

Pressure-Tolerant Sub-Systems for 6 000 m Deep-Sea Applications

Project Goal

Development of concepts for pressure-tolerant electronic and mechatronic systems in deep-sea environments
Project duration: July 2006 - December 2009

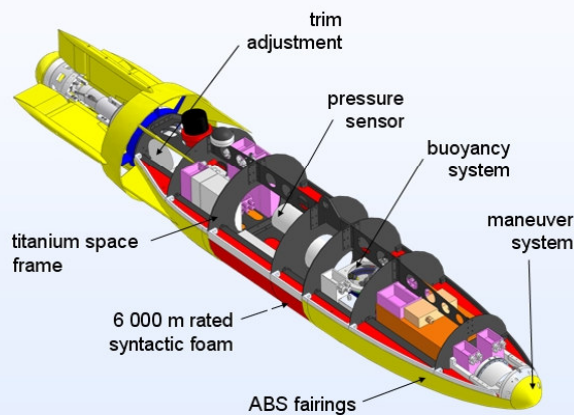
Approach

- novel design approach of a pressure-tolerant autonomous unmanned underwater vehicle (UUV)
- test of pressure-tolerant electr. and mechatr. components
- evaluation of castings for electronic components
- design, pressure tests and long-term sea water tests of pressure-tolerant assemblies

Conclusion

- designated assemblies can go down to almost any diving depth
- pressure-tolerant UUVs exhibit significant advantages like lightweight design and immensely reduced costs
- flexible overall vehicle design with adaptable payload section serves for different tasks

Vessel Design



Technical Data

- diameter 0.55 m
- length 3.1 m
- depth rating 6 000 m
- survey speed 4 kn
- maximum speed 8 kn
- dry weight 300 kg
- power supply 5.2 kWh
- payload 0.6 m

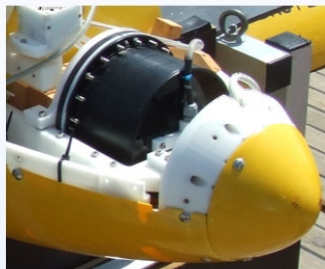
Applications

- ocean exploration and surveying
- sea floor mapping
- inspection of pipeline and cable routes
- explorations for oil and gas industry
- data collection as profiler

Adjustment of Trim Angle

Applications

- adjustment of pitch angle during vehicle dive cruises
- fine tuning of static trim in case of installation of additional devices within vehicle
- balancing in case of change in trim while using manipulators (grapplers)



Characteristics

- pitch adjustment through shifting fluid with a density different from water
- seawater-proof
- operational up to 600 bar ambient pressure
- compensation of disturbances through pitch-control
- 15° attainable pitch in bow and stern direction

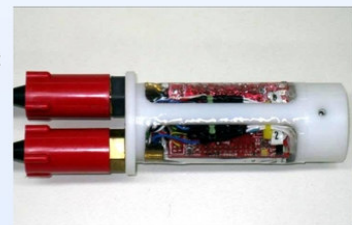
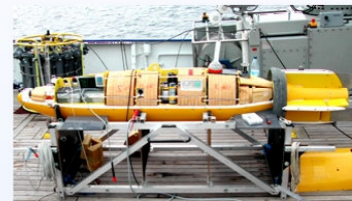
Pressure and Depth Control Sensor

Applications

- measurement of hydrostatic pressure and temperature
- depth control for underwater vehicles

Characteristics

- highly integrated low cost and overall pressure tolerant device
- small dimensions
- range 0 to 6 000 m
- accuracy 0.1 m
- temperature compensated - 10 to 80°C
- integrated microcontroller for pre- and post processing
- adaptable depth calculation algorithm
- communication via RS-232, RS-422 or analogue signals
- PC-Interface



Maneuver System



Applications

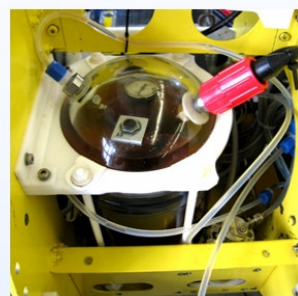
- vehicle turns and sidelong movements
- performance of docking maneuvers at docking stations for data transfer and charging
- maintaining position relative to sea floor despite cross currents

Characteristics

- lateral water jet from two systems at the tips of bow and stern
- seawater-proof and compact design
- 25 N thrust of each system
- water jet nozzle is 360° revolvable around longitudinal vehicle axis
- full 360° vehicle turn in approx. 45 seconds
- negligible contribution to vehicle drag coefficient



Buoyancy System



Applications

- vessel dive assistance through active buoyancy trim
- control of designated depth
- compensation of changes in seawater density
- compensation of additional payload components

Characteristics

- highly efficient modular hydraulic design
- more than 6 000 m operation range
- 700 W total power demand while deployed
- 26 N trim capacity
- expandable in tankage
- fast control response to commands
- fully controllable due to Ethernet TCP/IP
- simple and fast maintenance

