



Sperry Marine Fleet Management Enterprise Solution

Performance Based Navigation (PBN)
Fuel Navigator Module

Alan Aitken

Canadian Regional Manager



Definition – Fleet Management

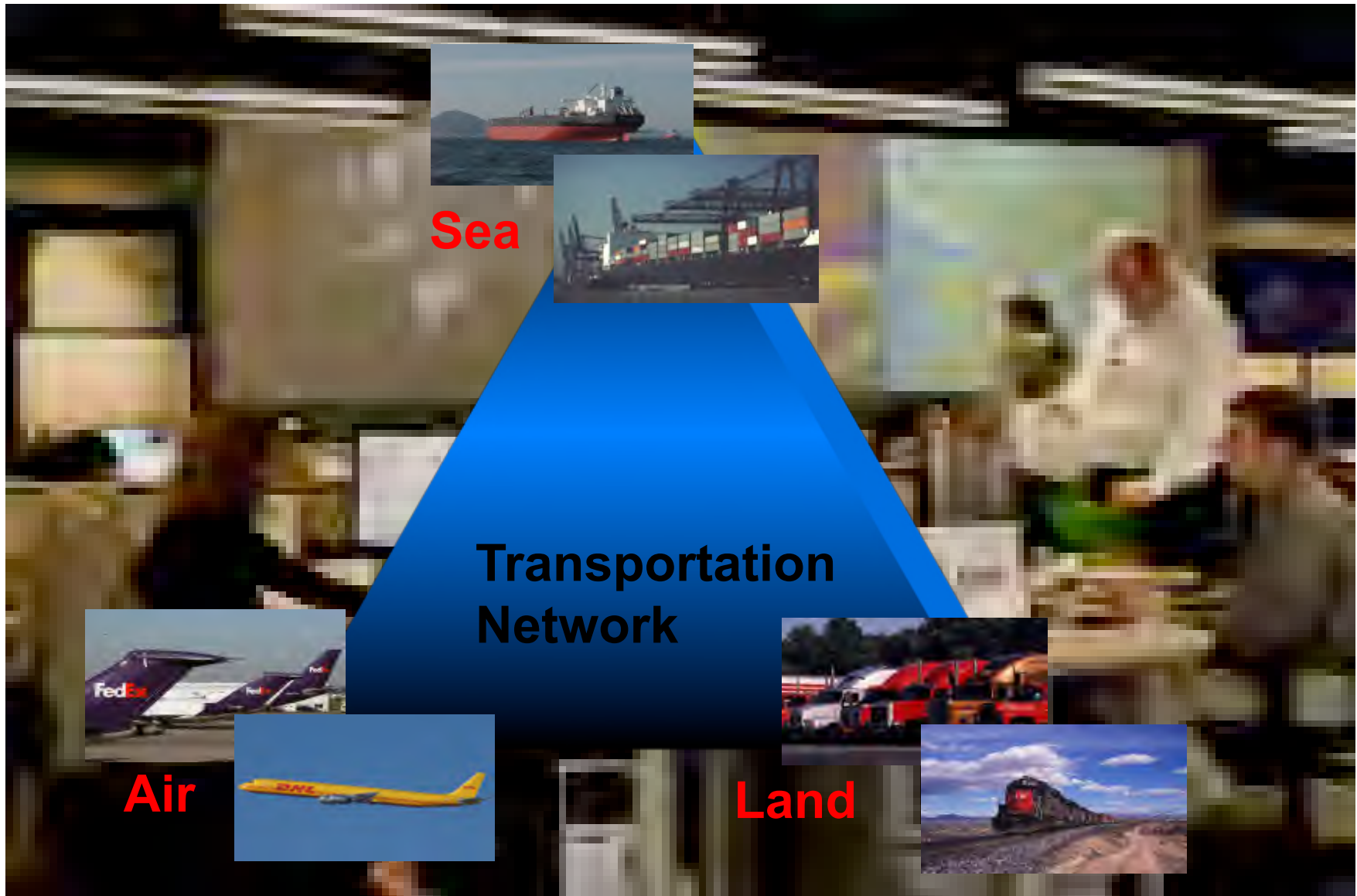
“ A way of managing infrastructure capital assets that ***minimizes the cost*** of owning and operating those assets and ***maximizes their performance*** over time “



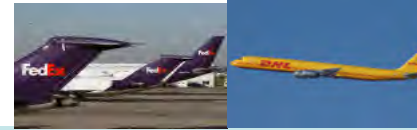
Asset Management



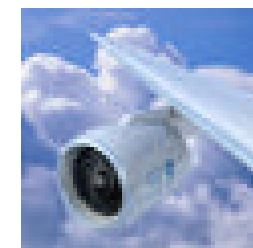
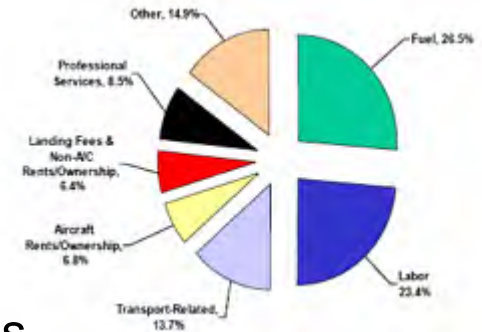
Asset Management & Transportation Industry



Asset Management - Air Segment



- Route Optimization
 - Fuel is top cost driver
 - Utilize centralized despatching and routing
 - En route airlines optimize speed, flight path and attitude to reduce airborne fuel consumption
 - Offer pilots and ground staff decision support tools
- Charting
 - Continuously updating latest airways sectors
 - Electronic chart services
- Online Asset Management / Telematics
 - Pratt & Whitney, Rolls-Royce and GE are offering engine support services utilizing connectivity
 - Web-based support portal



Asset Management Land Segment



- Route Optimization
 - Fuel is top cost driver in trucking and railroads
 - Utilize centralized dispatching and routing
 - Optimize speed and route
 - Real-time traffic alerts



- Charting
 - GPS-based navigation systems
 - Electronic map services



- Online Asset Management / Telematics
 - Utilizations of cell phone technology with complete monitoring and push services
 - Web-based support portal



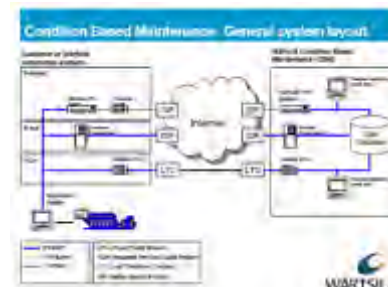


Asset Management Sea Segment

- Route Optimization
 - Fuel is top cost driver
 - Utilize weather and / or routing services – standalone capability
 - Ship centric decision making compared to centralized model in air and land segments

- Charting
 - ECDIS utilization is becoming a common practice
 - Electronic charts suppliers are expanding services

- Online Asset Management / Telematics
 - Early adapters are in area of Condition-Based Maintenance for marine engines (i.e., Wartsila)
 - Web-based support portal



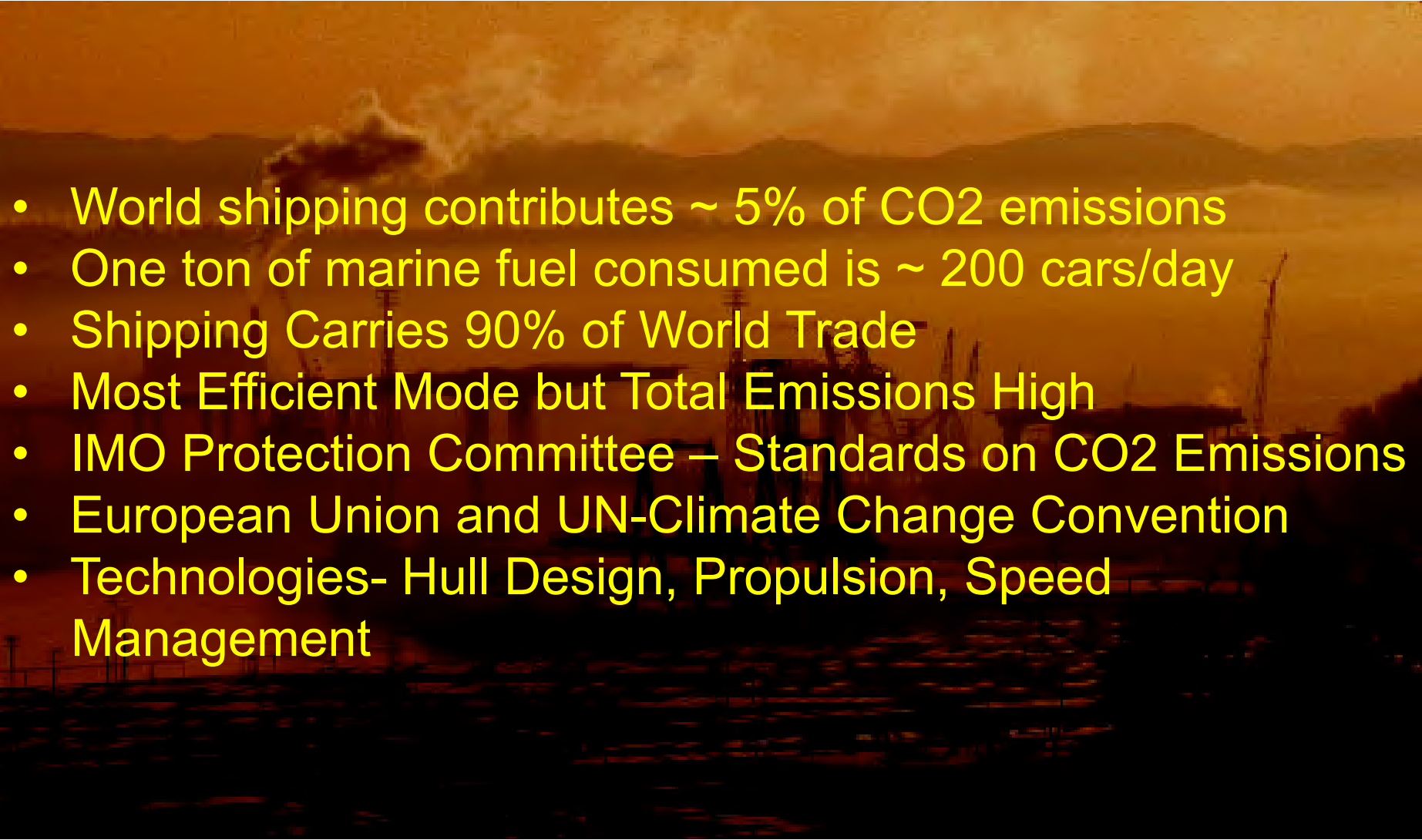
Customer Cost Drivers, Sea Segment



Typical Container Ship – 4,000 TEU

Typical Monthly Operating Expenses

Operating item	Expense (K\$)	Percent of Total
Fuel	\$ 335	44.1%
Port Charges	\$ 167	22.0%
Manning	\$ 78	10.3%
Maintenance	\$ 75	9.9%
Insurance	\$ 68	8.9%
Inventory	\$ 21	2.8%
Administration	\$ 15	2.0%
Satellite Communications	\$ 1	0.1%
Total	\$ 760	100.0%

- 
- World shipping contributes ~ 5% of CO2 emissions
 - One ton of marine fuel consumed is ~ 200 cars/day
 - Shipping Carries 90% of World Trade
 - Most Efficient Mode but Total Emissions High
 - IMO Protection Committee – Standards on CO2 Emissions
 - European Union and UN-Climate Change Convention
 - Technologies- Hull Design, Propulsion, Speed Management

Shipping Business - Changing Business Models

Traditional Management Methodology Inefficient Communications & Decentralized Decision Making

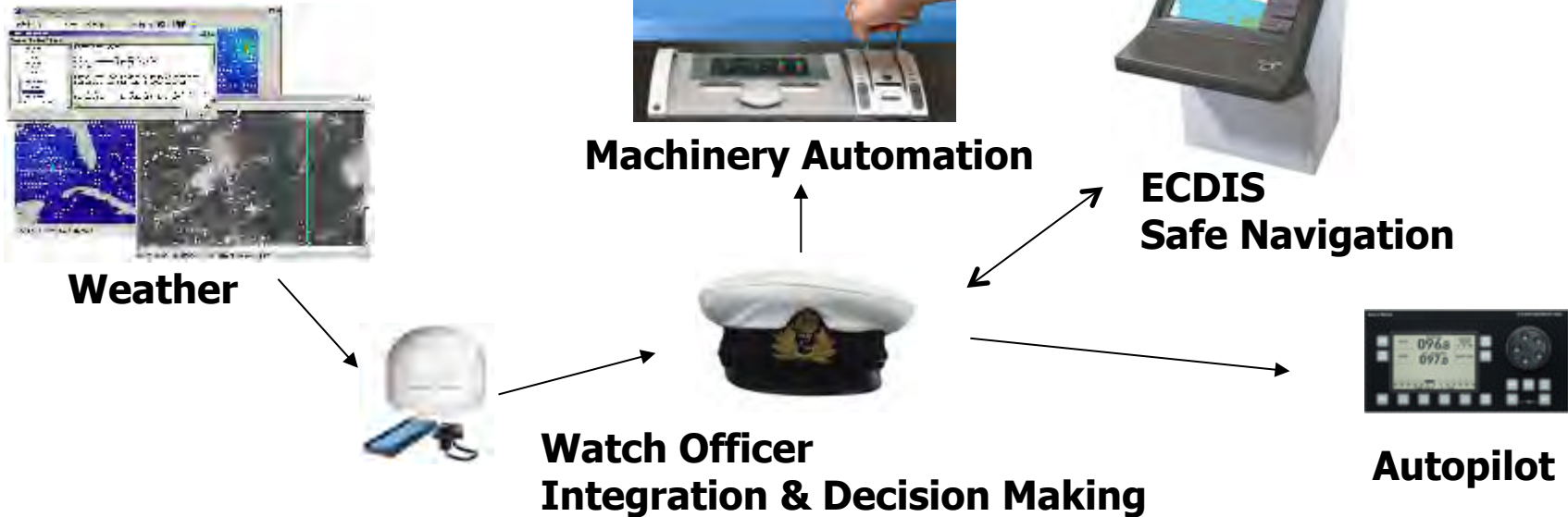


Enterprise Management Methodology Efficient Communications & Team Decision Making

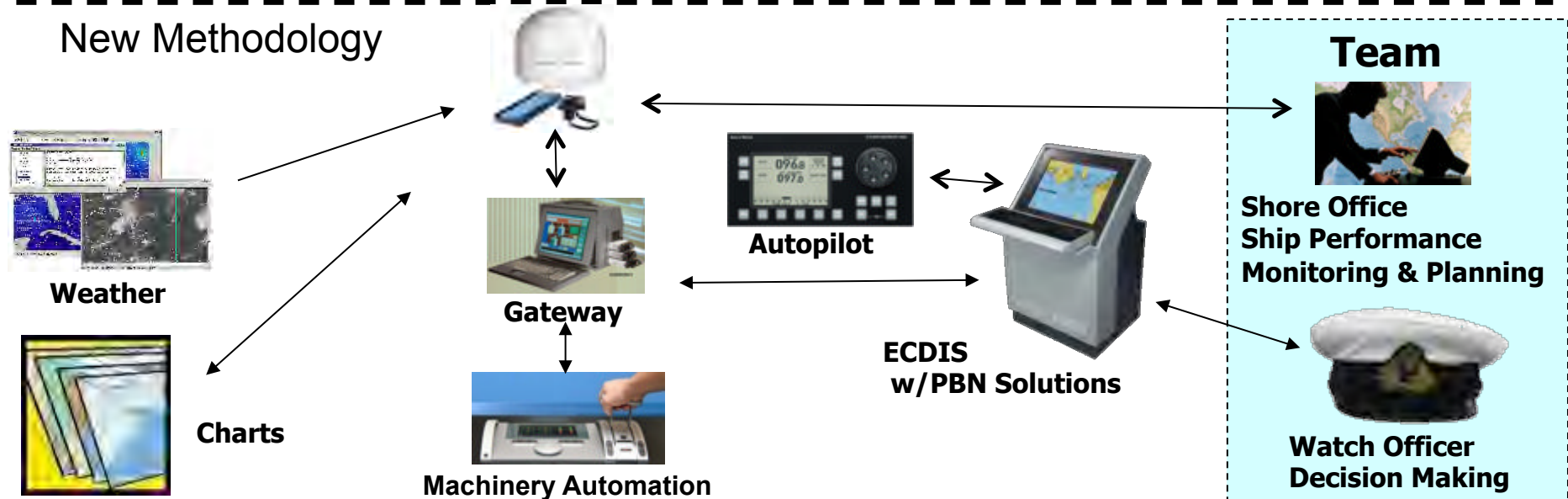


Changing Trends

Existing Methodology



New Methodology



VISIONMASTER FT



VisionMaster FT ARPA /Radar



VisionMaster FT Chart Radar



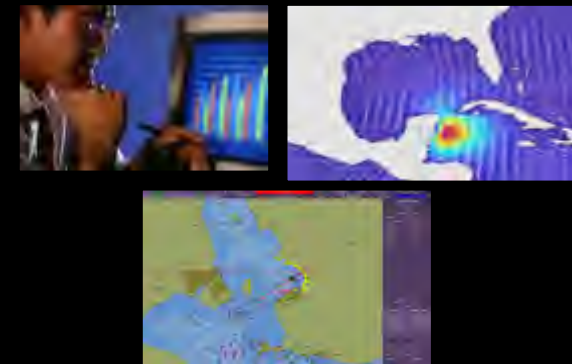
VisionMaster FT ECDIS



**VisionMaster FT TotalWatch
(Multi-Function Workstation)**



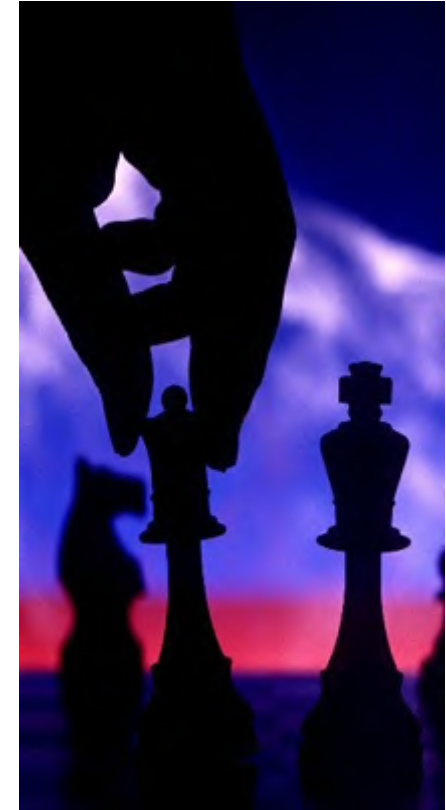
VisionMaster FT Integrated Bridge



VisionMaster FT Value Added Solutions

Goals – Performance Based Navigation

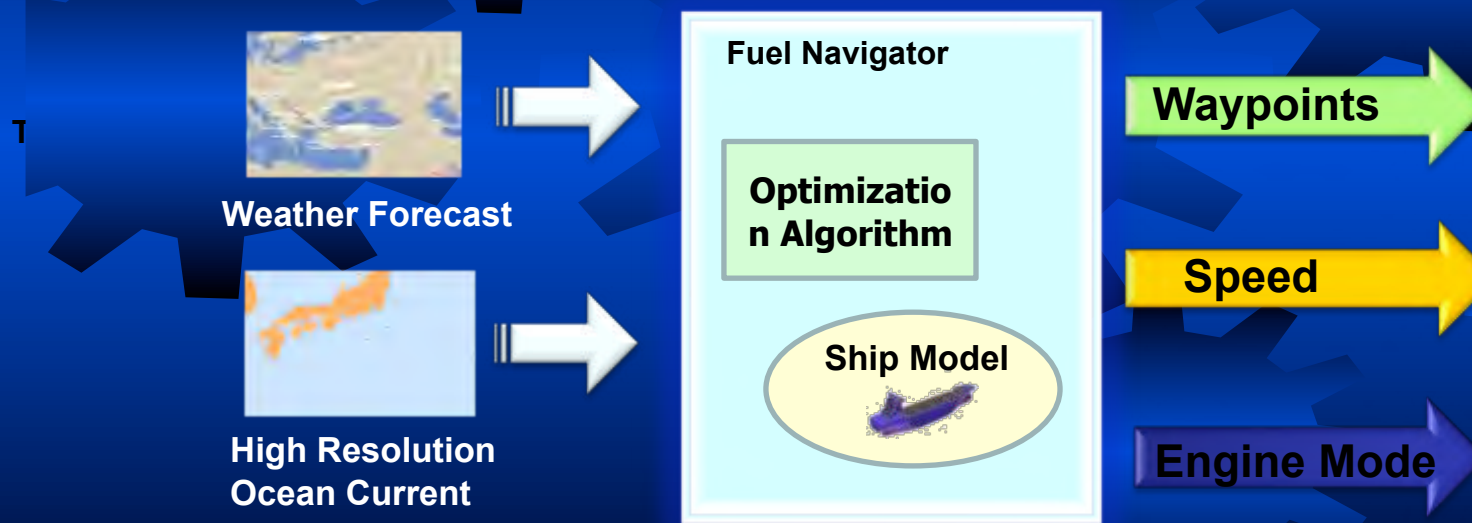
- Deliver real-time asset management
- Add value to business operations
- Act as a catalyst for change
- Close the ship to shore gap
- Leverage technology for business benefit
- **Optimize vessel performance**
- Automate all the business processes
- Create uninterrupted technology infrastructure
- Provide cost effective solutions



