NOAA Scientific Computer System (SCS version 4.0)

INMARTECH 2006
SCS Presentation
October 17, 2006

NOAA Scientific Computer System

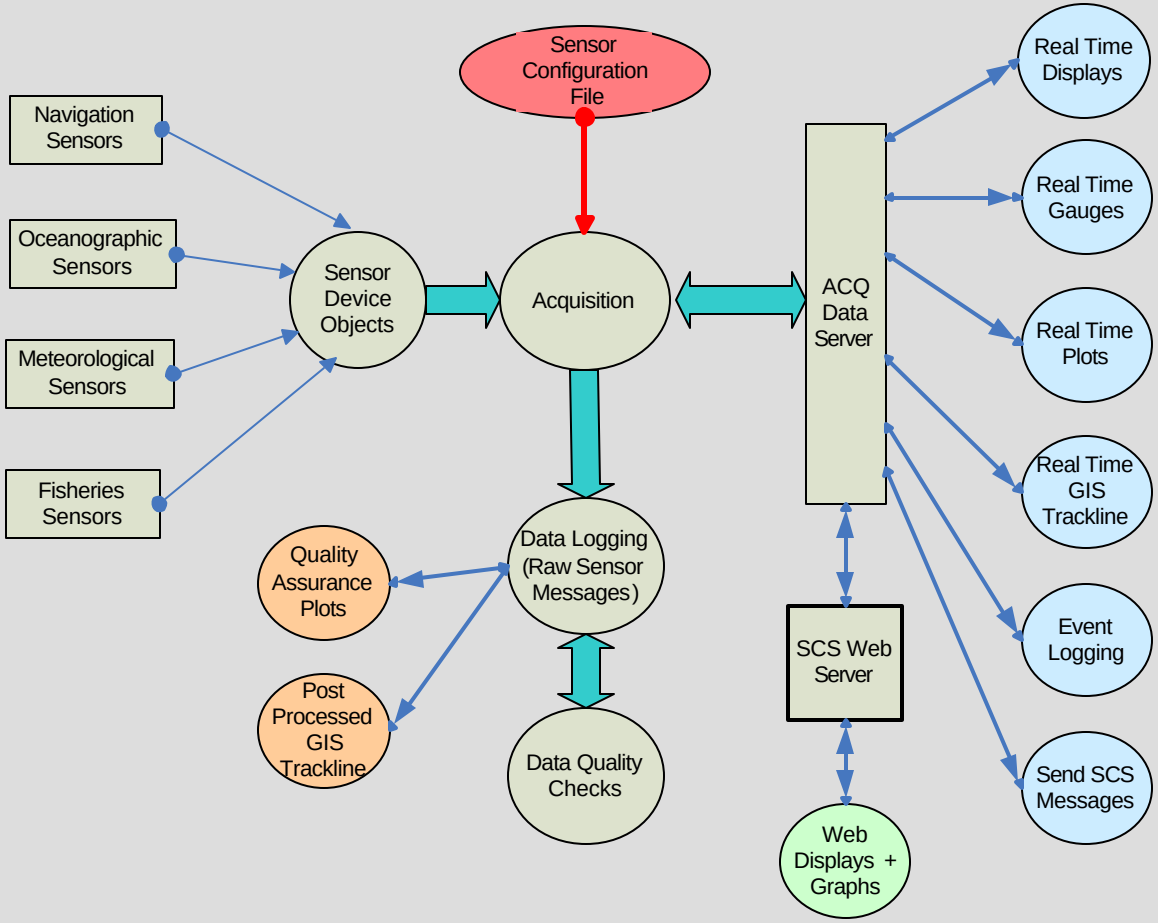
SCS Definition:

A shipboard data acquisition system used to collect environmental, oceanographic and fisheries sensor data in real time.

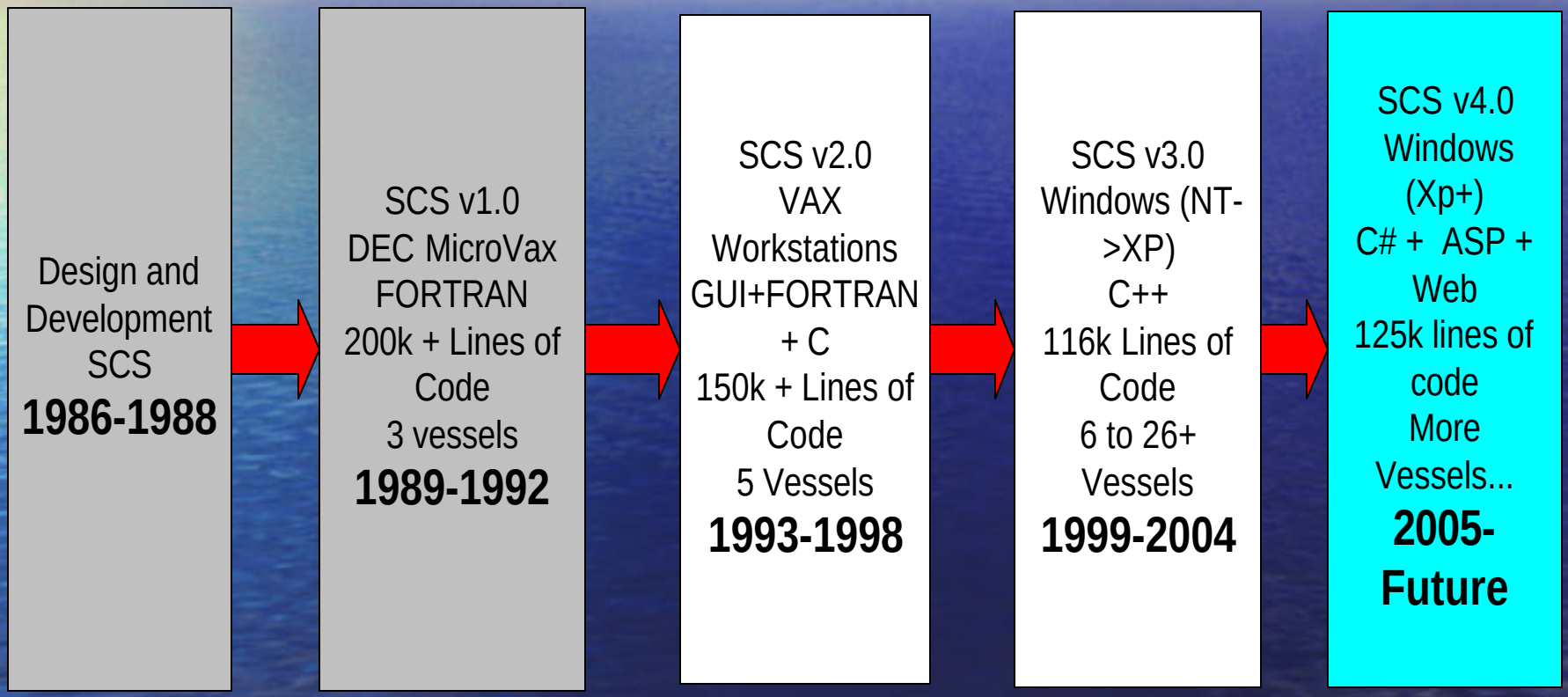
SCS Primary Functions

- Acquire real time sensor data
- Log raw data to disk
- Monitor incoming data for errors
- Display real time data in text and graphical formats
- Output data to remote PCs (serial and socket)
- User-configurable Event Data Logging
- QA Post Processing of ASCII data set
- Auto-Mailing of summary data (SAMOS and Shiptracker)
- End of cruise data products

SCS 4.0 – Data Flow



SCS System Development Life Cycle



The Rationale for SCS 4.0

- SCS 3.0 operation for 6+ years
- SCS 3.x limited expansion potential
- Microsoft .NET replaced Win32 API
- New Network Sensor Types emerging
- Web Centric Applications emerging
- FSCS 2.0 compatibility
- Improved Maintenance and reiability
- Re-vitalize Graphics
- Enhance GIS connectivity

SCS 4.0 – Sensor Definitions

- NMEA sentence label extenders
- TCP/IP and UDP sensor types
- “Calibrator sensors” no longer supported.
- Enhanced Derived Sensor Types
- Translate message codes to plain text
- Disable/Enable Sensors easily
- Internal/External sensor simulation with real data
- Device Object -> Parent Sensor -> Child Sensors
- Architecture Supports Enhanced Sensor Control

SCS 4.0 – ACQ Data Server

- ACQ Isolated by XML data Server
- Client and server talk in plain text
- XML Packet formatting standard.
- All Clients talk to ACQ via TCP/IP Sockets
- Easy for future apps to ask ACQ for data
  - Usable .NET DLLs for talking to SCS available

SCS 4.0 – Data Logging

- Simultaneous Dual System Logging
  - All Raw Message Data Logged
- "On demand" Compress and Lab files
  - Identical Format to SCS 3.x
- Event Logger file Formats Identical
- Specialized Site Event Logger
  - Designed for tracking Station/Site Events
  - Directly connects to database

Event Logger

- Provides scientists with personalized/ customized data logging
- Allows metadata to be associated with each event (i.e. vessel, cruise#, etc...)
- Event buttons provide for annotation while the event is running
- Several events can be run simultaneously
- Event Logger re-written for stability

SCS 4.0 – Graphic Displays

- Dundas-Chart used for time series plots.
  - Time Series (4 sensors on 2 axis)
  - XY Plots
- Dundas-Gauge used for gauge displays.
  - Customizable Gauges for easy viewing
  - Instrument Panels of Mixed Gauges
  - 50 plus Gauge templates available
- Dundas-Chart ASP used for time series plots on Web
  - Time Series (4 sensors on 2 axis)
  - XY Plots

SCS 4.0 - GIS

- New track line plot app based on ESRI GIS software library.
- Can track ship and towed body simultaneously.
- Can display data in ESRI Shape files, Grids and Coverages.
- Can write track line data as Shape file.
- Tracklines can overlay imagery layers.
- Overlay historic tracklines from RAW files
- Extensible

SCS 4.0 – Web Service

- Web browser connections to Dedicated SCS Web Service
- Provides Web Text Displays
- Provides Web Time Series Plots
- Provides Web Logging Status Display
- Provides Sensor Configuration Listings
- Extensible in the future by Users/ NMAO

