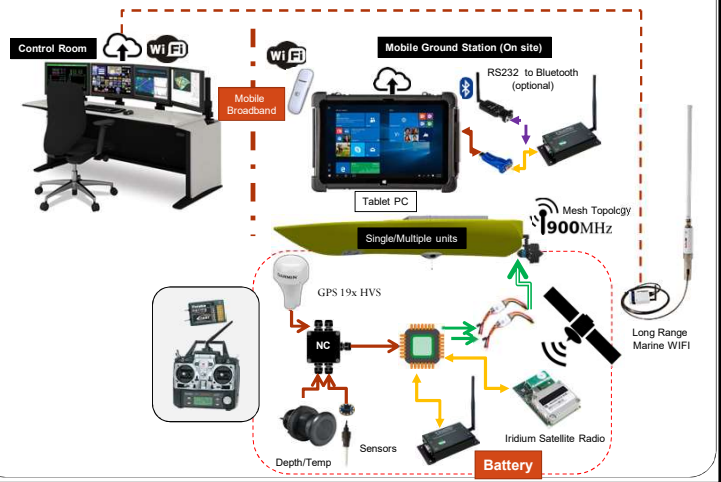
3. Main components of the vehicle

i. Hull Design
ii. Propulsion System
iii. Navigation System & Control
iv. Data Collection
v. Data transmission
vi. Power Management

https://www.evologics.de/en/products/sonobot/index.html

General System Architecture of USV/ASV



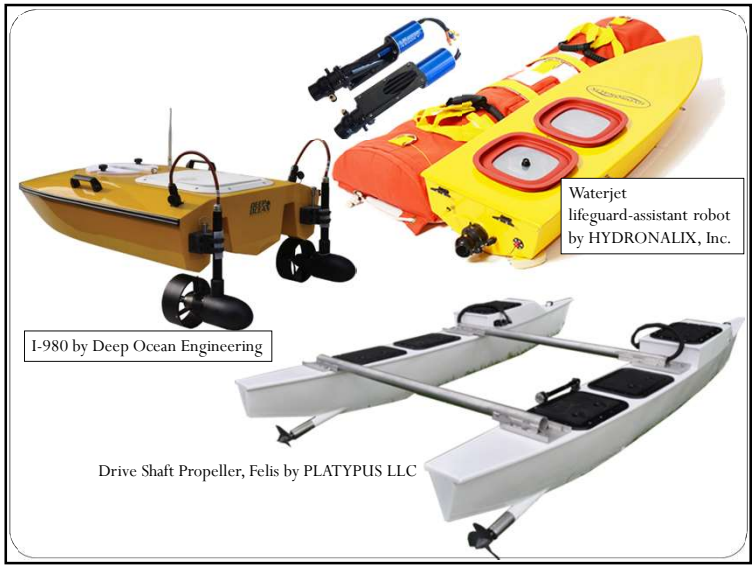
3. Main components of the vehicle

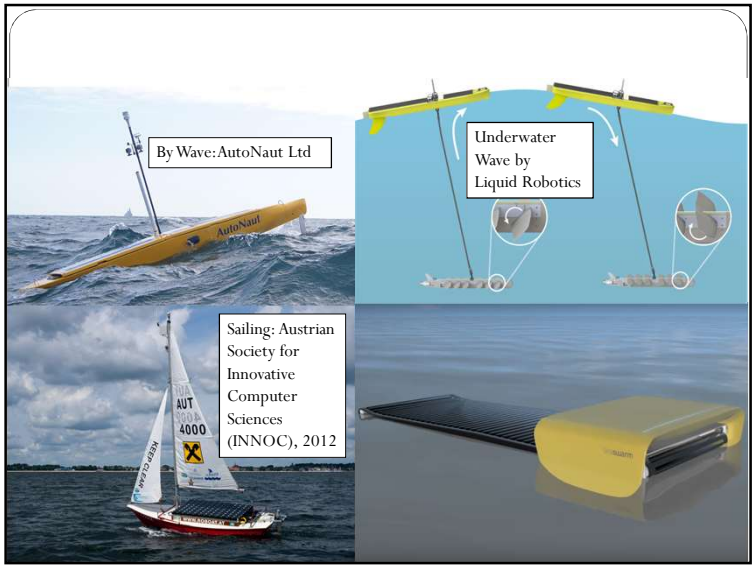
i. **Hull Design**
ii. Propulsion System
iii. Navigation System & Control
iv. Data Collection
v. Data transmission
vi. Power Management

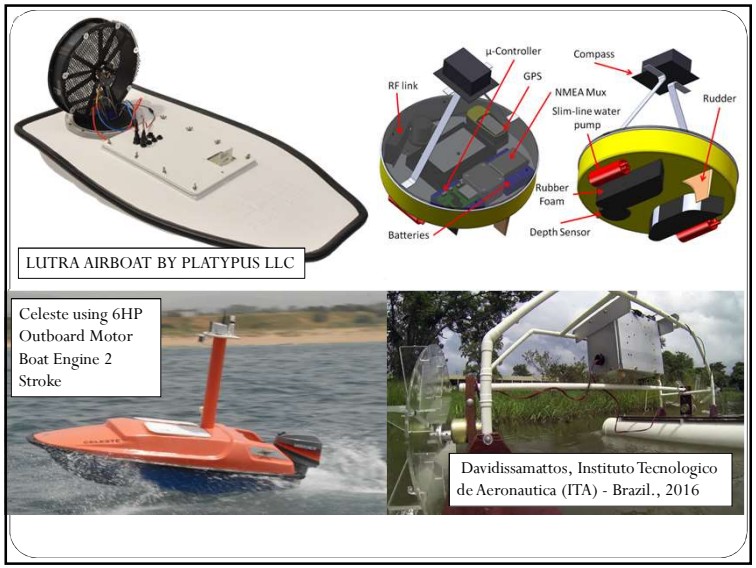
(Portable Size of ASV/USV)

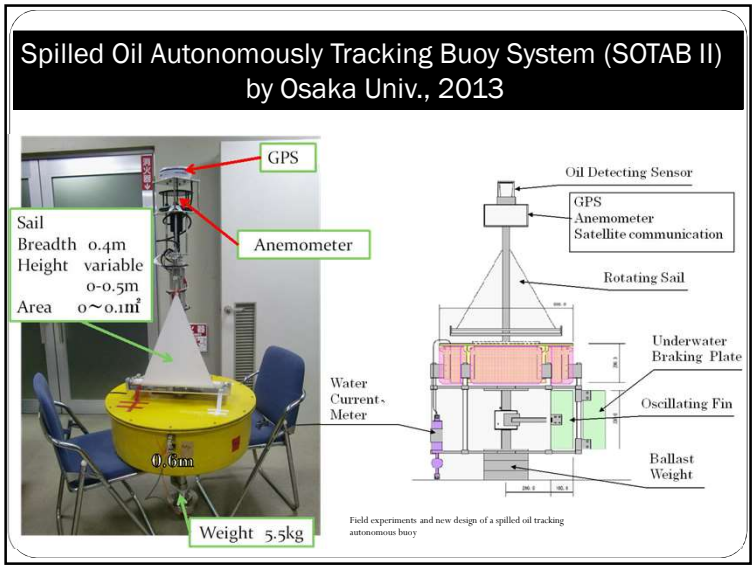
3. Main components of the vehicle

i. ~~Hull Design~~
ii. **Propulsion System**
iii. Navigation System & Control
iv. Data Collection
v. Data transmission
vi. Power Management