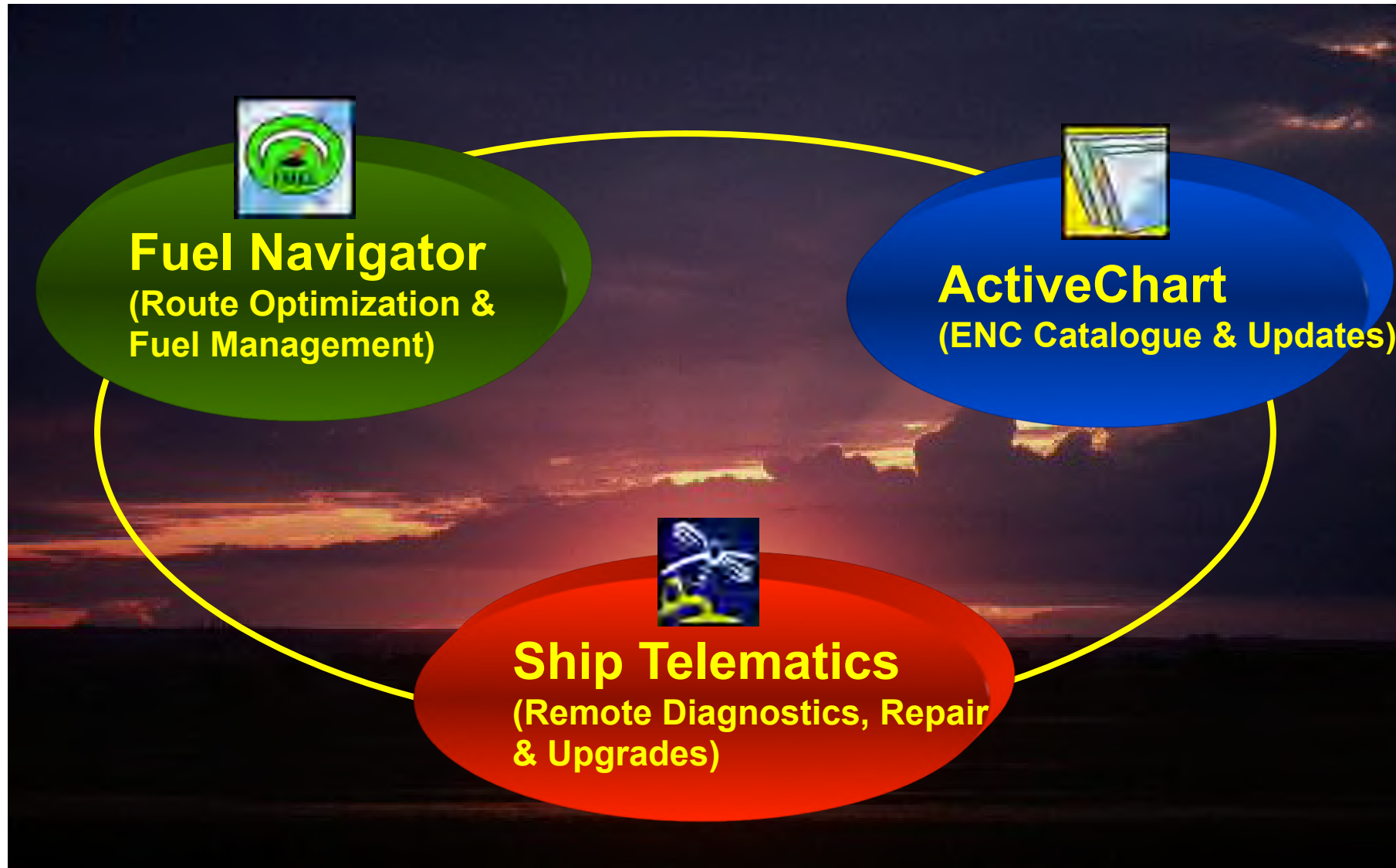
How do we save fuel?

Through voyage optimization by adjusting these parameters:

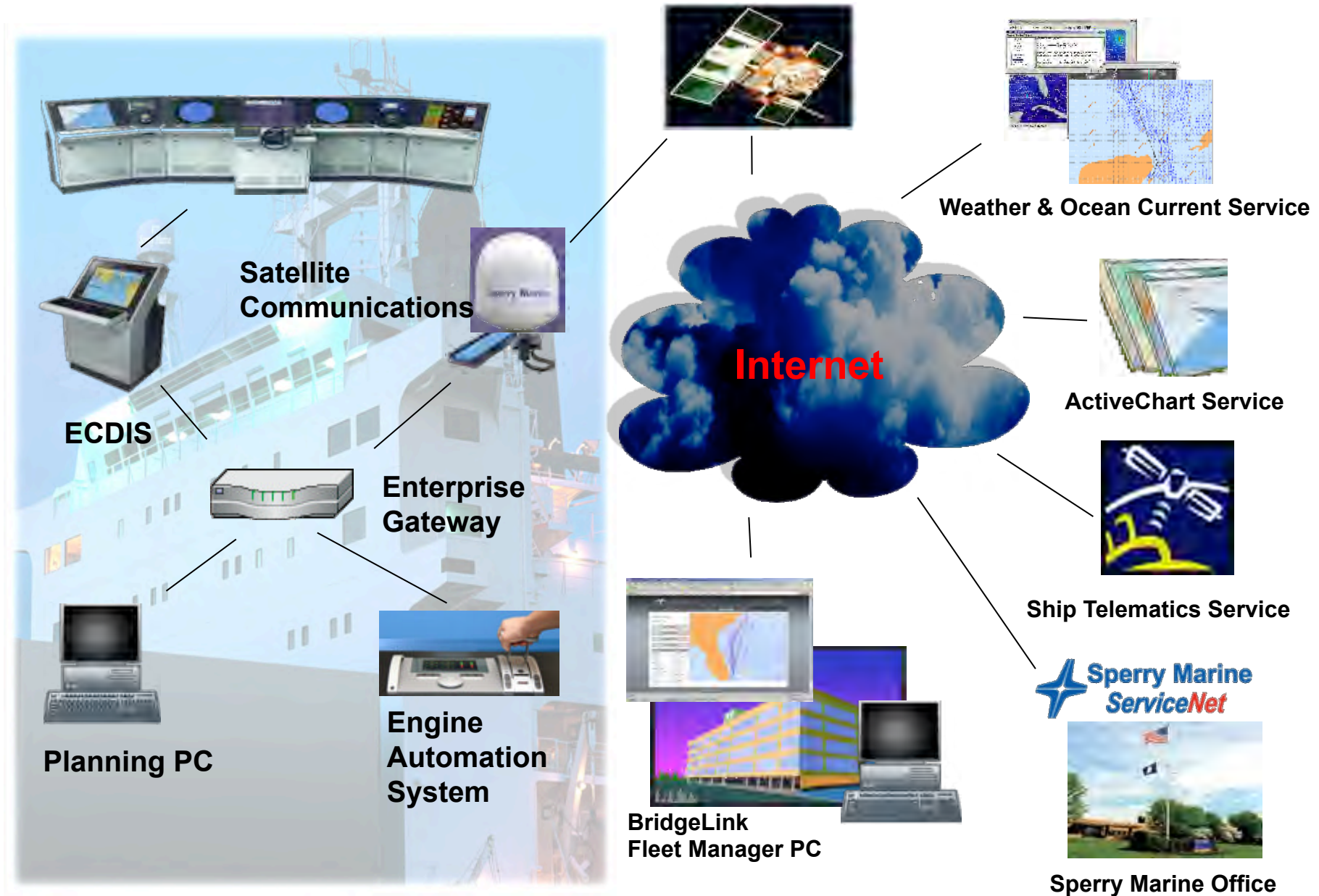
- **Waypoints**
- **Speed**
- **Engine Mode**



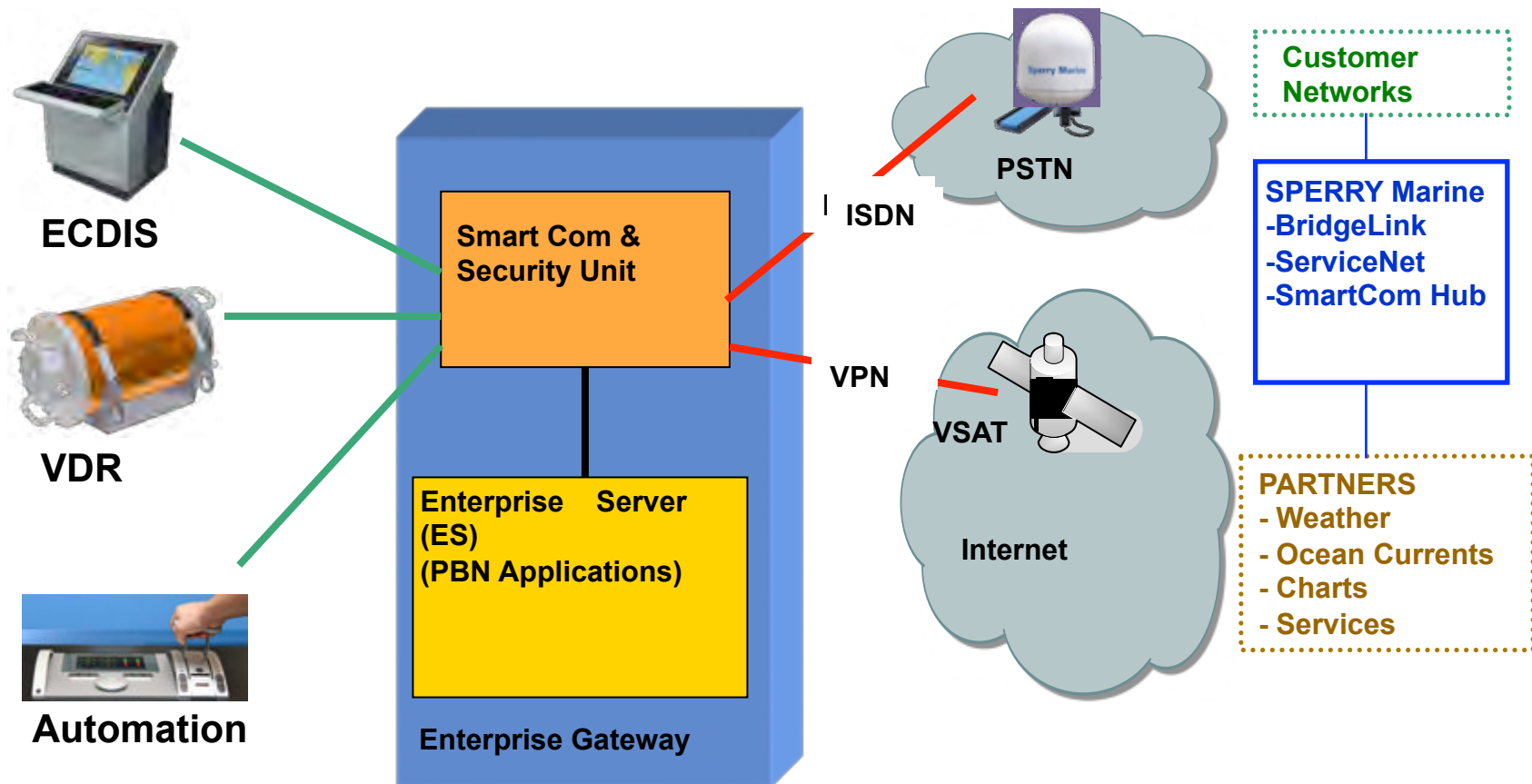
Performance Based Navigation Asset Management Solutions



Performance Based Navigation (PBN) Architecture

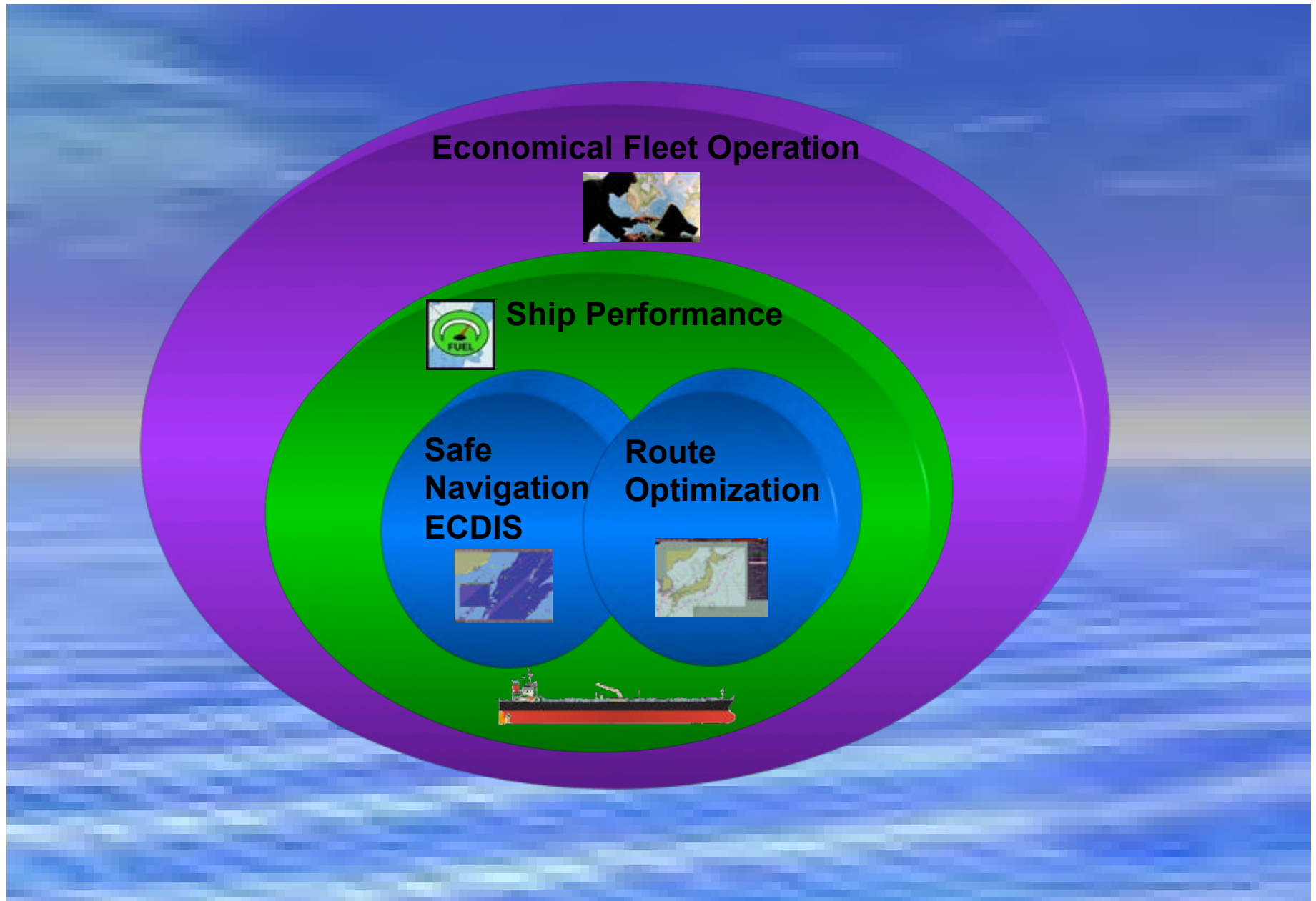


PBN Enterprise Gateway

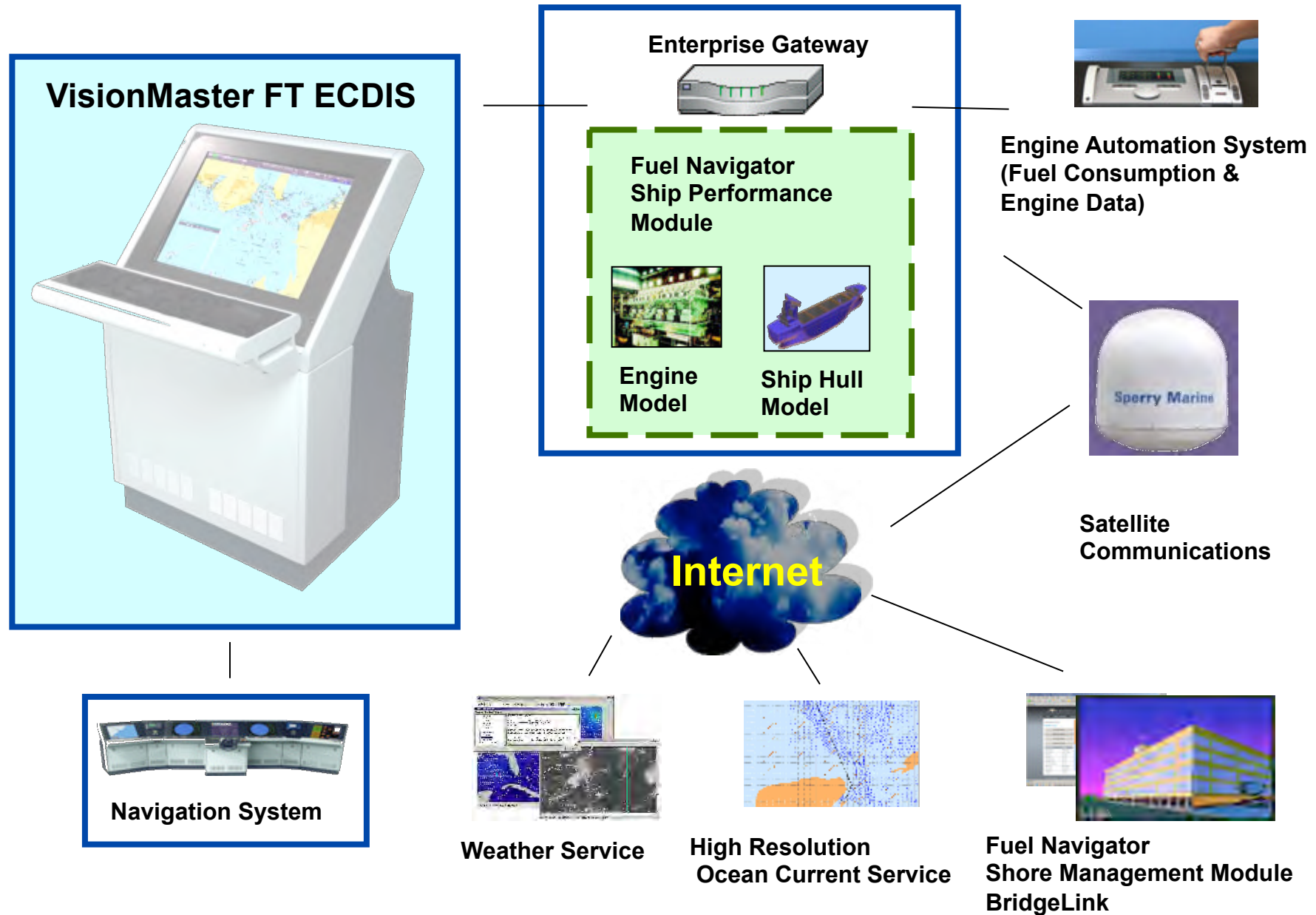


PBN Applications run in the protected Enterprise Gateway. There is no direct communication between red (external environment) and green lines (shipboard navigation equipment). There are no non-encrypted or non-secured Internet communications by any shipboard device.