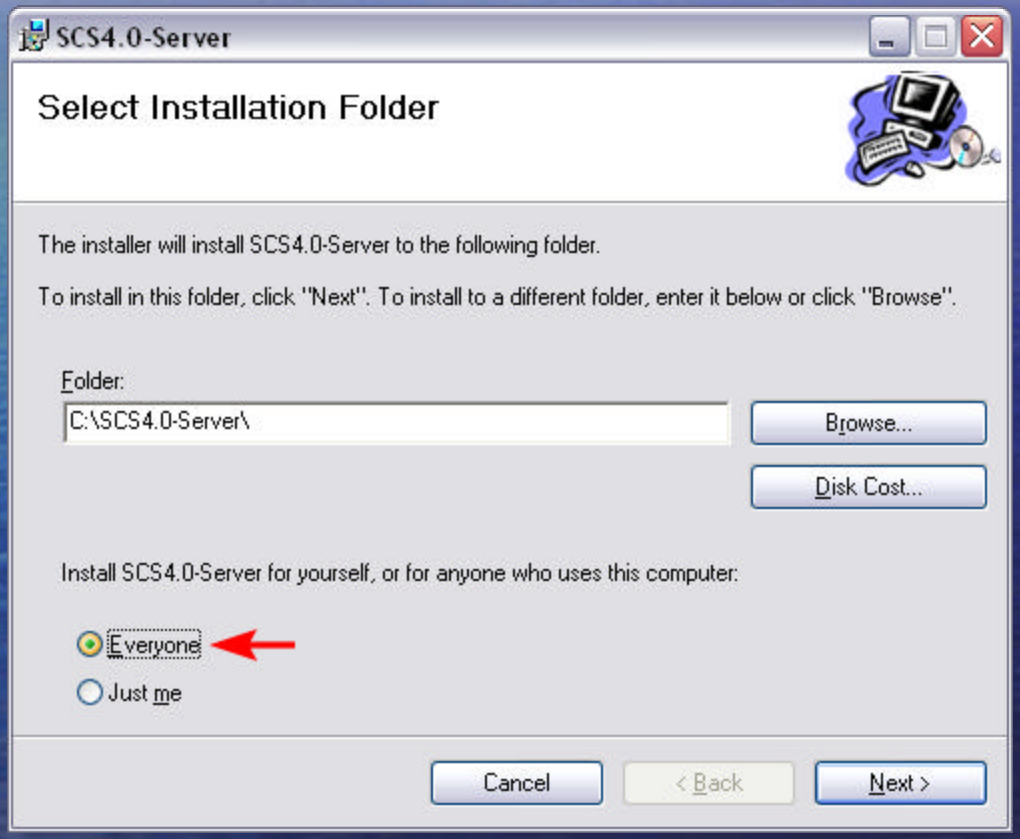
SCS Installations

Typical SCS Server
(Dell Poweredge 2850)
(DIGI Acceleport) serial ports

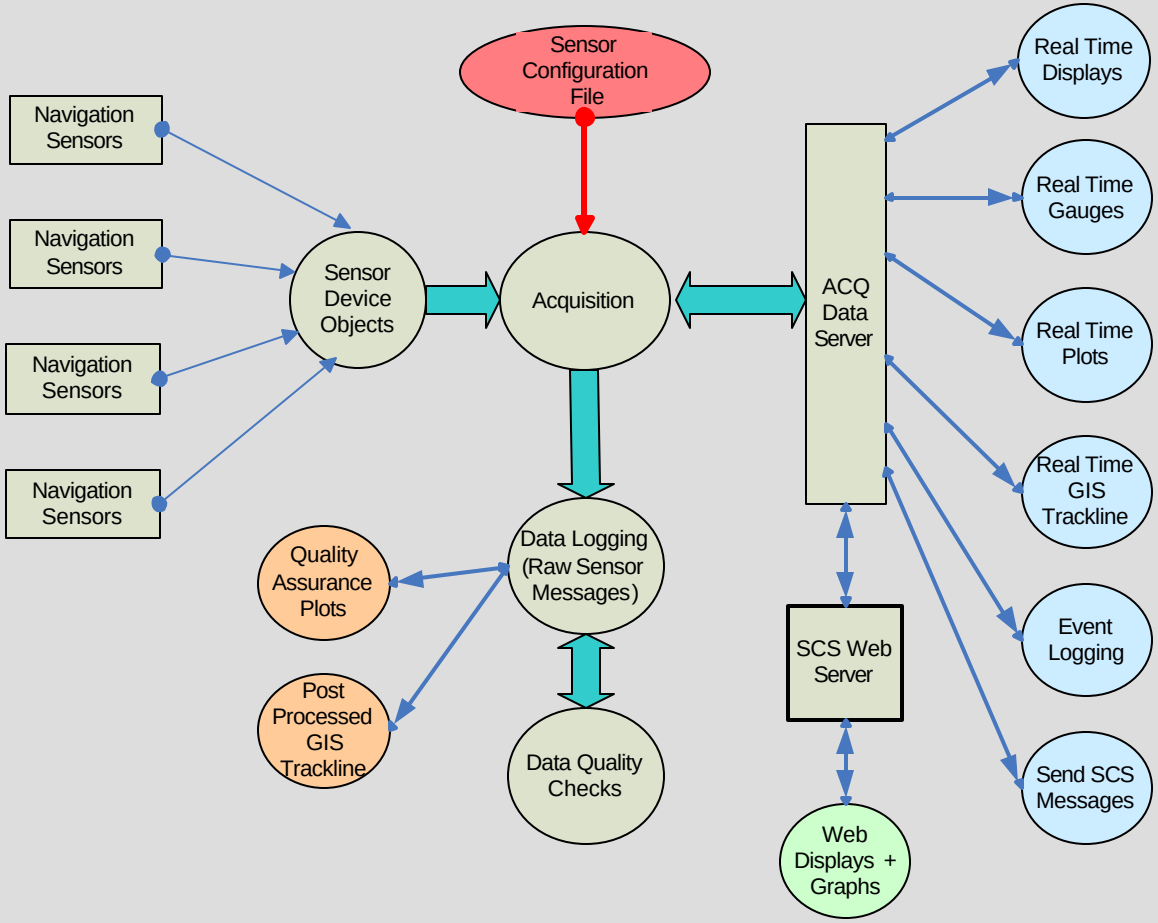
SCS uses less than 3% of CPU

PC Laptop (1Ghz+)
Windows XP
Edgeport USB serial Ports
Or
Network Serial Ports

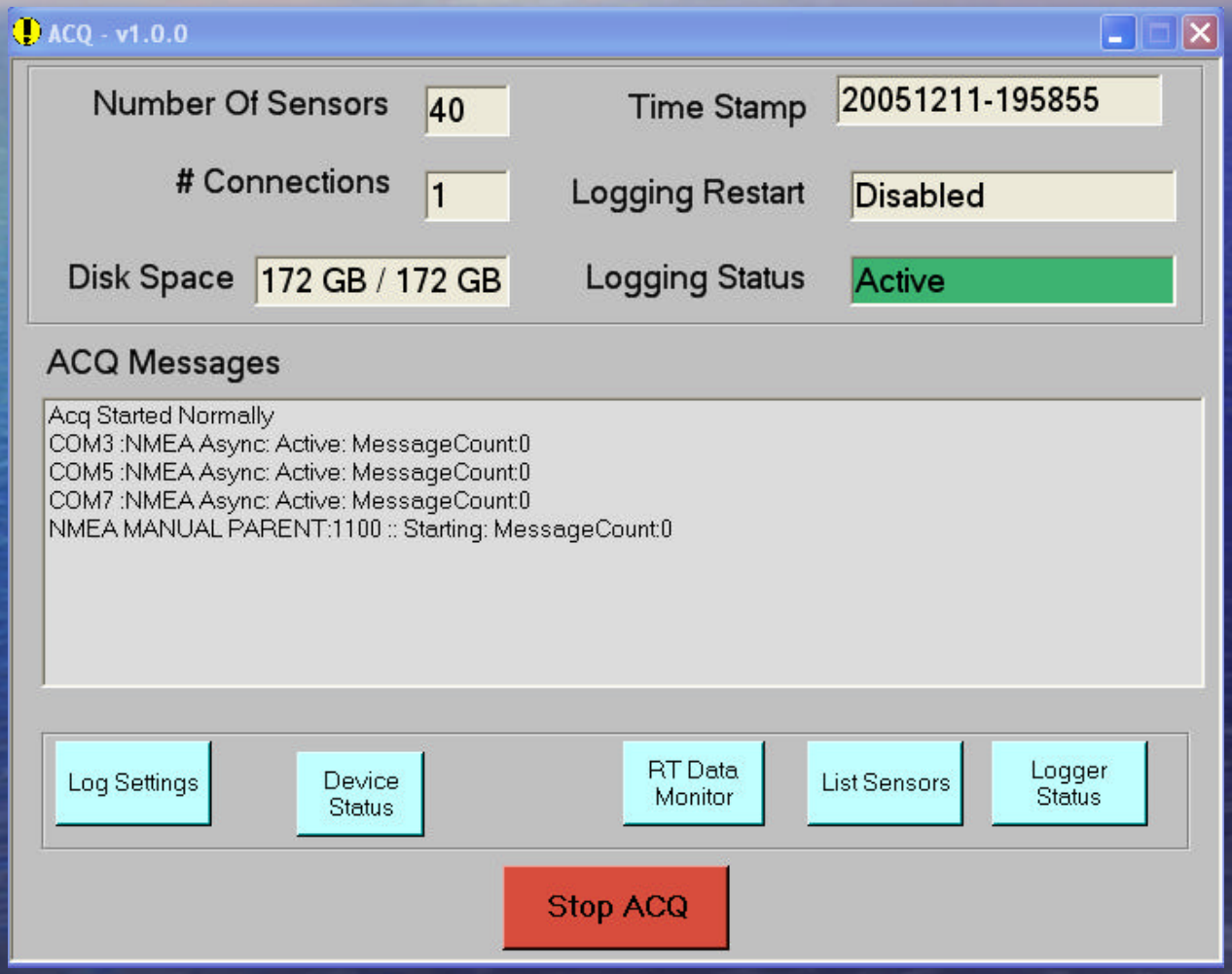
SCS 4.0 – Installation Wizard



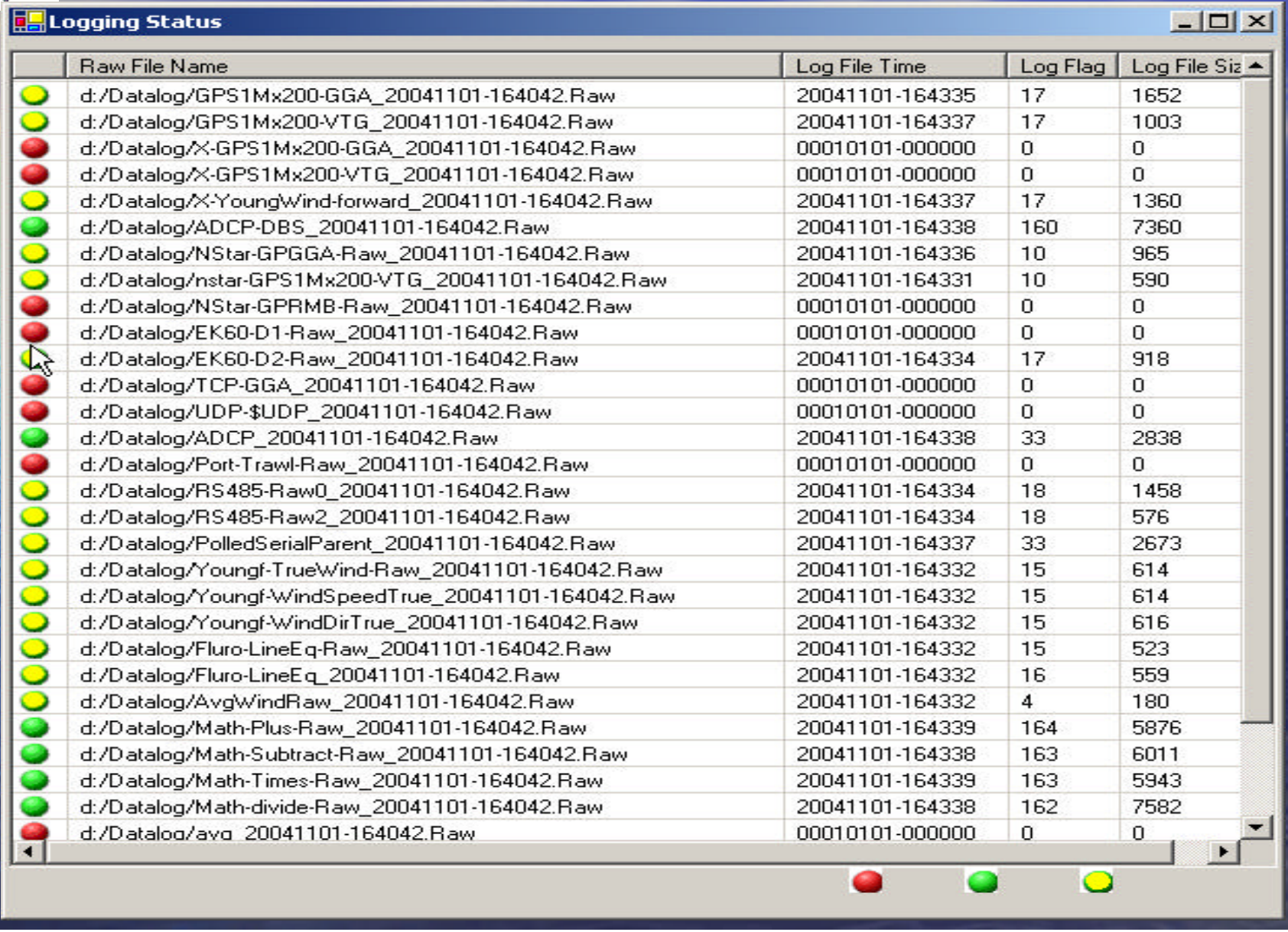
SCS 4.0 – Data Flow



SCS 4.0 – ACQ Main Window



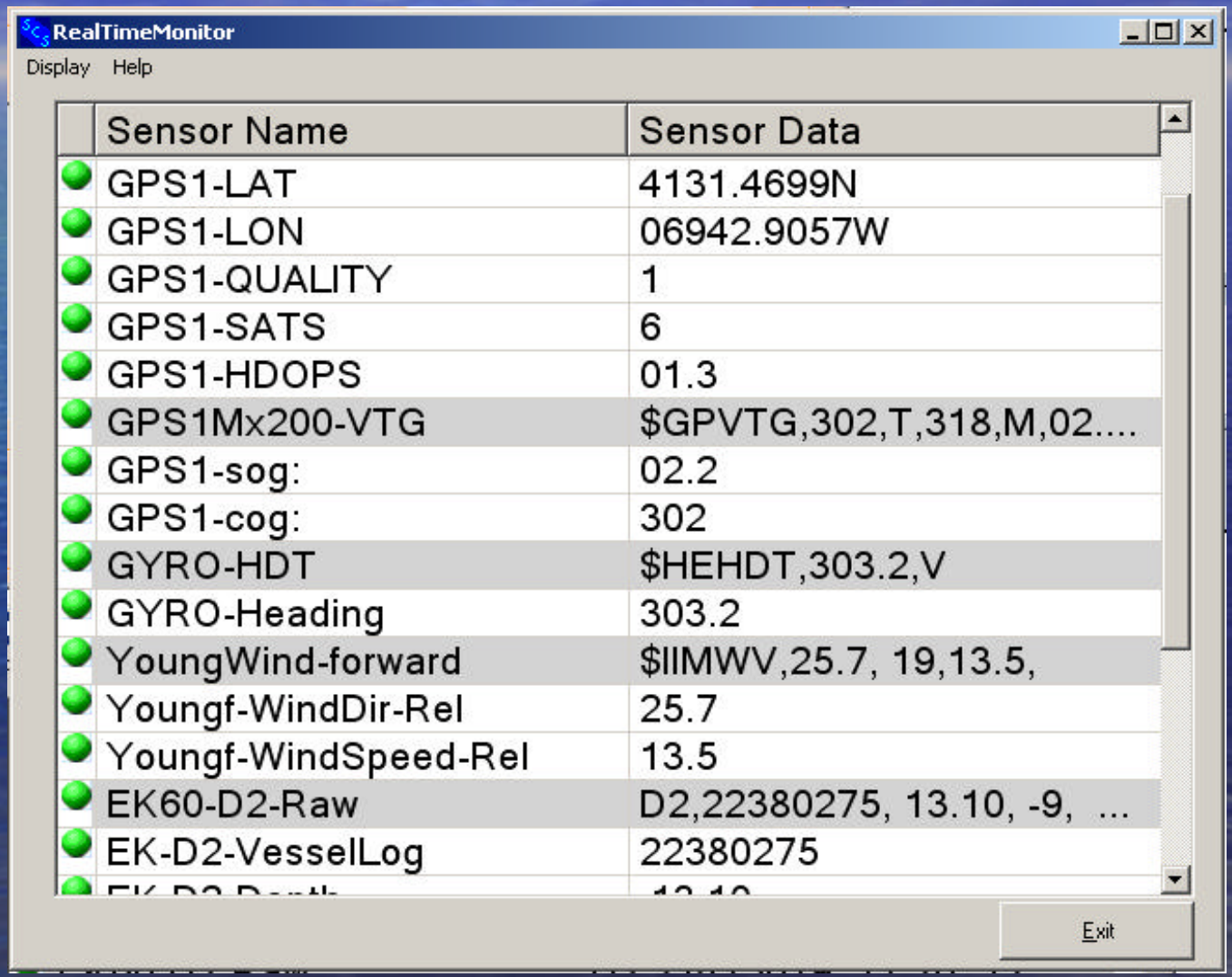
ACQ Logging Status



	Raw File Name	Log File Time	Log Flag	Log File Siz
	d:/Datalog/GPS1Mx200-GGA_20041101-164042.Raw	20041101-164335	17	1652
	d:/Datalog/GPS1Mx200-VTG_20041101-164042.Raw	20041101-164337	17	1003
	d:/Datalog/X-GPS1Mx200-GGA_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/X-GPS1Mx200-VTG_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/X-YoungWind-forward_20041101-164042.Raw	20041101-164337	17	1360
	d:/Datalog/ADCP-DBS_20041101-164042.Raw	20041101-164338	160	7360
	d:/Datalog/NStar-GPGGA-Raw_20041101-164042.Raw	20041101-164336	10	965
	d:/Datalog/nstar-GPS1Mx200-VTG_20041101-164042.Raw	20041101-164331	10	590
	d:/Datalog/NStar-GPRMB-Raw_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/EK60-D1-Raw_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/EK60-D2-Raw_20041101-164042.Raw	20041101-164334	17	918