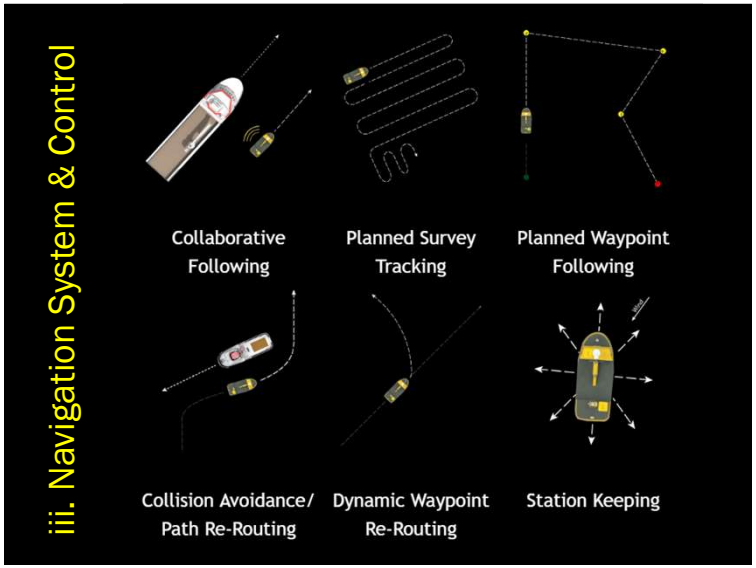




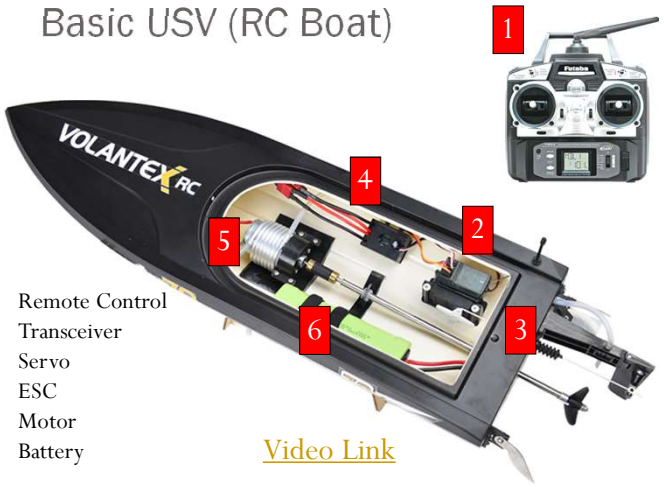


3. Main components of the vehicle

- ~~i. Hull Design~~
- ~~ii. Propulsion System~~
- **iii. Navigation System & Control**
- iv. Data Collection
- v. Data transmission
- vi. Power Management



Basic USV (RC Boat)



1. Remote Control
2. Transceiver
3. Servo
4. ESC
5. Motor
6. Battery

Video Link

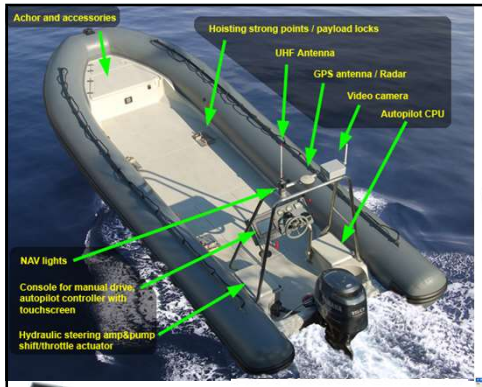
ASV

The Hardware List for the POCV:

- Battery Pack: Six 5000mAH 1.2 Volt NiMH SubC cells.
- Hull: Models By Design Cygnus DS25.
- Power Regulation: Flytron 3.3v & 5v Tiny Regulators.
- Ancillaries: Adafruit 16-Channel 12-bit PWM/Servo Driver - i²c interface - PCA9685.
- Rudder: JR NES-505 Servo.
- Electronic Speed Controller: Mtronics MicroViper Marine10.
- Motor: MFA 919D 540 Motor With Attached Single Ratio Metal Gearbox 2.5:1.
- Propulsion: Raboesch Brass 4 Bladed Kort Propeller RH A-Type Blades (40mm Diameter M4 Thread).
- Propshaft: Raboesch Waterproof Propshaft (186mm M4 Thread).
- **Command & Control: Raspberry Pi.**
- **Compass: CMPS10 - Tilt Compensated Compass Module.**
- **GPS: Navigatron v2 - i²c GPS.**
- **Webcam: Kinobo 5 Megapixel USB Webcam .**
- **Wifi: TP-Link TL-WN722NC**
- **USB Wifi Dongle .**
- **Satellite Comms: RockBLOCK Two-Way Satellite Communicator.**

- **Underwater Sensors & Probes.....**

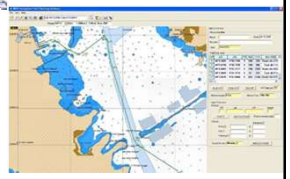
http://www.bluebird-electric.net/artificial_intelligence_autonomous_robotics/fishpi_raspberry_pi_computer_autonomous_boat_marine_unmanned_surface_vessel_proof_of_concept.htm

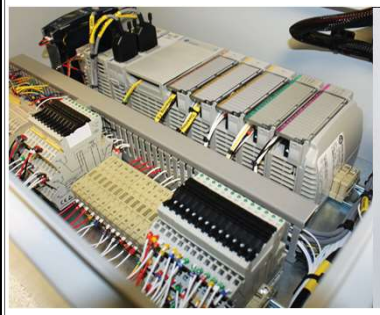


The Operator Control Station (OCS)
The Central Monitoring System (CMS)

Drive console

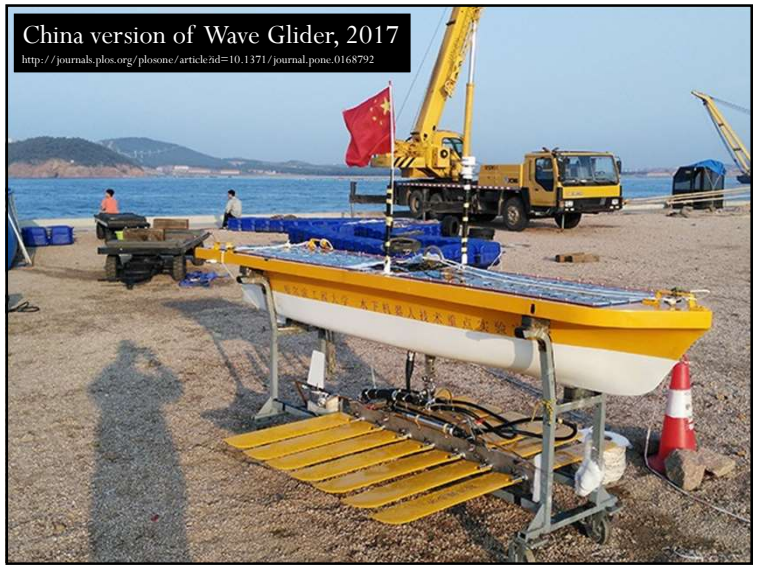
Autopilot control unit (ACU)