Fuel Navigator Concept



Fuel Navigator Application Architecture



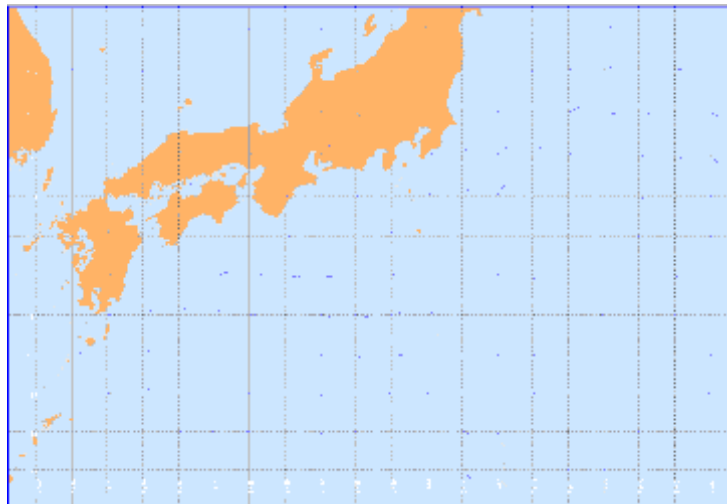
Value Proposition – Accurate Ocean Current

Traditional Methodology (one degree)

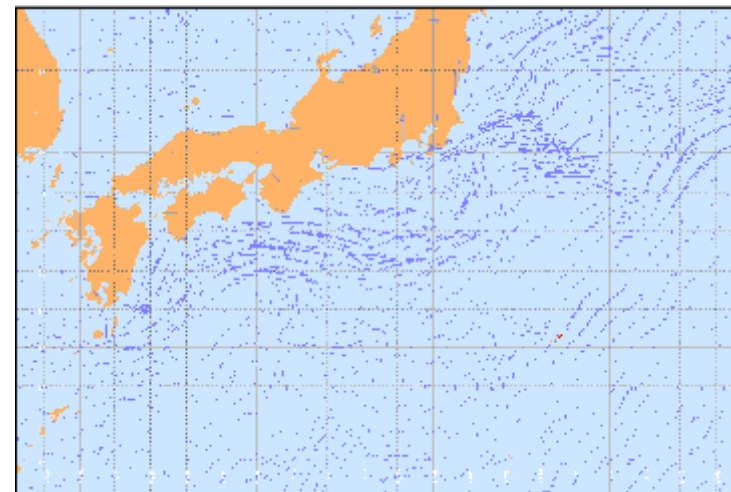
- Only statistical “pilot chart “ocean currents have been available.
- Pilot charts are based on averaged long time observations
- On many sea areas, the accuracy of this method is not suitable for accurate voyage planning

New Methodology (1/8 degree)

- Utilizes short term, high resolution satellite based ocean current forecast
- Global coverage, 1/8 degree resolution, new update available every 48 hrs.

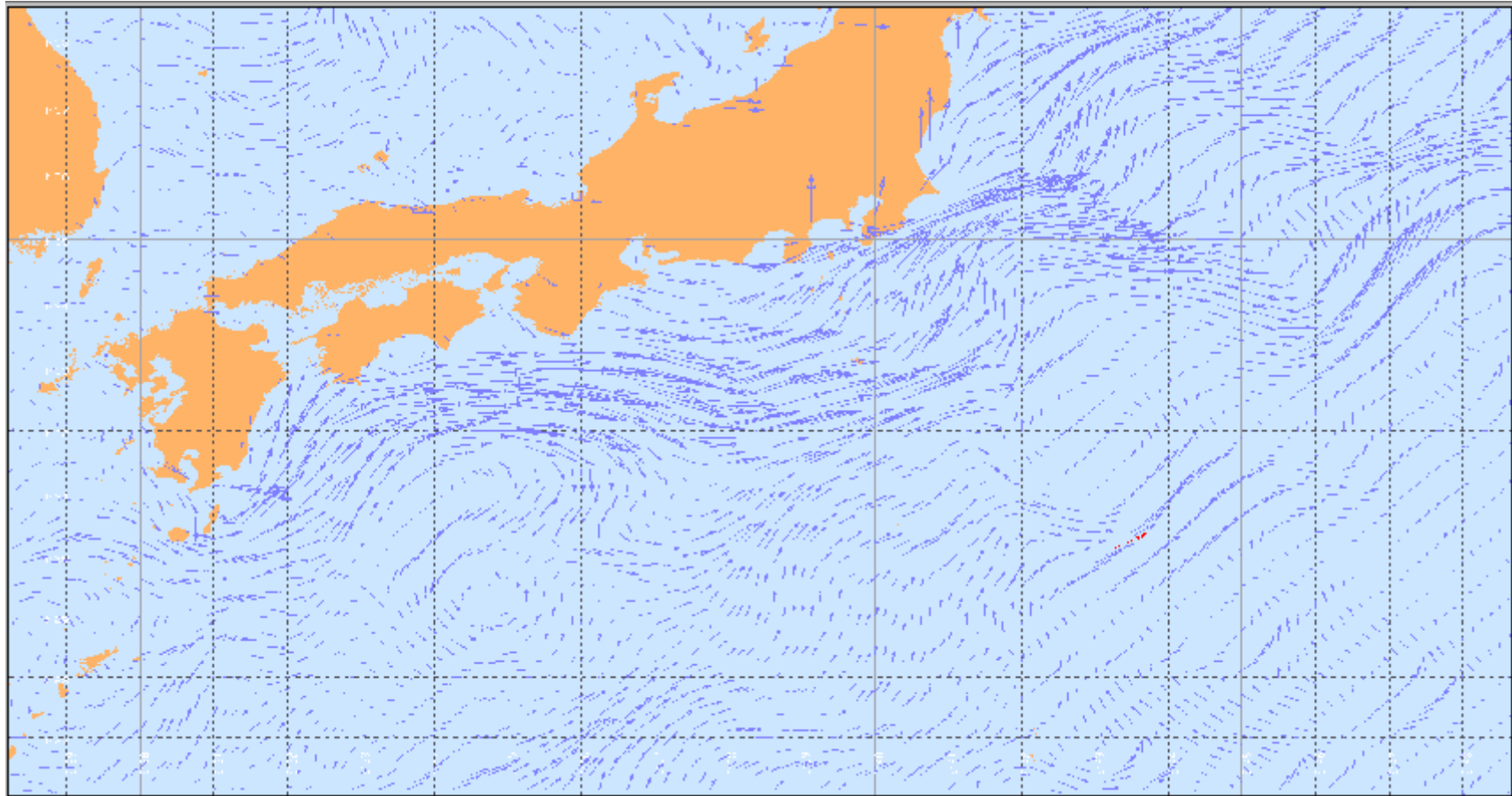


One Degree Resolution



1/ 8 Degree Resolution

Value Proposition – Accurate Ocean Current



Satellite based current forecast for 2007-03-27. 1/8 deg resolution.
Max current speed 3.9 knots.

Objectives - Fuel Navigator Solution

Economical Fleet Operation

Ship Performance Module

Minimize Fuel Costs

- Optimization of routes, speed and engine mode
- Monitoring ship performance & fuel consumption
- Providing decision support tools for master



Knowledge Management Office Module - BridgeLink

Cost Effective Fleet Operation

- Route planning and fuel budgeting
- Monitoring, analysis and reporting on ship performance
- Responding to schedule changes by most economical solution
- Providing decision support tools for efficient asset management



Fuel Navigator Application Highlights



- **Ship Performance Module - Planning**

- Integrated with ECDIS functionality for safe navigation and voyage execution
- Utilizes advanced performance models for ship hull and engine – Benefit is accurate hydrostatics
- Planning routes, voyages and schedules
 - ✓ Voyage planning
 - ✓ Estimating costs of route
 - ✓ Analyzing / viewing weather and current conditions
- Optimizing ship operation based on environmental conditions
 - ✓ Finds the theoretical optimum operation in the given conditions
 - ✓ Follows the optimal plan using speed pilot interface
 - ✓ Immediate comparison of the plan with the minimum cost plan



Fuel Navigator Application Highlights



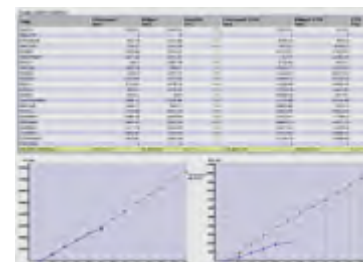
- **Ship Performance Module - At Sea**

- Executing the optimal speed profile with speed pilot connection or manual setting
- Re-optimizing the speed profile, engine mode and route when
 - ✓ Weather / ocean current forecast changes
 - ✓ Ship's arrival time is changed
 - ✓ Ship deviates from the planned route
- Reporting to shore organization
 - ✓ Follow up fuel consumption and budgeting
 - ✓ Navigation voyage data

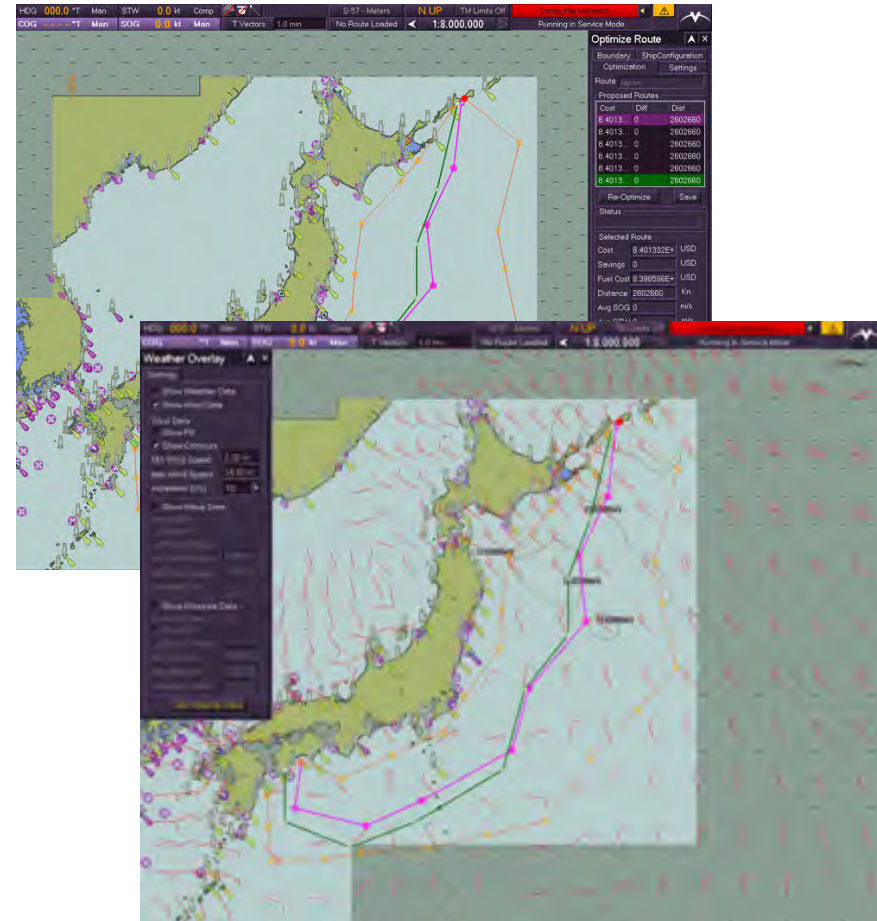


Fuel Navigator Application Highlights

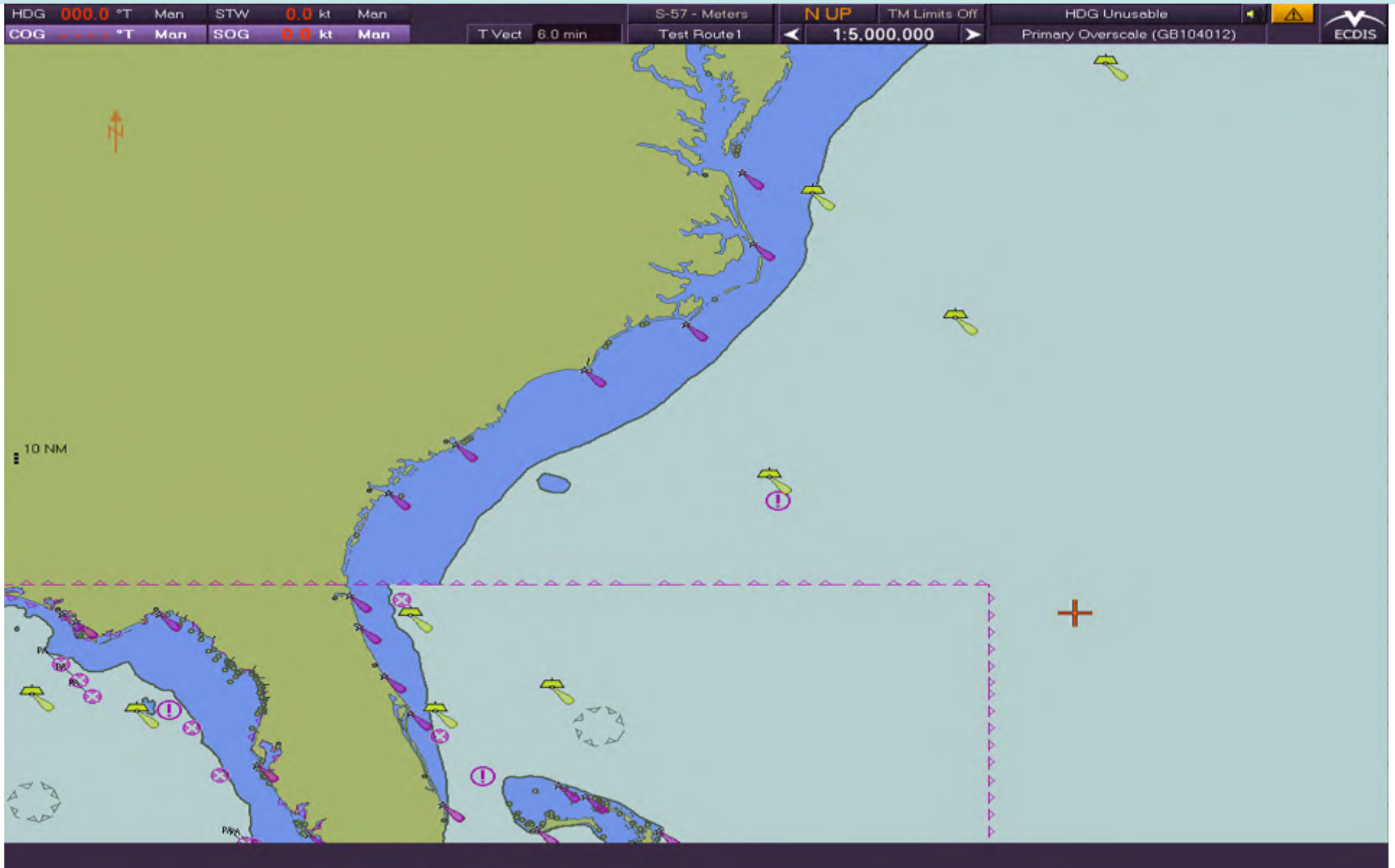
- Office Management Module
 - Web-based BridgeLink decision support portal
 - Follow-up of fleet performance
 - Simulation of costs for a changed ETA
 - Reporting
 - Vessel fuel consumption and key performance Indicators
 - Fleet's energy consumption
 - Fuel Inventories
 - Automatic processing of ship fuel consumption reports into an up-to-date fleet-wide database



Sample Fuel Navigator Screen Displays



PBN Fuel Navigator Demo



Fuel Navigator - Main Menu

HDG **N/A** ° Man STW **N/A** kt Comp S-57 - Meters **N UP** TM Limits Off Config File Mismatch
COG **N/A** ° Man SOG **N/A** kt Man T Vectors 6.0 min No Route Loaded **1:8,000,000** Running in Service Mode

Routes

- Monitor Route
- ETA Calculator
- Edit Route
- Optimize Route
- Weather Overlay
- Temp Route
- Route Status
- File Import / Export
- Route Display Settings

Main Menu

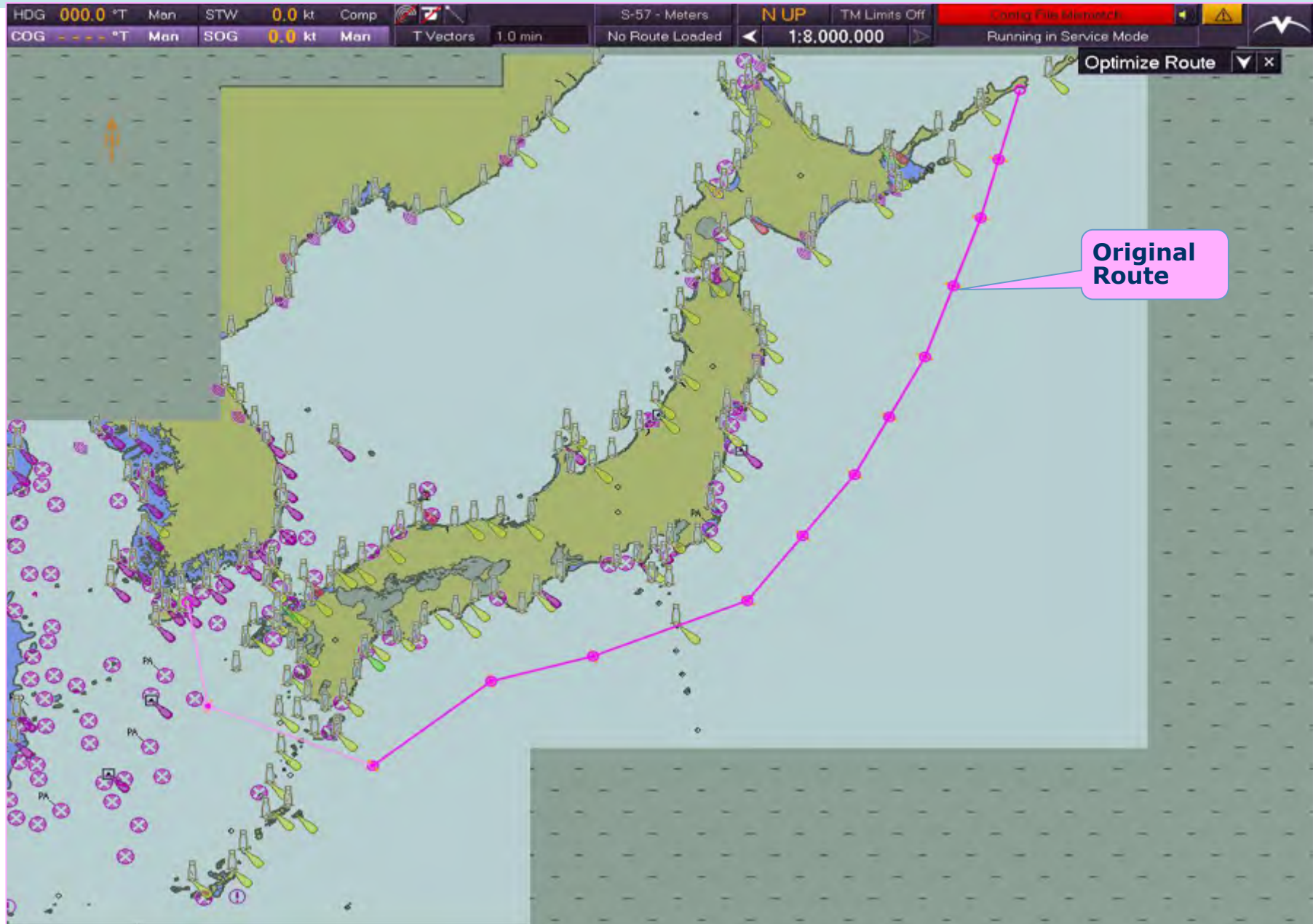
Targets	Alarms
Routes	Sensors
Nav Tools	Charts
System	Brilliance
Help	