	d:/Datalog/TCP-GGA_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/UDP-$UDP_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/ADCP_20041101-164042.Raw	20041101-164338	33	2838
	d:/Datalog/Port-Trawl-Raw_20041101-164042.Raw	00010101-000000	0	0
	d:/Datalog/RS485-Raw0_20041101-164042.Raw	20041101-164334	18	1458
	d:/Datalog/RS485-Raw2_20041101-164042.Raw	20041101-164334	18	576
	d:/Datalog/PolledSerialParent_20041101-164042.Raw	20041101-164337	33	2673
	d:/Datalog/Youngf-TrueWind-Raw_20041101-164042.Raw	20041101-164332	15	614
	d:/Datalog/Youngf-WindSpeedTrue_20041101-164042.Raw	20041101-164332	15	614
	d:/Datalog/Youngf-WindDirTrue_20041101-164042.Raw	20041101-164332	15	616
	d:/Datalog/Fluro-LineEq-Raw_20041101-164042.Raw	20041101-164332	15	523
	d:/Datalog/Fluro-LineEq_20041101-164042.Raw	20041101-164332	16	559
	d:/Datalog/AvgWindRaw_20041101-164042.Raw	20041101-164332	4	180
	d:/Datalog/Math-Plus-Raw_20041101-164042.Raw	20041101-164339	164	5876
	d:/Datalog/Math-Subtract-Raw_20041101-164042.Raw	20041101-164338	163	6011
	d:/Datalog/Math-Times-Raw_20041101-164042.Raw	20041101-164339	163	5943
	d:/Datalog/Math-divide-Raw_20041101-164042.Raw	20041101-164338	162	7582
	d:/Datalog/avg_20041101-164042.Raw	00010101-000000	0	0