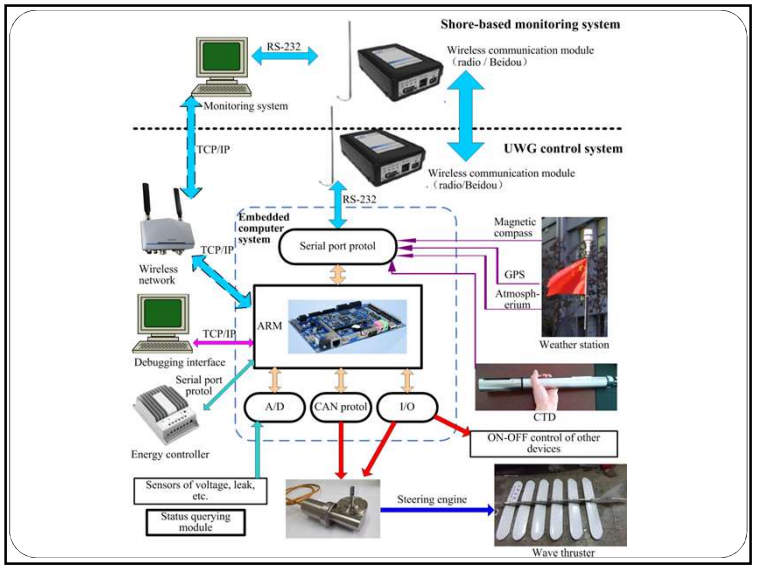


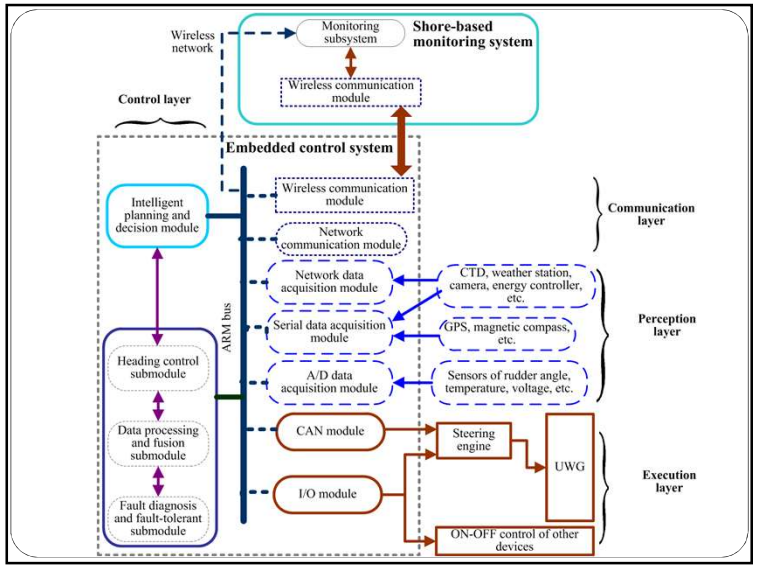


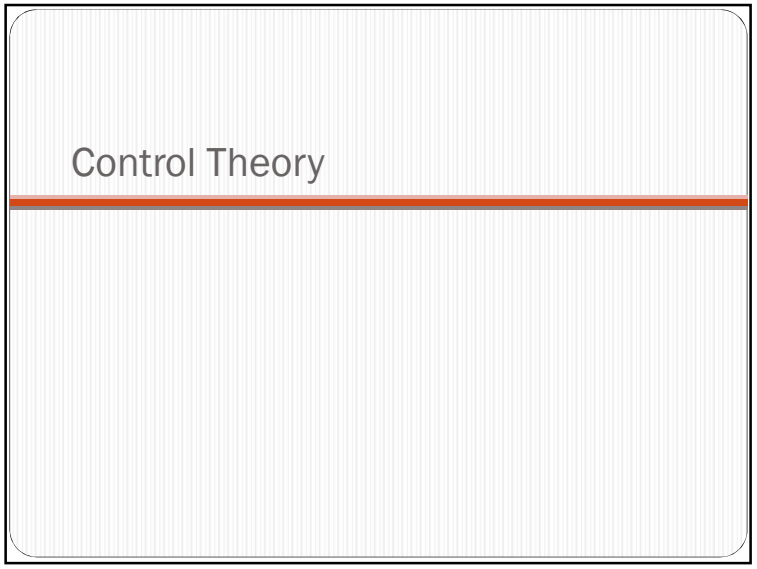
ASView-Core by ASV Global, UK

AutoNav™ Control System
by Seafloor System Inc.

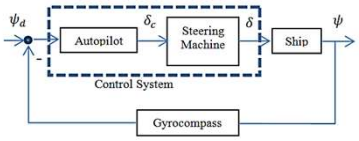

China version of Wave Glider, 2017
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0168792

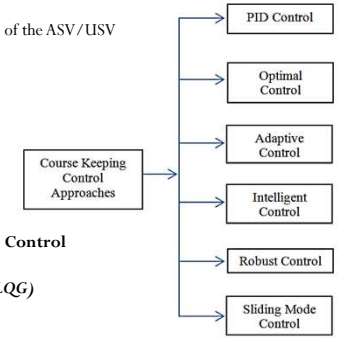

Shore-based monitoring system
RS-232
Wireless communication module (radio / Beidou)
Monitoring system
TCP/IP
UWG control system
Wireless communication module (radio/Beidou)
RS-232
Embedded computer system
Serial port protol
Magnetic compass
GPS
Atmosph-erium
Weather station
TCP/IP
Wireless network
ARM
TCP/IP
Debugging interface
Serial port protol
A/D
CAN protol
I/O
CTD
ON-OFF control of other devices
Energy controller
Sensors of voltage, leak, etc.
Status querying module
Steering engine
Wave thruster


Wireless network
Monitoring subsystem
Shore-based monitoring system
Wireless communication module
Control layer
Embedded control system
Intelligent planning and decision module
Wireless communication module
Network communication module
Communication layer
Network data acquisition module
CTD, weather station, camera, energy controller, etc.
Serial data acquisition module
GPS, magnetic compass, etc.
Perception layer
A/D data acquisition module
Sensors of rudder angle, temperature, voltage, etc.
ARM bus
Heading control submodule
Data processing and fusion submodule
Fault diagnosis and fault-tolerant submodule
CAN module
Steering engine
UWG
I/O module
Execution layer
ON-OFF control of other devices


Control Theory

Course keeping control system for automatic heading of the ASV/USV

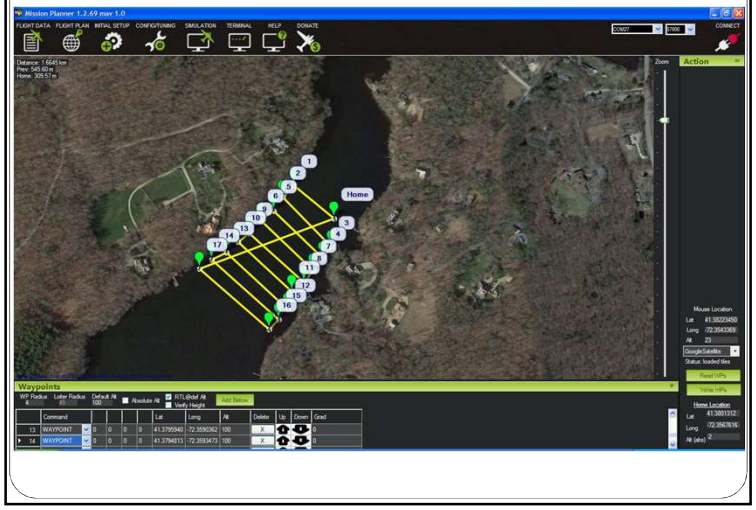


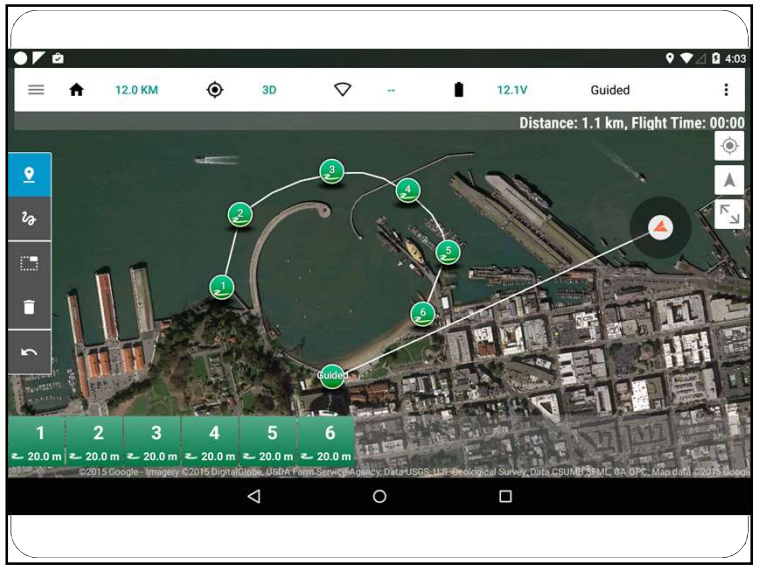


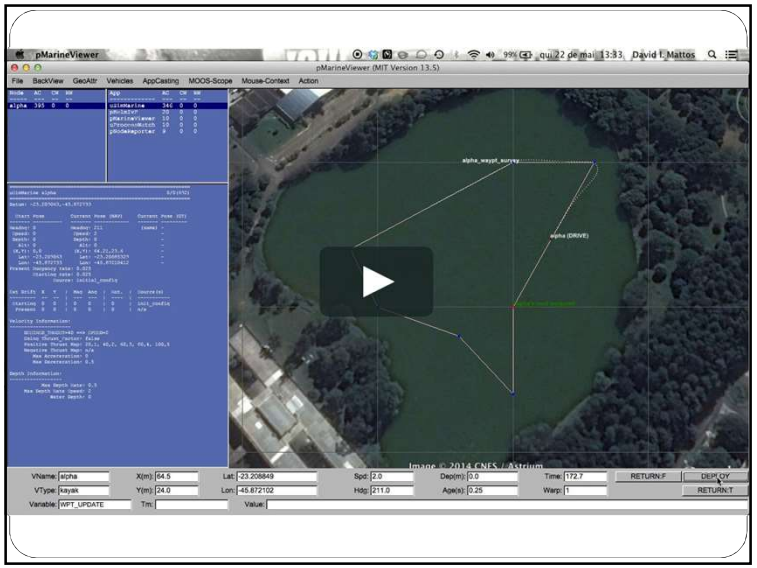
1. **Classical Control Methods Based on PID Control**
2. **Optimal Control Methods**
   1. ***Linear-Quadratic-Gaussian Control (LQG)***
   2. ***Model Predictive Control (MPC)***
3. ***Model Predictive Control (MPC)***
   1. ***Adaptive Control Based On Back stepping Control Design***
   2. ***Adaptive Control Based on Gain Scheduling***
4. **Intelligent Control**
   1. ***Genetic Algorithms , Neural Networks , Fuzzy Logic***
   2. ***Others***
5. **Robust Control**
6. **Sliding Mode Control**