Fuel Navigator - Ship Configuration

The screenshot displays the Fuel Navigator software interface. At the top, a status bar shows various parameters: HDG 000.0 °T, Man, STW 0.0 kt, Comp, S-57 - Meters, N UP, TM Limits Off, Comp File Upload, COG --- °T, Man, SOG 0.0 kt, Man, T Vectors 1.0 min, No Route Loaded, 1:8,000,000, and Running in Service Mode. The main area is a map with a pink route line and numerous yellow and purple markers. A yellow callout box labeled 'Ship Configuration Control' points to a panel on the right. This panel, titled 'Optimize Route', contains a 'Settings' tab with the following data:

Ship Configuration	
Alt Draft	8.5 m
ForeDraft	8.5 m
Gm	1.0 m
CostPerHour	103.0 USD
ModeChngCost	311.0 USD
WaterDensity	01.02 Kg/m3
WaterTemp	15.3 °C
DefaultAuxPwr	3.9 MW
ShaftGenPower	0.00 MW
FuelPrice	350.0 USD/Ton
Aux Service Rating	100.0 %
Max Service Rating	99.8 %
Fouling	Some
FuelHeat	8.0 Kj/kg
Propeller RPM	0 To 0
Port Engine Modes	Starbrd Engine Mode
1ME	1ME
✓ 2ME	✓ 2ME
✓ 3ME	✓ 3ME

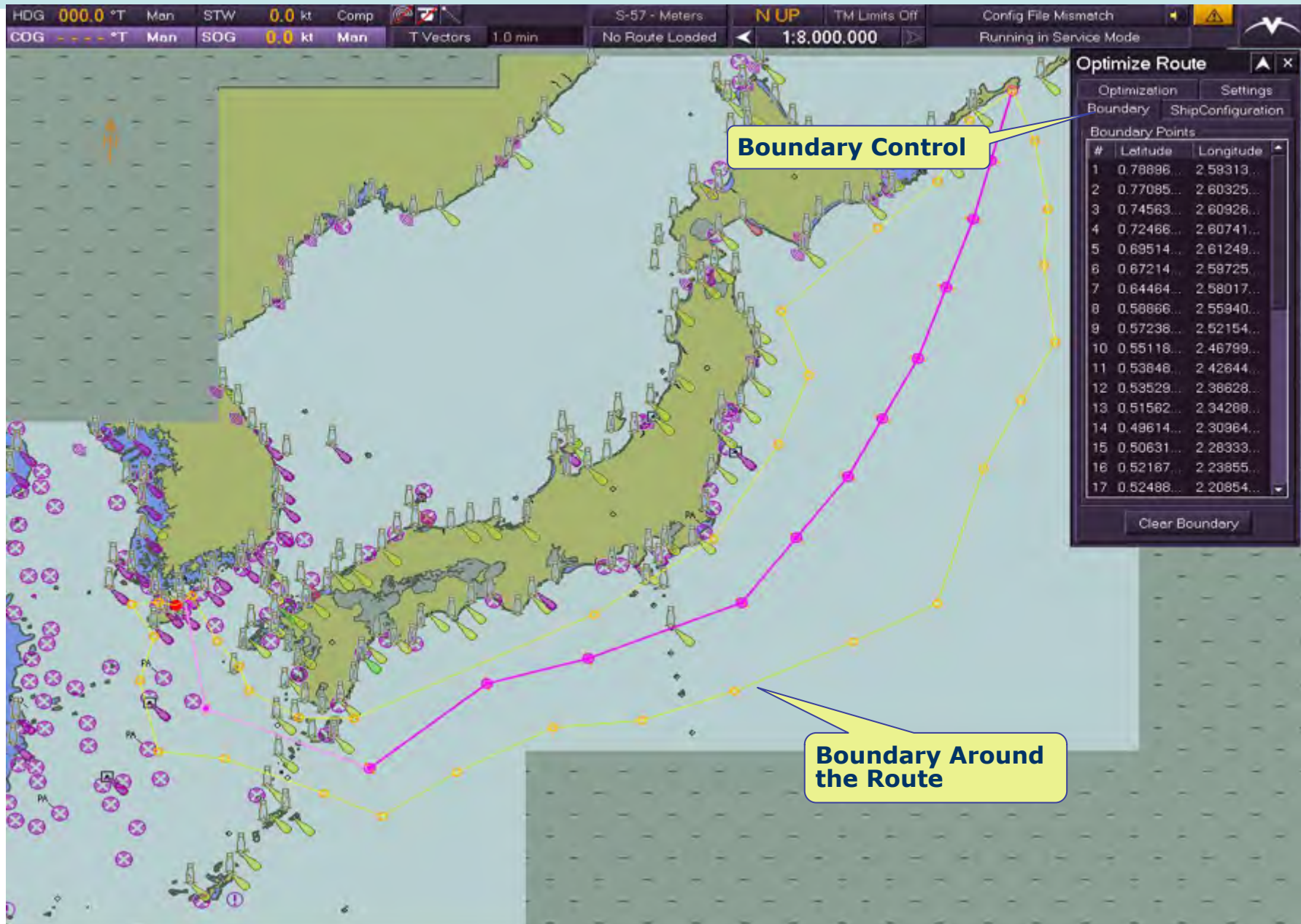
Fuel Navigator - Original Route



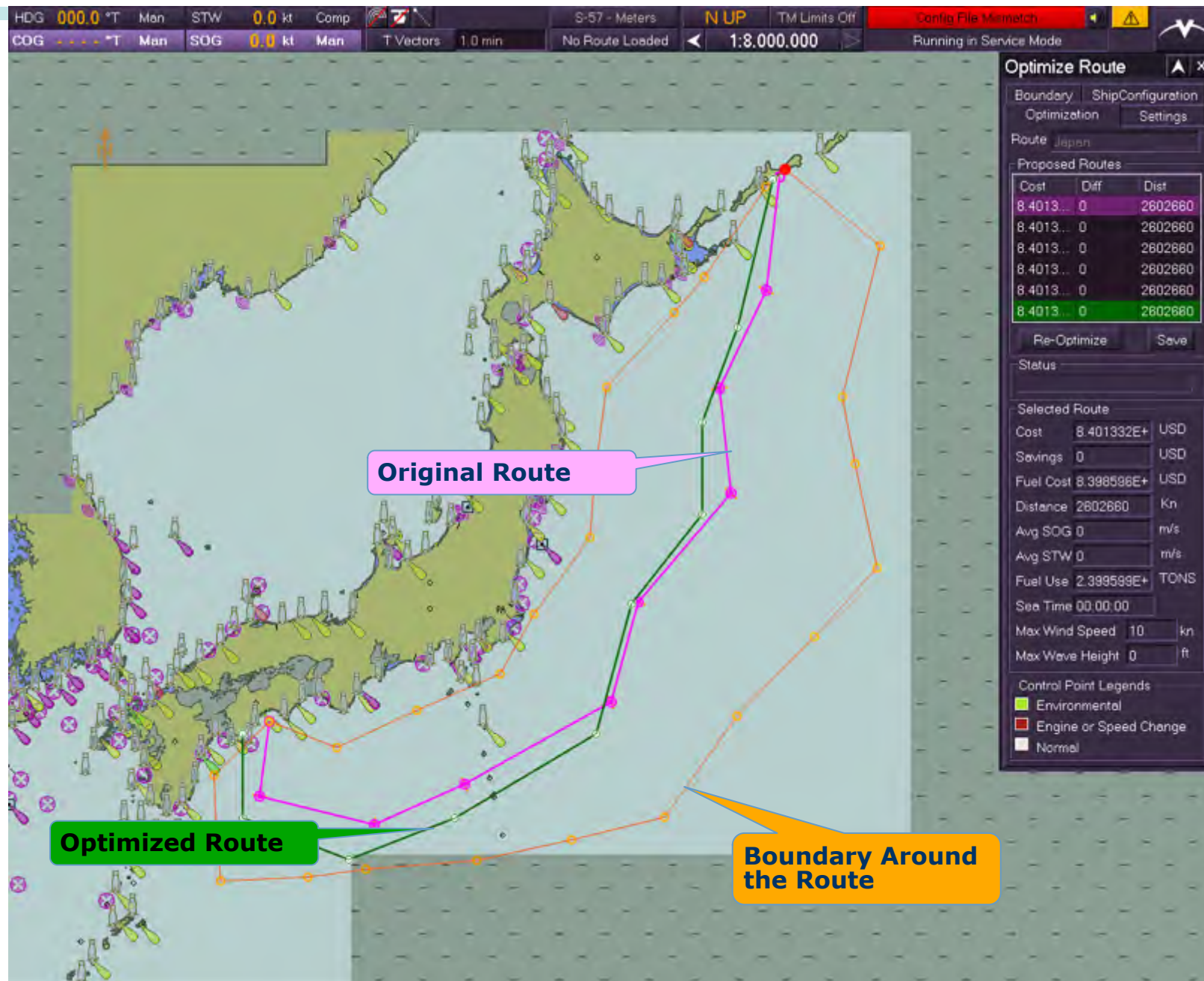
Fuel Navigator - Optimization Settings

The screenshot displays the Fuel Navigator software interface. At the top, a status bar shows various parameters: HDG 000.0 °T, STW 0.0 kt, S-57 - Meters, N UP, TM Limits Off, COG --- °T, SOG 0.0 kt, T Vectors 1.0 min, No Route Loaded, 1:8,000,000, and Running in Service Mode. The main map area shows a coastal region with a pink route line and numerous waypoints. A yellow callout box labeled "Optimization Settings Control" points to the "Optimize Route" panel on the right. This panel includes tabs for "Boundary" and "ShipConfiguration", and sub-sections for "Optimization Settings" (with "Route Optimization" selected), "Cost Calculation" (with "Automatic Cost Calculation" checked), "Optimization Waypoints" (Start: 1, End: 14), and "Request Type" (with "Cheapest" selected for all options). A "Clear Session" button is at the bottom of the panel.

Fuel Navigator – Boundary Drawing



Fuel Navigator - Optimized Route



Fuel Navigator – Optimization Wizard w/ Alternative Routes

The screenshot displays the Fuel Navigator Optimization Wizard interface. At the top, there are various status indicators including HDG, COG, Man, STW, SOG, and speed in knots. A scale of 1:8,000,000 is shown. The main window is titled 'Optimization Wizard' and contains a 'Results' section with a table of route options. Below the table, there are summary statistics for the selected route and navigation controls like 'Start Over', 'Back', and 'Next'. The background is a map showing a route through a complex waterway system with various waypoints and depth contours.

Optimization Wizard Results

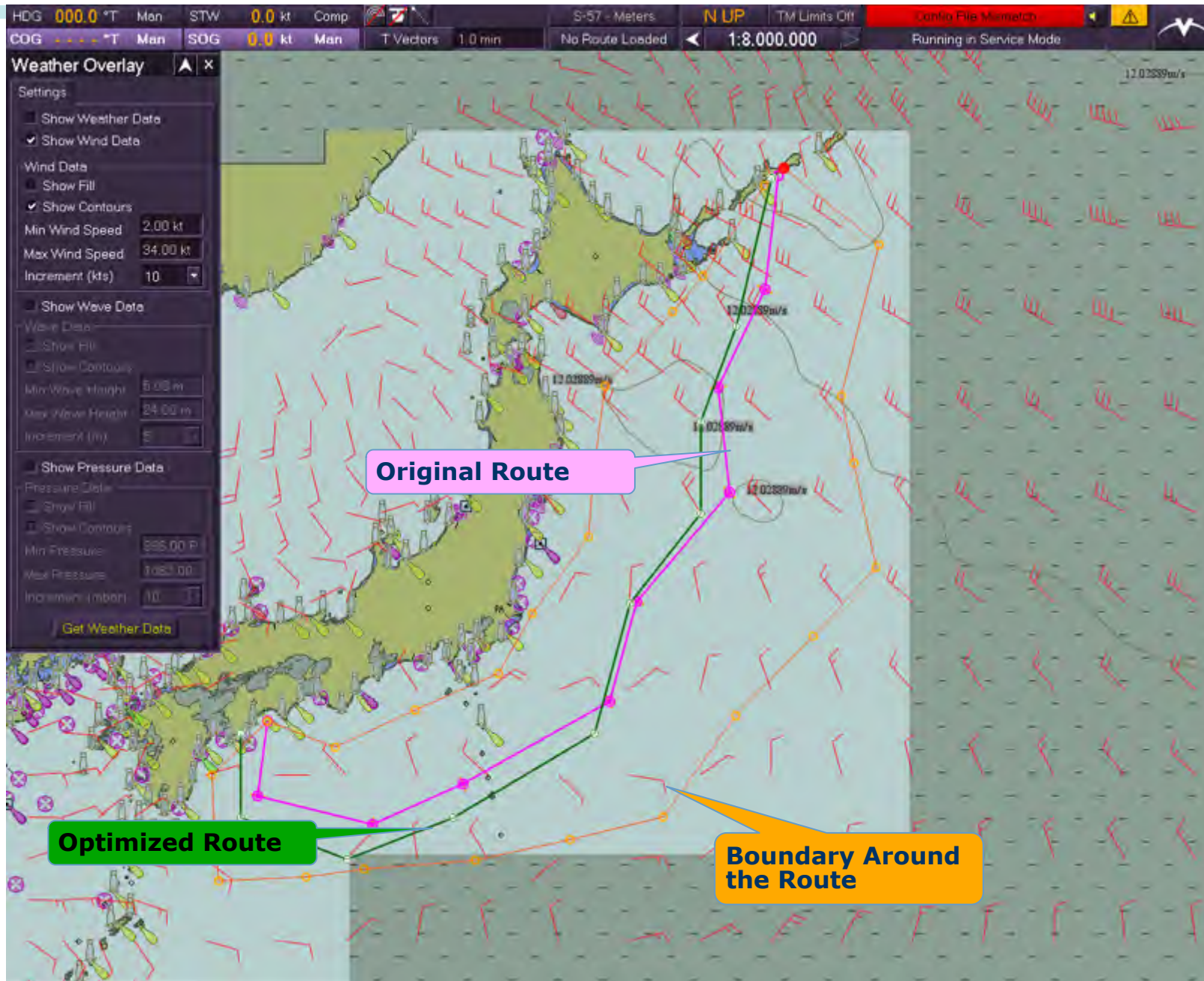
Name	Cost (USD)	Fuel Cost (USD)	Savings (USD)	Savings (%)
Original	271567	267942	0	0
Max ETA Margin	246325	242845	25282	9
Min Distance	246325	242845	25282	9
Min Cost	246325	242845	25282	9
Min Hull Stress	258725	255295	12862	5
Min Head Wind	258725	255295	12862	5

Summary Statistics:

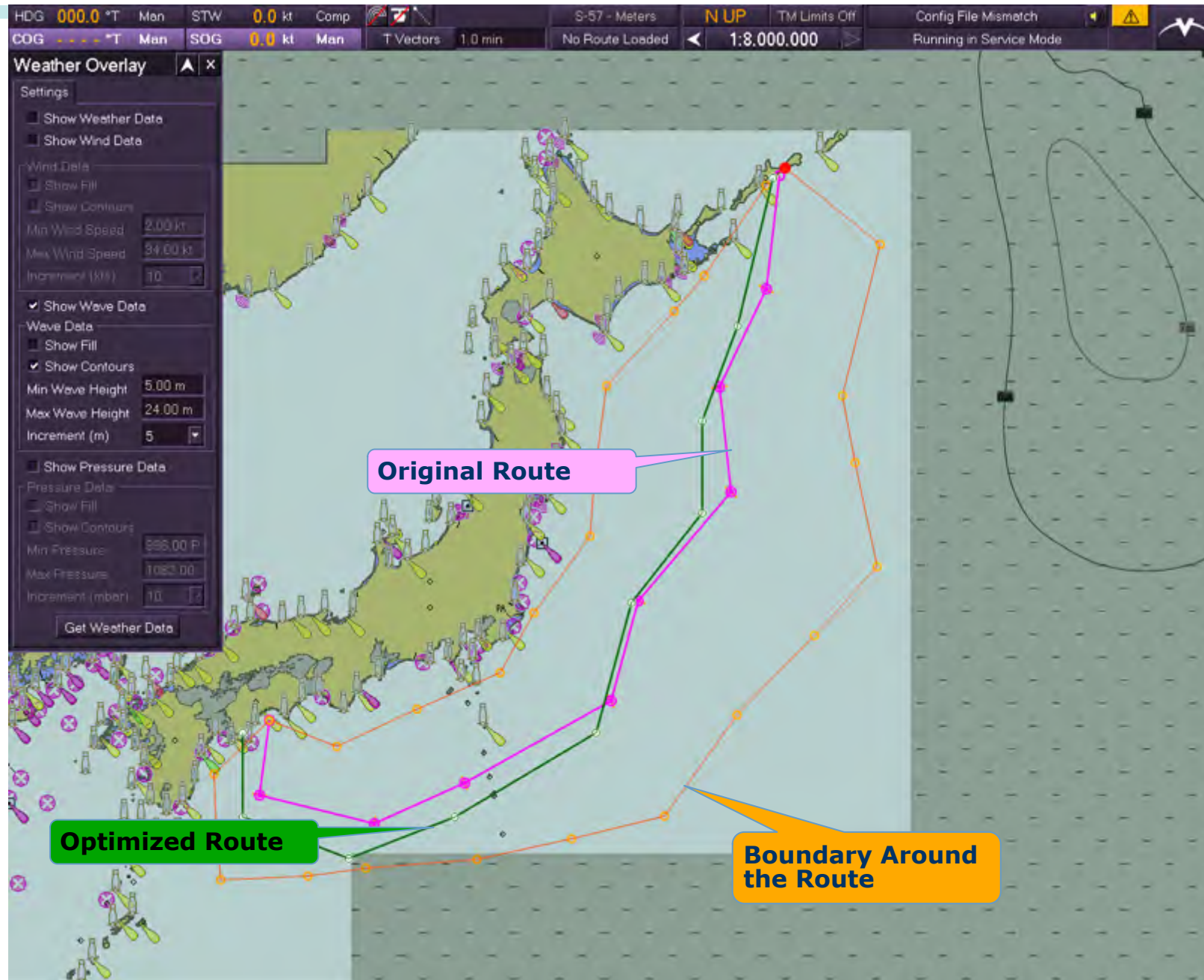
- Total Cost (USD): 246325
- Fuel Cost (USD): 242845
- Fuel Use (TONS): 485.89
- Buffer Time (hh:mm): 9:9
- Distance: 1181.62 NM
- SOG: 17.44 kn
- STW: 18.21 kn
- Max Wave: 3.48 m
- Max Wind: 32.98 kn

Map features include a scale bar for 10 NM, a 'Scale Filter Applied' warning, and various depth contours (e.g., 101200, 101400, 101600, 101800, 102000).