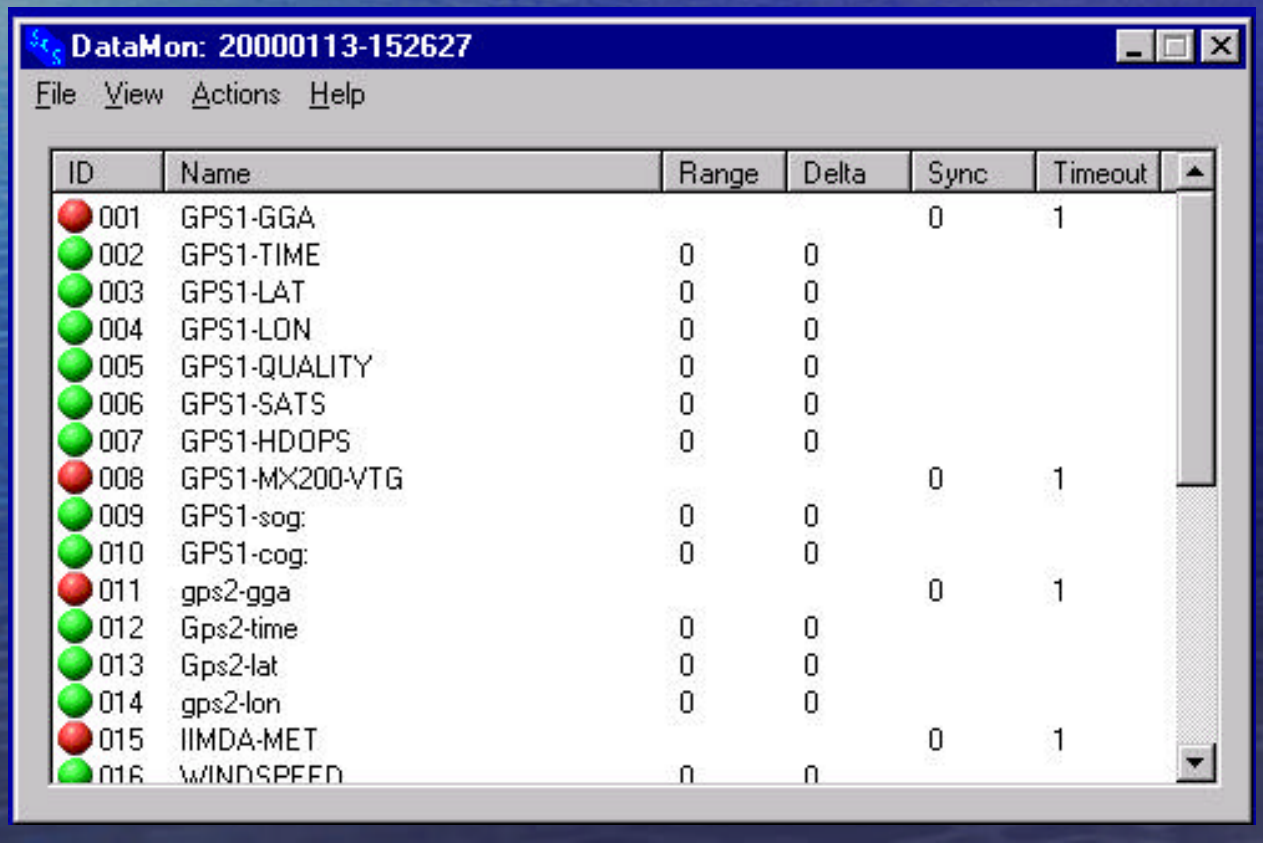
ACQ Real Time Monitor

- All sensors or just parents
- Status LEDs
- Sort in any column



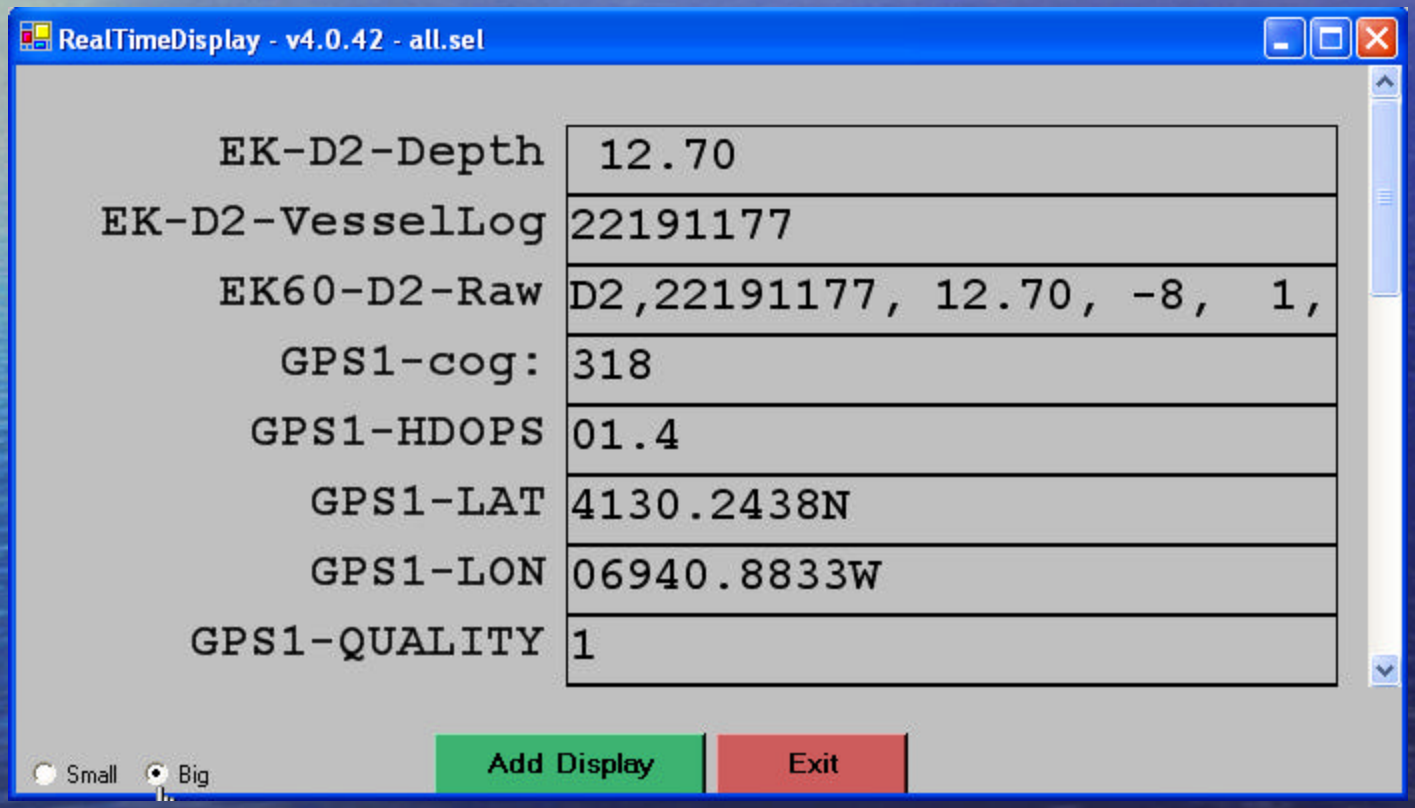
Data Monitoring/QA

- Range Checks
- Delta Checks
- Synch Checks
- Sensor Timeouts



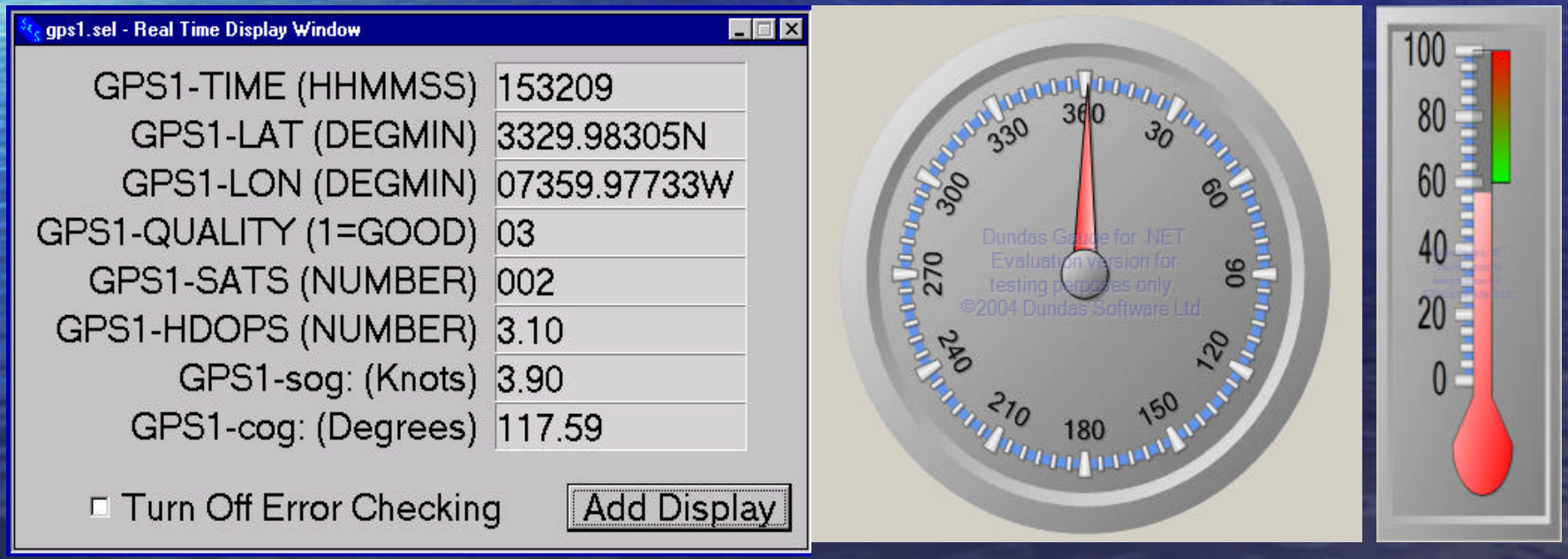
ID	Name	Range	Delta	Sync	Timeout
001	GPS1-GGA			0	1
002	GPS1-TIME	0	0		
003	GPS1-LAT	0	0		
004	GPS1-LON	0	0		
005	GPS1-QUALITY	0	0		
006	GPS1-SATS	0	0		
007	GPS1-HDOPS	0	0		
008	GPS1-MX200-VTG			0	1
009	GPS1-sog:	0	0		
010	GPS1-cog:	0	0		
011	gps2-gga			0	1
012	Gps2-time	0	0		
013	Gps2-lat	0	0		
014	gps2-lon	0	0		
015	IIMDA-MET			0	1
016	WINDSPEED	0	0		

SCS 4.0 – Real Time Display

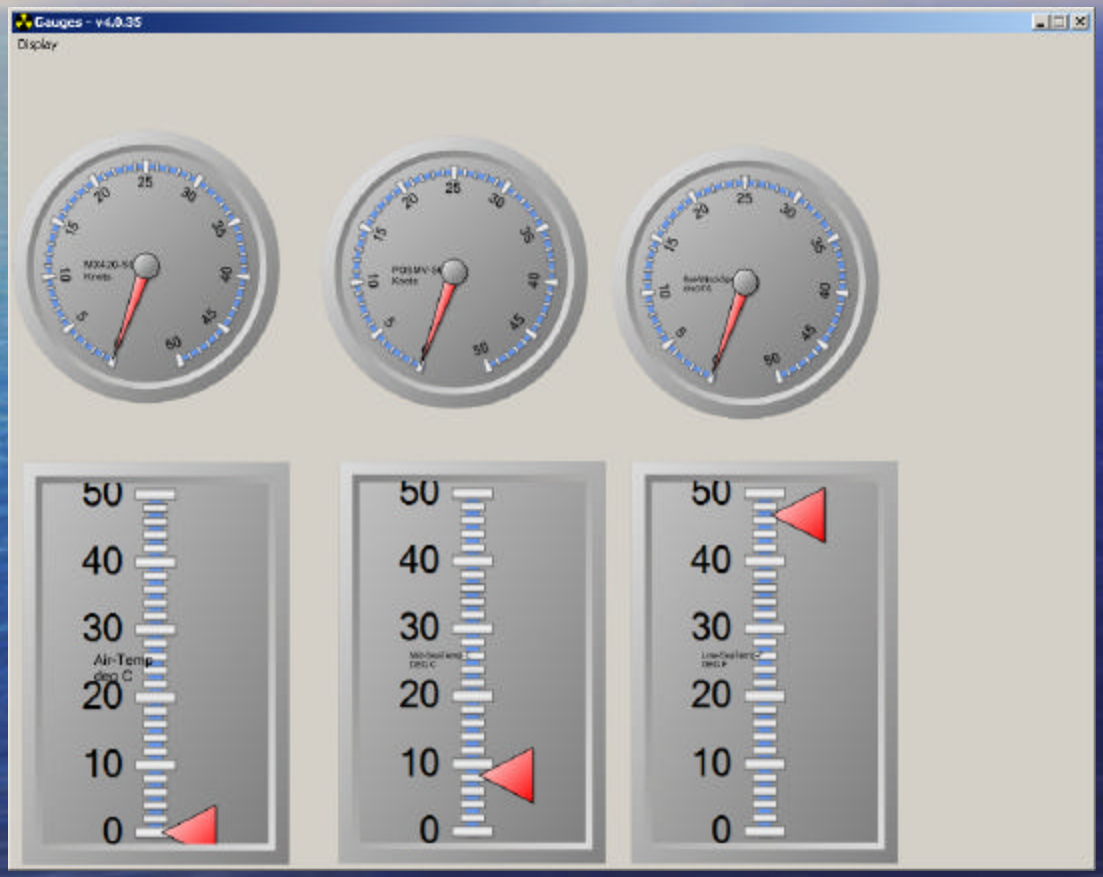


Real Time Displays/Gauges

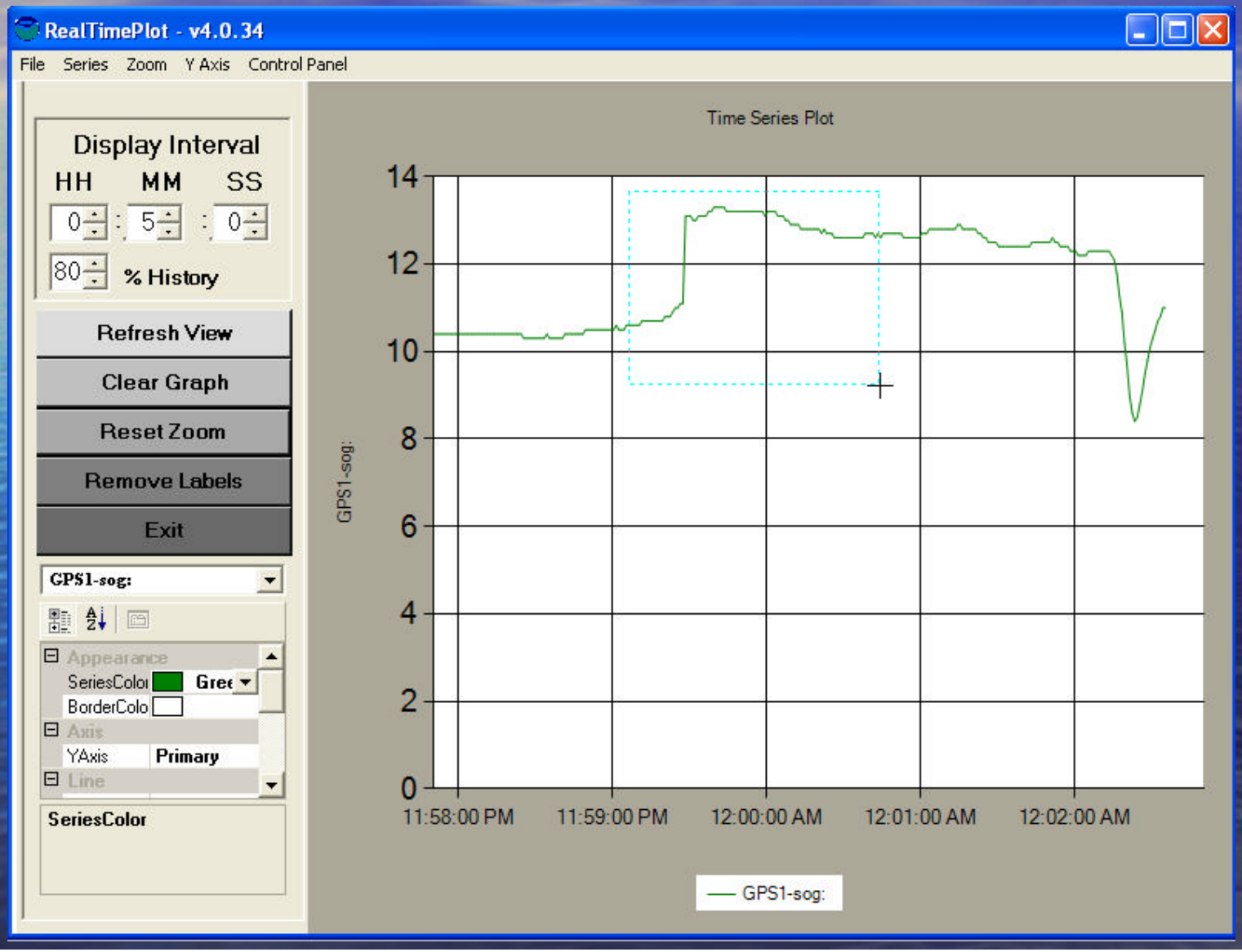
- Provides basic visualization of real-time data
- Displays are user-configurable
- Visual indication when data fails to update
- User Configurable Instrument Panels



