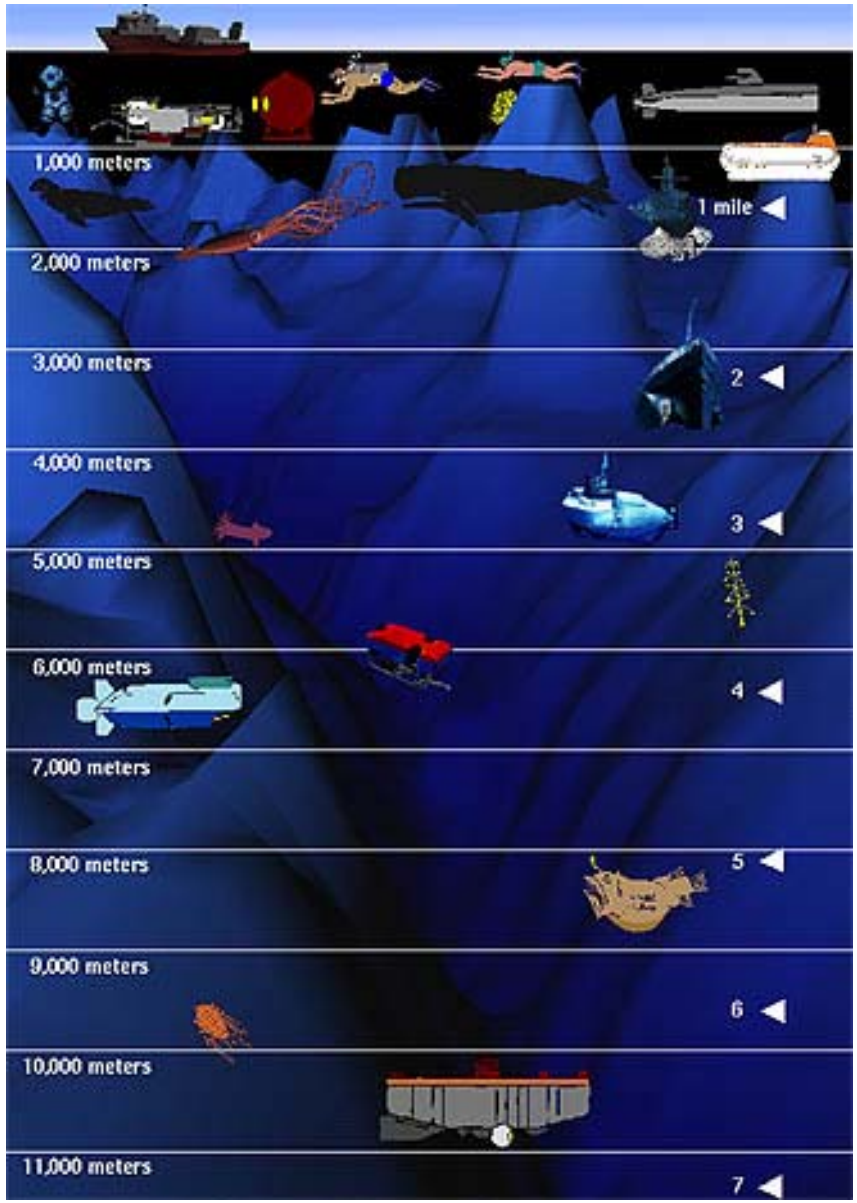
Ocean Platforms

- Lecture I
  - Ships
  - Buoys
  - Satellites
  - Cabled Observatories

- Lecture II
  - Manned Submersibles
  - Remotely Operated Vehicles (ROVs)
  - Autonomous Underwater Vehicles (AUVs)
  - The future….