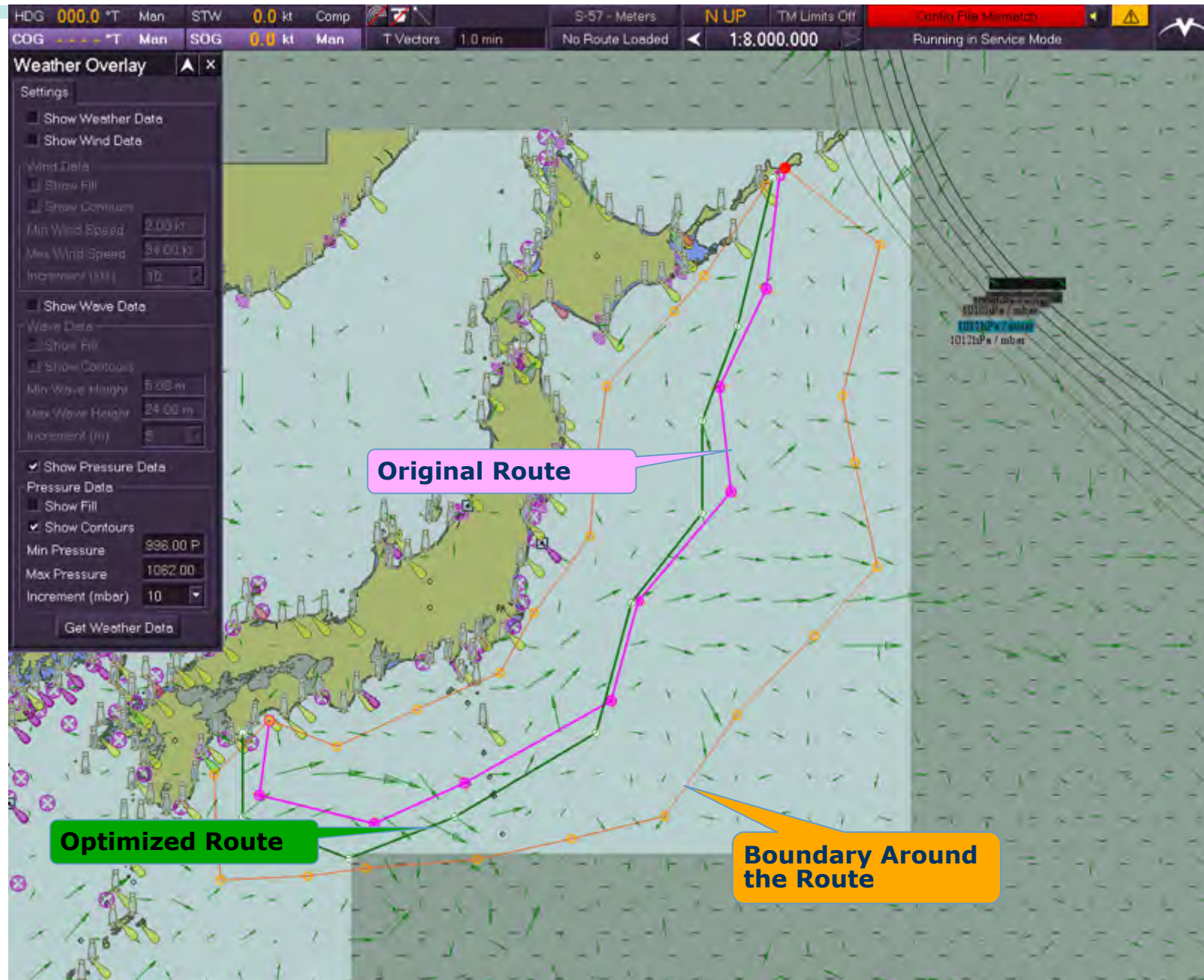
Fuel Navigator - Optimized Route with Wind



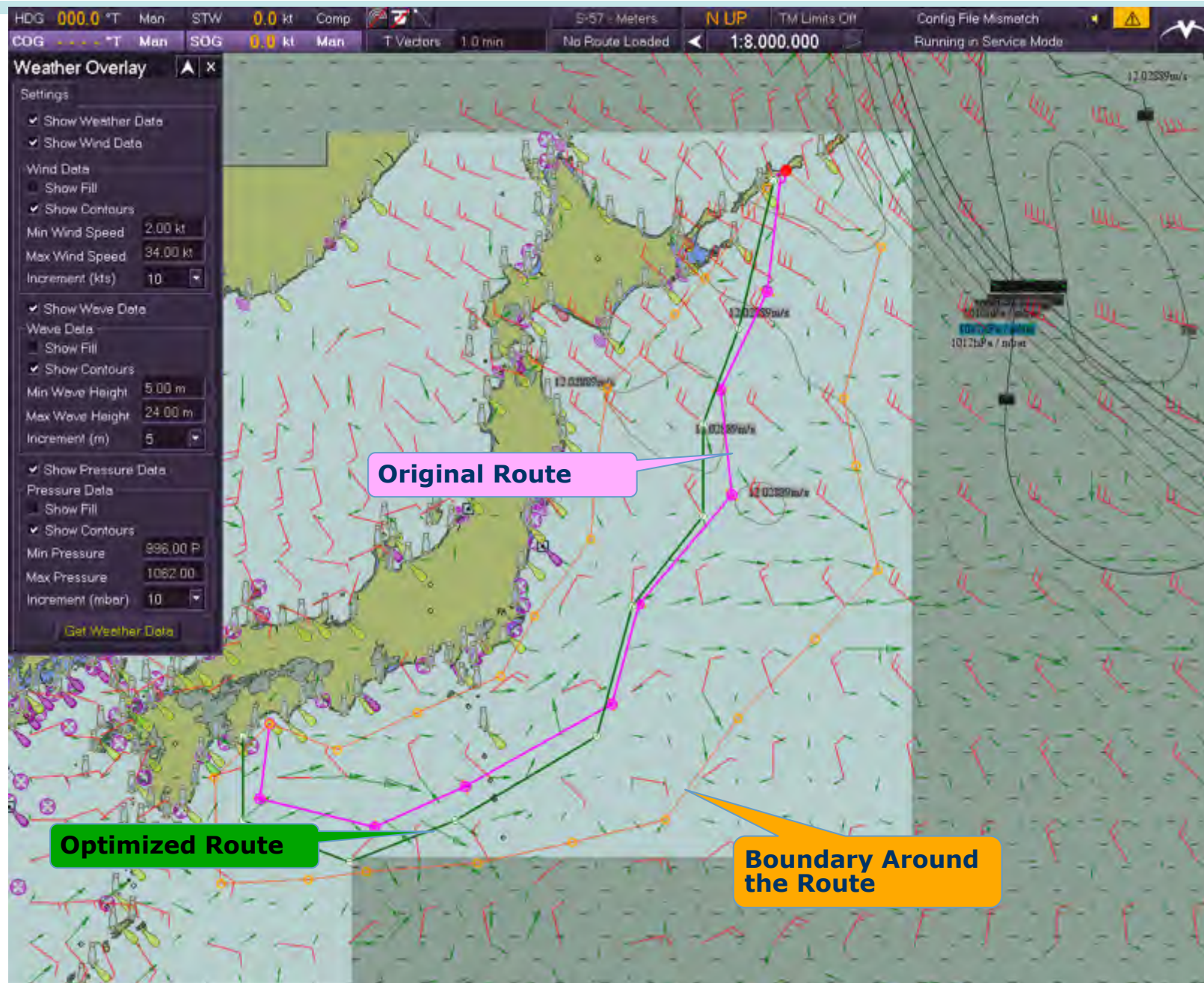
Fuel Navigator -Optimized Route with Wave



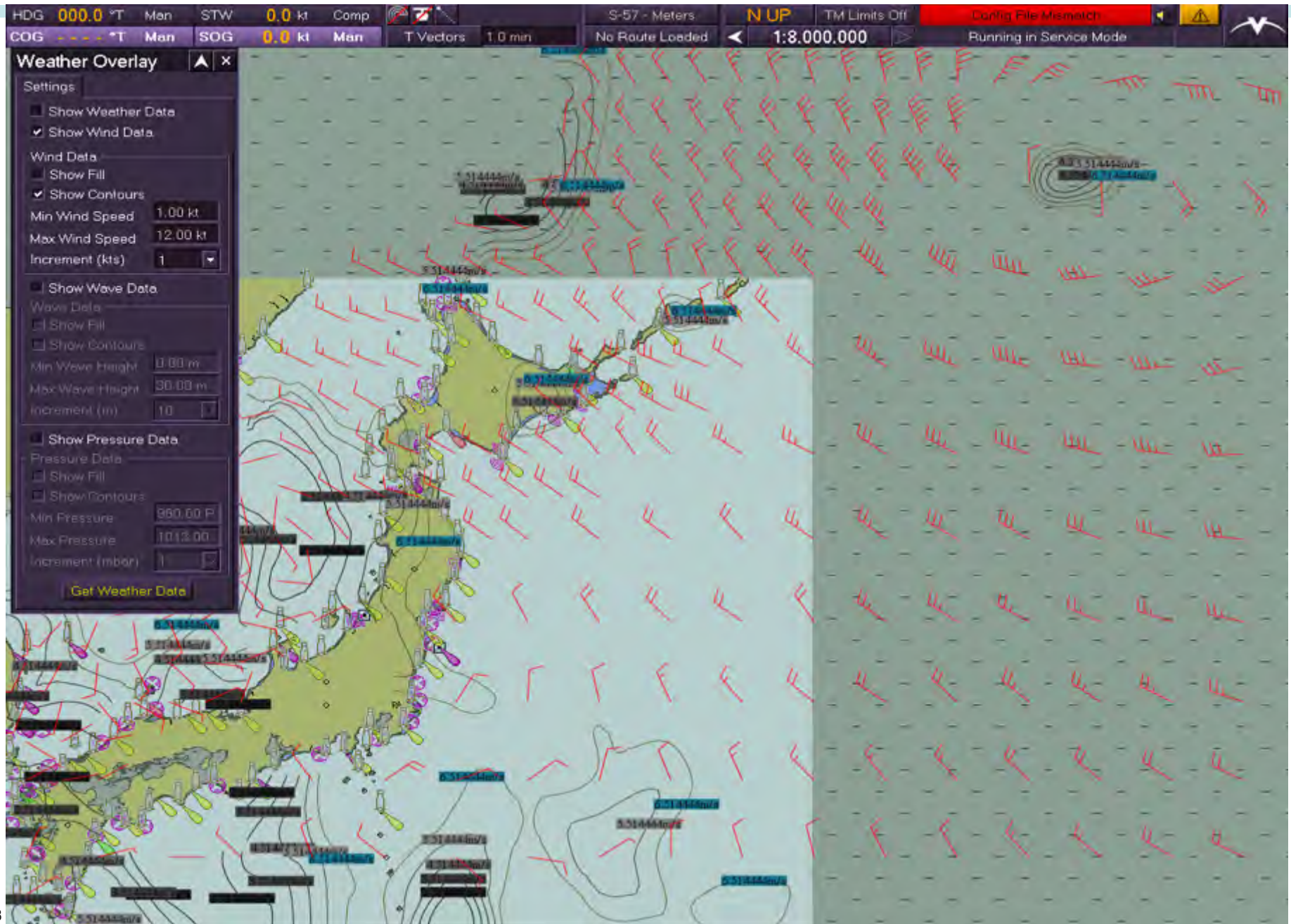
Fuel Navigator - Optimized Route with Pressure



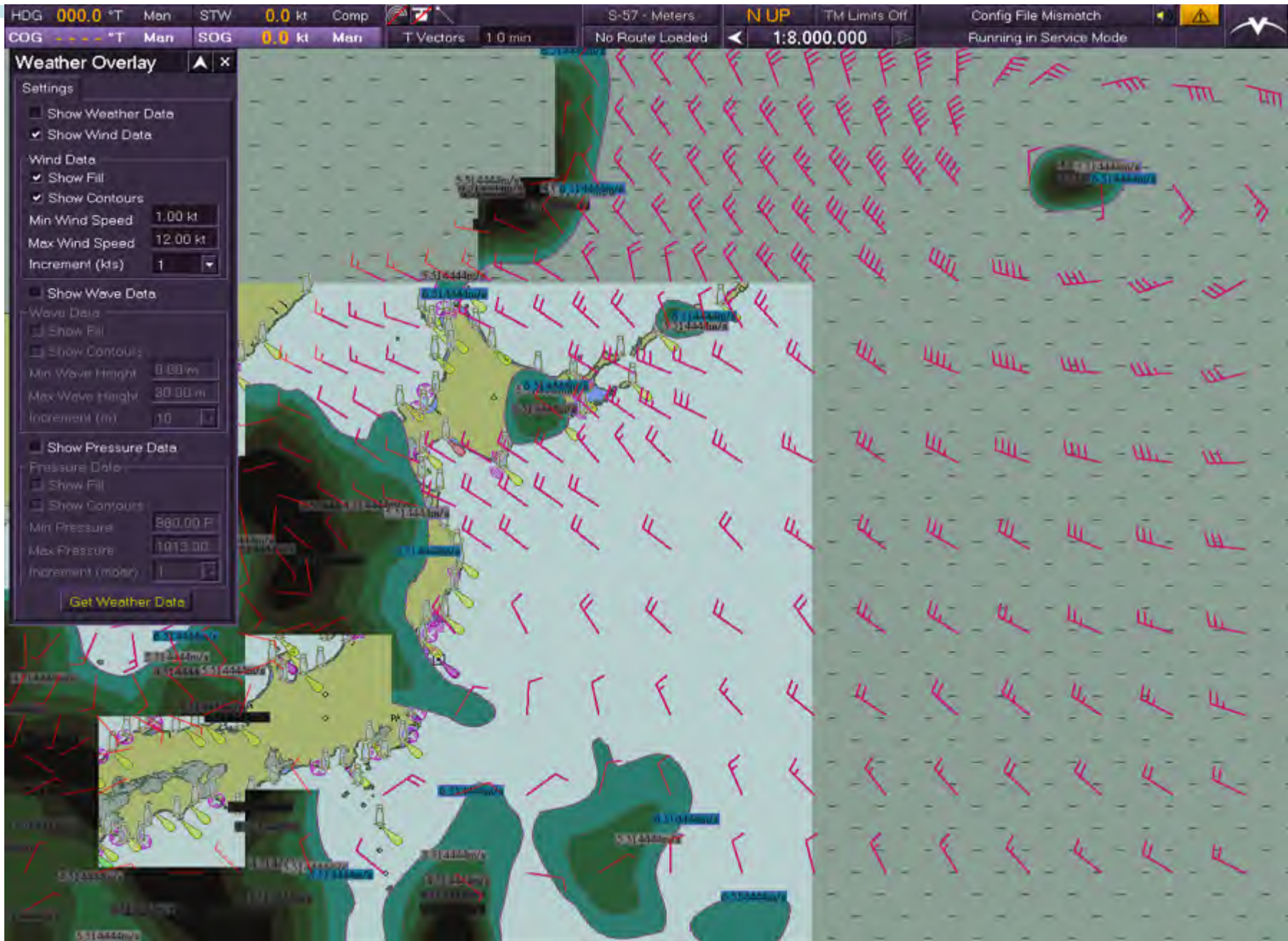
Fuel Navigator - Optimized Route with Wind, Wave and Pressure Contour



