- c. System Display Requirements
 - i. Ruggedized laptop or tablet
 - ii. Minimum 4 hour battery life at full brightness
 - iii. Wireless connection to sensors
- d. Software Requirements (all currently met by Rose Point ECS)
 - i. Seamless updates of NOAA S-57 charts (or equivalent)
 - ii. Timely updates on software version and bug fixes
 - iii. Provide pilot with graphic display of position and numerical navigation data
 - iv. Properly utilize and graphically display Rate of Turn data and vessel prediction
 - v. Display vessel meeting points along routes
 - vi. Display other vessel AIS data
 - vii. Display Meteorological data from NOAA PORTS system
- e. Portability and timely initialization
 - i. Lightweight for carriage by pilot on pilot ladder
 - ii. Setup time less than 10 minutes
- f. System Support and Maintenance Requirements
 - i. US working hours phone support for technical issues
 - ii. 4 year term of full hardware warranty
 - iii. 4 year term for software support, updates and new versions
 - iv. Established protocol for shipping of equipment in need of repair to vendor facility

San Francisco Bay Pilots Navigation Technology

Precision Docking System for ULCV piloting - Program Status and Update Requirements

1. Existing Technology
 - a. Booz Allen Hamilton (BAH) (formerly ARINC) PilotMate PM1-4 System with hardware and software. Three individual systems each consisting of:
 - i. 1 SPU (signal processing unit) with dual GPS (WAAS DGPS) antennas, embedded gyro, AIS receiver, WiFi and battery.
 - ii. 2 Ruggedized MS Windows touchscreen tablets with custom PDS software.
 - b. In service in 2011. Currently nearing end of useful life. Minimal support available now and in the future. No development plans for replacement next generation equipment at this time.
 - c. The PilotMate equipment will have little value when replaced as it is an obsolete, mostly unsupported system.
2. Advances in Available Technology
 - a. mGNSS - Multiple Global Navigation Satellite System receivers now available in a form factor suitable for piloting applications. Using more than one (as in PM1-4 system) constellation of satellites adds performance, accuracy, and reliability to the solution, especially in piloting environments with obstructions and shadowing of the view of satellites. Multiple frequency receivers (GPS L1/L2) also add accuracy and reliability to systems by enabling real time ionospheric corrections.
 - b. High precision vessel dynamics for very close quarters maneuvering of high displacement vessels.
 - c. Advanced, easy to configure and use software packages.
 - d. Server based support for software, firmware, navigational chart and high precision bathymetry updates and distribution.
3. Replacement Precision Docking System requirements
 - a. Must provide - Fully independent of ship sensors and pilot plug
 - i. High accuracy position - Sub-meter DGPS (SBAS/WAAS or MF beacon)
 - ii. High accuracy course over ground (COG)
 - iii. Very accurate speed over ground (SOG) - 1 cm/second
 - iv. Independent stable heading - 0.1 degree
 - v. Rate of turn (ROT) - 1 degree/minute
 - vi. Local AIS contacts by VHF link
 - vii. Wireless connection from sensors to pilot display
 - b. System Display and Requirements
 - i. Lightweight Tablet
 - ii. Rugged weatherproof design (external case can satisfy weatherproof needs)
 - iii. Minimum 4 hour battery life at full brightness
 - iv. Use S-57 NOAA charts (or equivalent)
 - v. Can view high definition bathymetry
 - vi. Provide pilot with graphic and numerical display of position and vessel dynamics
 - vii. Have wireless broadband connection to receive meteorological data and server support.
 - c. System Software Requirements
 - i. Use S-57 NOAA charts (or equivalent)
 - ii. Can view high definition bathymetry
 - iii. Provide pilot with graphic and numerical display of position and vessel dynamics
 - iv. Process and display meteorological data such as PORTS wind and current sensors in Oakland
 - d. Portability and timely initialization
 - i. Lightweight for carriage by pilot on pilot ladder or by heaving line
 - ii. Weatherproof case or bag
 - iii. Setup time less than 10 minutes
 - iv.
 - e. System Support and Maintenance Requirements
 - i. US working hours phone support for technical issues
 - ii. 4 year term of full hardware warranty
 - iii. 4 year term for software support, updates and new versions
 - iv. Established protocol for shipping of equipment in need of repair to vendor facility

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Precision Docking System for ULCV piloting - Identification of Potential Vendors

1. Sensor Hardware

- a. **AD Navigation** - Founded in 2002. Based in Norway, a SAAB Group Company. U.S. 3rd party vendor/representative based in Texas.

AD Navigation AS <http://www.adnavigation.com/>
Reservatveien 8
N-3118 Tønsberg, Norway
Phone: +47 69253300
info@adnav.com

- b. **Navicom Dynamics** - Based in New Zealand. U.S based 3rd party vendor/representative based in San Francisco

Navicom Dynamics <http://navicomdynamics.com/>
2 Parkhead Place
Albany, Auckland 0632
New Zealand
Phone: +(64) 9 915-5330
info@navicomdynamics.com

- c. **Marimatech** - Founded in 1988. Based in Denmark, a Trelleborg Company. U.S. Trelleborg office based in Texas.

Marimatech A/S <http://www.marimatech.com/>
Samsvej 31
DK-8382 Hinnerup, Aarhus
Denmark
Phone: +45 86 91 22 45
info@marimatech.com

2. Software

- a. **SEAIq Pilot** - Enterprise Subscription Navigation Software. Based in Texas

SEAIq, Sakhalin, LLC <http://seaiq.com/enterprise.html>
Mailing: 2885 Sanford Ave SW #15525
Grandville, MI 49418
Phone: 406-580-4000
info@seaiq.com

- b. **SafePilot** - by Marimatech (same vendor as above)

PilotMate System Costs 2011 to Present

| Vendor | Date | Amount | Detail |
|---------------------|--------------|------------------|----------------------------------|
| ARINC | 5/6/2011 | 32,476.00 | Equipment Purchase |
| ARINC | 8/19/2011 | 26,658.38 | Equipment Purchase |
| ARINC | 10/25/2012 | 720.48 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 3/21/2013 | 1,801.20 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 5/14/2013 | 3,167.44 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 8/21/2013 | 745.28 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 9/21/2013 | 372.64 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 12/19/2013 | 2,381.00 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 5/30/2014 | 458.14 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 6/5/2014 | 13,967.85 | Equipment Purchase |
| BOOZ ALLEN HAMILTON | 8/25/2014 | 290.79 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 11/25/2014 | 191.75 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 2/24/2015 | 395.38 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 3/19/2015 | 6,449.33 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 5/26/2015 | 790.76 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 9/28/2015 | 587.66 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 10/27/2015 | 197.69 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 11/23/2015 | 395.38 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 12/30/2015 | 593.07 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 1/27/2016 | 239.99 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 3/16/2016 | 1,870.70 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 5/16/2016 | 1,924.36 | Maintenance, Support and Repairs |
| BOOZ ALLEN HAMILTON | 6/22/2016 | 777.50 | Maintenance, Support and Repairs |
| | Total | 97,452.77 | |

Equipment Cost 2011 & 2014 **73,102.23**

Maintenance, Support and Repair Cost 2011-2016 **24,350.54**