

Fuel Accountability
& Management System

FUSIONTM

“Giving You The Power to
Optimize Fuel Efficiency”



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FTI document number - SL-68219 Rev. C



Introduction

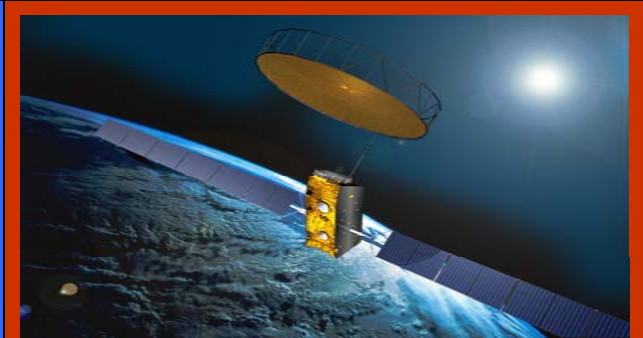
SL-68219 Rev. C



The **Fusion™** on-board system enables the crew to see in real-time the fuel consumption and engine efficiency.... so they can optimize fuel usage; the data is continuously recorded so that...

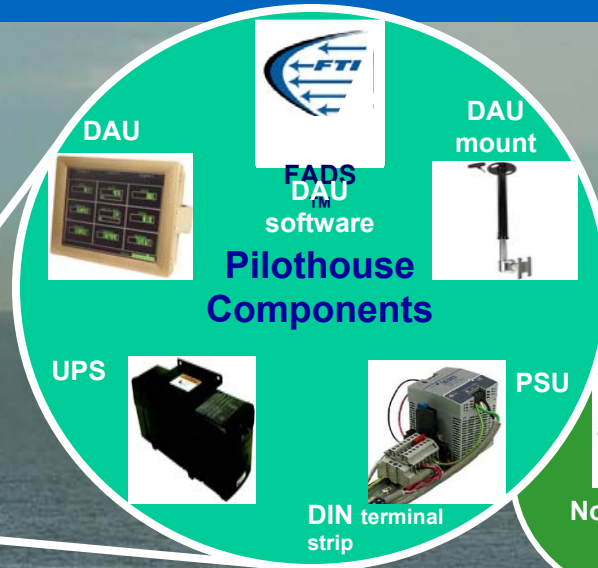


...once back in port the **Fusion™ Fleet Manager** utility can be used to analyze where every drop of fuel is being used across the entire fleet; summary data can also be sent via email...



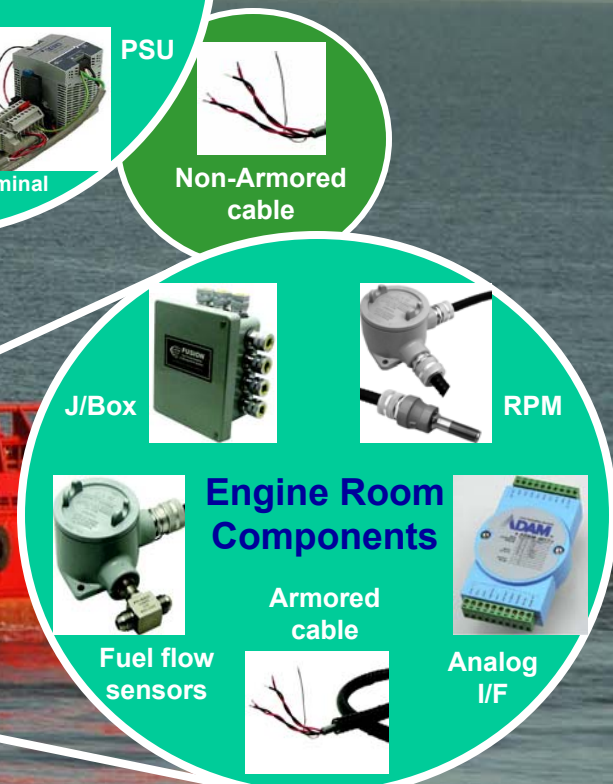
... the **Fusion™ Event Manager** can transmit a summary of the data while the vessel is at sea from anywhere in the world, by connecting via satellite (or GPRS network for harbor boats)

On-board components



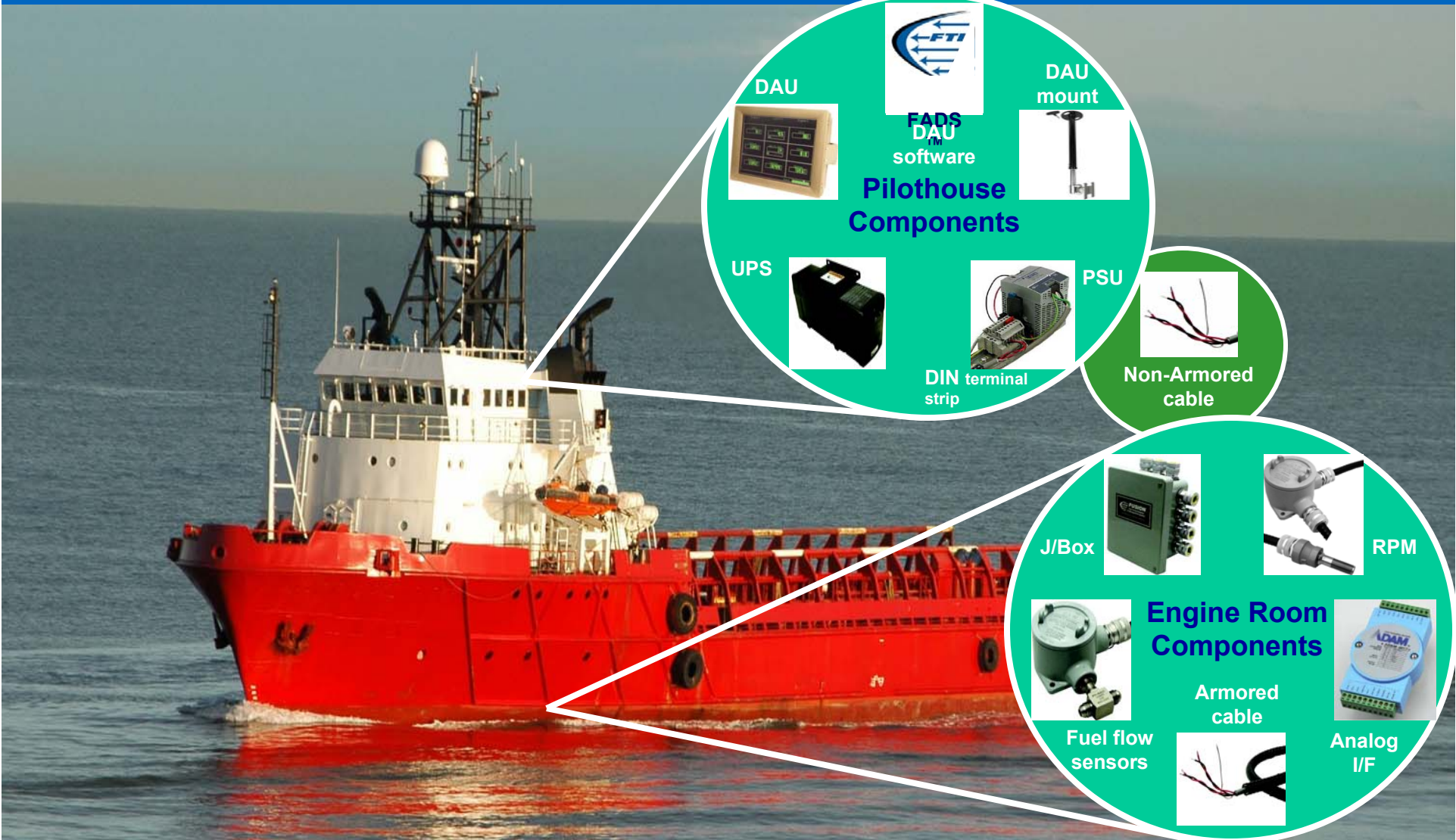
Pilothouse Components

- DAU (Data Acquisition Unit)
- FADS DDU software (FTI logo)
- DAU mount
- UPS (Uninterruptible Power Supply)
- DIN terminal strip
- PSU (Power Supply Unit)