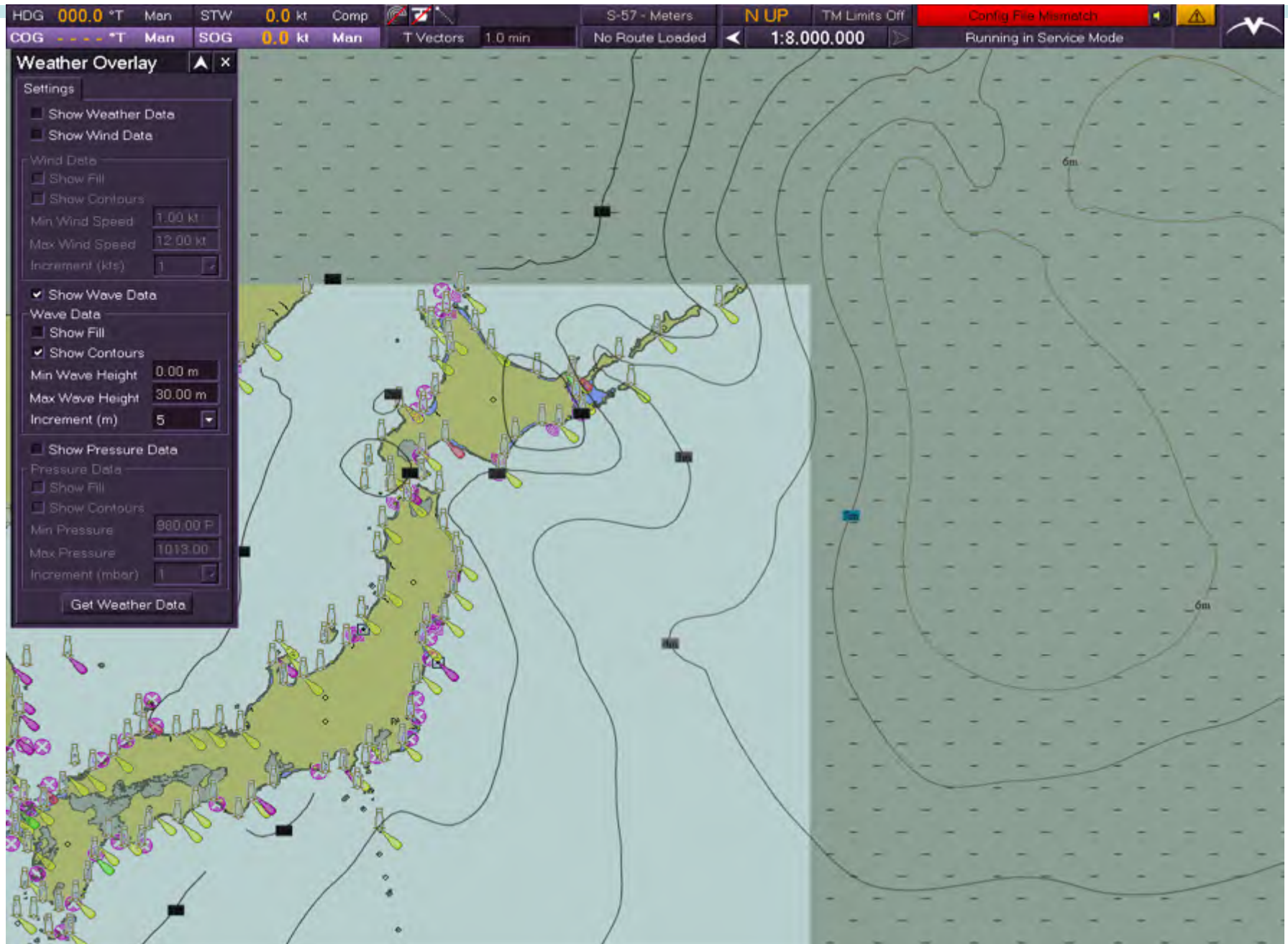
Fuel Navigator - Wind with Contour



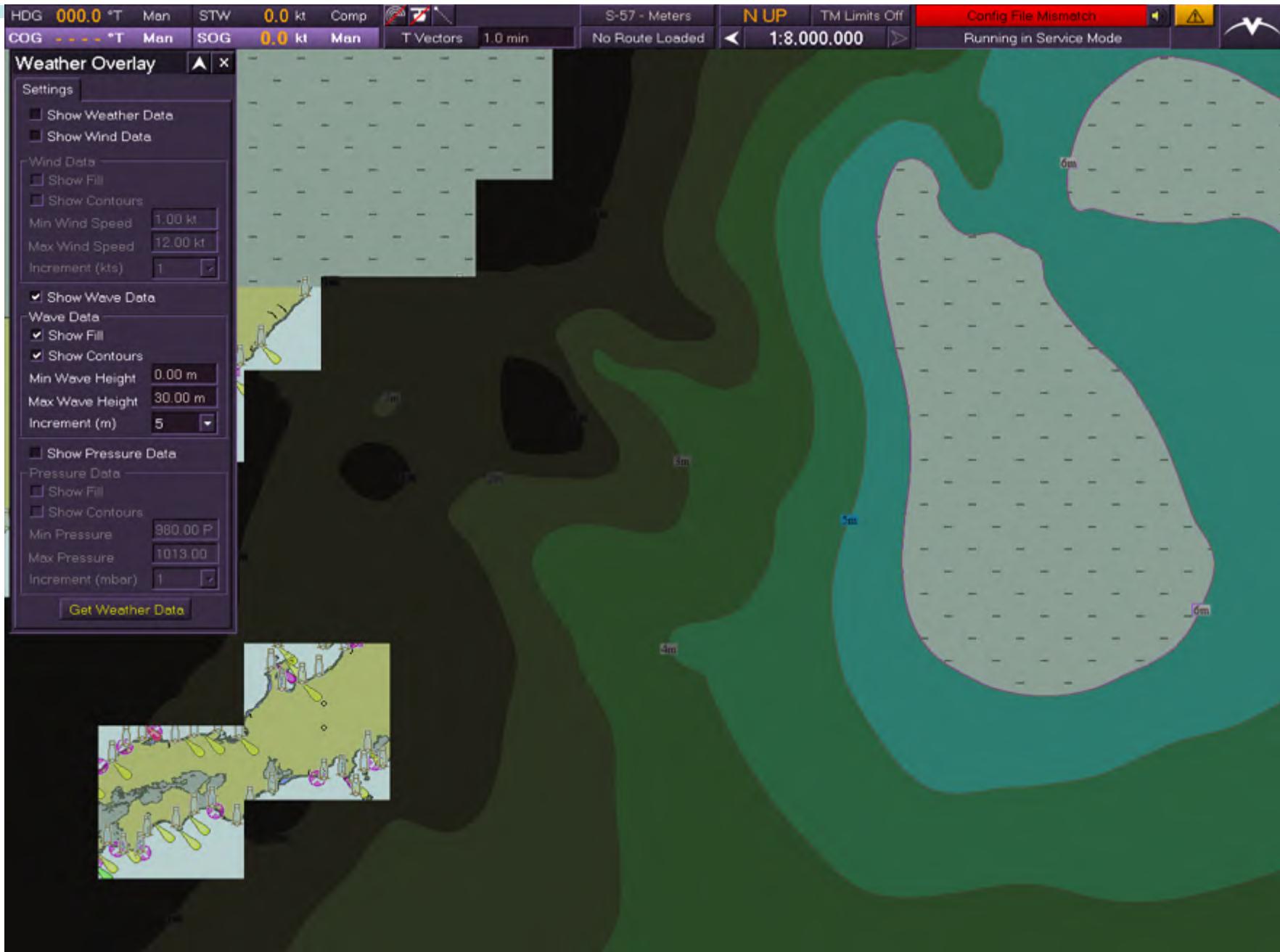
Fuel Navigator - Wind with Fill and Contour



Fuel Navigator - Wave with Contour



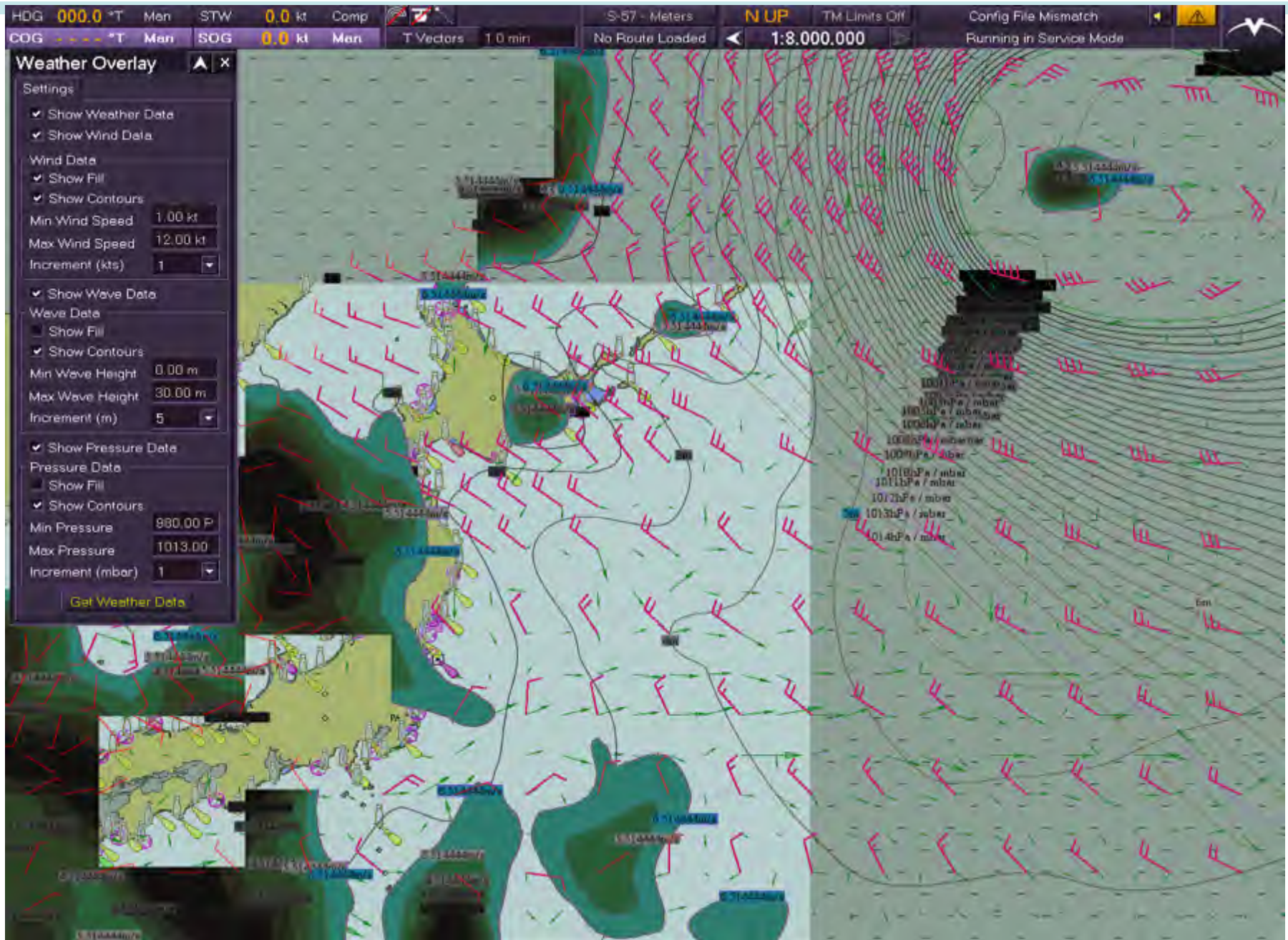
Fuel Navigator - Wave with Fill and Contour



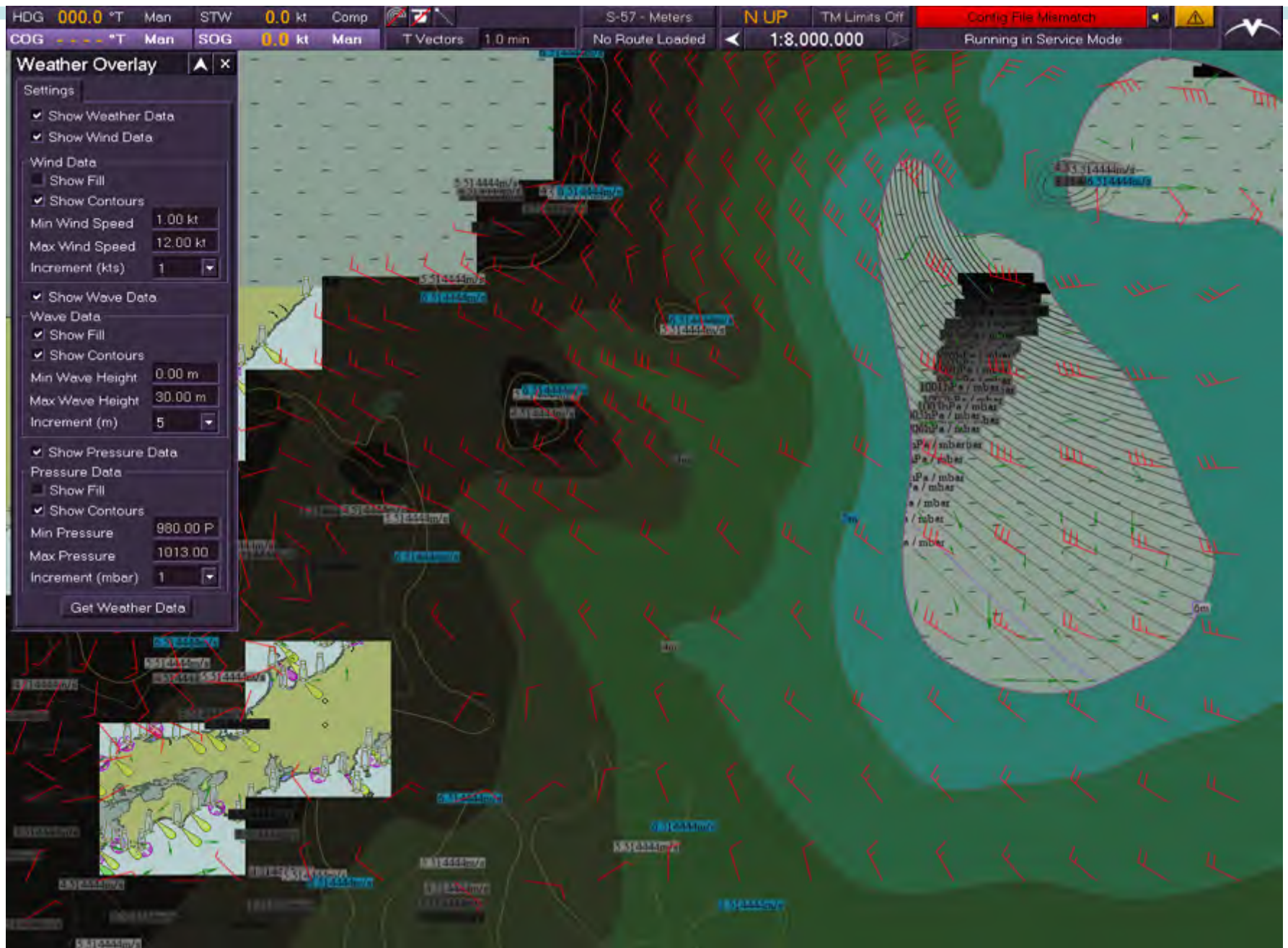
Fuel Navigator - Wind, Wave and Pressure with Contour



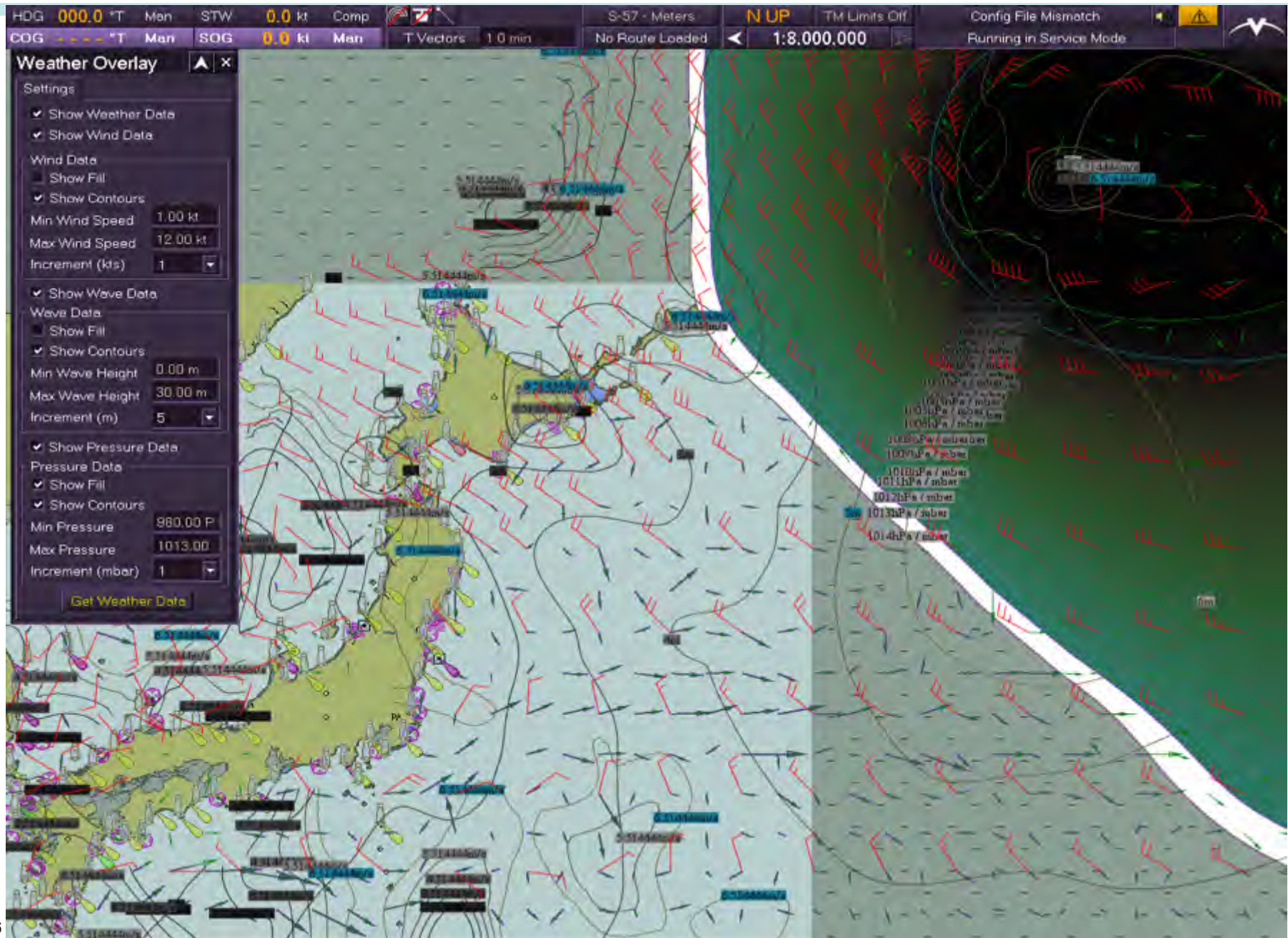
Fuel Navigator - Wave & Pressure with Contour and Wind with Fill & Contour