M. N. Azzeria , 2015

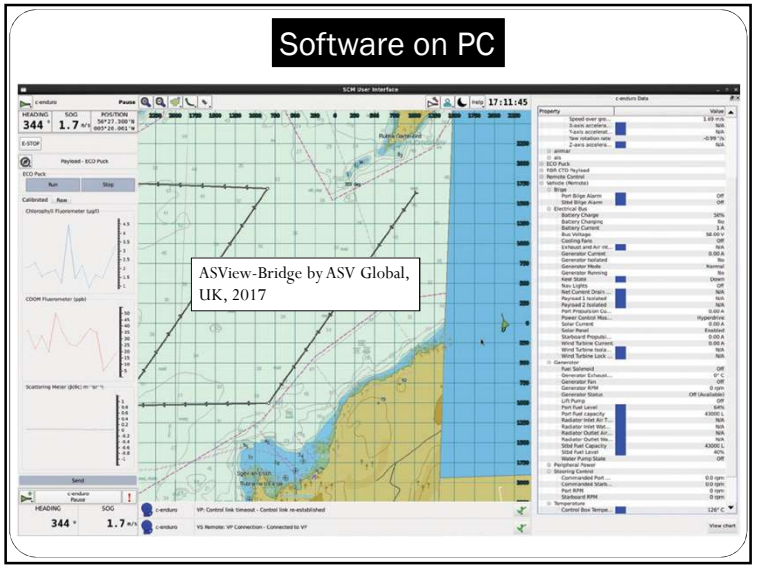
Navigation Software

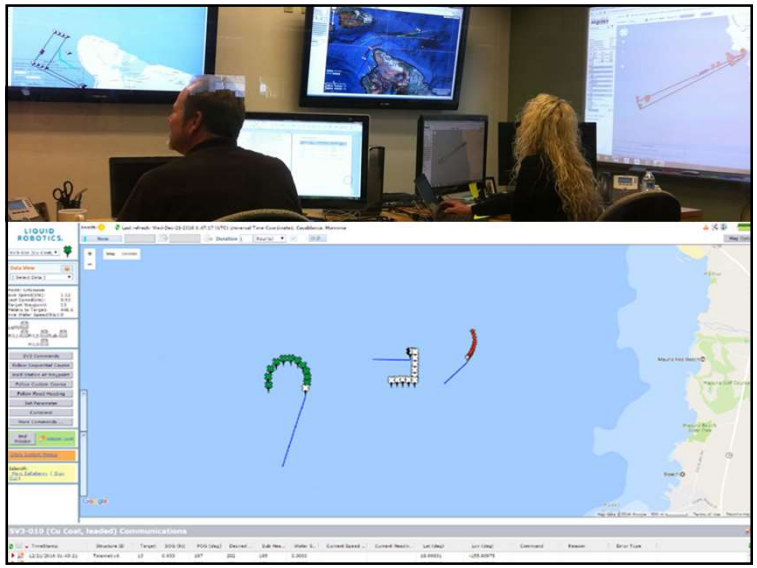


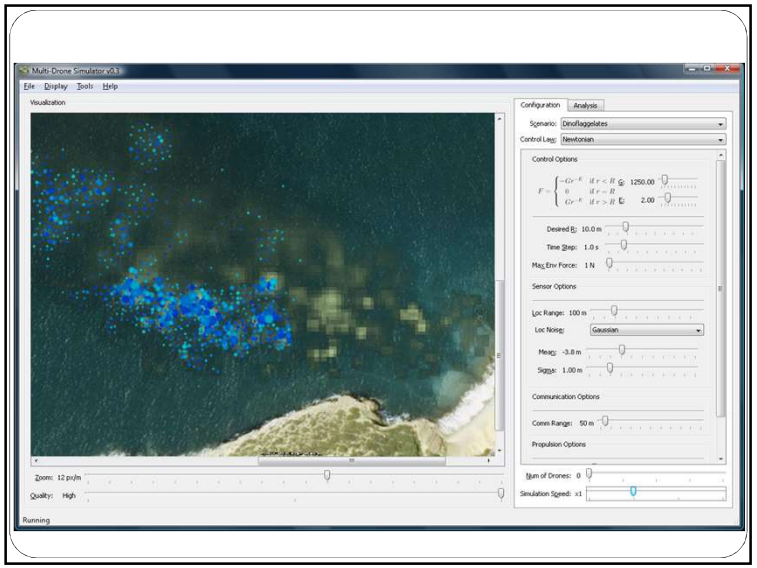

12.0 KM
3D
12.1V
Guided
Distance: 1.1 km, Flight Time: 00:00
1
2
3
4
5
6
20.0 m
©2015 Google - Imagery ©2015 DigitalGlobe, USDA Farm Service Agency, Data USGS, U.S. Geological Survey, Data CSUMB SFML, GA OPC, Map data ©2015 Google


pMarineViewer
pMarineViewer (MIT Version 13.5)
David L Mattos


MOOS-ivP Documentation
moos-ivp.org Documentation 2.680 LAMSS PavLab Edit
IvP Helm | Utils | Labs | Help
2.680 Labs
01 Machine Setup
02 Intro to C++
03 Intro to MOOS
04 MOOS Programming
04X MOOS Progr. Hints
05 Ocean Environment
06 Helm Autonomy
07 Multi-Vehicle Simulation
08 Distributed Simulation
09 Inter-Vehicle Messaging
10 Hazard Search Part I
11 Acoustic Comms
13 Hazard Search Part II
14 Payload Autonomy Part I
15 Payload Autonomy Part II
16 Behavior Writing
17 Front Estimation
18 In-Water Front Estimate
Ten Short C++ Labs
01 C++ Program Structure
02 C++ Cmd Line Args
03 C++ Functions
04 C++ I/O and Vectors
05 C++ Classes, Random #'s
06 C++ Deserialization
07 C++ Build Systems
08 C++ Inheritance
09 C++ TBD Lab
10 C++ TBD Lab
Coding Guidelines
01 C++ Coding Guidlines
02 C++ STyle Guidelines
Lab 14 - Introduction to the PABLO Payload Autonomy Computer
April, 2015
Alon Yaari, ayaari@mit.edu
Michael Benjamin, mikerb@mit.edu
Henrik Schmidt, henrik@mit.edu


Software on PC
ASView-Bridge by ASV Global, UK, 2017





3. Main components of the vehicle

i. ~~Hull Design~~
ii. ~~Propulsion System~~
iii. ~~Navigation System~~
iv. **Data Collection & Control**
v. Data transmission
vi. Power Management

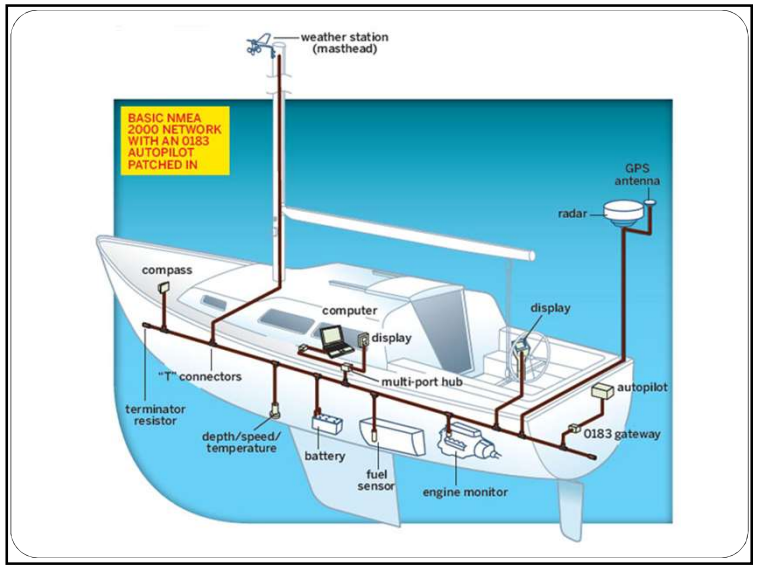
iv. Data Collections

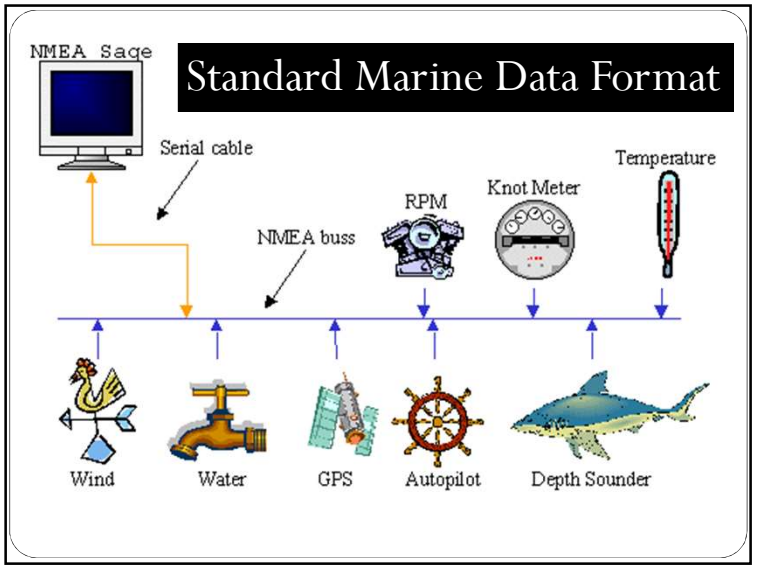
Top

- GPS
- Wind Speed/Direction
- Air Temperature
- Humidity
- Air Pressure
- IMU
- Compass
- Camera