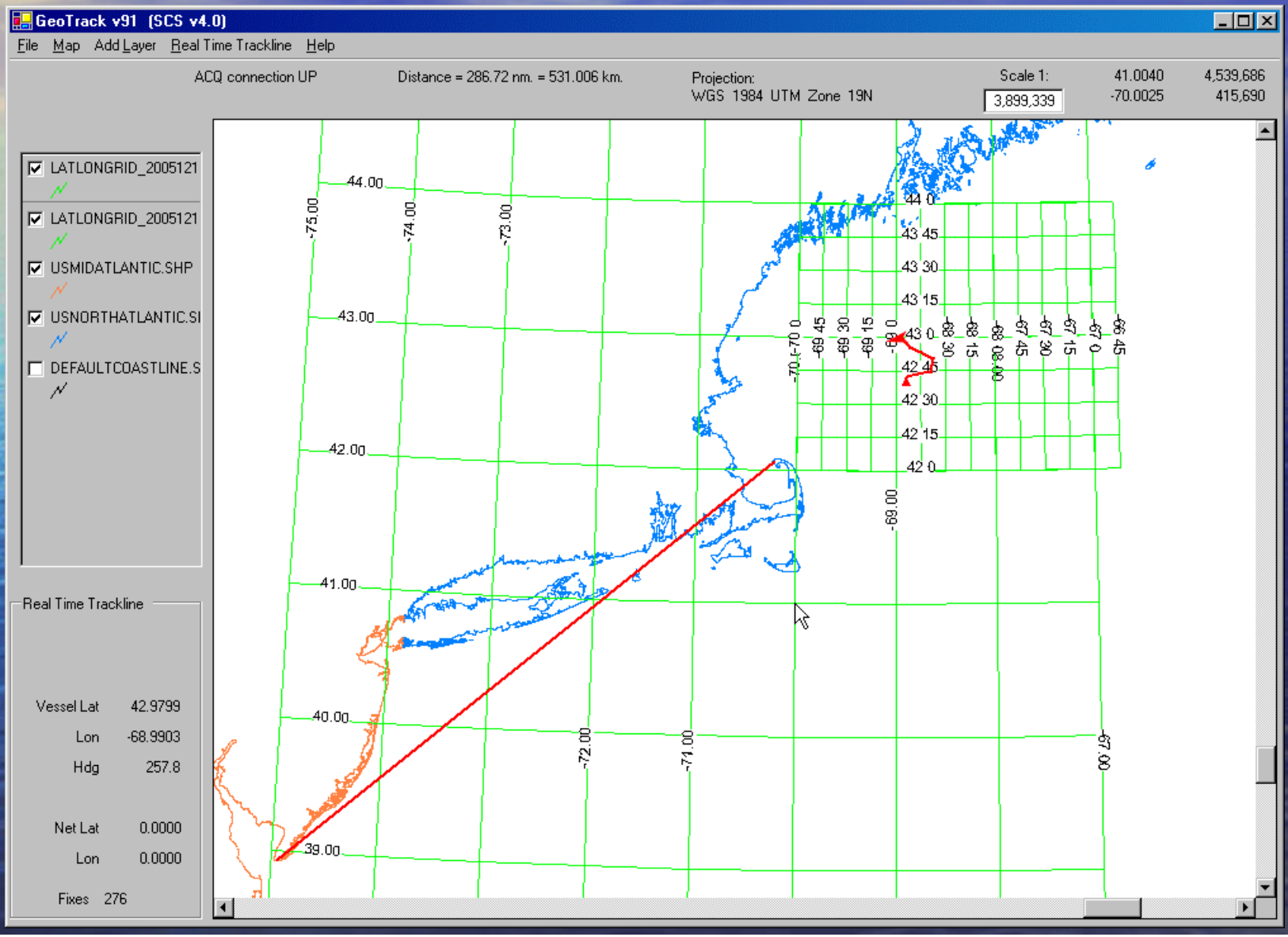
SCS 4.0 – Gauge Displays

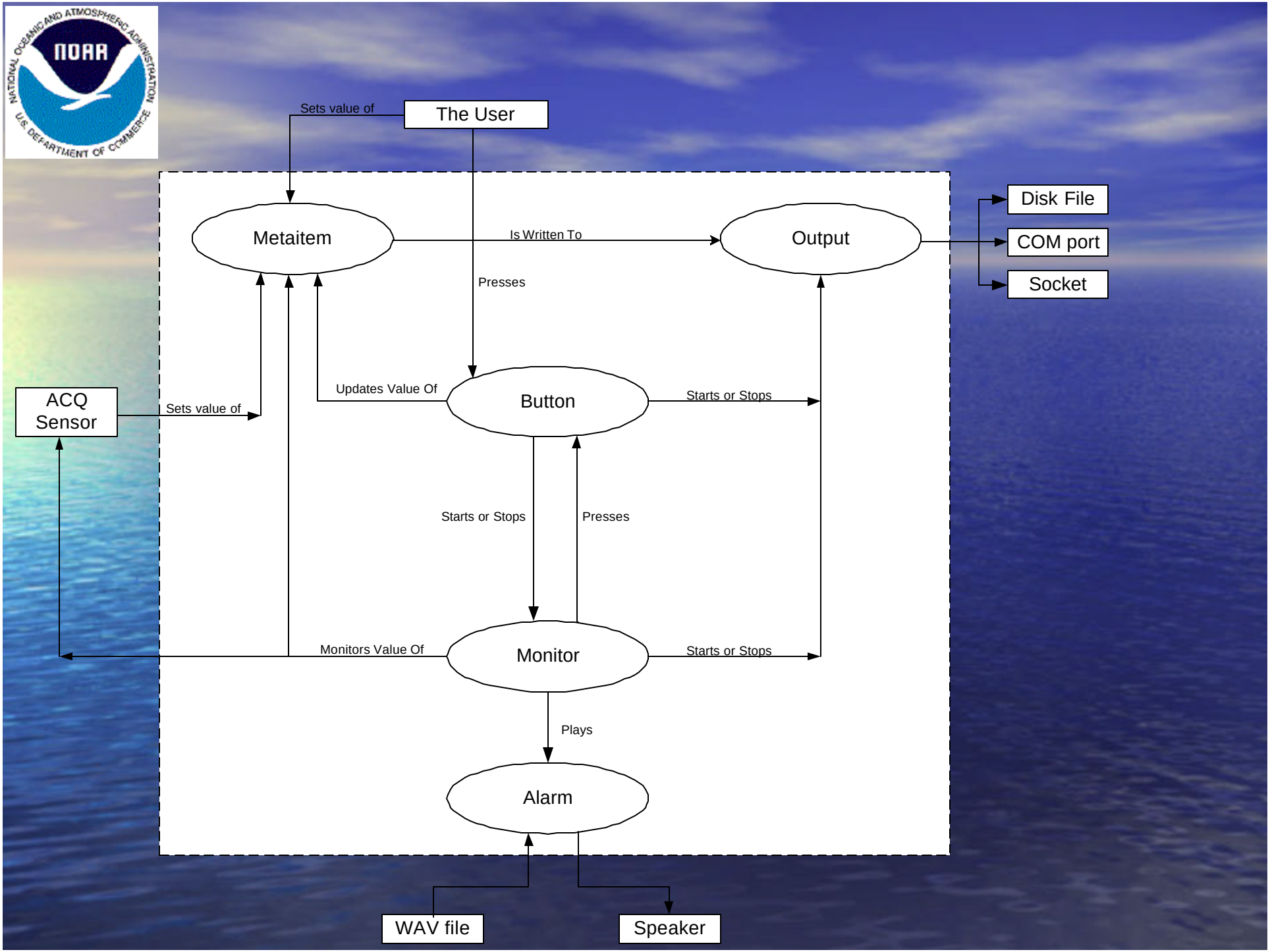


SCS 4.0 – Real Time Series Plot

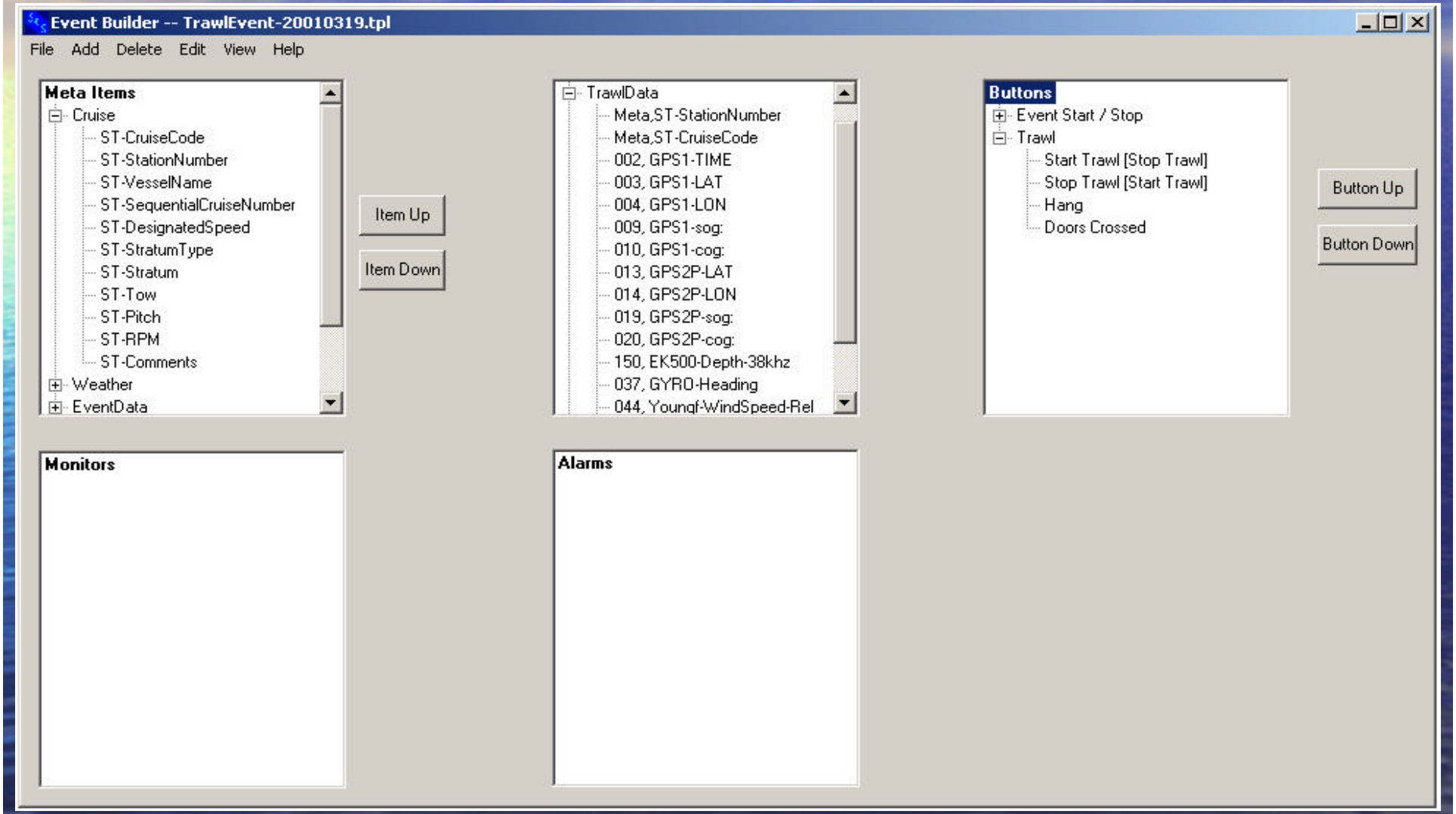


SCS 4.0 – GIS Track Line Plot

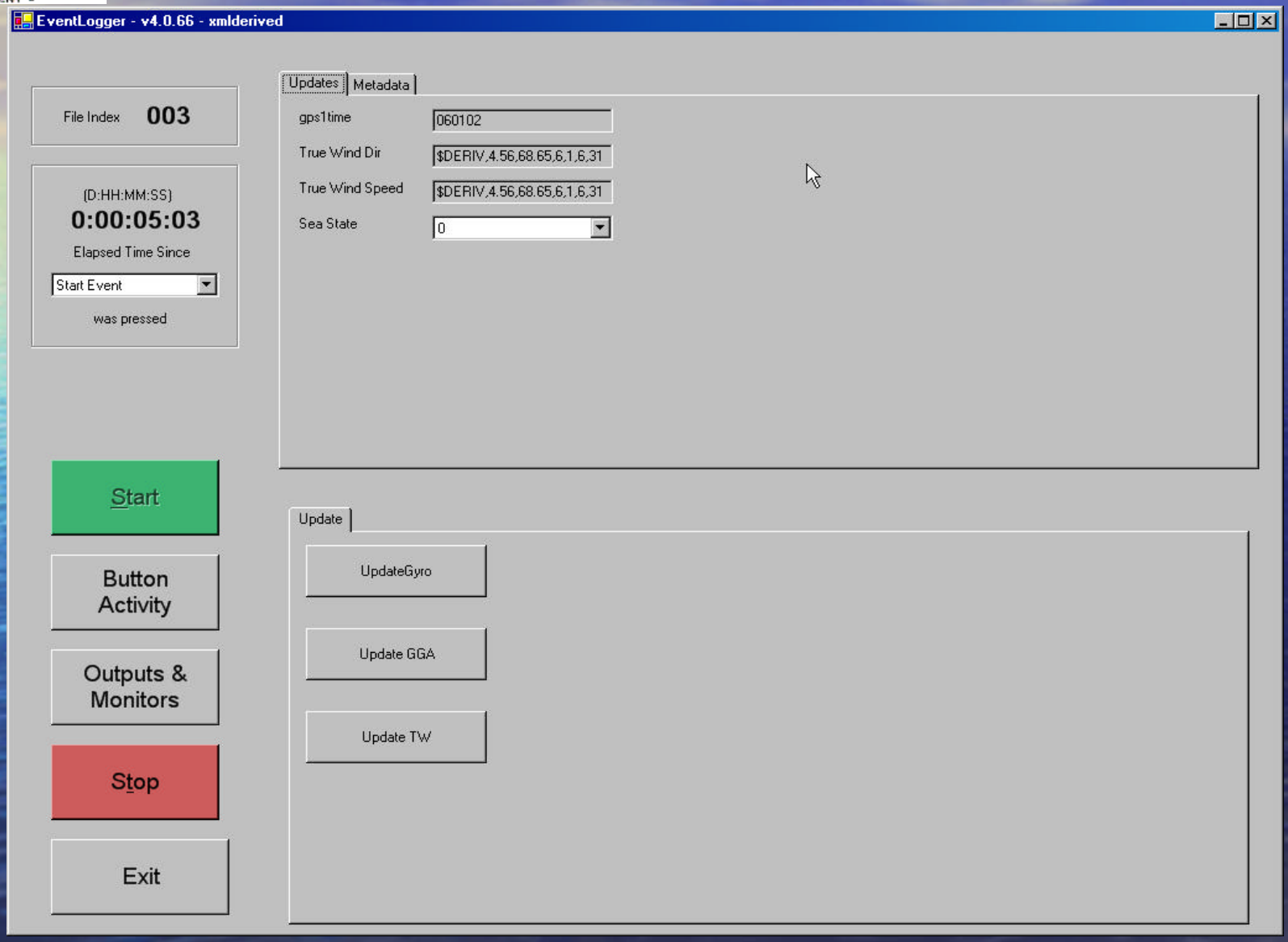



Sets value of
The User
Metaitem
Is Written To
Output
Disk File
COM port
Socket
Presses
Updates Value Of
Button
Starts or Stops
ACQ Sensor
Sets value of
Starts or Stops
Presses
Monitors Value Of
Monitor
Starts or Stops
Plays
Alarm
WAV file
Speaker