Engine Room Components

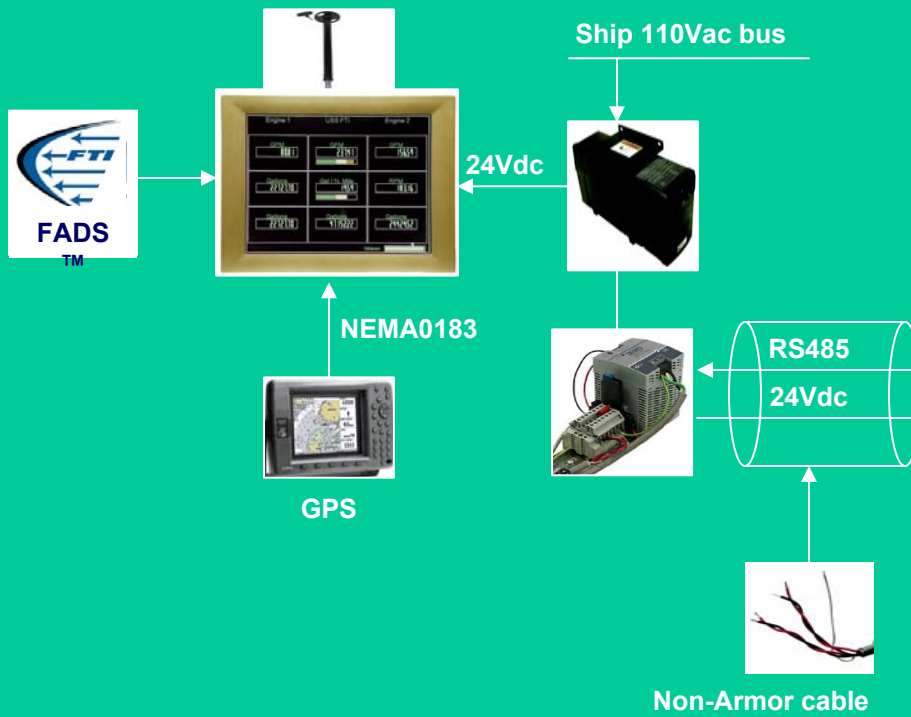
- J/Box
- RPM (Revolutions Per Minute sensor)
- Fuel flow sensors
- Armored cable
- Analog I/F (Interchangeable Face)



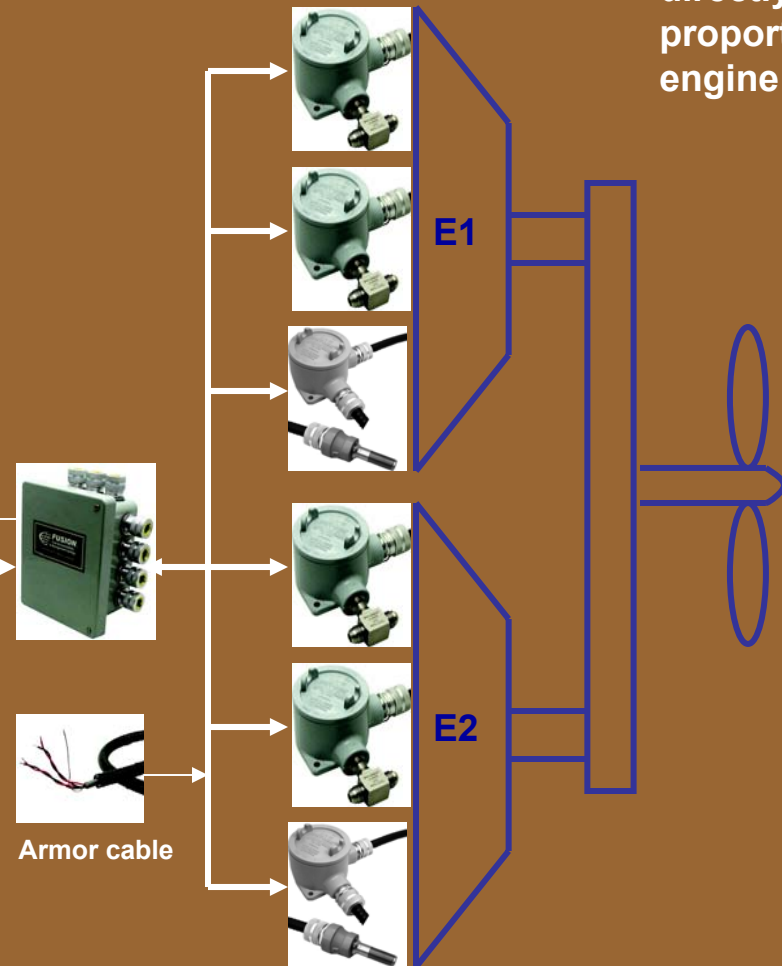
System Components

US twin engine mechanical propulsion – Fixed Pitch Propeller

PILOTHOUSE



ENGINE ROOM



Vessel power is directly proportional to engine RPM

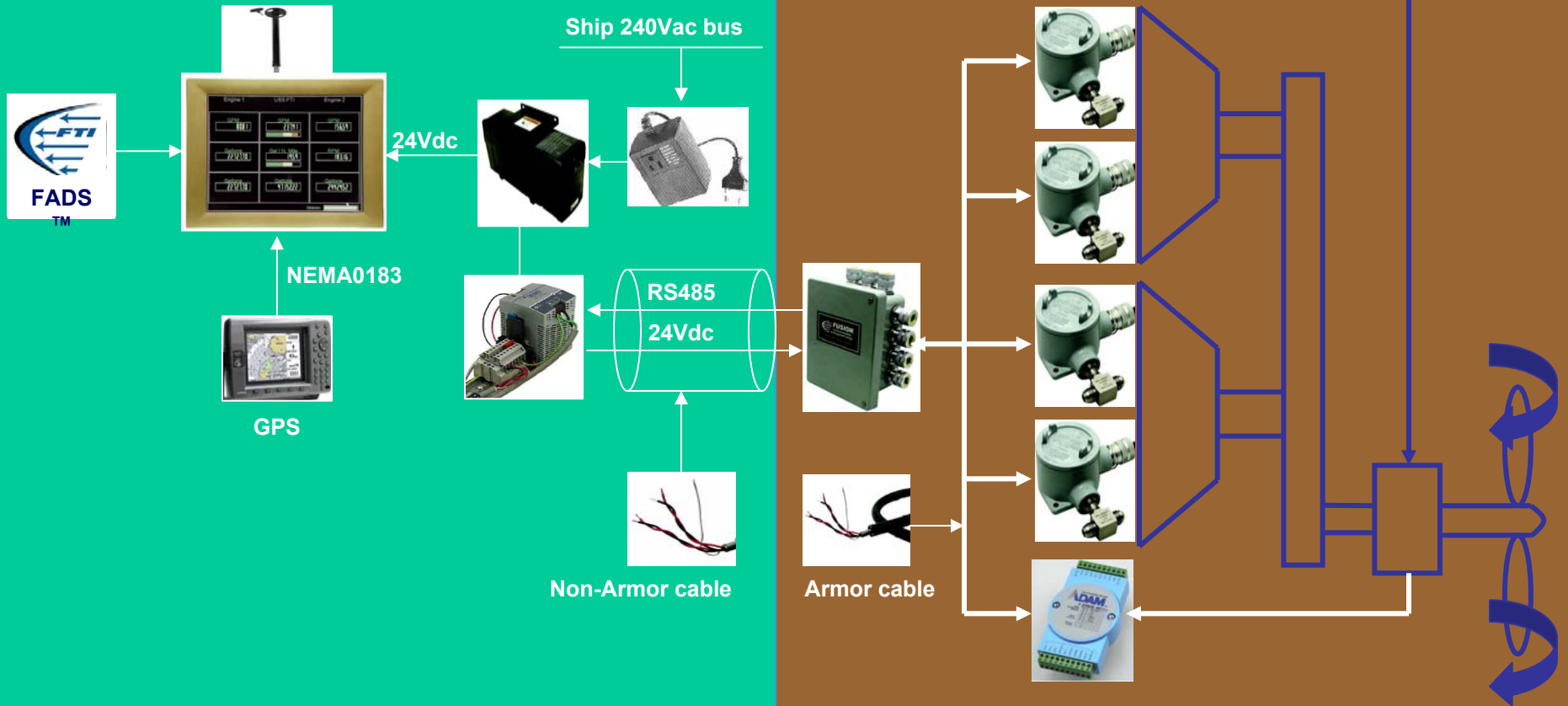
System Components

UK mechanical propulsion – Controllable Pitch Propeller (CPP)

