Sperry Marine
Fleet Management Enterprise Solution

Performance Based Navigation (PBN)
Fuel Navigator Module

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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 Trends – Transportation Industry
• Performance Based Navigation – Asset Management Solution Suite
Asset Management & Transportation Industry

Transportation Network

Sea

Air

Land
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 despatching 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

<table>
<thead>
<tr>
<th>Operating item</th>
<th>Expense (K$)</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>$335</td>
<td>44.1%</td>
</tr>
<tr>
<td>Port Charges</td>
<td>$167</td>
<td>22.0%</td>
</tr>
<tr>
<td>Manning</td>
<td>$78</td>
<td>10.3%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$75</td>
<td>9.9%</td>
</tr>
<tr>
<td>Insurance</td>
<td>$68</td>
<td>8.9%</td>
</tr>
<tr>
<td>Inventory</td>
<td>$21</td>
<td>2.8%</td>
</tr>
<tr>
<td>Administration</td>
<td>$15</td>
<td>2.0%</td>
</tr>
<tr>
<td>Satellite Communications</td>
<td>$1</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$760</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Environment and Shipping

- 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

- Weather
- Machinery Automation
- Watch Officer Integration & Decision Making
- ECDIS Safe Navigation

New Methodology

- Weather
- Charts
- Gateway
- Machinery Automation
- Autopilot
- ECDIS w/PBN Solutions

Team

- Shore Office
- Ship Performance Monitoring & Planning
- Watch Officer Decision Making
VisionMaster FT ARPA/Radar

VisionMaster FT Chart Radar

VisionMaster FT ECDIS

VisionMaster FT Integrated Bridge

VisionMaster FT TotalWatch
(Multi-Function Workstation)

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**

- Weather Forecast
- High Resolution Ocean Current
- Optimizatio
- Fuel Navigator
- Algorithm
- Ship Model
- Waypoints
- Speed
- Engine Mode
Performance Based Navigation
Asset Management Solutions

Fuel Navigator
(Route Optimization & Fuel Management)

ActiveChart
(ENC Catalogue & Updates)

Ship Telematics
(Remote Diagnostics, Repair & Upgrades)
Performance Based Navigation (PBN) Architecture

- Satellite Communications
- ECDIS
- Enterprise Gateway
- Planning PC
- Engine Automation System
- BridgeLink Fleet Manager PC
- Weather & Ocean Current Service
- ActiveChart Service
- Ship Telematics Service
- Sperry Marine Office
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

- Economical Fleet Operation
- Ship Performance
- Safe Navigation (ECDIS)
- Route Optimization
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.
Value Proposition – Accurate Ocean Current

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
Fuel Navigator - Ship Configuration

Ship Configuration Control
Fuel Navigator - Original Route
Fuel Navigator - Optimization Settings

Optimization Settings Control
Fuel Navigator – Boundary Drawing

Boundary Control

Boundary Around the Route
Fuel Navigator - Optimized Route
Fuel Navigator – Optimization Wizard w/ Alternative Routes
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 - Pressure 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

VisionMaster FT ECDIS

Enterprise Gateway

Satellite Communications
ActiveChart Application Highlights

- 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

VisionMaster FT Integrated Bridge

SmartCom Router

VDR

VPN or EMAIL via Internet

ISDN via PSTN

Desktop PC
BridgeLink w/ Ship Telematics

Customer Office

Sperry Marine ServiceNet
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

Fleet

Select a Vessel

Cygnus Voyager
BRIDGELINK - 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°46'55" N

Welcome James Wood

Logout
Voyage Plan

Select a Vessel

Cygnus Voyager

Select a Route

San Francisco to Los

Route Summary

<table>
<thead>
<tr>
<th>Route Summary</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Route</td>
<td>San Francisco to Los Angeles</td>
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<tr>
<td>Scheduled ETA</td>
<td>11/17/2007 00:00:00</td>
</tr>
<tr>
<td>Actual ETA</td>
<td>11/17/2007 00:00:00</td>
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<tr>
<td>Route TTG</td>
<td>0:0:0</td>
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<tr>
<td>Route</td>
<td>1006403.00</td>
</tr>
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</table>