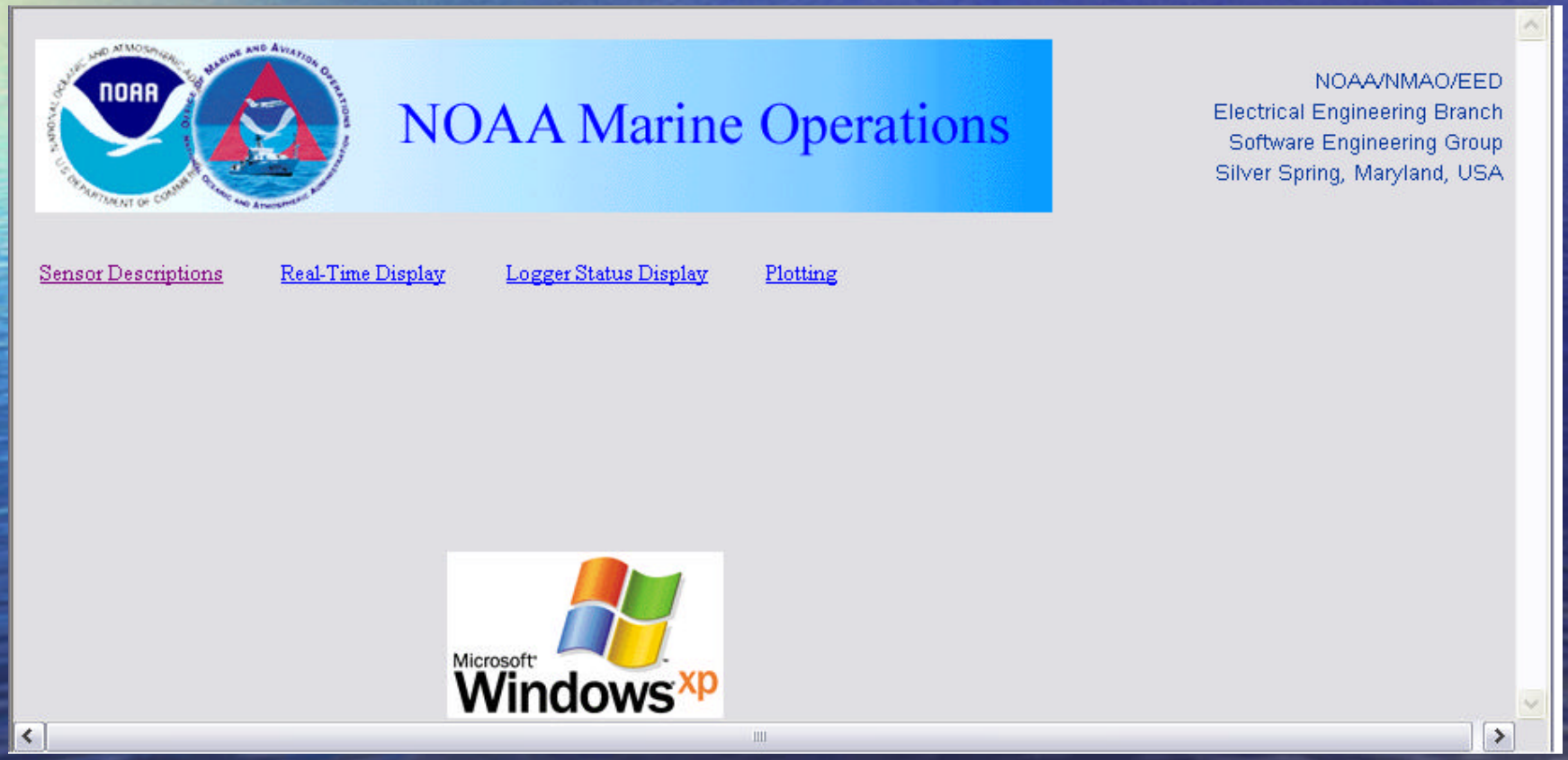
SCS 4.0 – Event Builder



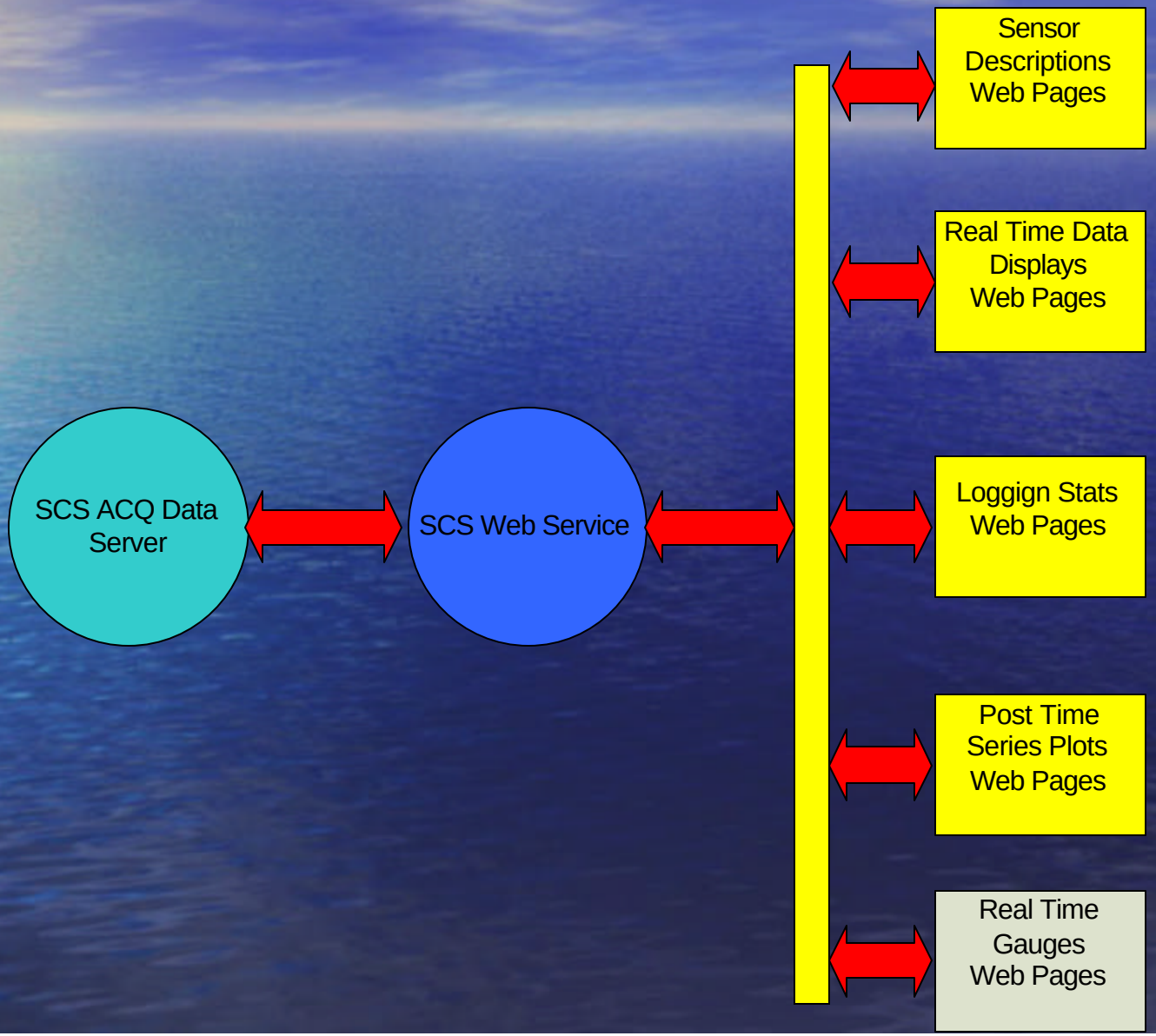
SCS 4.0 – Event Logger



SCS 4.0 Web Access



SCS Web Interface



SCS Web (Sensor Descriptions)

Web SCS Logger Status

Raw File Name	Last Log Time	Log Flag	Log File Size
C:\SCS4.0-Server\DATALOG40\PCODE-GPGGA_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\PCODE-VTG_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\MX200-GPGGA_20051212-163853.Raw	20051215-214424	27753	2470017
C:\SCS4.0-Server\DATALOG40\MX200-GPVTG_20051212-163853.Raw	20051215-214425	27753	1665180
C:\SCS4.0-Server\DATALOG40\NORTHSTAR-GPGGA_20051212-163853.Raw	20051215-214424	27753	2386763
C:\SCS4.0-Server\DATALOG40\NORTHSTAR-GPVTG_20051212-163853.Raw	20051215-214424	27753	1637427
C:\SCS4.0-Server\DATALOG40\GYRO-RAW_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\YOUNG-MET-RAW_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\Rain-WIMRA_20051212-163853.Raw	20051215-214424	27753	2192487
C:\SCS4.0-Server\DATALOG40\Rain-WIMRB_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\Seapath_20051212-163853.Raw	20051215-214424	27753	1470909
C:\SCS4.0-Server\DATALOG40\SocketGyro_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\SocketGPGGA_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\IMET-Wind2-RAW_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\SEABIRD-SBE21_20051212-163853.Raw	20051215-214402	9251	296032
C:\SCS4.0-Server\DATALOG40\Barometer-RAW_20051212-163853.Raw	20051215-214424	27753	784152
C:\SCS4.0-Server\DATALOG40\Fluorometer-RAW_20051212-163853.Raw	20051215-214402	9251	703076
C:\SCS4.0-Server\DATALOG40\Bathy-RAW_20051212-163853.Raw	20051215-214425	27753	2470017
C:\SCS4.0-Server\DATALOG40\Robertson-RAW_20051212-163853.Raw	20051215-214424	27753	1221129
C:\SCS4.0-Server\DATALOG40\Winch-Hydro-Raw_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\Winch-Traction-Raw_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\PCODE-SOG-MSecs_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\Mast-Twind_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\IMET-RWind2-Spd-Knts_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\IMET-TWind2-kts_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\ODEC-Speed-MSecs_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\IMET-TWind2-MSEC_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\Baro-CorrectedSeaLevel_20051212-163853.Raw	20051215-214424	27752	1214886
C:\SCS4.0-Server\DATALOG40\AvgRwind2Dir_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\BATHY-FATHOMS_20051212-163853.Raw	00010101-000000	0	0
C:\SCS4.0-Server\DATALOG40\ShipNotes_20051212-163853.Raw	20051214-180020	2	68