Bottom

- Depth sensor
  - Single
  - Multi-beam
- ADCP
- Sonde (Multiparameter)
- Smart Hydrophone
- Wave height/direction
- Water sampler
- Camera





Comparing NMEA 2000® and NMEA 0183 Sentences

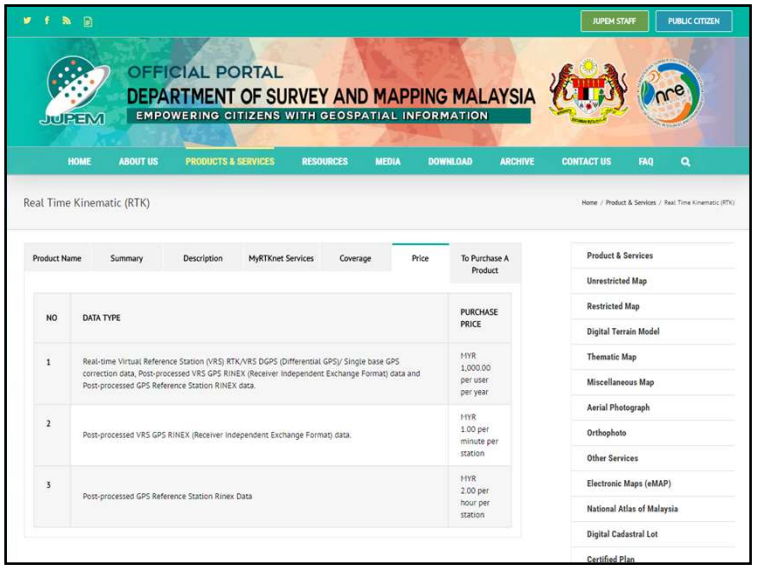
	NMEA 2000	NMEA 0183
65280	Heave (Proprietary PGN)	PFEC, GPhve
126992	System Time	RMC, **ZDA**
127245	Rudder	RSA
127250	Vessel Heading129540	HDG, HDM, HDT, RMA, **RMC**, VHW PFEC, GPatt
127251	Rate of Turn	ROT
127257	Attitude	PFEC, GPatt
127258	Magnetic Variation	HDG, RMA, **RMC**
128259	Speed, Water referenced	RMA, **RMC**, VHW, **VTG**
128267	Water Depth	DBT DPT
129025	Position, Rapid Update	GGA, **GLL**, GNS, RMA, **RMC**
129026	COG & SOG, Rapid Update	RMA, RMC, **VTG**
129029	GNSS Position Data	GGA, **GLL**, GNS, RMA
129033	Time & Date	RMC, **ZDA**
129283	Cross Track Error	**APB, RMB, XTE**
129284	Navigation Data	**APB, RMB**, WPL, ZTG
130306	Wind Data	MDA, **MWV**, VWR, VWT
130310	Environmental Parameters	MDA, **MTW**
130311		
129540	GNSS Sats in view	**GSV**
129285	Navigation-Route/WP information	**APB, RMB**, WPL, ZTG
130577	Direction Data	RMA, **RMC**, VHW, **VTG**

Bold: PGNs and sentences whose settings are active at the default setting

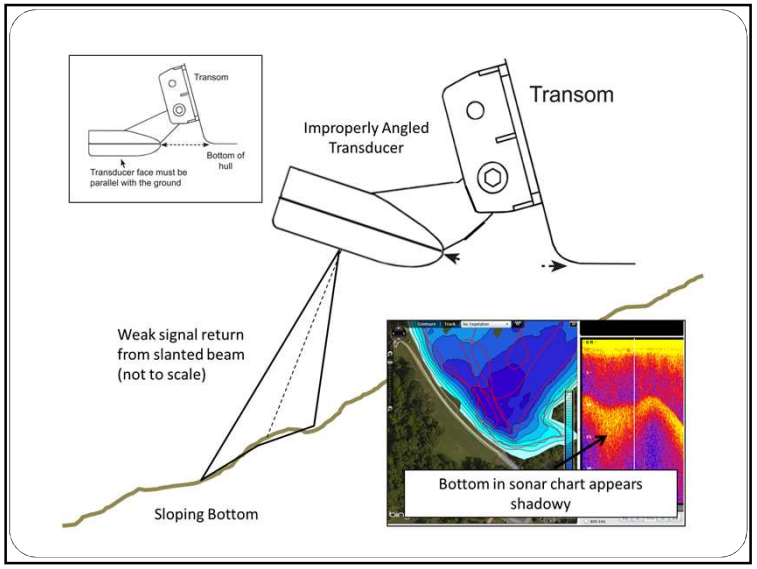
$GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47

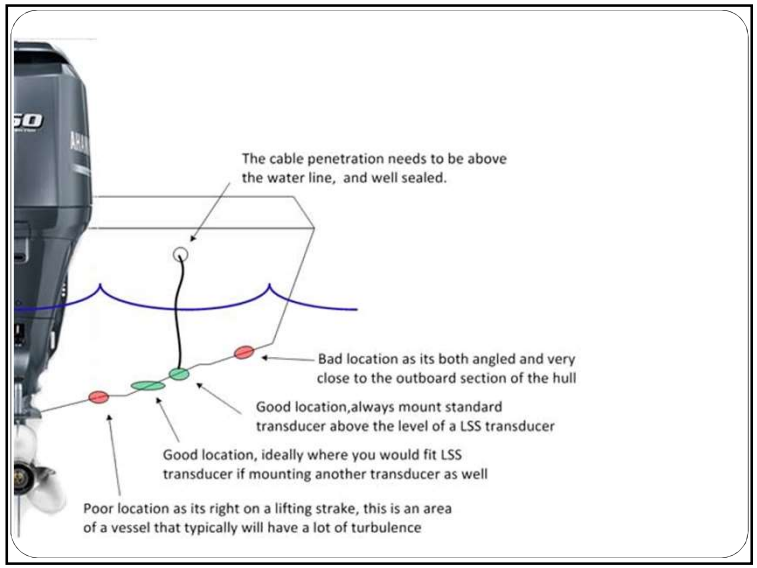
Where:

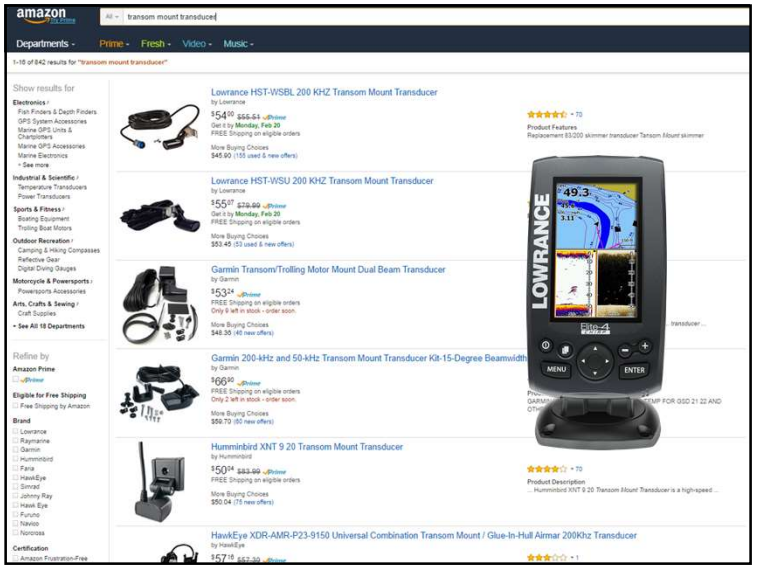
GGA Global Positioning System Fix Data
123519 Fix taken at 12:35:19 UTC
4807.038,N Latitude 48 deg 07.038' N
01131.000,E Longitude 11 deg 31.000' E
1 Fix quality: 0 = invalid
1 = GPS fix (SPS)
2 = DGPS fix
3 = PPS fix
4 = Real Time Kinematic
5 = Float RTK
6 = estimated (dead reckoning) (2.3 feature)
7 = Manual input mode
8 = Simulation mode
08 Number of satellites being tracked
0.9 Horizontal dilution of position
545.4,M Altitude, Meters, above mean sea level
46.9,M Height of geoid (mean sea level) above WGS84 ellipsoid
(empty field) time in seconds since last DGPS update
(empty field) DGPS station ID number
*47 the checksum data, always begins with *