- How deep do vehicles go?
  - Diving suits
  - Military submarines
  - Research submarines
  - Remotely operated vehicles (ROVs)
  - Autonomous underwater vehicles (AUVs)
- How deep is the ocean?
  - Mean depth ~4,000 m
  - Deepest ~11,000 m
- How tall is Mt. Everest?
  - 8,850 m



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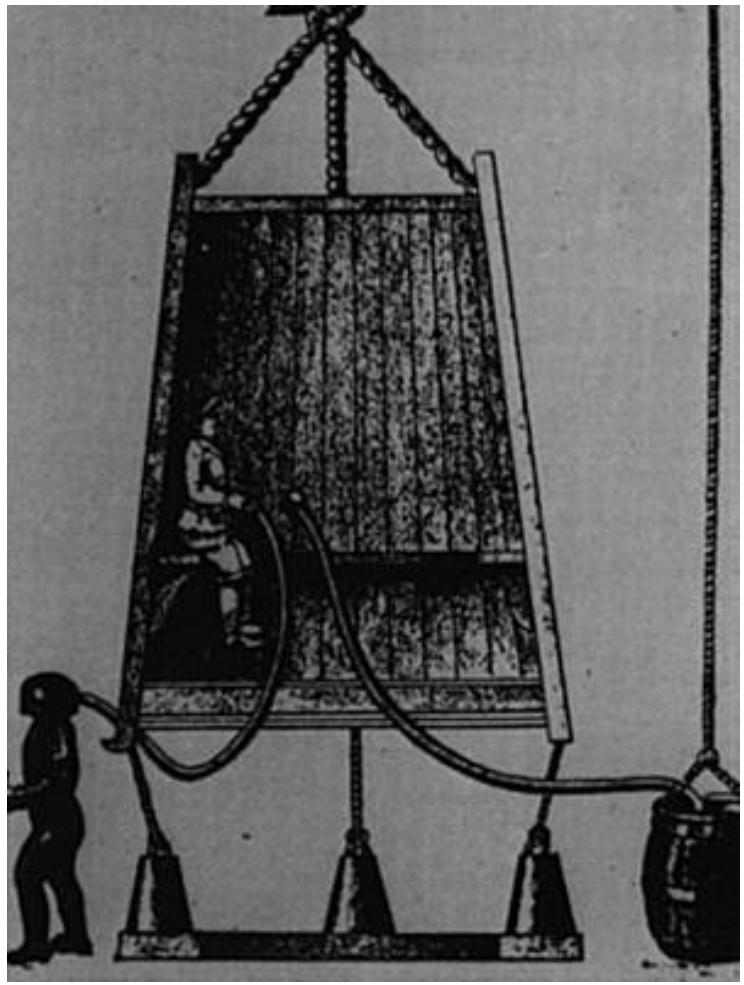
Manned Diving – Diving Bells

- Aristotle wrote about their use in the 4th century BC
- Edmund Halley developed a diving bell in 1690
  - 60 cubic feet
  - Air replenished in weighted casks
  - Used for depths of 20-60 ft



Manned Diving – Diving Suits

- Diving helmet
  - Provides air
  - Doesn't protect from pressure
- Jim suit
  - Rigid suit
  - Capable of 600 m depth
  - Robotic claws used