PILOTHOUSE

ENGINE ROOM

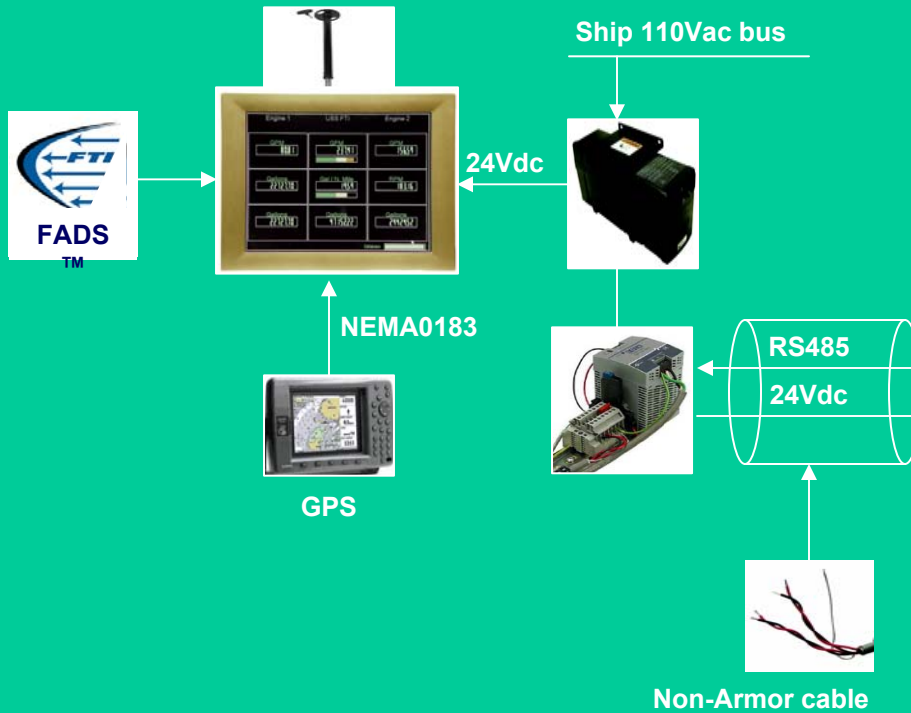
Vessel power is proportional to CPP°



System Components

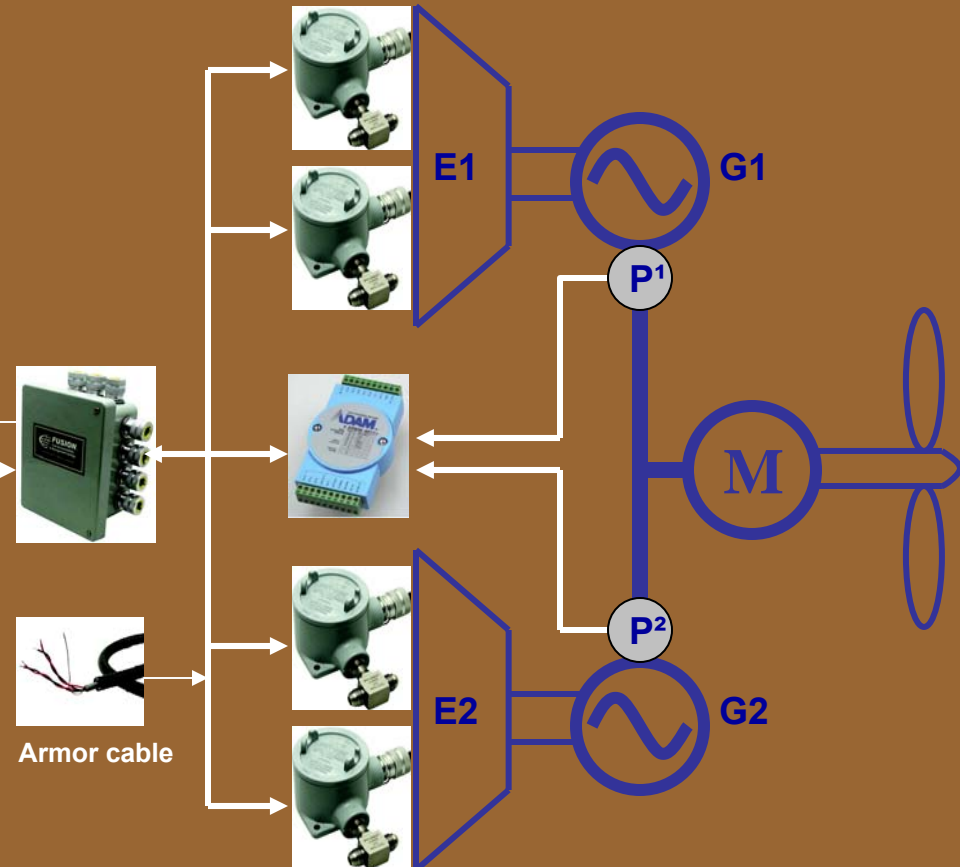
US Electrical propulsion (and vessel generators)

PILOTHOUSE



ENGINE ROOM

Vessel power is proportional to $G1 + G2$ power



Pilothouse DAU/Display



- **Fusion™** utilizes a sun-light readable, night-time dimmable, 12" color LCD touch screen Data Acquisition Unit (DAU)
- The data is continuously recorded for later transfer to the **Fleet Manager** data analysis utility, or as a summary data email via the **Event Manager** utility
- Real-time fuel data is clearly presented to the crew using digital and 'at-a-glance' analog displays
- The DAU is fitted with an integral NMEA0183 GPS interface for collection of vessel speed and position data

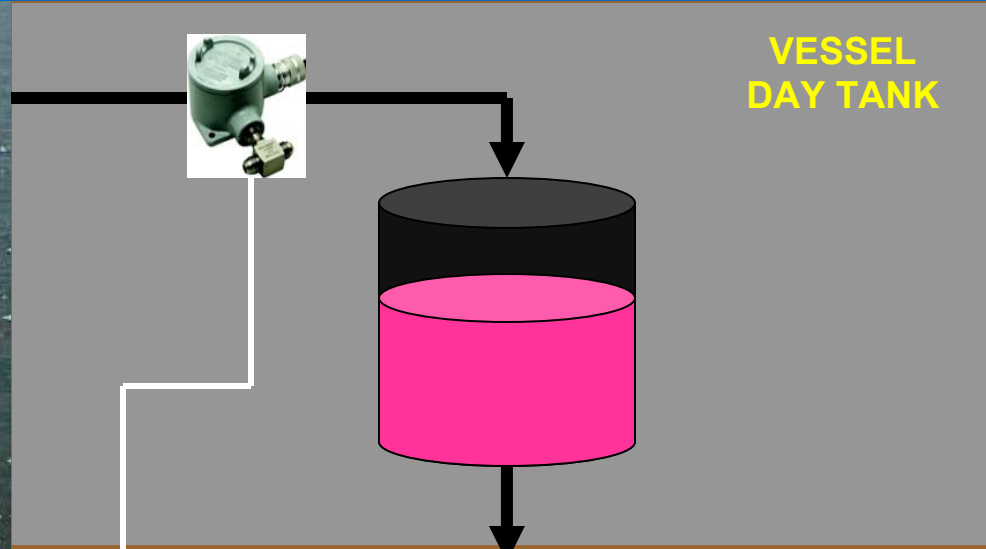
Sensors



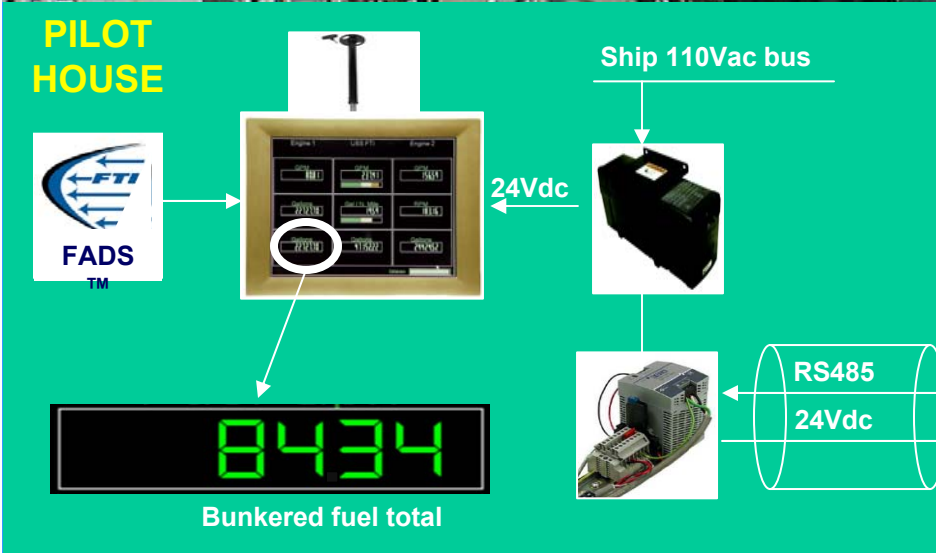
- **Fusion™** special purpose marine fuel flow meters use 'fail-open' geometry for uncompromised vessel safety
- Tolerant to the flow pulsations created by reciprocating engines
- Temperature compensation for precise accuracy
- Designed and tested for the harsh environment of a vessel engine room
- RS-485 output via water proof cable gland using armored cable
- Range of sizes to fit any marine diesel engine, with larger sensors to measure bunkered fuel also available
- Analog to RS485 converter to connect other vessel signals; eg:- CPP, gen power