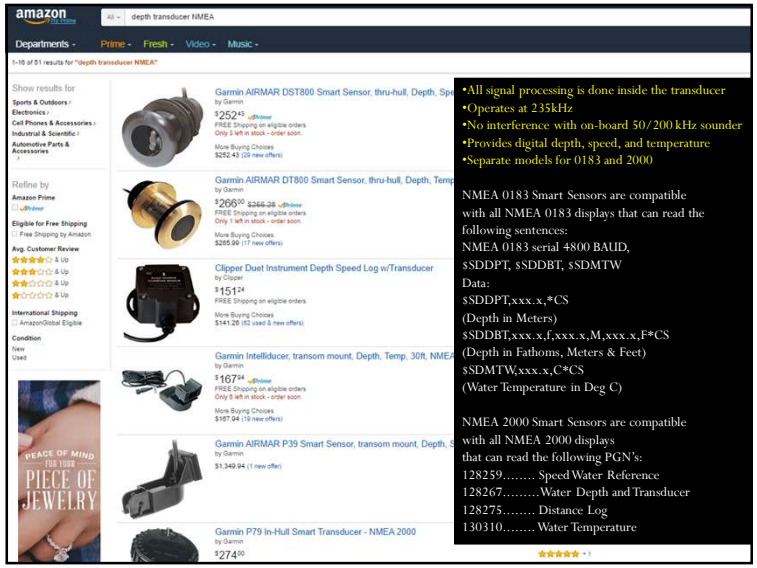

JUPEM STAFF
PUBLIC CITIZEN
OFFICIAL PORTAL
DEPARTMENT OF SURVEY AND MAPPING MALAYSIA
EMPOWERING CITIZENS WITH GEOSPATIAL INFORMATION
HOME
ABOUT US
PRODUCTS & SERVICES
RESOURCES
MEDIA
DOWNLOAD
ARCHIVE
CONTACT US
FAQ
Real Time Kinematic (RTK)
Product Name
Summary
Description
MyRTKnet Services
Coverage
Price
To Purchase A Product
NO
DATA TYPE
PURCHASE PRICE
1
Real-time Virtual Reference Station (VRS) RTK/VRS DGPS (Differential GPS)/ Single base GPS correction data, Post-processed VRS GPS RINEX (Receiver Independent Exchange Format) data and Post-processed GPS Reference Station RINEX data.
MYR 1,000.00 per user per year
2
Post-processed VRS GPS RINEX (Receiver Independent Exchange Format) data.
MYR 1.00 per minute per station
3
Post-processed GPS Reference Station Rinex Data
MYR 2.00 per hour per station
Product & Services
Unrestricted Map
Restricted Map
Digital Terrain Model
Thematic Map
Miscellaneous Map
Aerial Photograph
Orthophoto
Other Services
Electronic Maps (eMAP)
National Atlas of Malaysia
Digital Cadastral Lot
Certified Plan


Garmin Transducers
GMN-0101010700
Thru-hull Mount, bronze, depth
GMN-0101011900
Thru-hull Mount, plastic, depth
GMN-0101018301
Thru-hull Mount, bronze, depth, temperature, speed
GMN-0101019201
Transom Mount, plastic, depth, temperature, speed
GMN-0101019301
Thru-hull Mount/Long Stem, bronze, depth, temperature, speed
GMN-0101024900
Transom Trolling Mount, plastic, depth, temperature
GMN-0101032700
In-hull Mount, plastic

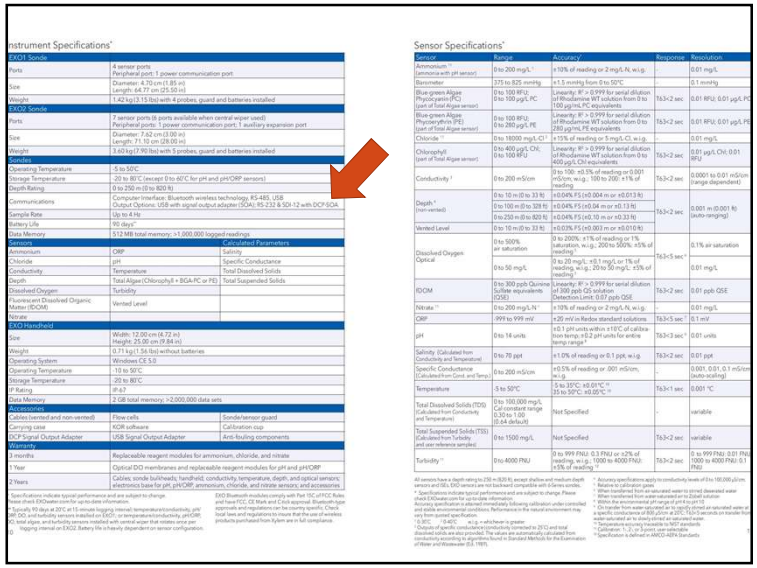

Transom
Bottom of hull
Transducer face must be parallel with the ground
Improperly Angled Transducer
Transom
Weak signal return from slanted beam (not to scale)
Bottom in sonar chart appears shadowy
Sloping Bottom


The cable penetration needs to be above
the water line, and well sealed.
Bad location as its both angled and very
close to the outboard section of the hull
Good location,always mount standard
transducer above the level of a LSS transducer
Good location, ideally where you would fit LSS
transducer if mounting another transducer as well
Poor location as its right on a lifting strake, this is an area
of a vessel that typically will have a lot of turbulence


amazon
transom mount transducer
Departments
Prime
Fresh
Video
Music
Lowrance HST-WSBL 200 KHZ Transom Mount Transducer
Lowrance HST-WSU 200 KHZ Transom Mount Transducer
Garmin Transom/Trolling Motor Mount Dual Beam Transducer
Garmin 200-kHz and 50-kHz Transom Mount Transducer Kit-15-Degree Beamwidth
Humminbird XNT 9 20 Transom Mount Transducer
HawkEye XDR-AMR-P23-9150 Universal Combination Transom Mount / Glue-In-Hull Airmar 200Khz Transducer
LOWRANCE
MENU
ENTER


amazon
depth transducer NMEA
Departments
Prime
Fresh
Video
Music
Garmin AIRMAR DST800 Smart Sensor, thru-hull, Depth,
Garmin AIRMAR DT800 Smart Sensor, thru-hull, Depth,
Clipper Duet Instrument Depth Speed Log w/Transducer
Garmin Intelliducer, transom mount, Depth, Temp, 30ft, NMEA
Garmin AIRMAR P39 Smart Sensor, transom mount, Depth,
Garmin P79 In-Hull Smart Transducer - NMEA 2000
PEACE OF MIND FOR YOUR PIECE OF JEWELRY
•All signal processing is done inside the transducer
•Operates at 235kHz
•No interference with on-board 50/200 kHz sounder
•Provides digital depth, speed, and temperature
•Separate models for 0183 and 2000
NMEA 0183 Smart Sensors are compatible
with all NMEA 0183 displays that can read the
following sentences:
NMEA 0183 serial 4800 BAUD,
$SDDPT, $SDDBT, $SDMTW
Data:
$SDDPT,xxx.x,*CS
(Depth in Meters)
$SDDBT,xxx.x,f,xxx.x,M,xxx.x,F*CS
(Depth in Fathoms, Meters & Feet)
$SDMTW,xxx.x,C*CS
(Water Temperature in Deg C)
NMEA 2000 Smart Sensors are compatible
with all NMEA 2000 displays
that can read the following PGN's:
128259..... Speed Water Reference
128267..... Water Depth and Transducer
128275..... Distance Log
130310..... Water Temperature


REAL TIME MAPPING (ONSHORE GPS MODE)
deeper pro+
WI-FI
330ft/100m
260ft/80m
15X/5
GPS
SCAN AREA
100m
330ft