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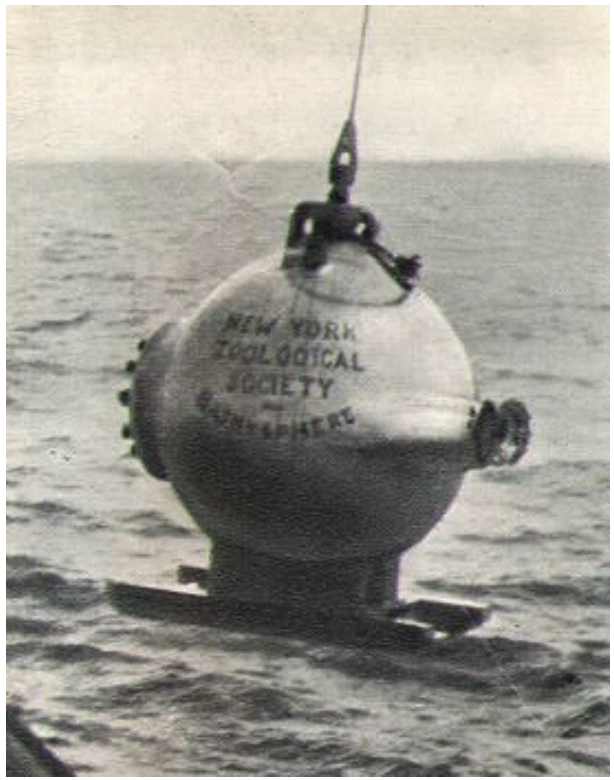
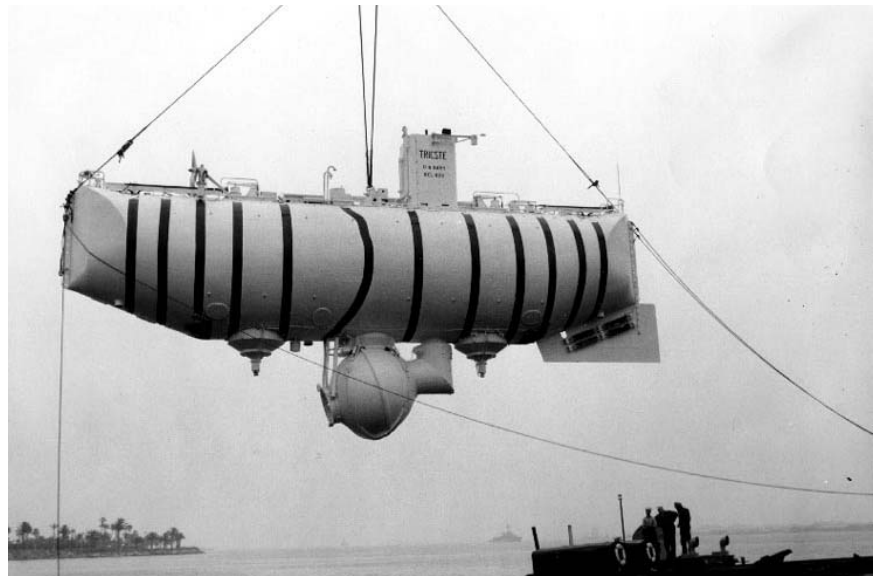
Manned Diving – Bathysphere

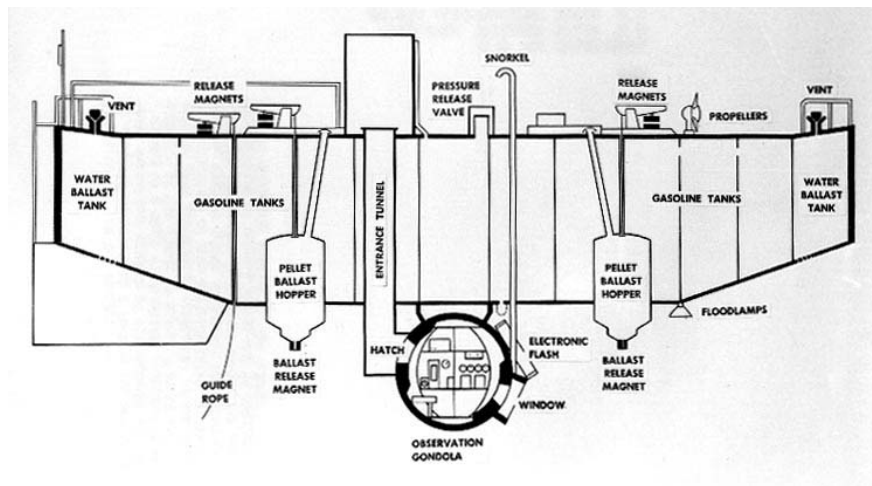
- Personnel sphere on a wire
- Developed in the 1930s
  - William Beebe and Otis Barton



Manned Diving – Bathyscapes

- Trieste
  - 50 ft long
  - Gasoline flotation
  - Water and iron ballast
  - 6 ft diameter steel capsule
    - Held two people
  - Two plexiglass windows
    - 4” inside, 16” outside, 6” thick
  - January 23, 1960
    - Challenger Deep (35,810’, 10,912 m)
    - 16,000 psi