Bunker fuel measurement

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VESSEL
DAY TANK



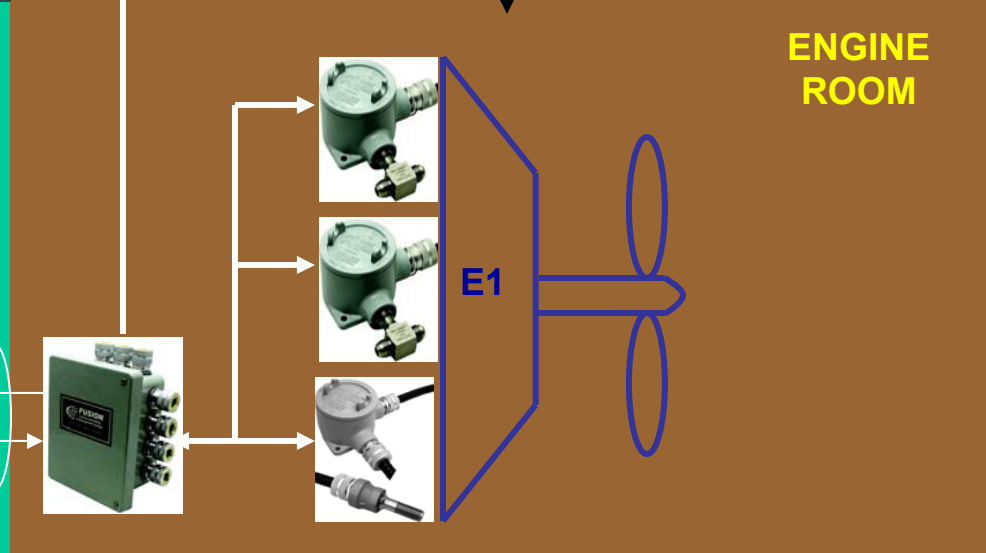
PILOT
HOUSE

Ship 110Vac bus

24Vdc

RS485
24Vdc

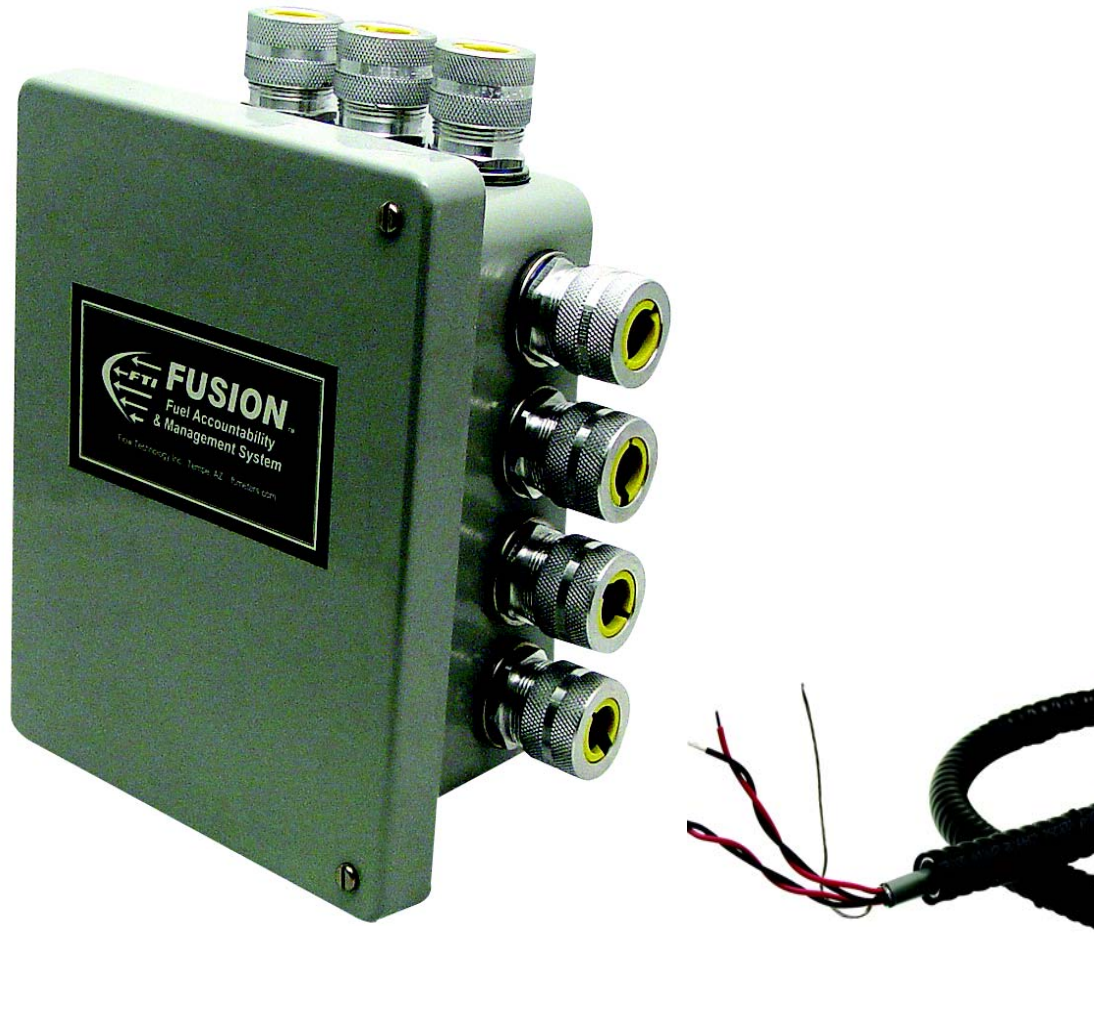
Bunkered fuel total



ENGINE
ROOM

E1

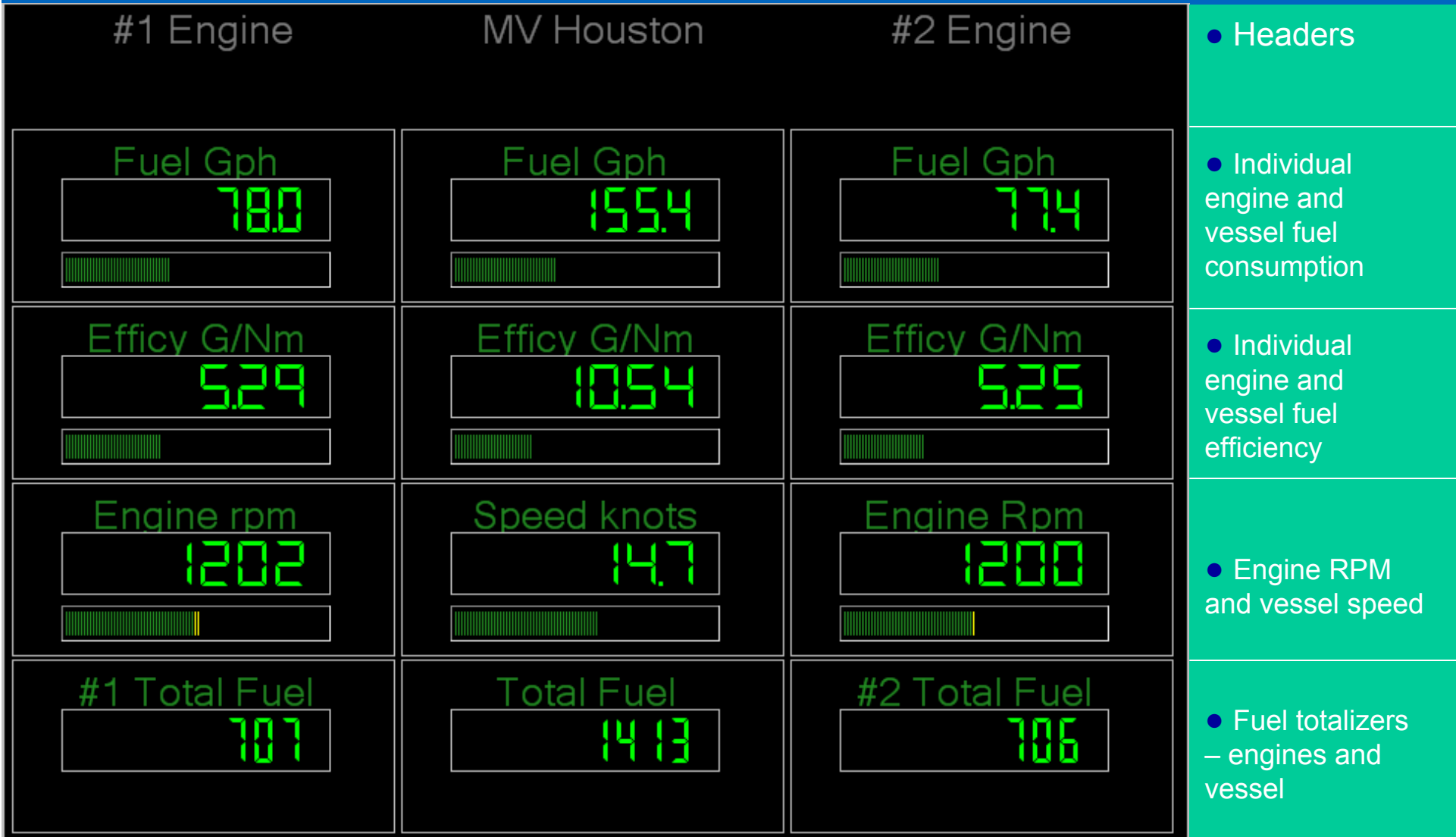
Junction Box



- **Fusion™** utilizes a NEMA 4X junction box to connect individual sensor signals to a single RS 485 bus, that is then sent to the pilothouse DAU, keeping the cabling between engine room and pilothouse to the minimum
- Junction boxes can be 'daisy chained' together depending on the number of engines and their location on the vessel
- Armored cable is used throughout the engine room to provide an extremely robust and reliable installation

DAU main screen

fully configurable but here is a typical twin engine example



DAU 'analog' gauges

Fuel Gph

04.34



Efficy G/Nm

5.67



- **Fusion™** 'at-a-glance' configurable color coded analog gauges are used to allow busy crew members to see simply and quickly the real-time status of any parameter
- In this example the fuel consumption rate (Fuel Gph) has a 'cautionary' value so the gauge shows yellow
- The engine efficiency level (Efficy G/Nm) has reached a 'warning' value so the gauge shows red
- Gauge settings can be determined by **Fusion™ Fleet Manager** data analysis

Fleet Manager

- When back in port the fuel data can be transferred using a USB memory stick to the Operator's centralized computer system...
- Where **Fusion™ Fleet Manager** utility can be used to convert the data to Microsoft® Excel® tables and graphs



Report Generation

Set Report Parameters

Fusion Fleet Manager™ - Prepare Reports

- FTI Operations
 - Atlantic Fleet
 - Defiant
 - Voyager
 - Pacific Fleet
- No 2 Operator

Chart data for:	Starting Date/Time:	Ending Date/Time:	Color:
Total: Defiant	2007- Jun -01 00:00:00	2007- Jul -31 23:59:59	Blue
Total: Voyager	2007- Jun -01 00:00:00	2007- Jul -31 23:59:59	Red

- In this case just 2 vessels are being reviewed for the months of June and July 2007, with an averaging data period of 1 day....