Fuel Navigator - Wind & Pressure with Contour and Wave with Fill & Contour

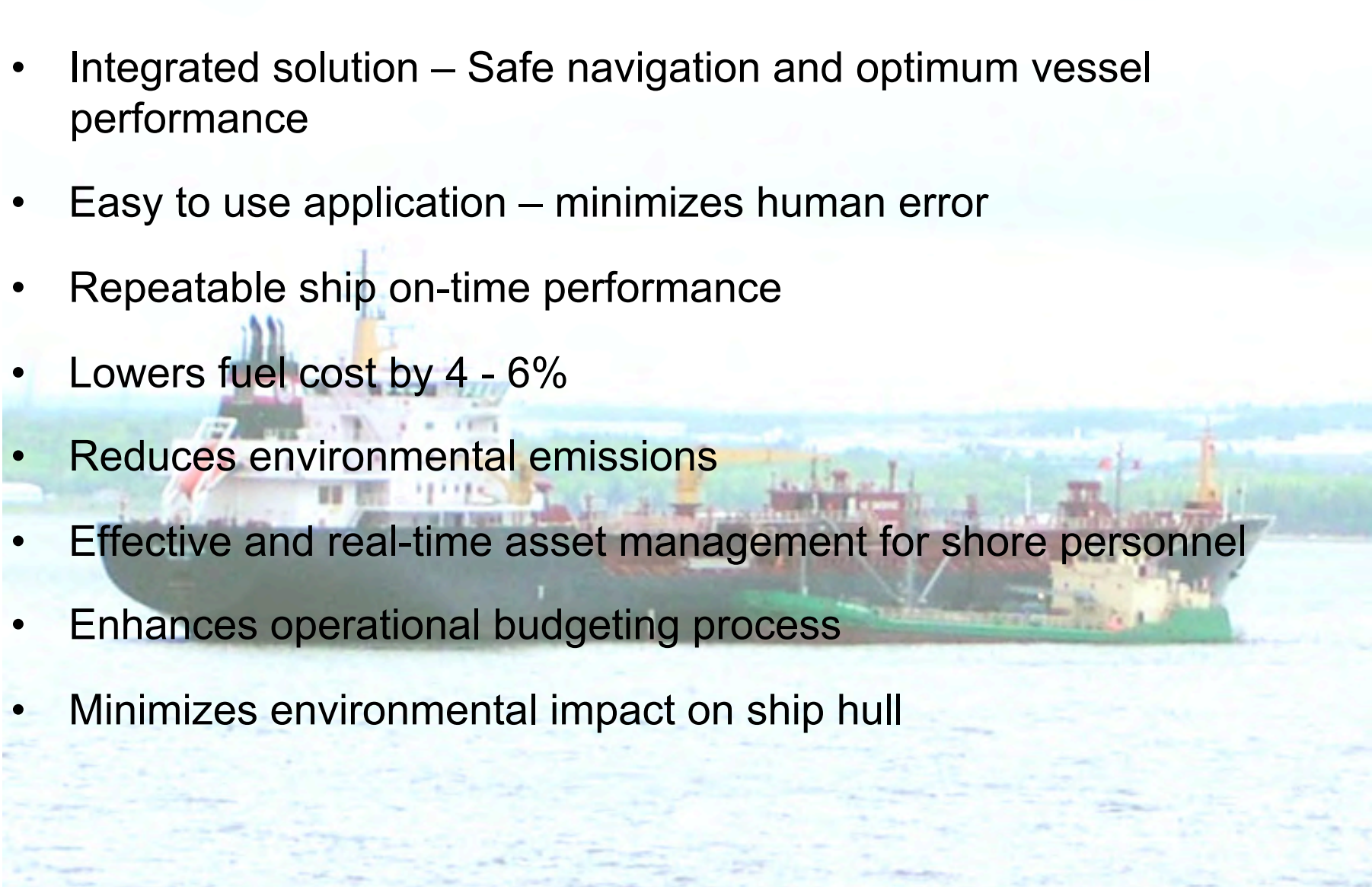


Fuel Navigator - Wind & Wave with Contour & Pressure with Fill & Contour

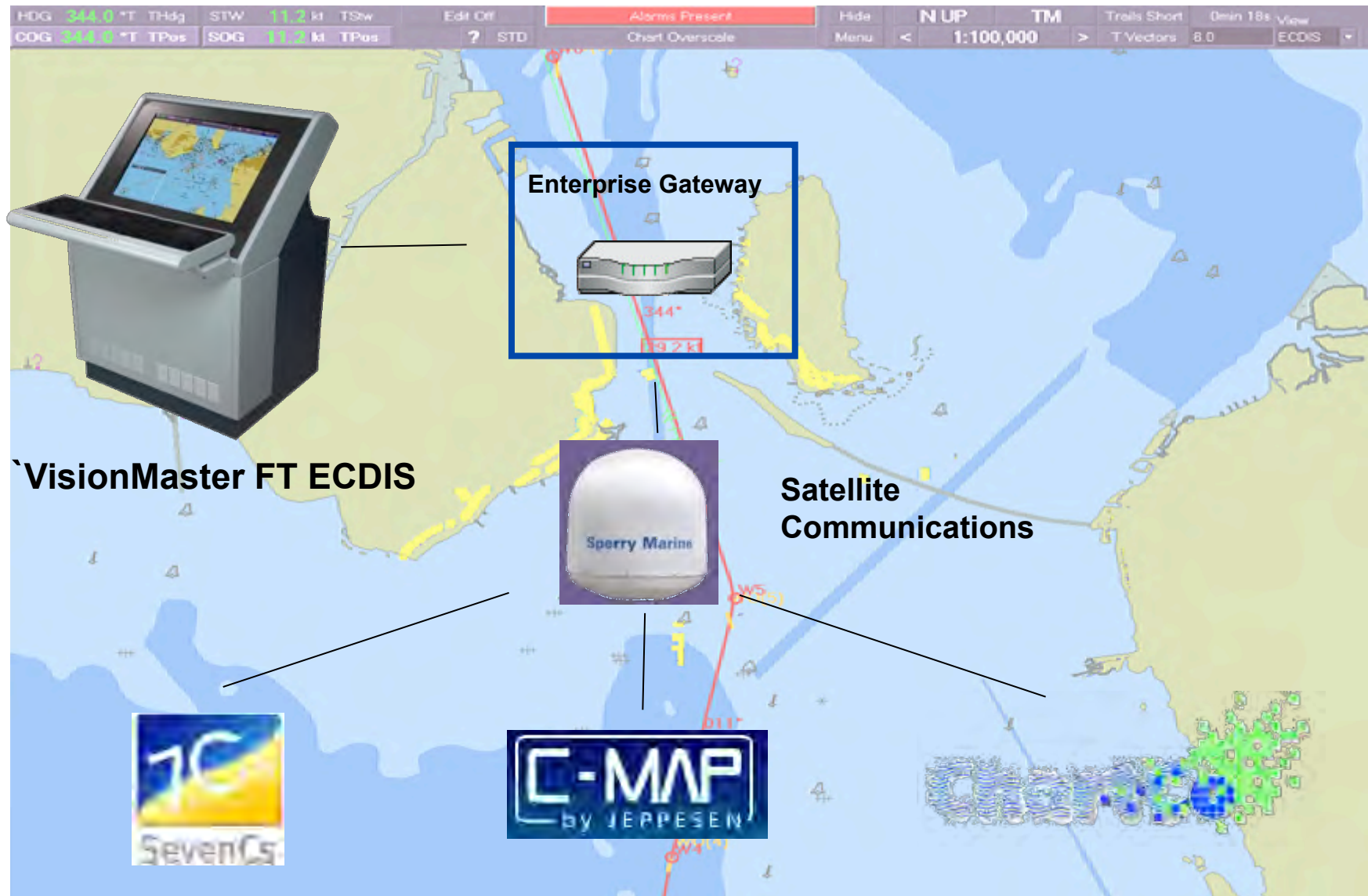


Fuel Navigator Customer Benefits

- Integrated solution – Safe navigation and optimum vessel performance
- Easy to use application – minimizes human error
- Repeatable ship on-time performance
- Lowers fuel cost by 4 - 6%
- Reduces environmental emissions
- Effective and real-time asset management for shore personnel
- Enhances operational budgeting process
- Minimizes environmental impact on ship hull



ActiveChart Application Architecture

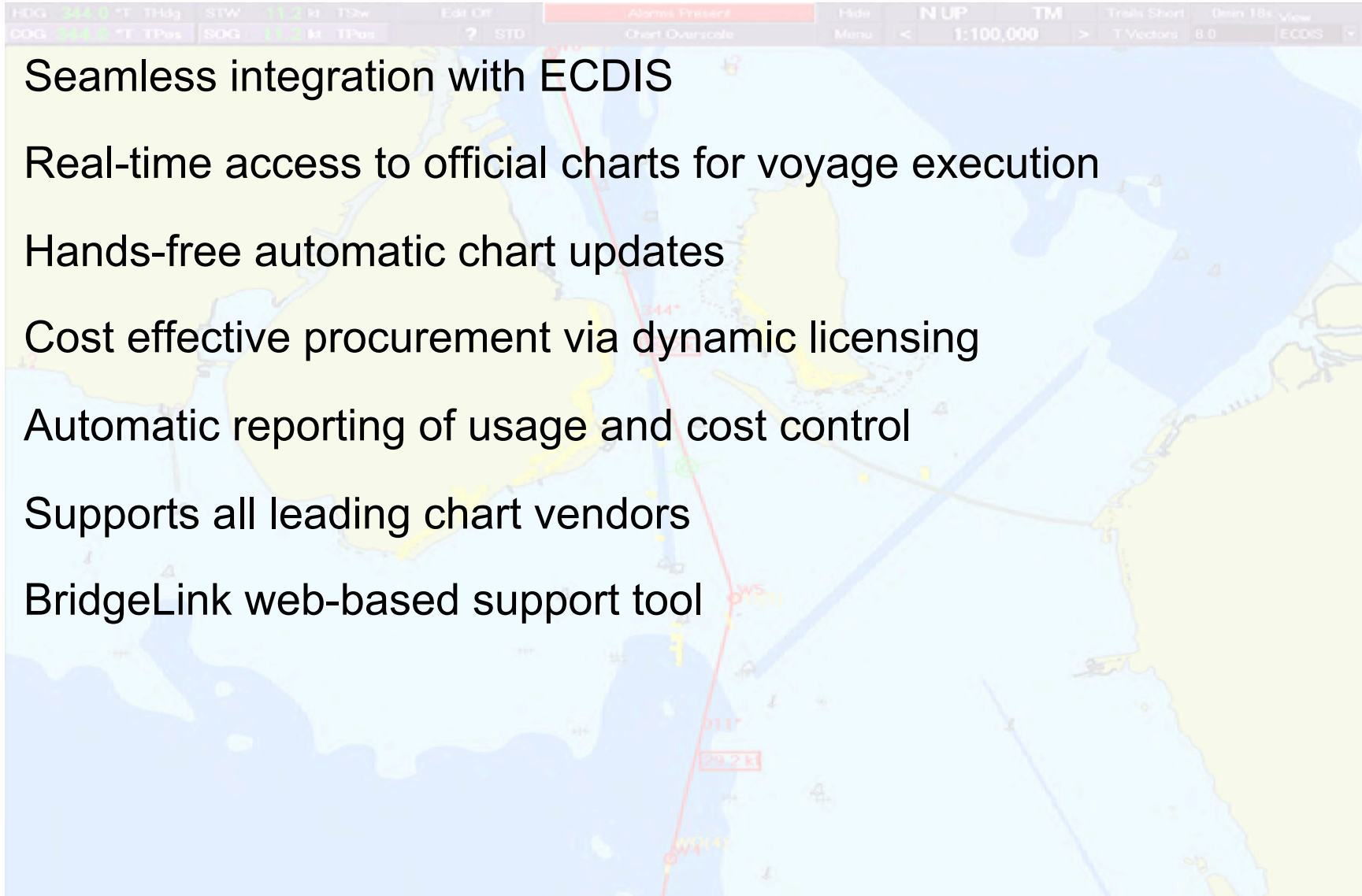


ActiveChart Application Highlights



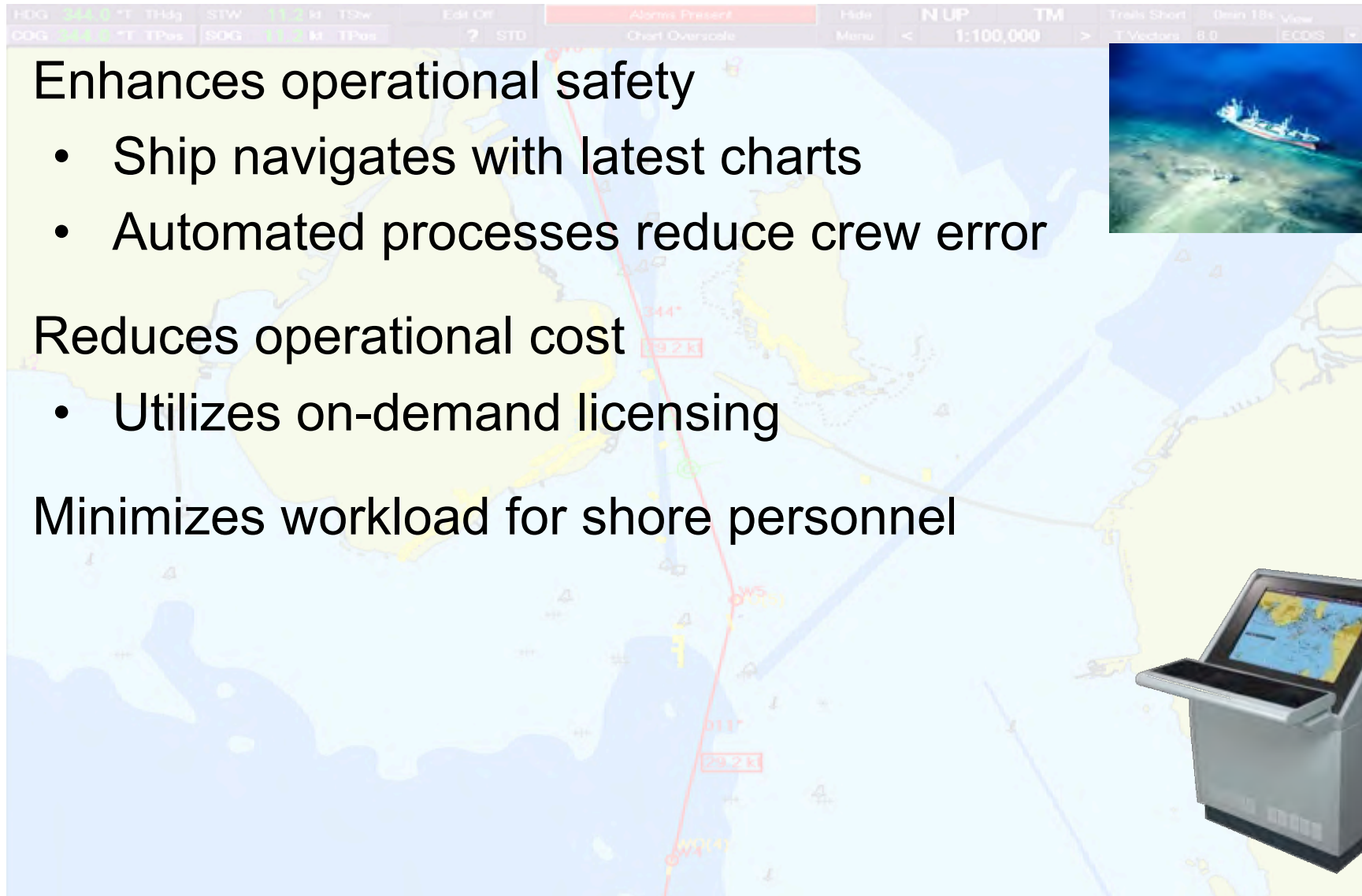
NORTHROP GRUMMAN

- Seamless integration with ECDIS
- Real-time access to official charts for voyage execution
- Hands-free automatic chart updates
- Cost effective procurement via dynamic licensing
- Automatic reporting of usage and cost control
- Supports all leading chart vendors
- BridgeLink web-based support tool



ActiveChart Customer Benefits

- Enhances operational safety
 - Ship navigates with latest charts
 - Automated processes reduce crew error
- Reduces operational cost
 - Utilizes on-demand licensing
- Minimizes workload for shore personnel

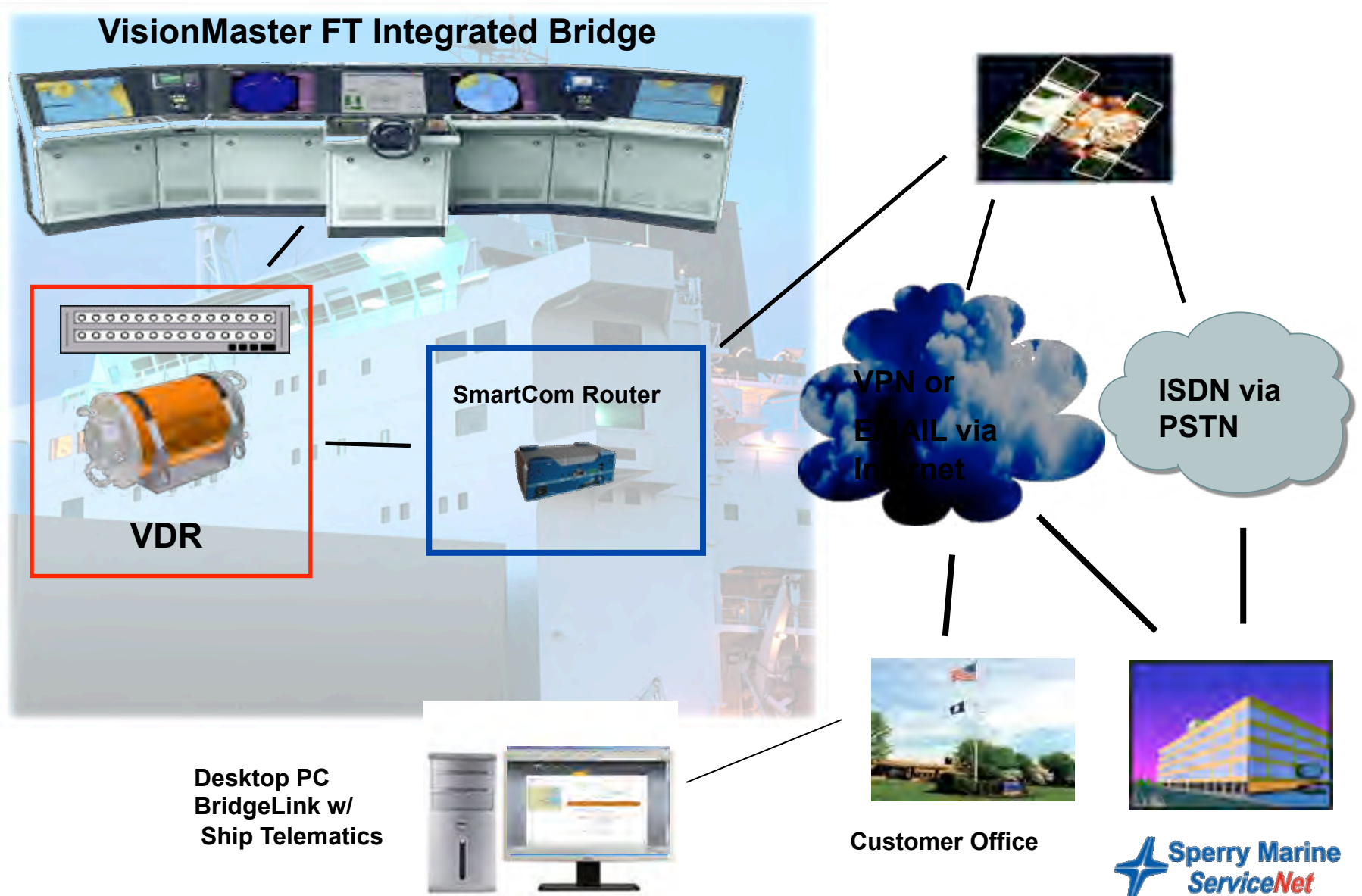


Ship Telematics – Basic Service

- Implementation
 - Subscription Service
- Scope
 - BridgeLink web-based portal
 - Fleet positions on global map
 - Ship Operational Data (Voyage Plan, ETA, Etc.)
 - Incident Management - Download VDR Files
 - Equipment Alerts (Failures & Alarms)
 - Bridge Configuration & Documentation Library
 - Online ServiceNet Connectivity – Order Service



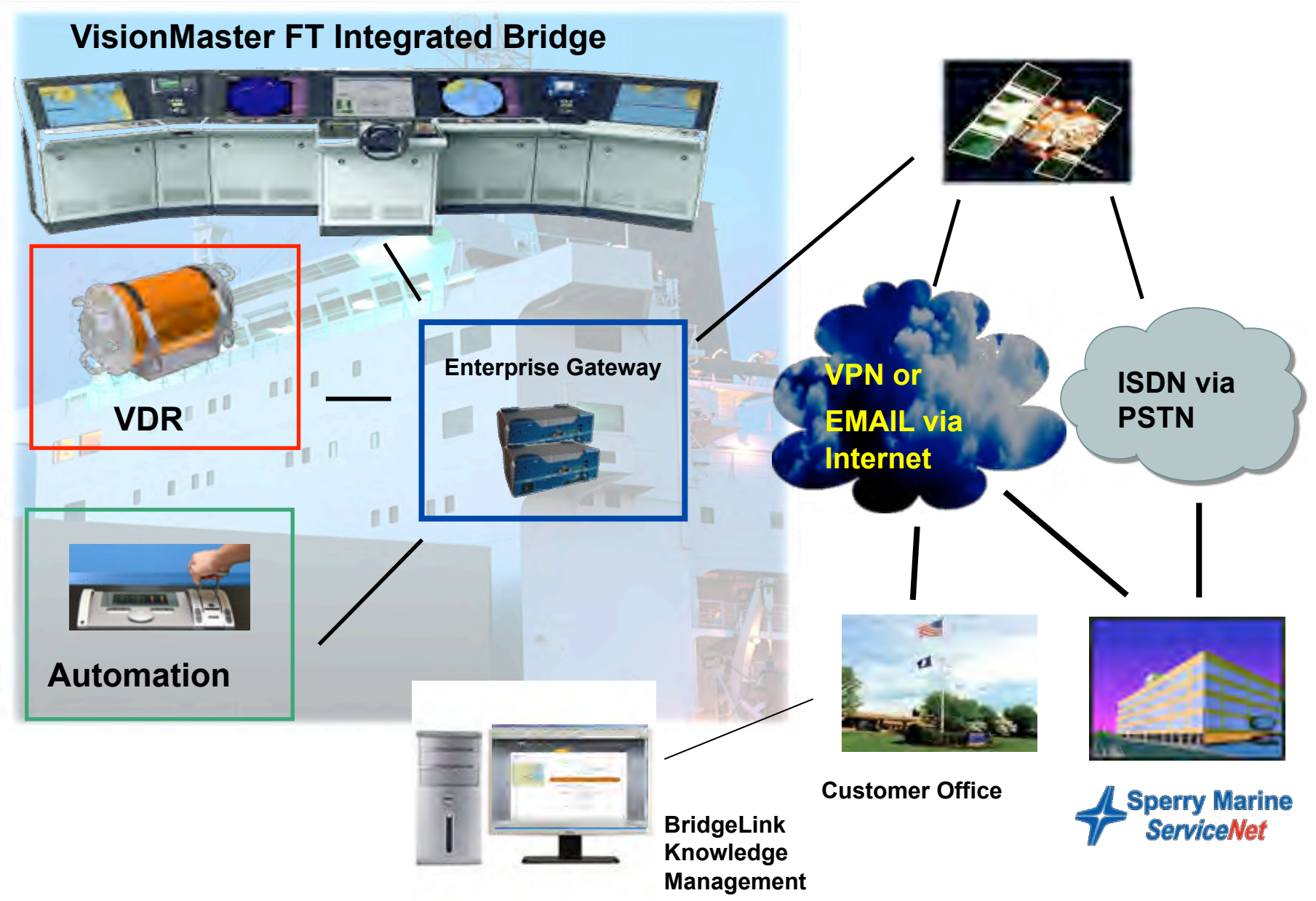
Basic Ship Telematics Design Concept



Ship Telematics – Premium Service

- Implementation
 - Subscription service utilizing e-mail and/or broadband connectivity
- Scope
 - Basic Service
 - Develop and transfer voyage plans to ship
 - Equipment status reports, diagnostics and online repair
 - Product software updates
 - Product Upgrades (ex. Radar to ChartRadar, Radar to ECDIS, etc.)
 - Incident Management - stream Live VDR Data
 - Online connectivity to expanded ServiceNet application
 - Weather and ocean current service
 - Download files from future ship's electronic log book
 - Linkage to online port service vendors