Name: San Francisco
Latitude: 37°48'55" N
Longitude: 122°36'47" W
Fuel Saved ($) : 2000
## Fuel Navigator

Select a Vessel

**Cygnus Voyager**

Select a Waypoint

**San Francisco**

<table>
<thead>
<tr>
<th>Route Name</th>
<th>Original Cost</th>
<th>Cost after Optimization</th>
<th>Original Distance</th>
<th>Distance after Optimization</th>
<th>Original Fuel Usage</th>
<th>Fuel Usage after Optimization</th>
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<tbody>
<tr>
<td>San Francisco to Los Angeles</td>
<td>50000</td>
<td>35000</td>
<td>32434</td>
<td>29433</td>
<td>1500</td>
<td>1200</td>
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<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Actual Arrival Time</td>
<td>11/13/2007 12:00:00 AM</td>
</tr>
<tr>
<td>Planned Arrival time</td>
<td>11/13/2007 12:00:00 AM</td>
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<tr>
<td>Average SOG (knots)</td>
<td>24</td>
</tr>
<tr>
<td>Planned SOG (knots)</td>
<td>25</td>
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<tr>
<td>Average STW (knots)</td>
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<tr>
<td>Average Course</td>
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<tr>
<td>Planned nautical miles</td>
<td>33</td>
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<tr>
<td>Actual nautical miles</td>
<td>44</td>
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<tr>
<td>Engines used</td>
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<tr>
<td>Average Propulsion Power</td>
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</table>
BRIDGELINK- Reports Page

Reports
Select a Vessel

Cygnus Voyager

Fuel Usage Optimization Report

Cygnus Voyager

Graphical Reports
- Cost Analysis Report
- Fuel Usage Analysis Report
- Waypoint Analysis Report
- Route Cost Division 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 (%)

Fleet Overview
A high level view of fleet fuel economy and activity data.

Cumulative Savings Comparison By Vessel (%)

Fleet Tabular Report

<table>
<thead>
<tr>
<th>Ship</th>
<th>Original Distance (NM)</th>
<th>Optimized Distance (NM)</th>
<th>Actual Distance (NM)</th>
<th>Original Consumption (MT)</th>
<th>Optimized Consumption (MT)</th>
<th>Actual Consumption (MT)</th>
<th>Original Fuel Savings ($)</th>
<th>Optimized Fuel Savings ($)</th>
<th>Actual Fuel Savings ($)</th>
<th>Optimized Fuel Savings (%)</th>
<th>Original Cost ($)</th>
<th>Optimized Cost ($)</th>
<th>Actual Cost ($)</th>
<th>Utilization Factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neptune</td>
<td>12,422.99</td>
<td>12,422.99</td>
<td>12,425.14</td>
<td>4,672.50</td>
<td>4,451.02</td>
<td>4,463.66</td>
<td>$60,739.39</td>
<td>$68,067.06</td>
<td>2.56%</td>
<td>2.98%</td>
<td>$232,531.30</td>
<td>$226,306.70</td>
<td>$221,967.09</td>
<td>112.06%</td>
</tr>
<tr>
<td>Nautilus</td>
<td>2,506.00</td>
<td>2,506.00</td>
<td>2,486.94</td>
<td>963.03</td>
<td>909.30</td>
<td>904.98</td>
<td>$26,866.16</td>
<td>$29,026.92</td>
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<td>6.03%</td>
<td>$49,966.56</td>
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</tr>
<tr>
<td>Nautilus</td>
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<td>23,199.15</td>
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<td>9,555.12</td>
<td>933.54</td>
<td>936.74</td>
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<td>6.47%</td>
<td>$464,133.00</td>
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<tr>
<td>Asia</td>
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<td>2,609.95</td>
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<td>6.61%</td>
<td>$168,273.40</td>
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<tr>
<td>Pacific</td>
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<td>15,472.83</td>
<td>15,439.58</td>
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<td>$1,458,530.00</td>
<td>$1,349,521.00</td>
<td>$1,324,950.50</td>
<td>100.16%</td>
</tr>
</tbody>
</table>
BRIDGELINK- ActiveChart Page

ActiveChart

Welcome James Wood | Logout
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