<input type="radio"/> Points	62
<input checked="" type="radio"/> Interval	1 Day

Extract and Chart Data

Exit Prepare Reports



- Reports are prepared on a hierarchical basis

- Up to 8 vessels, or engines, can be analyzed or compared against each other

- The data interval period can be anything from a few seconds up to years, Fleet Manager automatically takes care of all the data compression and averaging



Tabular Report

Microsoft Excel - Fusion Fleet Manager1

File Edit View Insert Format Tools Data FlashPaper Window Contribute Help Adobe PDF

Type a question for help

Open In Contribute Publish To Website Post To Blog

L19

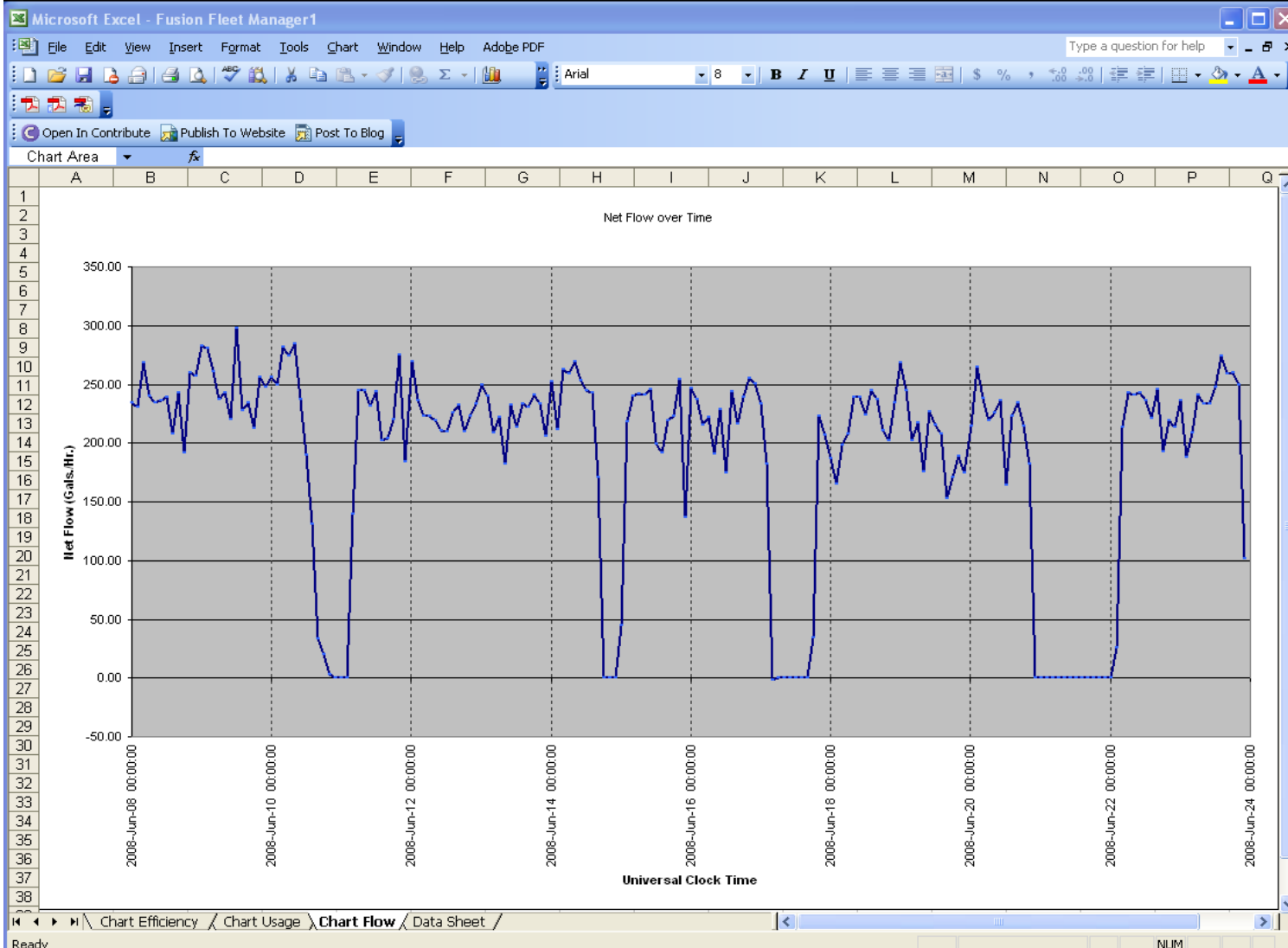
	A	B	C	D	E	F	G	H	I	J	K
1		Total: Taimania									
2		2008-Jun-08 00:00:00								VE000000DE000010	VE000000DE000010
3		2008-Jun-23 23:59:59						VE000000	VE000000	10	10
4	Delta Time	UTC	Net Flow	Fuel Used	Efficiency		UTC Time	Vessel Speed	Average Flow	Average RPM	
5	0:00:00:00	2008-Jun-08 00:00:00				0	2008-Jun-08 02:00:00	20.50496519	234.6955861	972.0920969	
6	0:02:00:00	2008-Jun-08 02:00:00	234.70	469.39	11.45	2	2008-Jun-08 04:00:00	23.31516872	230.8020458	970.6947492	
7	0:04:00:00	2008-Jun-08 04:00:00	230.80	461.60	9.90	3	2008-Jun-08 06:00:00	24.16224251	268.0524056	970.0195348	
8	0:06:00:00	2008-Jun-08 06:00:00	268.05	536.10	11.09	4	2008-Jun-08 08:00:00	15.20067303	239.6673301	969.538848	
9	0:08:00:00	2008-Jun-08 08:00:00	239.67	479.33	15.77	5	2008-Jun-08 10:00:00	8.716071102	234.3008868	969.7676682	
10	0:10:00:00	2008-Jun-08 10:00:00	234.30	468.60	26.88	6	2008-Jun-08 12:00:00	8.816297029	236.2592648	969.9897144	
11	0:12:00:00	2008-Jun-08 12:00:00	236.26	472.52	26.80	7	2008-Jun-08 14:00:00	6.726814212	239.3813205	969.5092954	
12	0:14:00:00	2008-Jun-08 14:00:00	239.38	478.76	35.59	8	2008-Jun-08 16:00:00	8.188856709	208.1609869	969.1682253	
13	0:16:00:00	2008-Jun-08 16:00:00	208.16	416.32	25.42	9	2008-Jun-08 18:00:00	12.55121259	243.3560992	969.0138482	
14	0:18:00:00	2008-Jun-08 18:00:00	243.36	486.71	19.39	10	2008-Jun-08 20:00:00	9.701218661	191.2609106	968.9055448	
15	0:20:00:00	2008-Jun-08 20:00:00	191.26	382.52	19.72	11	2008-Jun-08 22:00:00	7.684697155	260.385273	968.629284	
16	0:22:00:00	2008-Jun-08 22:00:00	260.39	520.77	33.88	12	2008-Jun-09 00:00:00	7.350417545	257.3416155	968.6598281	
17	1:00:00:00	2008-Jun-09 00:00:00	257.34	514.68	35.01	13	2008-Jun-09 02:00:00	18.26286934	282.6674747	968.8571602	
18	1:02:00:00	2008-Jun-09 02:00:00	282.67	565.33	15.48	14	2008-Jun-09 04:00:00	14.65363103	280.9741964	968.636644	
19	1:04:00:00	2008-Jun-09 04:00:00	280.97	561.95	19.17	15	2008-Jun-09 06:00:00	6.974787113	261.1903665	968.2360025	
20	1:06:00:00	2008-Jun-09 06:00:00	261.19	522.38	37.45	16	2008-Jun-09 08:00:00	11.11451853	237.5557516	968.172674	
21	1:08:00:00	2008-Jun-09 08:00:00	237.56	475.11	21.37	17	2008-Jun-09 10:00:00	8.039050084	243.2587814	969.7532814	
22	1:10:00:00	2008-Jun-09 10:00:00	243.26	486.52	30.26	18	2008-Jun-09 12:00:00	6.747613835	220.4215715	969.8401667	
23	1:12:00:00	2008-Jun-09 12:00:00	220.42	440.84	32.67	19	2008-Jun-09 14:00:00	5.12523735	298.2304262	969.8642068	
24	1:14:00:00	2008-Jun-09 14:00:00	298.23	596.46	58.19	20	2008-Jun-09 16:00:00	6.446064282	228.1141717	969.9659493	
25	1:16:00:00	2008-Jun-09 16:00:00	228.11	456.23	35.39	21	2008-Jun-09 18:00:00	5.90185431	234.2351327	969.717076	
26	1:18:00:00	2008-Jun-09 18:00:00	234.24	468.47	39.69	22	2008-Jun-09 20:00:00	6.691064142	212.3336373	969.6625922	
27	1:20:00:00	2008-Jun-09 20:00:00	212.33	424.67	32.22	23	2008-Jun-09 22:00:00	7.291324156	255.9661001	969.7202297	
28	1:22:00:00	2008-Jun-09 22:00:00	255.99	511.97	35.11	24	2008-Jun-10 00:00:00	5.008679888	247.2574226	969.5603677	
29	2:00:00:00	2008-Jun-10 00:00:00	247.26	494.51	49.37	25	2008-Jun-10 02:00:00	11.1798381	256.5663085	969.6477678	
30	2:02:00:00	2008-Jun-10 02:00:00	256.57	513.13	22.95	26	2008-Jun-10 04:00:00	9.681518856	249.2976356	969.6982951	
31	2:04:00:00	2008-Jun-10 04:00:00	249.30	498.60	25.75	27	2008-Jun-10 06:00:00	18.05655505	282.142768	969.5601089	
32	2:06:00:00	2008-Jun-10 06:00:00	282.14	564.29	15.63	28	2008-Jun-10 08:00:00	17.32742315	273.9681526	969.4386284	
33	2:08:00:00	2008-Jun-10 08:00:00	273.97	547.94	15.81	29	2008-Jun-10 10:00:00	20.10338982	284.2297358	969.3383471	
34	2:10:00:00	2008-Jun-10 10:00:00	284.23	568.46	14.14	30	2008-Jun-10 12:00:00	18.63027827	237.5223267	969.1345648	
35	2:12:00:00	2008-Jun-10 12:00:00	237.52	475.04	12.75	31	2008-Jun-10 14:00:00	16.7836842	189.49688	968.7988362	
36	2:14:00:00	2008-Jun-10 14:00:00	189.49	378.99	11.29	32	2008-Jun-10 16:00:00	7.793839637	130.8077186	969.2139926	