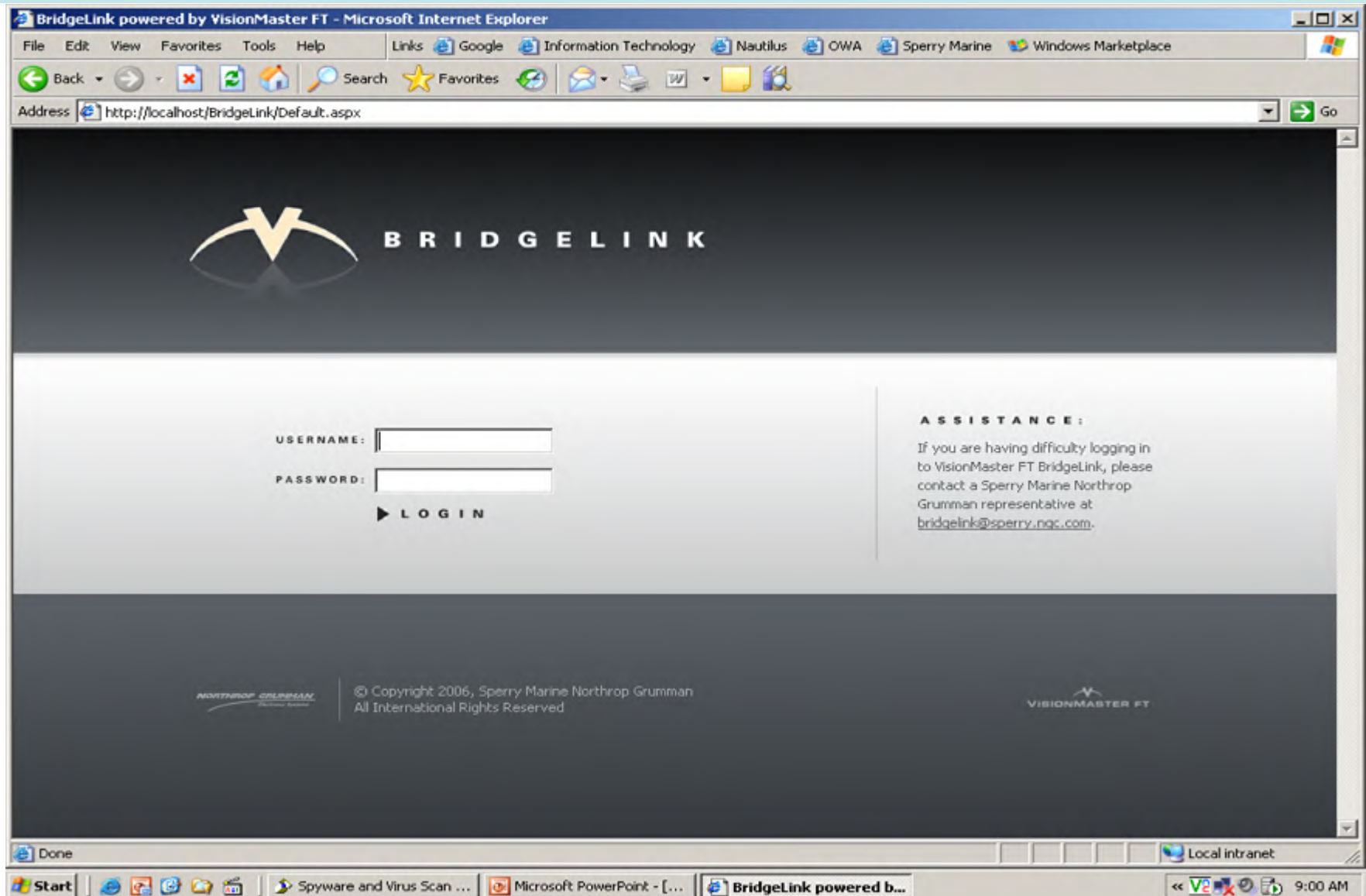
Premium Ship Telematics Design Concept



Ship Telematics Customer Benefits

- Real-time asset management
- Reduces maintenance and repair costs
 - Timely preventative action
 - Effective execution of repair work
 - Extends equipment service life
- Enhances vessel operational performance
- Seamless link to Sperry Marine ServiceNet

BRIDGELINK Internet Customer Portal



<http://59.163.69.30:7081/Default.aspx>

BRIDGELINK- Fleet Status Page

Y! Search Web Upgrade your Toolbar Now! Mail My Yahoo! HotJobs Games

BRIDGELINK Welcome James Wood | Log

FLEET VESSEL SUMMARY VOYAGE PLAN TELEMATICS FUEL NAVIGATOR REPORTS ACTIVECHART ADMINISTRATIVE

Fleet

Select a Vessel

Cygnus Voyager



BRIDGELINK- Vessel Summary

Y! Search Web Upgrade your Toolbar Now! Mail My Yahoo! HotJobs Games

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FLEET **VESSEL SUMMARY** VOYAGE PLAN TELEMATICS FUEL NAVIGATOR REPORTS ACTIVECHART

Vessel Summary

Select a Vessel

Cygnus Voyager

Cygnus Voyager

Summary	
Total Miles Travelled	32435 KN
Heading	44.00 °
Speed	0.00 kts
Pos Lat	37°48'55"

Pacific Ocean Northern Part

Map labels: British Columbia, Vancouver [Canada], Fresh Bay [United States of America], Sacramento [United States of America], Sausalito [United States of America], Gulf of California, Gulf of Mexico

BRIDGELINK- Voyage Plan Page

Search Web
Upgrade your Toolbar Now!
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[VOYAGE PLAN](#)
[TELEMATICS](#)
[FUEL NAVIGATOR](#)
[REPORTS](#)
[ACTIVECHART](#)
[ADMIN](#)

Voyage Plan

Select a Vessel

Cygnus Voyager

Select a Route

San Francisco to Los Angeles

Route Summary

Route	San Francisco to Los Angeles
Scheduled ETA	11/17/2007 00:00:00
Actual ETA	11/17/2007 00:00:00
Route TTG	0:0:0
Route	1006403.00



BRIDGELINK- Fuel Navigator Page

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FLEET
VESSEL SUMMARY
VOYAGE PLAN
TELEMATICS
FUEL NAVIGATOR
REPORTS
ACTIVECHART

Fuel Navigator

Select a Vessel

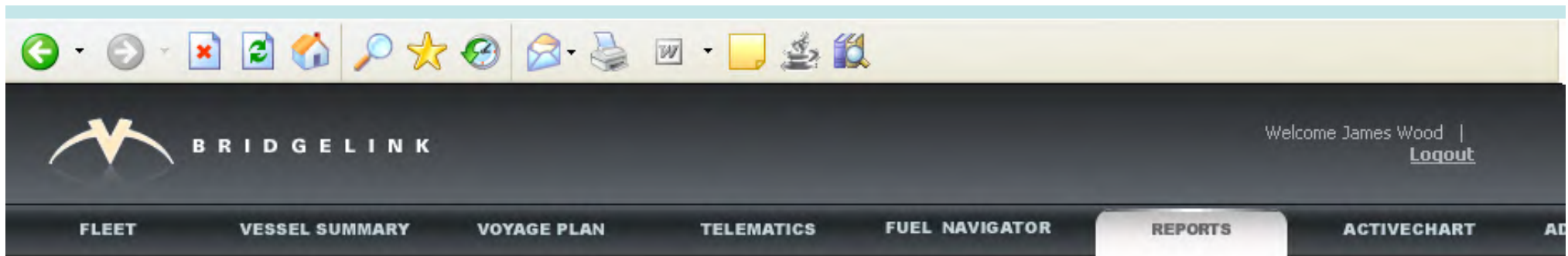
Route Name	Original Cost	Cost after Optimization	Original Distance	Distance after Optimization	Original Fuel Usage	Fuel Usage after Optimization
San Francisco to Los Angeles	50000	35000	32434	29433	1500	1200

Select a Waypoint

Cygnus Voyager

Parameter	Value
Actual Arrival Time	11/13/2007 12:00:00 AM
Planned Arrival time	11/13/2007 12:00:00 AM
Average SOG (knots)	24
Planned SOG (knots)	25
Average STW (knots)	24
Average Course	24
Planned nautical miles	33
Actual nautical miles	44
Engines used	1
Average Propulsion Power	6

BRIDGELINK- Reports Page



Reports

Select a Vessel

Cygnus Voyager

Cygnus Voyager

Graphical Reports

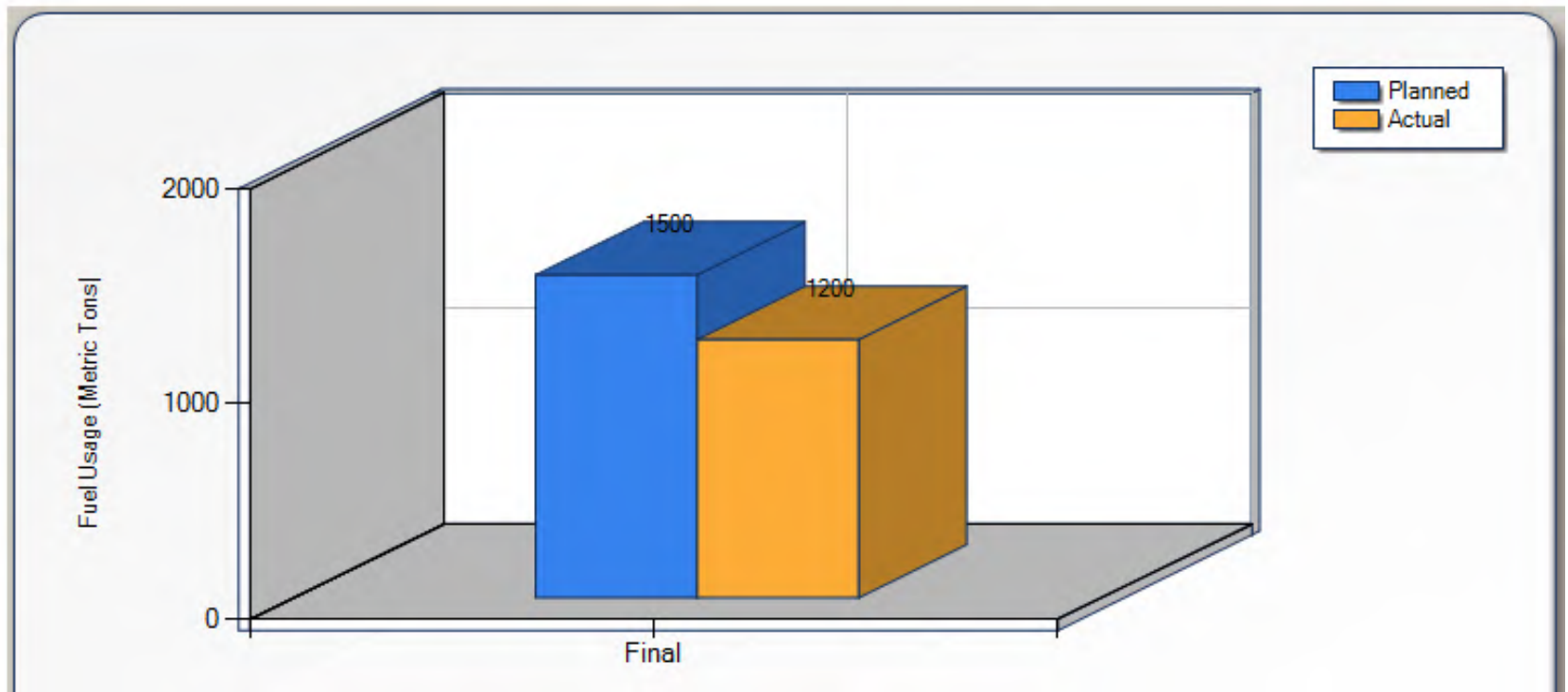
[Cost Analysis Report](#)

[Fuel Usage Analysis Report](#)

[Waypoint Analysis Report](#)

[Route Cost Division Report](#)

Fuel Usage Optimization Report



How do we know that we are saving fuel?

BridgeLink Web portal reporting tool.....

Methodology

Approach A:

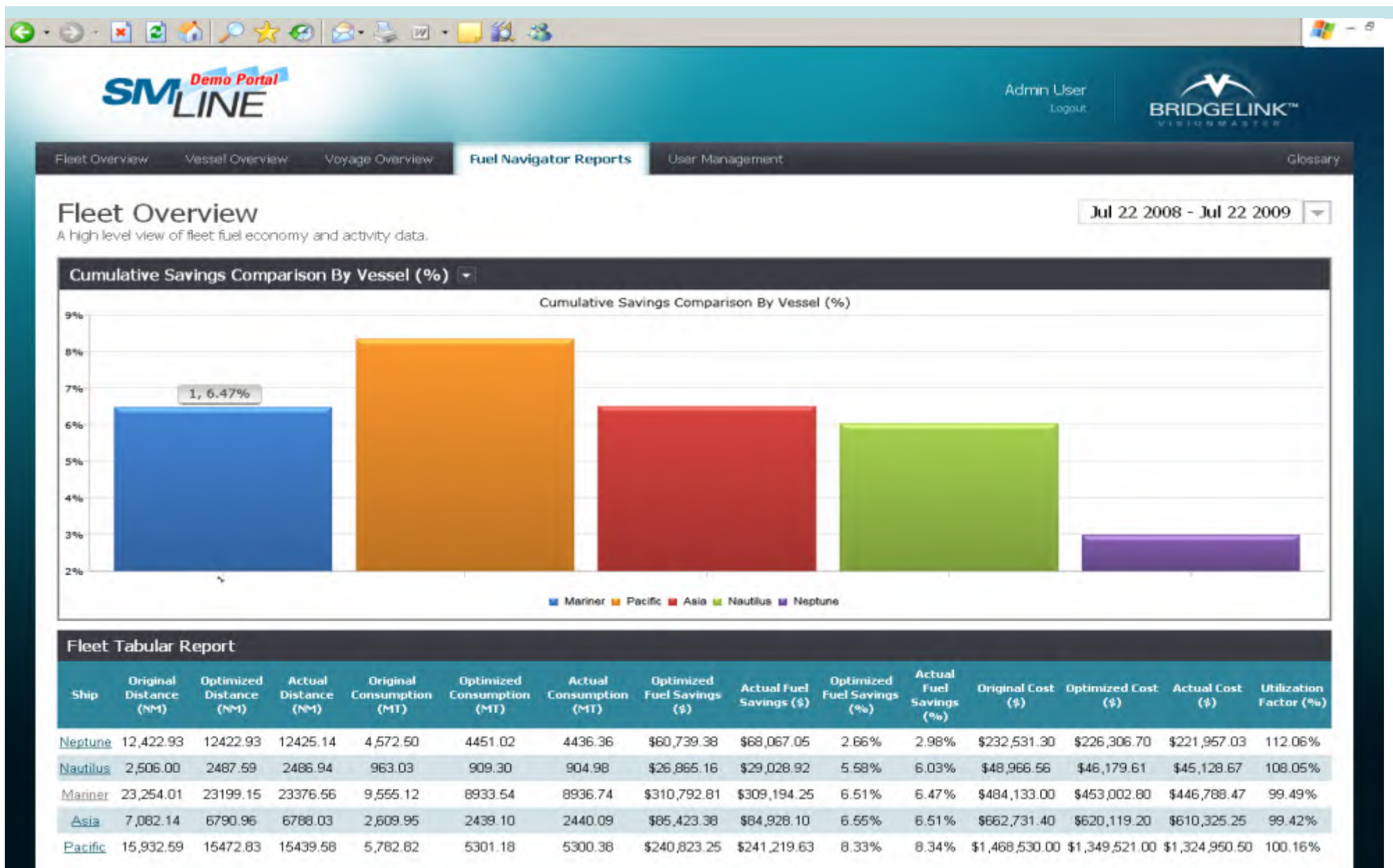
Compare Historical vs. Actual Consumption w/ Fuel Navigator

Approach B:


Compare Original Captain's Plan vs. Actual Consumption w/ Fuel Navigator



BridgeLink – Key Performance Indicator (KPI) Report: Cumulative Savings Comparison by Vessel (%)



BRIDGELINK- ActiveChart Page




BRIDGELINK

Welcome James Wood | [Logout](#)

FLEET VESSEL SUMMARY VOYAGE PLAN TELEMATICS FUEL NAVIGATOR REPORTS **ACTIVECHART**

ActiveChart

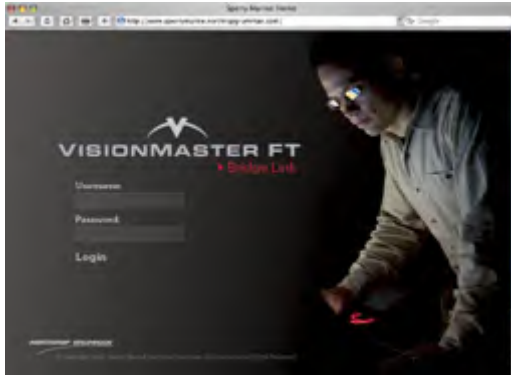
HOME DOWNLOADS FAQ CONTACT CHART-SHOP



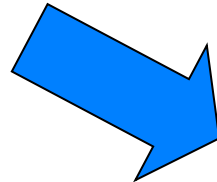
CHARTS SOFTWARE SERVICES SPECIALS myACCOUNT

Remote Monitoring & Diagnostics Value Added Solution

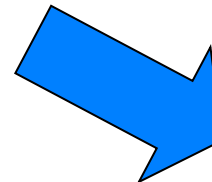
BridgeLink Online (internet) Portal



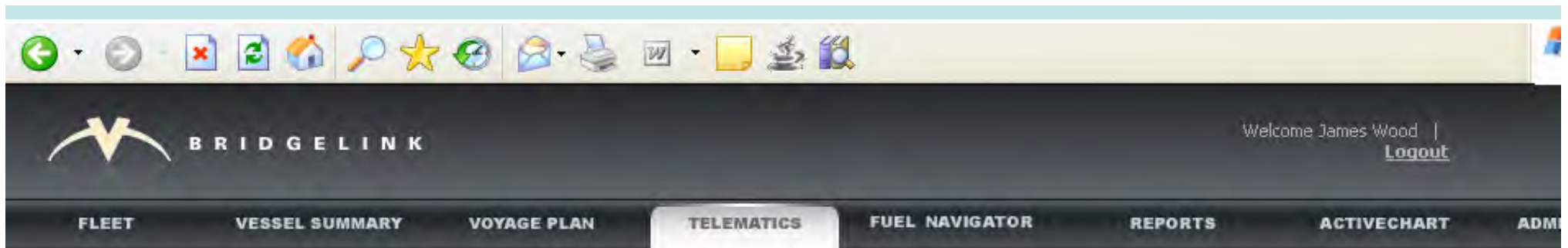
Ship Operations Monitoring



System Diagnostics



BRIDGELINK- Telematics Page

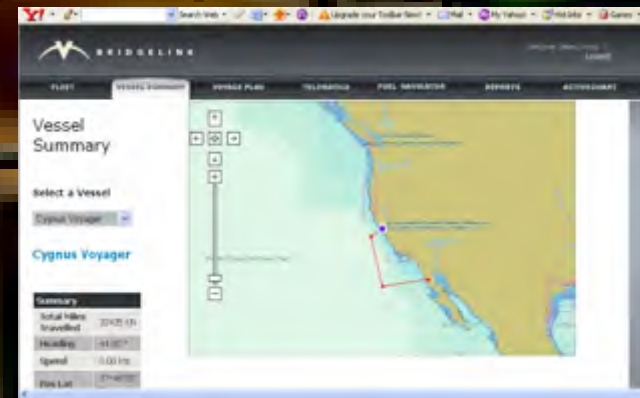


Telematics VDR Playback



Summary

Performance Based Navigation *Asset Management Delivered*



NORTHROP GRUMMAN