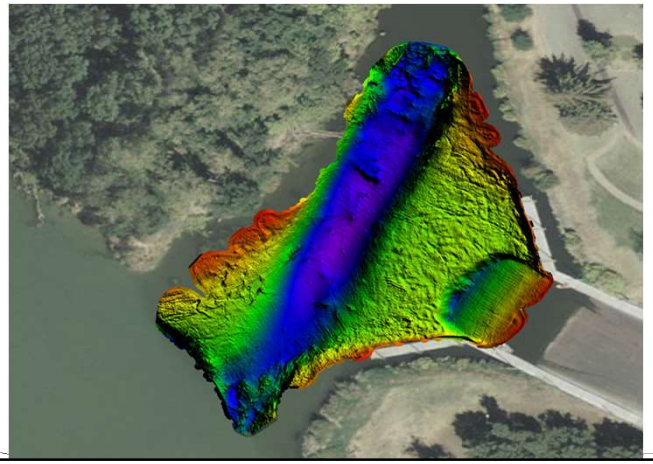
Automated Water Sampler & Heron USV

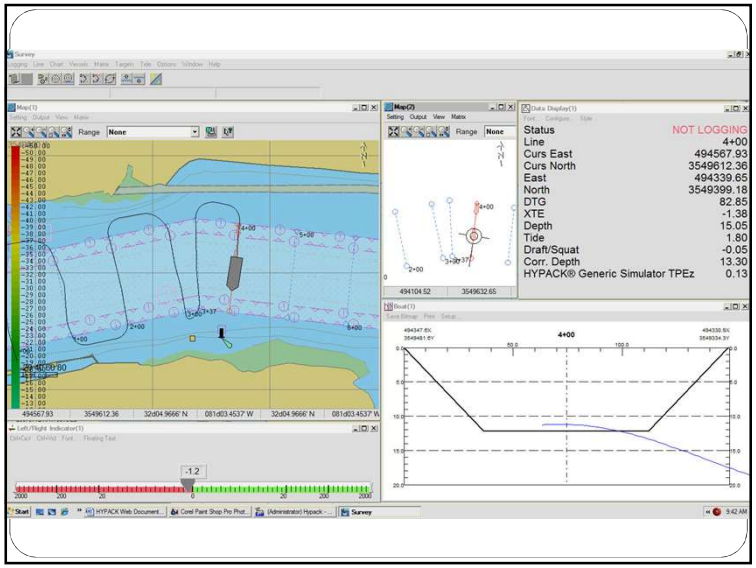
Video Link

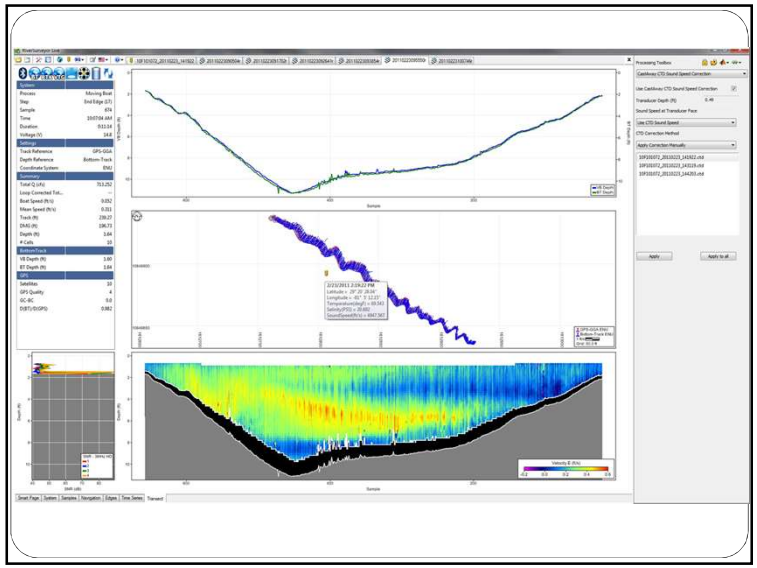
http://www.kc-denmark.dk/products.aspx

Software for Data Collection

Post processing Software: HYPACK, POS2000, QINSY







3. Main components of the vehicle

i. ~~Hull Design~~
ii. ~~Propulsion System~~
iii. ~~Navigation System & Control~~
iv. ~~Data Collection~~
v. **Data transmission**
vi. Power Management

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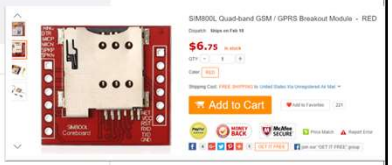

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Features and Benefits

- Quad-band GSM/GPRS 850/900/1800/1900 MHz
- DIN-rail housing and wall-mounting housing
- 2.5 kV RMS isolation for 1 min. for all serial signals (G2151I only)
- LED indicators for GSM/GPRS and data transmission status
- Extended operating temperature from -25 to 70°C (G2111-T only)

Introduction

The OnCell G2111/G2151I series of industrial quad-band GSM/GPRS modems are designed to transmit data and short messages (SMS) over GSM/GPRS mobile networks. The modems can be used to increase the efficiency of maintenance and communication, but do not require extensive training. In addition, the modems can be mounted on a DIN rail or wall. The OnCell G212111/G2151I series modems accept a 12 to 48 VDC power input, making them suitable for use with a variety of field power sources. The serial ports feature 15 kV ESD line protection to protect the products from harmful electrical discharge, and separate RS-232 and RS-422/485 interfaces are built into the OnCell G2151I, each with 2.5 kV RMS isolation protection for one minute. The two serial interfaces on the OnCell G2151I make it ideal for attaching all kinds of devices, such as stand-alone controllers, PC COM ports, and multi-dropped electric meters. In addition, the OnCell G2111-T has an extended operating temperature (-25 to 70°C) design that makes it suitable for heavy industrial use.

Long Range Bluetooth Module™ with chip antenna and iWrap 5.0 firmware

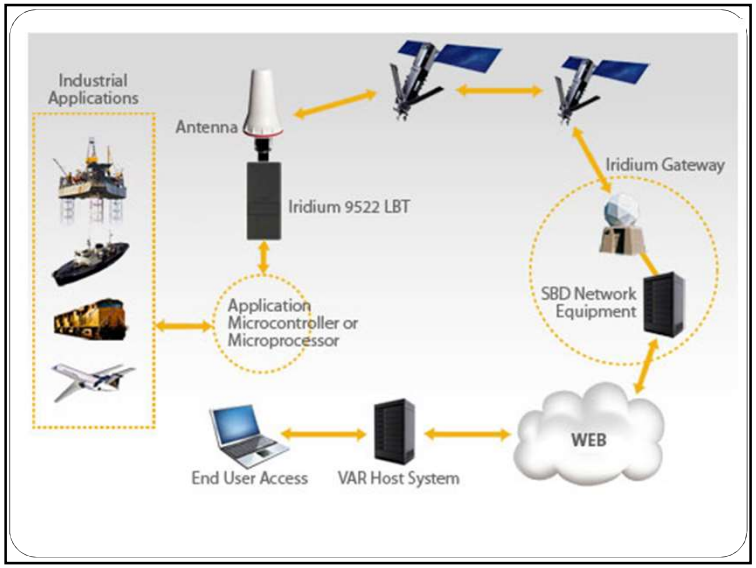
USD23.00

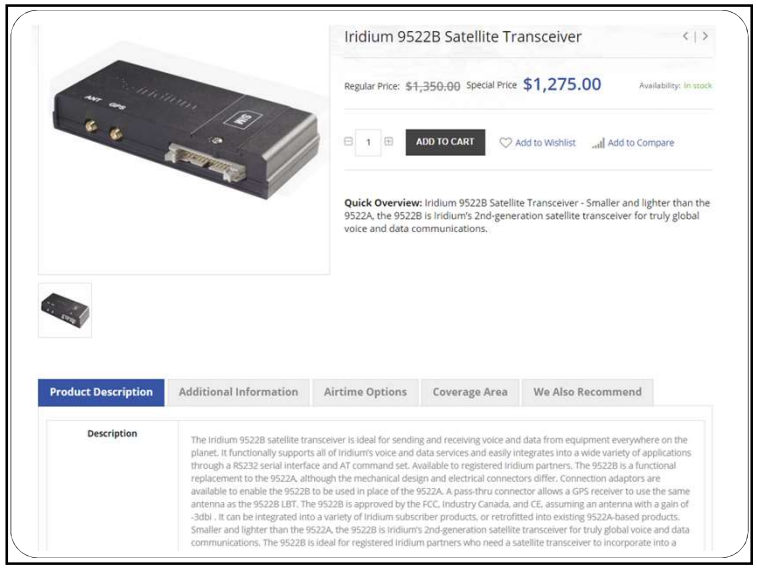
Manufacturer:	Silicon Labs
MFG Part #:	WT41-A-AI5
Part #:	WT41-A-AI5
Family:	Bluegiga
Availability:	In Stock
RoHS Status:	Green
End Of Life:	3/23/2016

Product Information | Features | Documents

Product Information

WT41-A-A14 by Bluegiga is truly a long range Bluetooth module offering impressive 1000 meters range between two WT41 Bluetooth modules. The WT41-A-A14 module utilizes Bluegiga's sophisticated radio frequency design methodologies and offers OEM's a trouble free product even with tight integration with surrounding electronics. WT41-A-A14 comes with Bluegiga's iWRAP firmware offering the users a simple software integration without the need of Bluetooth protocol or profile development. iWRAP is an embedded Bluetooth stack firmware. iWRAP exposes a powerful but easy-to-use command interface to manage Bluetooth operations. iWRAP hides the complexity of Bluetooth protocol stack and profiles from the end user.