Ready NUM

- Fleet Manager creates an Excel® spreadsheet tabular report of the engine and vessel data

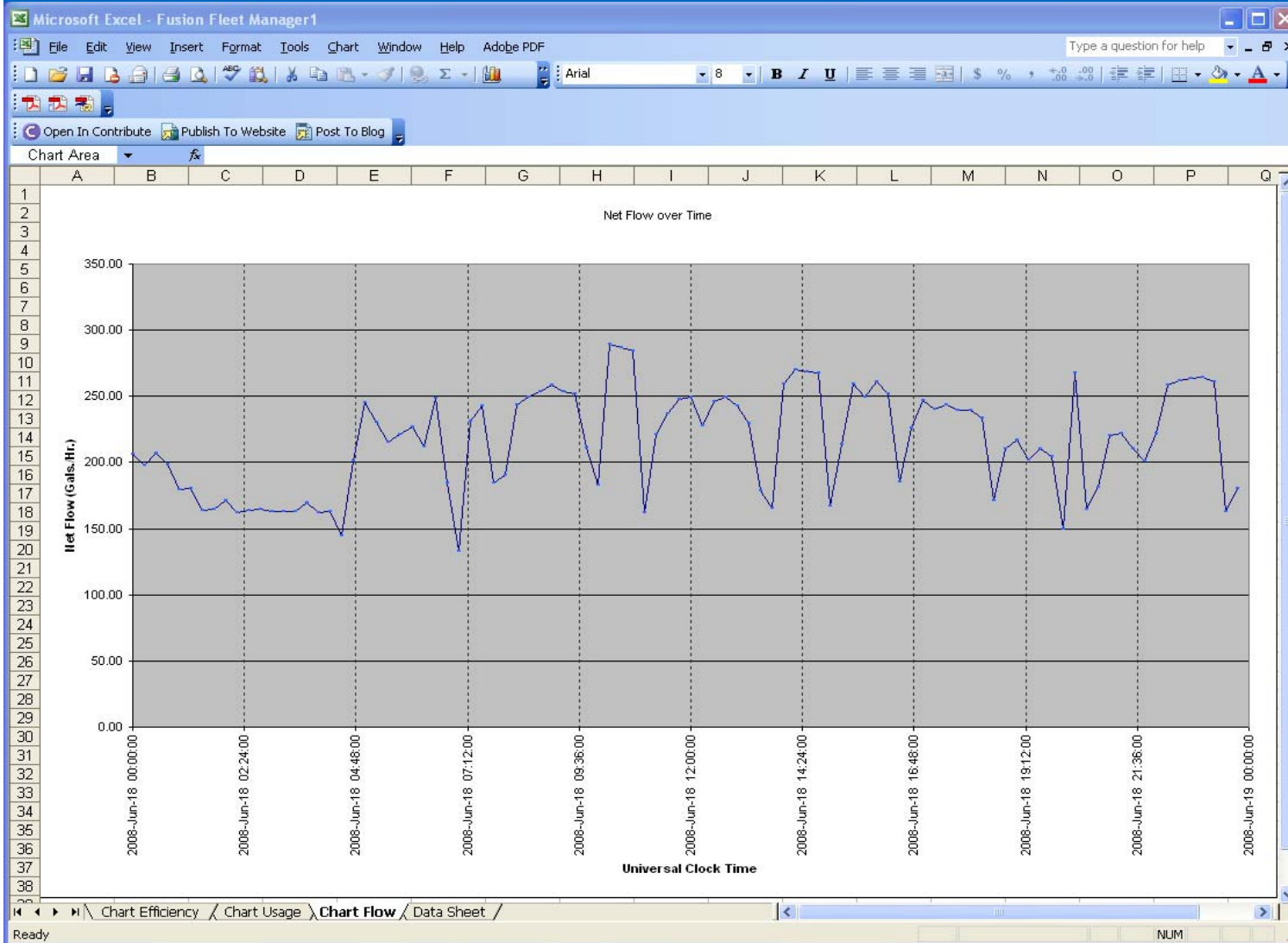
- In this example the average hourly fuel consumption of a single engine fishing boat “Taimania” is tabulated every 2.00 hours beginning at 00:00:00 on 8th June 2008; the table carries on to 23rd June 2008.

Tabular Report



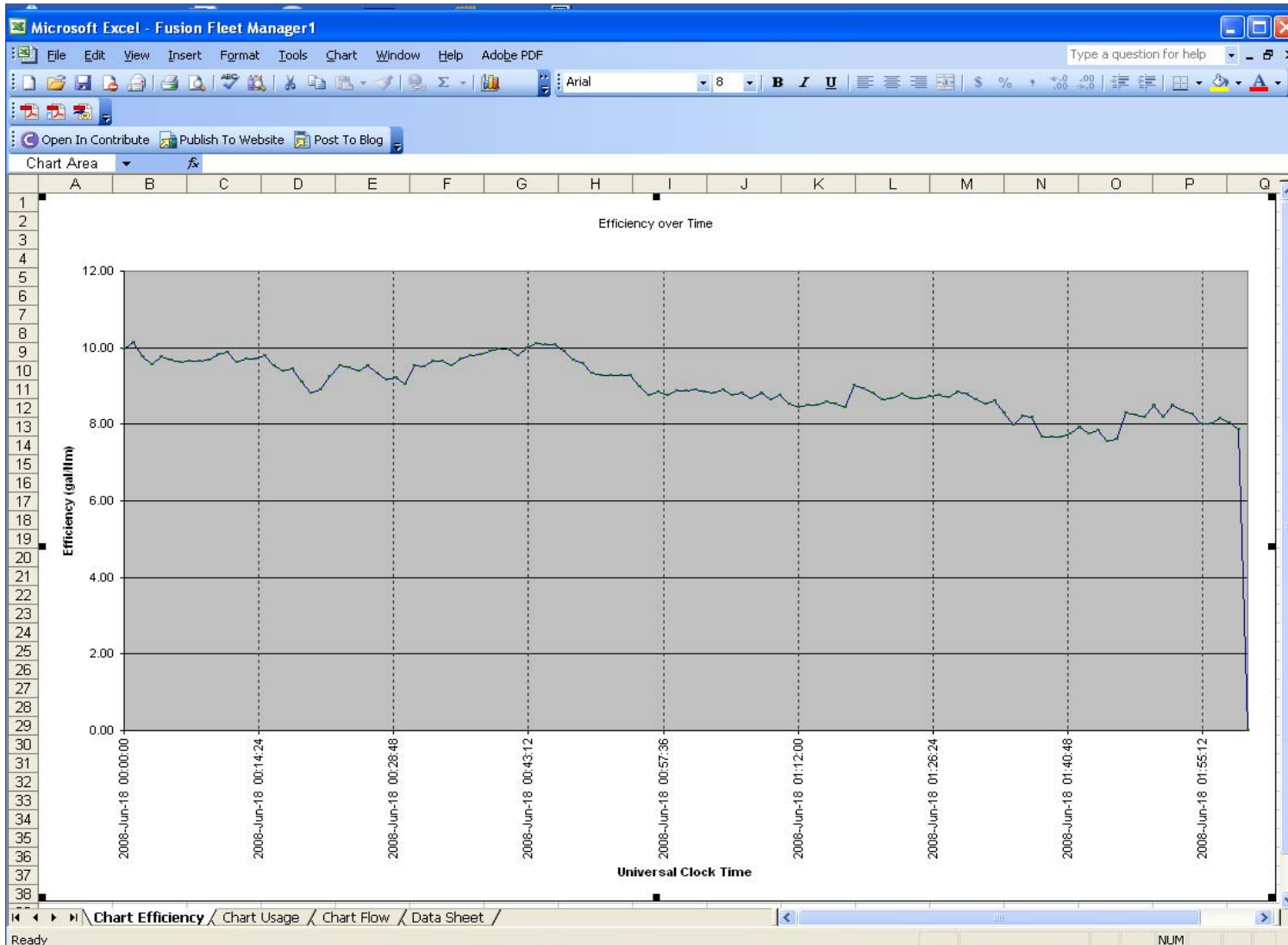
- **Fleet Manager** also creates graphical reports of the data
- Here we see the graphical version of the previous table showing the fuel consumption of “Taimania” from 8th June through 23rd June 2008.
- The 4 periods of zero consumption occur when the vessel returns from fishing in the Cook Straits