Web Displays Based on Window Displays

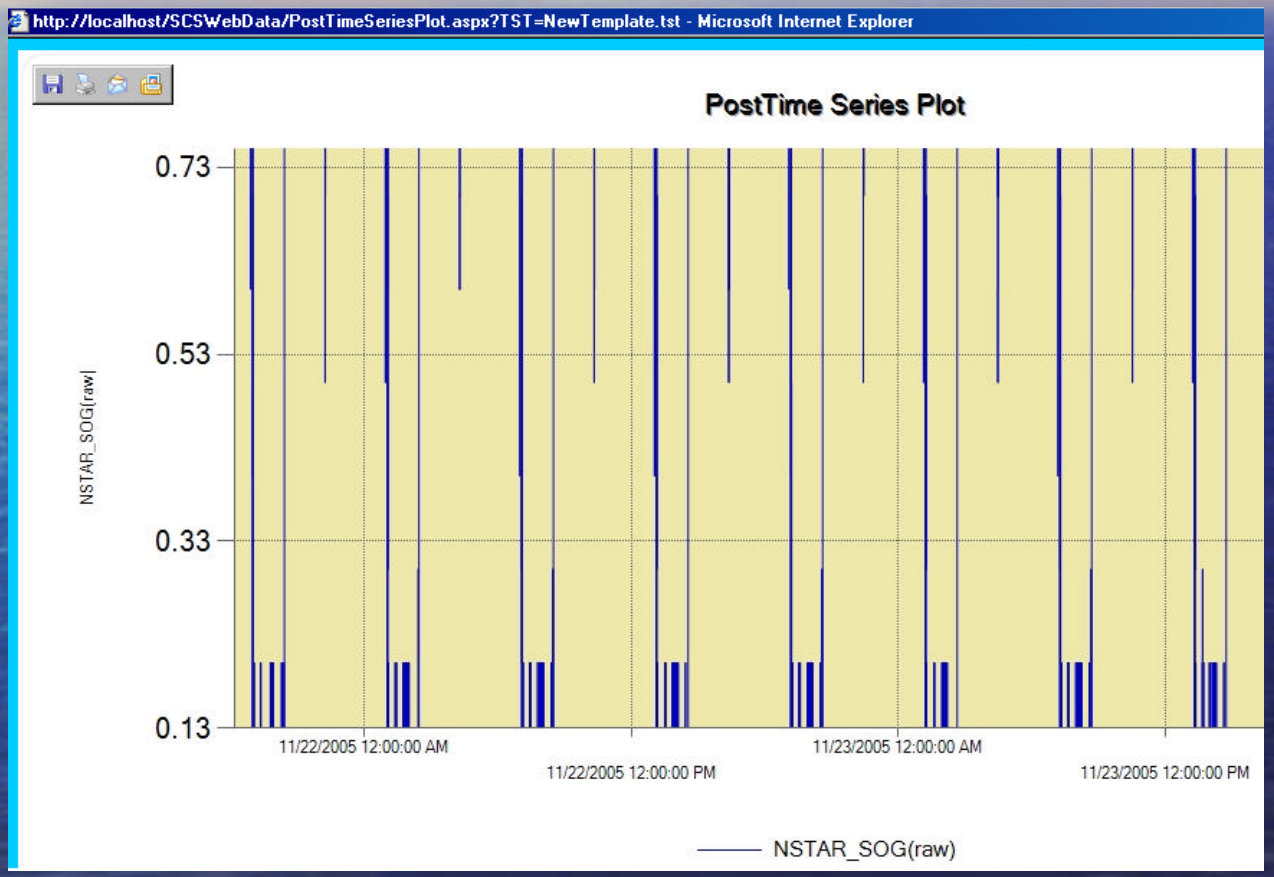
SCS Data Web Display

Sensor Name	Display Flag	Error Flag	Timestamps	Data Length	Data Value
PCODE-GPGGA	0	2	0	0	
PCODE-VTG	0	2	0	0	
MX200-GPGGA	277444	0	12/15/2005,21:43:00.577	65	$GPGGA,070600,3941.238,N,07226.891,W,1,6,01.5,0002.6,M,-034.9,M,,
MX200-GPVTG	277444	0	12/15/2005,21:43:00.812	36	$GPVTG,034.0,T,048.3,M,13.8,N,25.5,K
NORTHSTAR-GPGGA	277445	0	12/15/2005,21:43:01.170	62	$GPGGA,234126,3818.411,N,07337.558,W,2,04,2.60,0,M,,,1,0013*13
NORTHSTAR-GPVTG	277444	0	12/15/2005,21:43:00.671	35	$GPVTG,045,T,059,M,13.0,N,24.0,K*47
GYRO-RAW	0	2	0	0	
YOUNG-MET-RAW	0	2	0	0	
Rain-WIMRA	277444	0	12/15/2005,21:43:00.421	55	$WIMRA,3076.0,5239.0,******,5239.0,000.0,000.0 ,
Rain-WIMRB	0	2	0	0	
IMET-Wind2-RAW	0	2	0	0	
SEABIRD-SBE21	277445	0	12/15/2005,21:43:01.077	8	89FDB6F9
Barometer-RAW	554832	0	12/15/2005,21:43:00.421	4	
Fluorometer-RAW	277431	0	12/15/2005,21:43:00.499	52	050715 013236 38-38.7562 N 073-20.4595 W +12.9 034.8
Bathy-RAW	277444	0	12/15/2005,21:43:00.671	65	$WIMWV,036,R,011,N,A$WIMRB,1901.0,5245.0,5244.0 ,
Robertson-RAW	277444	0	12/15/2005,21:43:00.609	20	00878,000,00000,000
Winch-Hydro-Raw	0	2	0	0	
Winch-Traction-Raw	0	2	0	0	
Seapath	277445	0	12/15/2005,21:43:00.796	29	$PRDID,+001.15,+000.08,043.06

SCS Brief Data Display

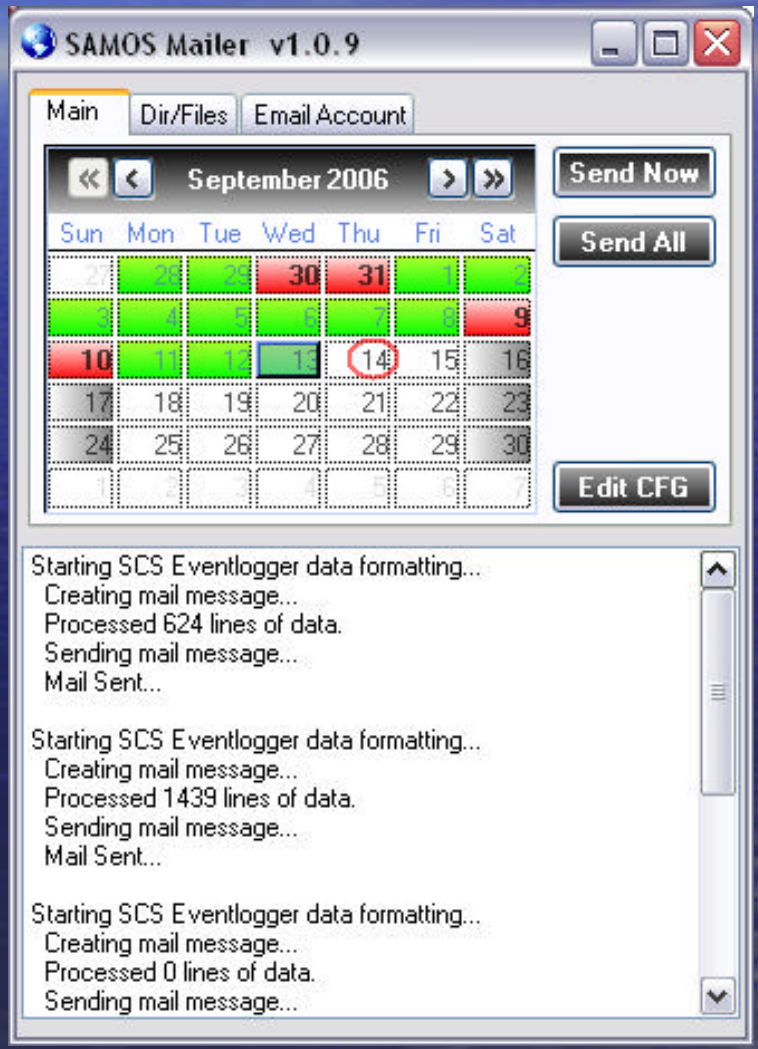
Sensor Name	Data Value
PCODE-GPGGA	
PCODE-VTG	
MX200-GPGGA	$GPGGA,071120,3942.275,N,07226.017,W,1,6,01.4,0002.5,M,-034.9,M,,
MX200-GPVTG	$GPVTG,032.1,T,046.4,M,14.0,N,26.0,K
NORTHSTAR-GPGGA	$GPGGA,234636,3819.294,N,07336.673,W,2,05,1.50,0,M,,,3,0013*17
NORTHSTAR-GPVTG	$GPVTG,034,T,048,M,13.1,N,24.2,K*42
GYRO-RAW	
YOUNG-MET-RAW	
Rain-WIMRA	$WIMRA,3101.0,5240.0,******,5239.0,000.0,000.0 ,
Rain-WIMRB	
IMET-Wind2-RAW	
SEABIRD-SBE21	8854B46A
Barometer-RAW	
Fluorometer-RAW	050715 013756 38-39.7142 N 073-19.6295 W +13.1 034.4
Bathy-RAW	$WIMWV,027,R,011,N,A$WIMRB,1872.0,5244.0,5244.0 ,
Robertson-RAW	000878,000,00000,000
Winch-Hydro-Raw	
Winch-Traction-Raw	
Seapath	$PRDID,+000.82,-000.61,032.42

Web Post Time Series Plot

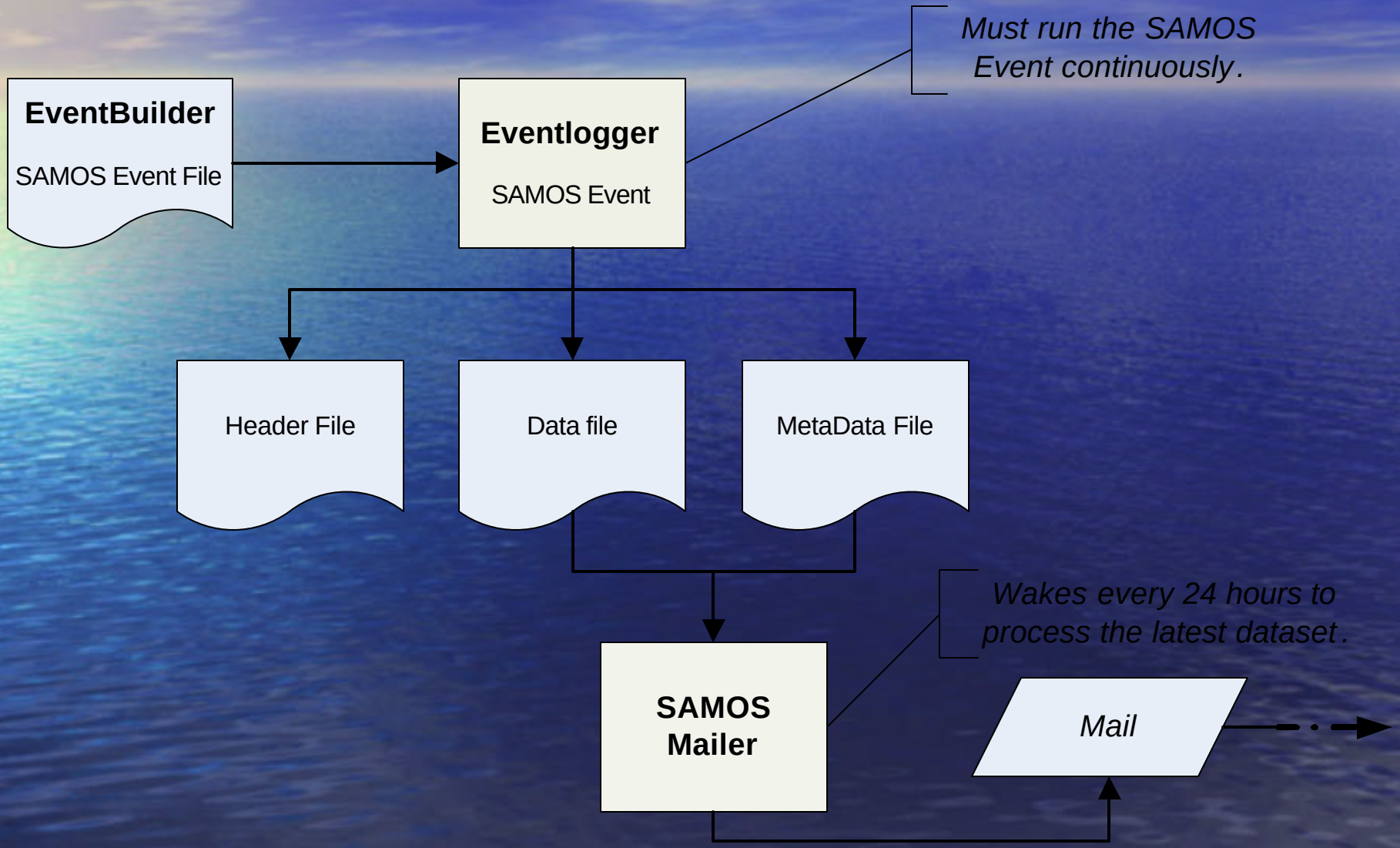


SAMOS Mailer

- Shipboard data transfer
- Automated
- Quality Assurance
- Unobtrusive
- Easy to install/run
- Requires SCS 4.0