Iridium 9522B Satellite Transceiver
Regular Price: $1,350.00 Special Price $1,275.00
Availability: In stock
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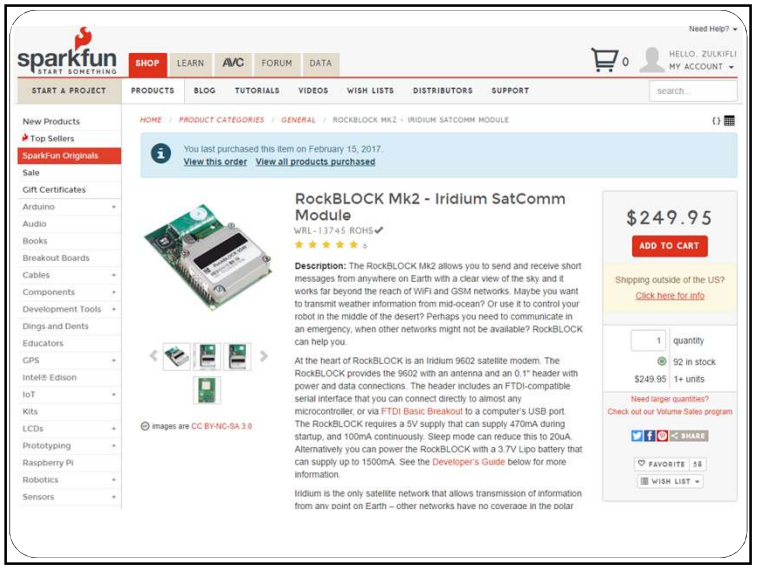
Quick Overview: Iridium 9522B Satellite Transceiver - Smaller and lighter than the 9522A, the 9522B is Iridium's 2nd-generation satellite transceiver for truly global voice and data communications.
Product Description
Additional Information
Airtime Options
Coverage Area
We Also Recommend
Description
The Iridium 9522B satellite transceiver is ideal for sending and receiving voice and data from equipment everywhere on the planet. It functionally supports all of Iridium's voice and data services and easily integrates into a wide variety of applications through a RS232 serial interface and AT command set. Available to registered Iridium partners. The 9522B is a functional replacement to the 9522A, although the mechanical design and electrical connectors differ. Connection adaptors are available to enable the 9522B to be used in place of the 9522A. A pass-thru connector allows a GPS receiver to use the same antenna as the 9522B LBT. The 9522B is approved by the FCC, Industry Canada, and CE, assuming an antenna with a gain of -3dbi . It can be integrated into a variety of Iridium subscriber products, or retrofitted into existing 9522A-based products. Smaller and lighter than the 9522A, the 9522B is Iridium's 2nd-generation satellite transceiver for truly global voice and data communications. The 9522B is ideal for registered Iridium partners who need a satellite transceiver to incorporate into a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RockBLOCK Mk2 - Iridium SatComm Module
WRL-13745 ROHS
Description: The RockBLOCK Mk2 allows you to send and receive short messages from anywhere on Earth with a clear view of the sky and it works far beyond the reach of WiFi and GSM networks. Maybe you want to transmit weather information from mid-ocean? Or use it to control your robot in the middle of the desert? Perhaps you need to communicate in an emergency, when other networks might not be available? RockBLOCK can help you.
At the heart of RockBLOCK is an Iridium 9602 satellite modem. The RockBLOCK provides the 9602 with an antenna and an 0.1" header with power and data connections. The header includes an FTDI-compatible serial interface that you can connect directly to almost any microcontroller, or via FTDI Basic Breakout to a computer's USB port. The RockBLOCK requires a 5V supply that can supply 470mA during startup, and 100mA continuously. Sleep mode can reduce this to 20uA. Alternatively you can power the RockBLOCK with a 3.7V Lipo battery that can supply up to 1500mA. See the Developer's Guide below for more information.
Iridium is the only satellite network that allows transmission of information from any point on Earth – other networks have no coverage in the polar
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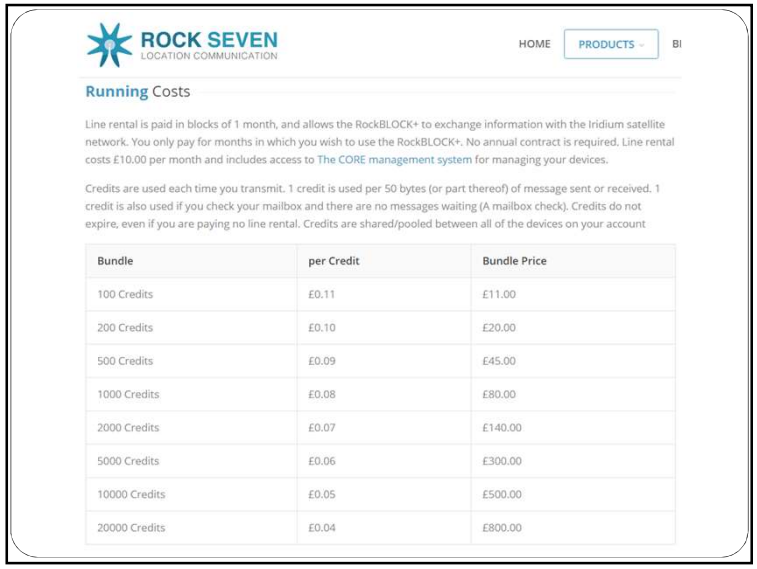
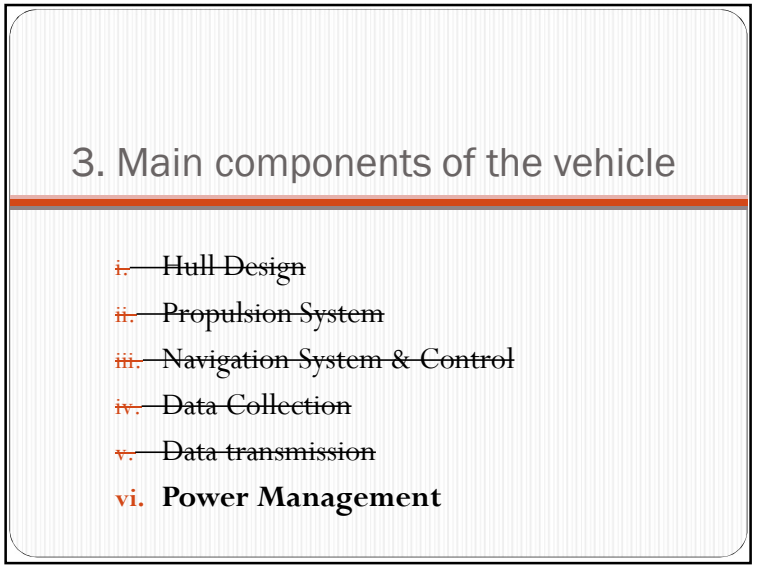

ROCK SEVEN
LOCATION COMMUNICATION
HOME
PRODUCTS
Running Costs
Line rental is paid in blocks of 1 month, and allows the RockBLOCK+ to exchange information with the Iridium satellite network. You only pay for months in which you wish to use the RockBLOCK+. No annual contract is required. Line rental costs £10.00 per month and includes access to The CORE management system for managing your devices.
Credits are used each time you transmit. 1 credit is used per 50 bytes (or part thereof) of message sent or received. 1 credit is also used if you check your mailbox and there are no messages waiting (A mailbox check). Credits do not expire, even if you are paying no line rental. Credits are shared/pooled between all of the devices on your account
Bundle | per Credit | Bundle Price
100 Credits | £0.11 | £11.00
200 Credits | £0.10 | £20.00
500 Credits | £0.09 | £45.00
1000 Credits | £0.08 | £80.00
2000 Credits | £0.07 | £140.00
5000 Credits | £0.06 | £300.00
10000 Credits | £0.05 | £500.00
20000 Credits | £0.04 | £800.00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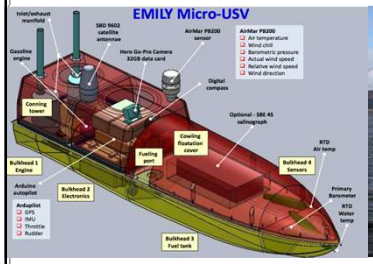
Engin, Battery, Payload, Endurance, Speed



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