Tabular Report



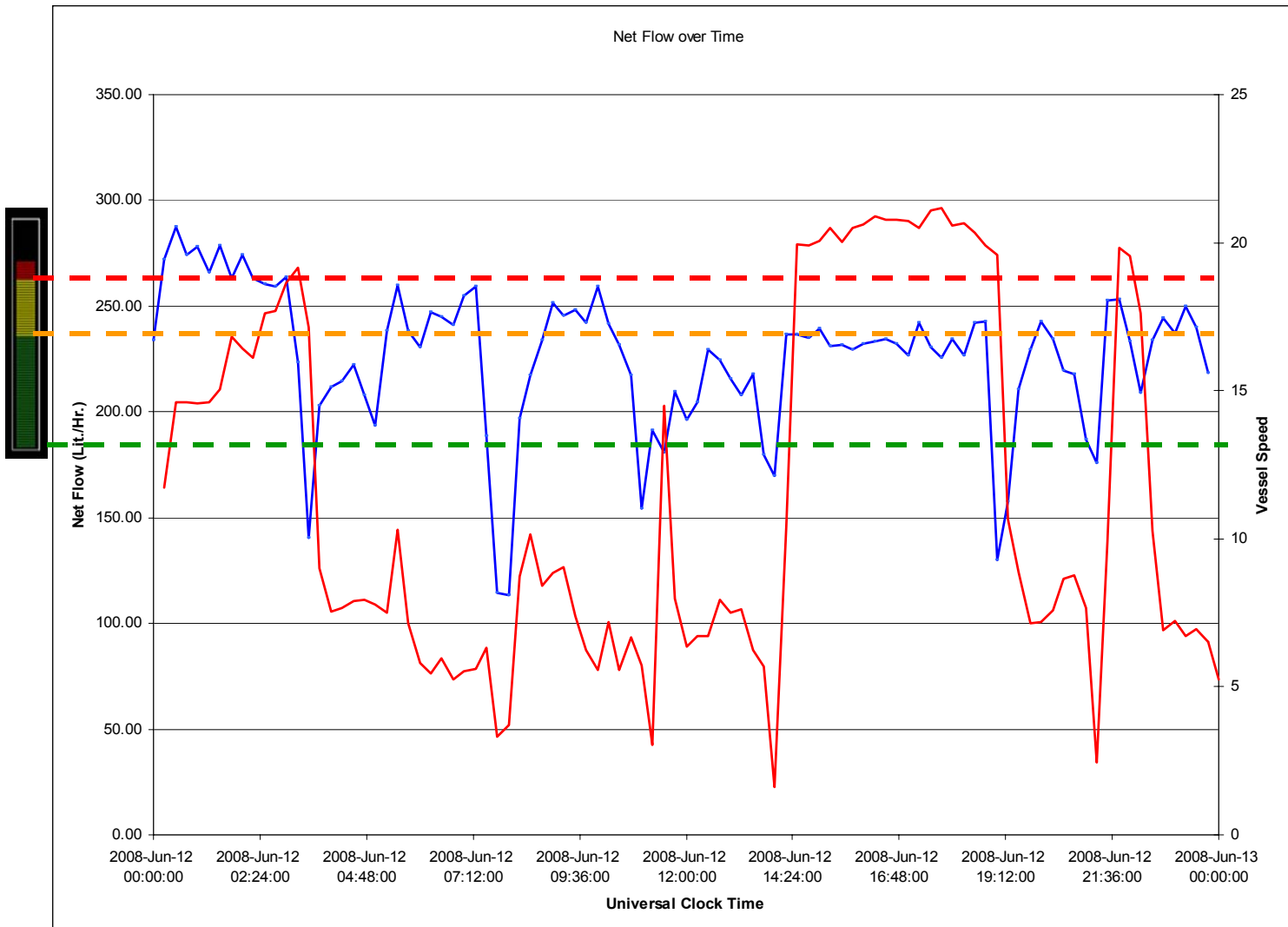
- If the Operator wants to analyze the data over a shorter time period he can reset the time base and the **Fleet Manager** will create new Excel® tables and graphs
- Here we see the fuel consumption data for just one 24 hour period (18th June). In this case the averaging is done every 15 minutes.

Tabular Report



- ...and now every 1 minute for a 2 hour period

Graphical Report



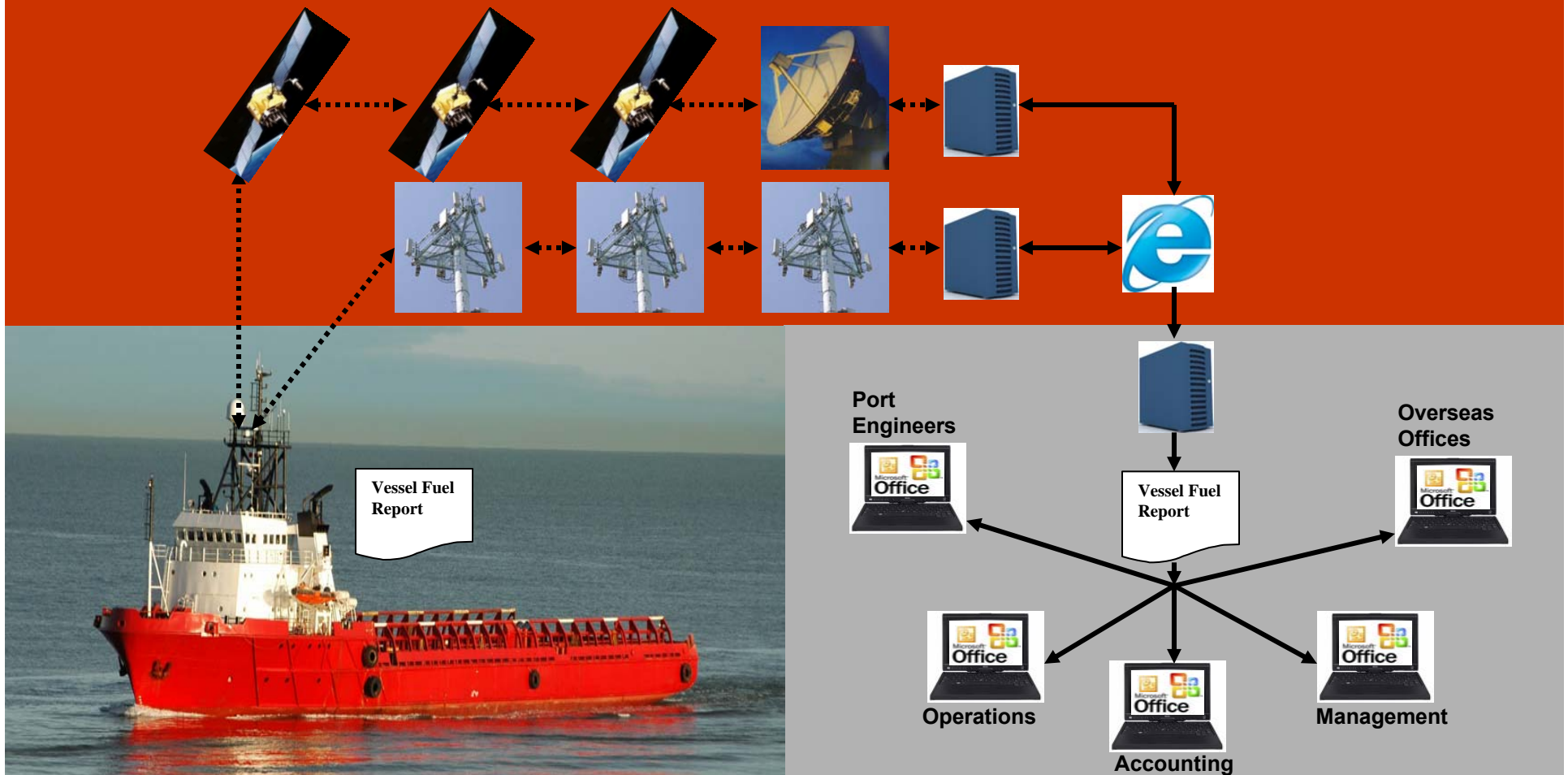
- The Operator can manipulate the data using Excel® to create other customized data and graphical reports as needed