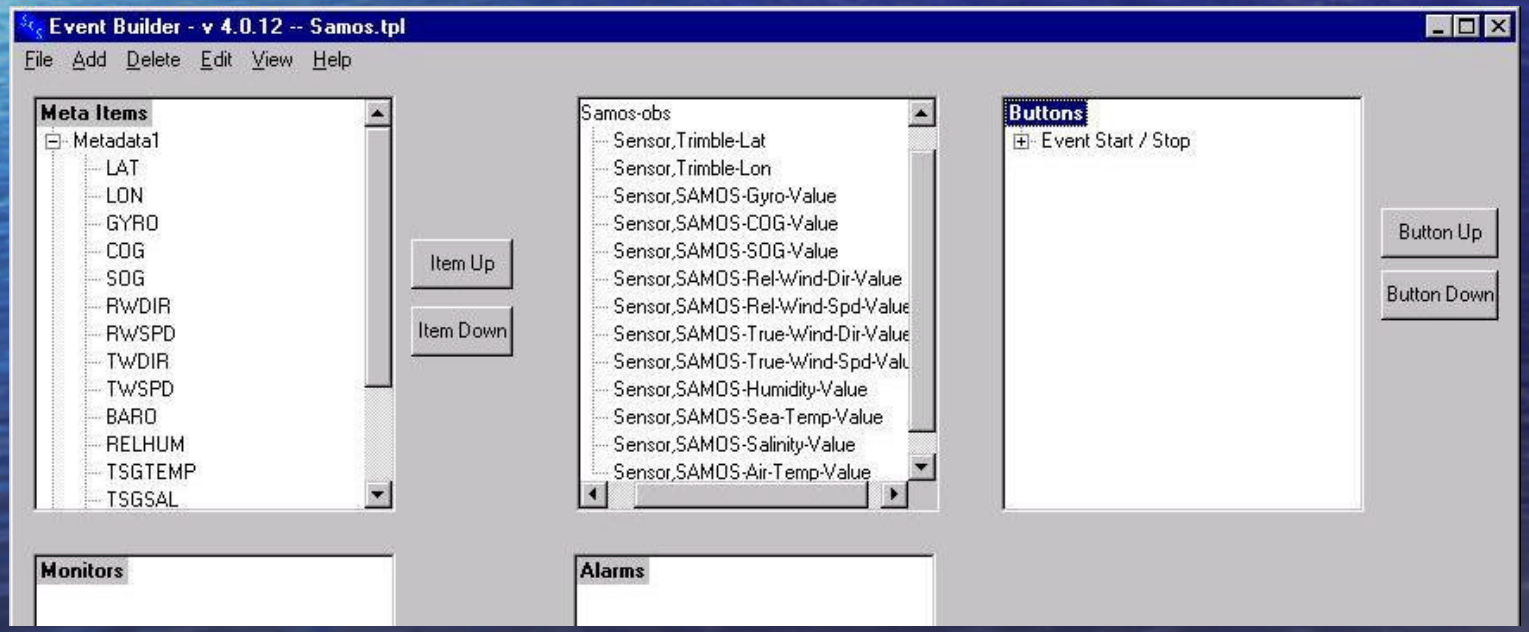


SAMOS Mailer - DFD



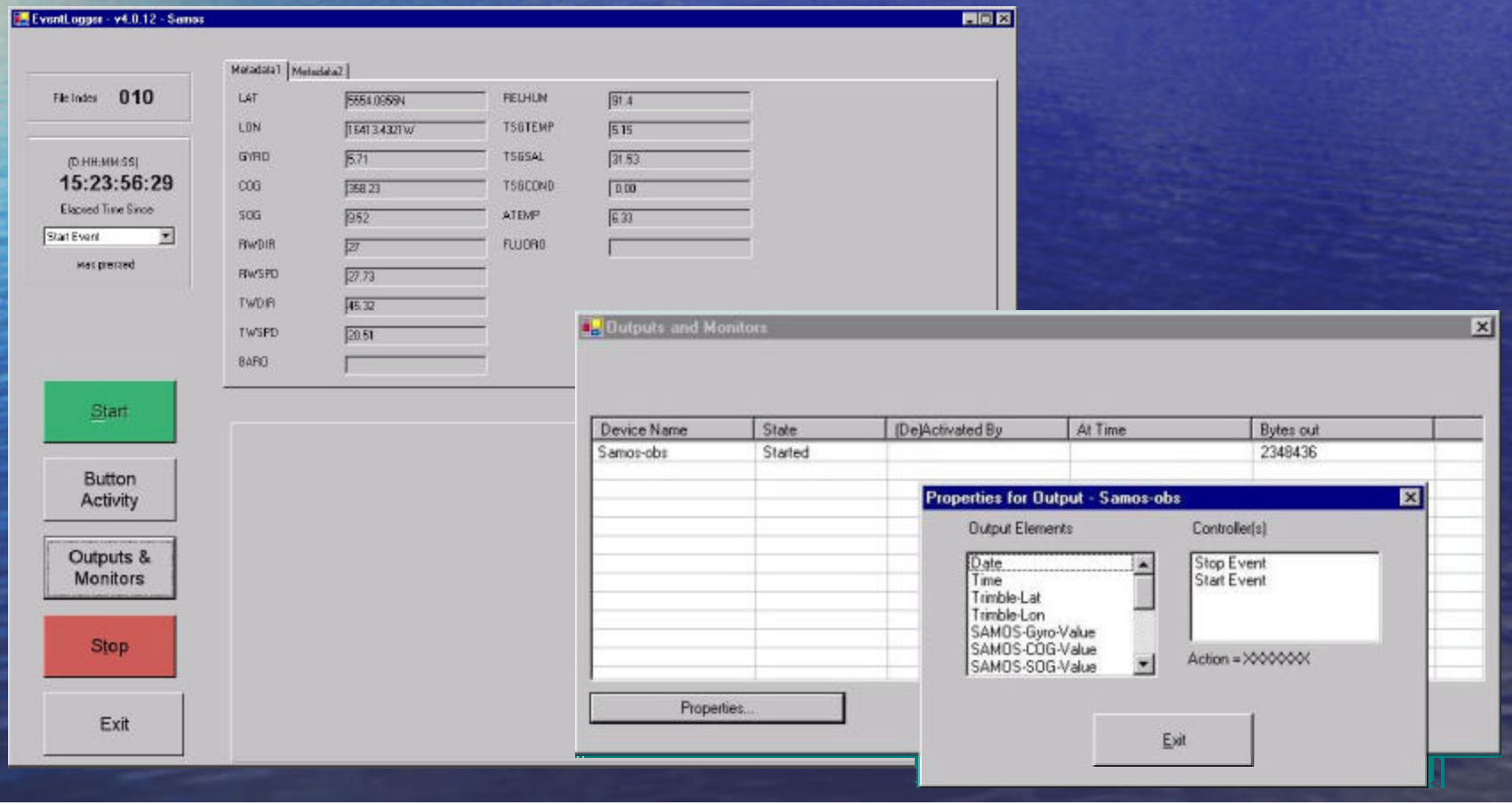
SAMOS Mailer - Eventlogger

- Relies extensively on Eventlogger features of SCS 4.0
- Dedicated SAMOS Event



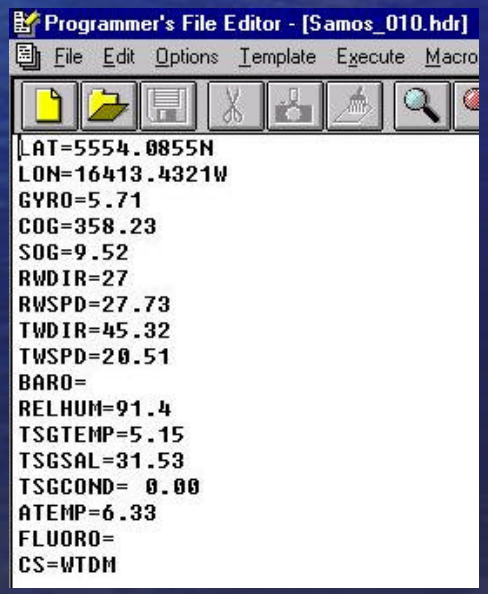
SAMOS Mailer - Eventlogger

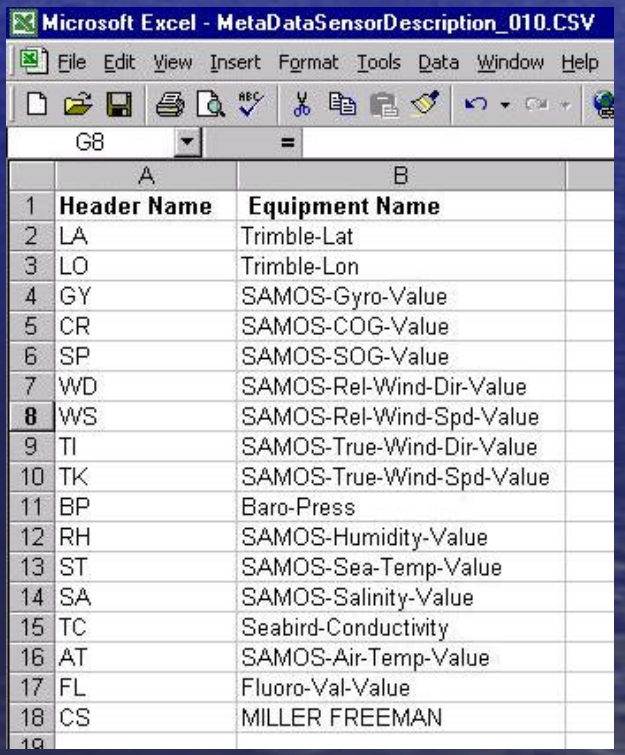
- SAMOS Event must run continuously.



SAMOS Mailer - Eventlogger

- Header file output - *.hdr
- MetaData file output - *.csv
- Provides sensor to genre correlation.





	A	B
1	**Header Name**	**Equipment Name**
2	LA	Trimble-Lat
3	LO	Trimble-Lon
4	GY	SAMOS-Gyro-Value
5	CR	SAMOS-COG-Value
6	SP	SAMOS-SOG-Value
7	WD	SAMOS-Rel-Wind-Dir-Value
8	WS	SAMOS-Rel-Wind-Spd-Value
9	TI	SAMOS-True-Wind-Dir-Value
10	TK	SAMOS-True-Wind-Spd-Value
11	BP	Baro-Press
12	RH	SAMOS-Humidity-Value
13	ST	SAMOS-Sea-Temp-Value
14	SA	SAMOS-Salinity-Value
15	TC	Seabird-Conductivity
16	AT	SAMOS-Air-Temp-Value
17	FL	Fluoro-Val-Value
18	CS	MILLER FREEMAN

SAMOS Mailer - Eventlogger

- Data file output - *.elg

Microsoft Excel - Samos-obs_009.elg

File Edit View Insert Format Tools Data Window Help

G4 = 13.18

	A	B	C	D	E	F	G
1	Date	Time	Trimble-Lat	Trimble-Lon	SAMOS-Gyro-Value	SAMOS-COG-Value	SAMOS-SOG-Value
2	09/11/2006	13:37:01	55.47777	-160.40775	67.25	66.53	13.05
3	09/11/2006	13:38:01	55.47924	-160.40185	67.37	66.14	13.14
4	09/11/2006	13:39:01	55.48092	-160.39612	63.71	62.67	13.18
5	09/11/2006	13:40:01	55.48269	-160.39053	61.04	60.08	13.23
6	09/11/2006	13:41:01	55.48458	-160.38495	60.29	59.23	13.22
7	09/11/2006	13:42:01	55.48649	-160.37937	60.29	59.12	13.2
8	09/11/2006	13:43:01	55.48836	-160.37384	60.11	59.17	13.26
9	09/11/2006	13:44:01	55.49030	-160.36844	59.24	57.91	13.28
10	09/11/2006	13:45:01	55.49234	-160.36292	58.63	57.09	13.17
11	09/11/2006	13:46:01	55.49434	-160.35759	58.21	56.5	13.15
12	09/11/2006	13:47:01	55.49634	-160.35219	58.18	56.77	13.13

SAMOS Mailer

- Customized formatting is applied to data output from Event.
- File is then compressed and mailed.

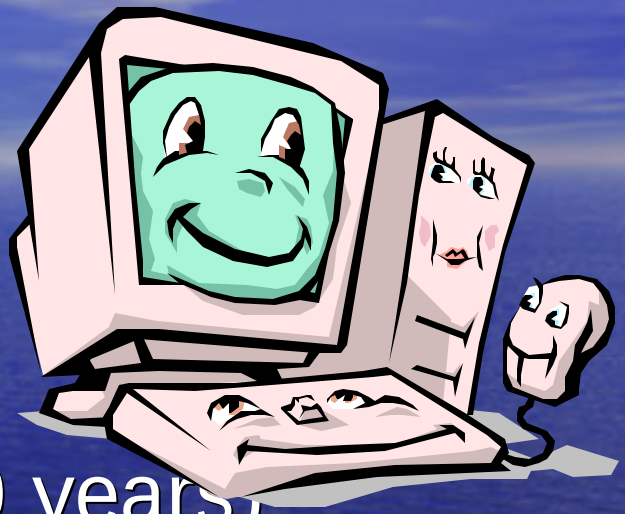
Microsoft Excel - MILLER FREEMAN_2006-10-10.csv [Read-Only]

File Edit View Insert Format Tools Data Window Help

C7 YMD:20061010

	A	B	C	D	E	F
1	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000026	LA:57.72682	LO:-152.51
2	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000126	LA:57.72685	LO:-152.51
3	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000226	LA:57.72683	LO:-152.51
4	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000326	LA:57.72682	LO:-152.51
5	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000426	LA:57.72681	LO:-152.51
6	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000526	LA:57.72680	LO:-152.51
7	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000626	LA:57.72680	LO:-152.51
8	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000726	LA:57.72681	LO:-152.51
9	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000826	LA:57.72681	LO:-152.51
10	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:000926	LA:57.72681	LO:-152.51
11	$SAMOS:001	CS:MILLER FREEMAN	YMD:20061010	HMS:001026	LA:57.72682	LO:-152.51

Overall SCS Advantages



- Simple to use
- Easy to manage
- Fast and easy to configure
- Stability (in use for over 10 years)
- Easy user-access to data
- Can be configured to use on any vessel without the need for new software modules

Vessels with SCS

- NOAA
  - 13 ships w/ SCS w/integrated sensor suite
  - 5 ships w/ SCS ShipTracker version (FA, RA, TJ, RU, CO)
  - NOAA NWFSC charter vessels

Direct Support

- US Coast Guard
  - Polar Star, Polar Sea, Healy
- Canadian Coast Guard
  - Wilfred Laurier, John P. Tully, W.E. Ricker, Vector
- UNOLS
  - Endeavor (URI), Weather Bird II (BBSR), Clifford A. Barnes (UW), Cape Hatteras
- British Antarctic Survey
  - James Clark Ross, Ernest Shackleton
- State Fisheries Vessels
  - Alabama, Mississippi, Louisiana, others???
- JAMSTEC
  - Marai
- SEACOOS
  - Suncoaster

Indirect Support

Partnership Efforts

- Brookhaven National Labs
- International SeaKeepers Society
- British Antarctic Survey
- UNOLS
- US Coast Guard
- Canadian Coast Guard
- National Oceanographic Data Center (NODC)
- National Marine Fisheries (NMFS)