- In this example the vessel fuel consumption (blue line) is plotted along with the vessel speed

- This data can be used to select the color transitions of the analog gauges

Event Manager option


- The **Fusion™ Event Manager** is an optional addition which allows summary data reports to be emailed from the vessels either by satellite or GPRS network to the Operator's offices and ports




On-board components




Satellite Antenna




FEMS Software




Sat modem




GPRS cell



DAU




FAD S DAU software




DAU mount


Pilothouse Components




UPS



PSU




J/Box




RPM


Engine Room Components



Fuel flow sensors



cable

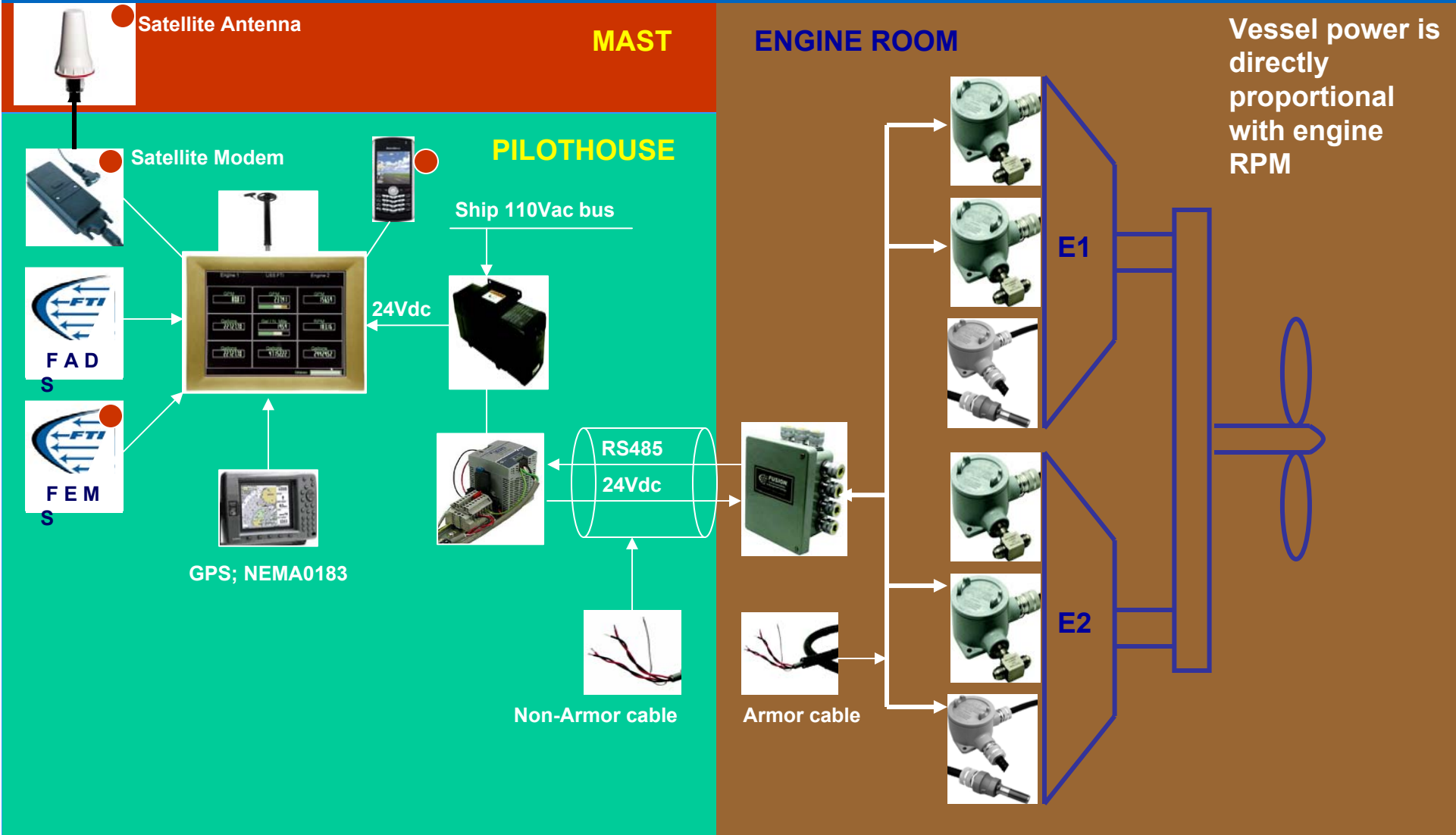


Analog I/F



System Components

Event Manager components added



Email reports

Fusion™ DAU data from MV Arizona

To... John.Doe@Operator1.com

To... James.Smith@Operator2.com

Attachments:  MV Arizona-01/02/2008.CSV

Vessel name: MV Arizona

Report Date: 01/02/2008

CSV File: MV Arizona;01/02/2008

This data report was provided by the Flow Technology Fusion™ Fuel Accountability and Management System. Do not reply to this message, please contact the Application Administrator for questions regarding this message.

Whoever is listed as an email recipient will receive an email from the vessel similar to this with a .CSV attachment....

Vessel name: MV Arizona

Report Date: 01/02/2008 00:00:00

Date/Time,Vessel:Fuel,Engine1:Fuel,Engine2:Fuel,Latitude,Longitude,System health

01/01/2008 00:00:00,212,105,107,37°25'82"N,122°05'36"W,Y

01/01/2008 04:00:00,245,121,124,38°00'23"N,122°45'12"W,Y

01/01/2008 08:00:00,235,117,118,38°30'08"N,122°59'49"W,Y

01/01/2008 12:00:00,222,110,112,39°34'12"N,123°24'00"W,Y

01/01/2008 16:00:00,250,121,129,40°00'45"N,123°58'32"W,Y

01/01/2008 20:00:00,232,115,117,40°32'04"N,124°10'22"W,Y

01/02/2009 00:00:00,245,121,124,40°49'58"N,124°56'43"W,Y

End

Which will show the summary data as a Comma Separated Value text file, which can then be reviewed, stored, printed, etc....

Return on Investment

- *“If you don’t measure it you can’t control it....”*
- **Fusion™** allows the management team of a marine vessel operator to quantitatively measure the effectiveness of fuel saving strategies and new equipment by providing accurate and reliable fuel consumption data
- **Fusion™** allows the crew to optimize fuel use by providing an instantaneous display of fuel consumption during all phases of vessel operation
- Even if this only results in a 2% improvement in fuel efficiency with the high price of fuel the financial savings can be considerable.....



* Based on \$ 1,040 / T for MDO – Houston 18th August 2008

Real world example

During the sea trials, the Caterpillar dealer installed their test flow meters in series with our system. We found this new technology to be so accurate, in the end, we used it to determine the horsepower and efficiency ratings of the engines instead of using the system supplied by Caterpillar. We were also pleased that there was support in North America for this technology.

On the first trips of the Felix-Antoine Savard, we started to use the system to determine the best load for fuel efficiency. We conducted comparisons between running the engines at 85% MCR and 95% MCR. At 85% MCR our speed through the water was 15.5 kts. At 95% MCR, the speed through the water was 16.5 kts. The difference in fuel consumption however was dramatic. The 10% difference resulted in approximately 100 litres per hour per engine. **In other words, one knot difference cost us 200 litres per hour!** Without this technology, we would have no way of knowing this.

Based on our initial success with the Felix-Antoine Savard, we purchased systems for four more vessels. These vessels run all year round. Two are based in Quebec City crossing between the city and Levis while the other two are based in Tadoussac on the north shore of Eastern Quebec. They cross the Saguenay River.

Marine Fuel Consumption System

On the average, our vessels are in service 5000 hours per year. Based on our graph the average price per litre during our study period was \$.215. Basing a conservative reduction in consumption of 45 litres per hour, we have saved 225,000 litres per vessel which translates into \$48,375.00 per year. When one looks at a fleet of vessels, the savings quickly multiply.



- Quebec Ferries achieved significantly more than 2% savings....

*Extracts from Maritech Conference,
Ontario, Canada by Pierre-Paul Desgagnés,
Director of Maritime Services, Quebec
Ferries*

FUSION™

SL-68219 Rev. C

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