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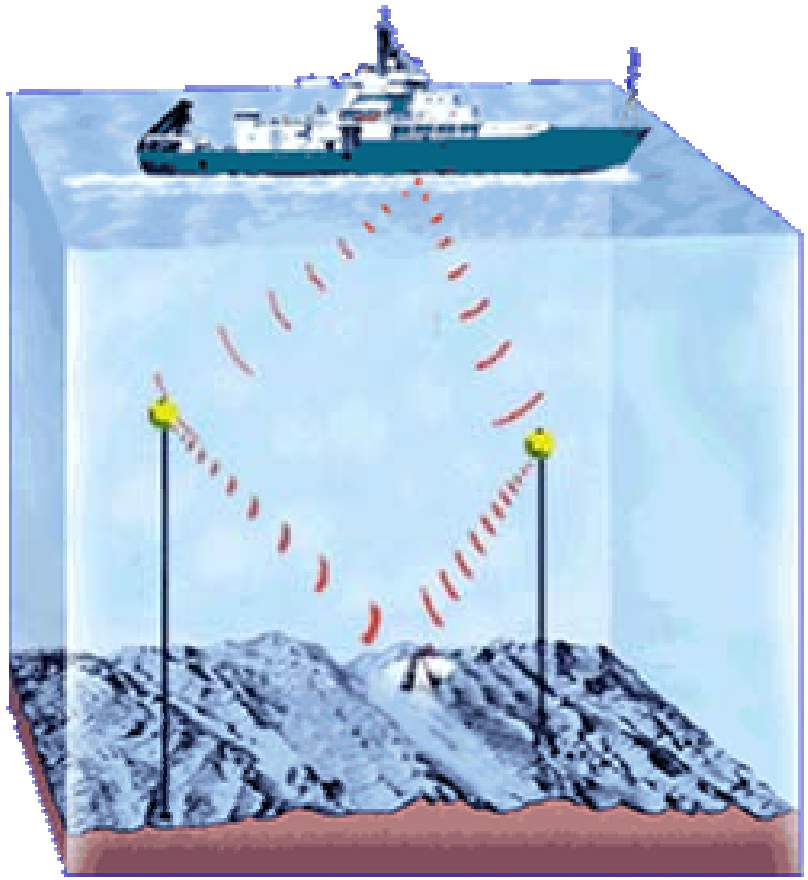
Unmanned Diving – Towed Sleds

- Camera sleds
- Sidescan sonar
- Chemical & biological sensors

Key Issues for deep submergence

- Power/Propulsion
  - Batteries
  - Cable
- Navigation
  - Transponders
  - Real-time Mapping
- Communication
  - Acoustic
  - Cable
    - Copper
    - Fiber



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Manned Submersibles

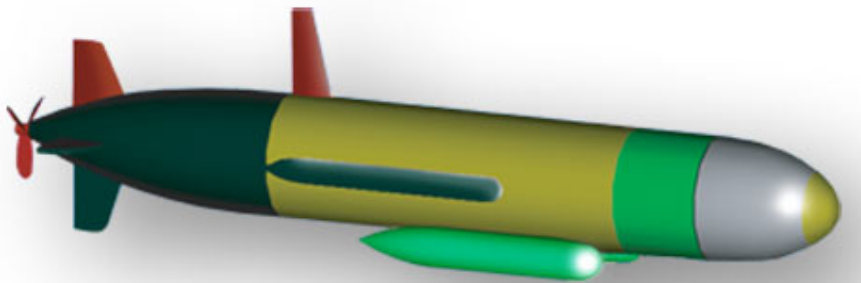
- Capabilities
  - Allow humans to visit the seafloor
  - Good manipulation & sample collecting
- Limitations
  - Dives limited to ~8 hours
  - Power limited by battery life
  - Limited payload
  - Visibility limited for science observers
  - Little contact with the surface — no real-time data transfer
  - Dependent on surface weather conditions

ROVs

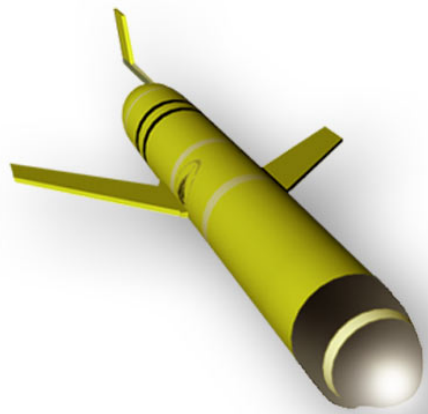
- Capabilities
  - Long dive times
  - Good manipulation
    - Force feedback
  - High-definition video
- Limitations
  - Tether limits movement
  - Dependent on surface weather conditions
  - Limited payload

Autonomous Underwater Vehicles (AUVs)

- Relative small, autonomous deep submergence vehicles that are pre-programed to perform specific tasks



REMUS
(Remote Environmental Monitoring Units)



Glider

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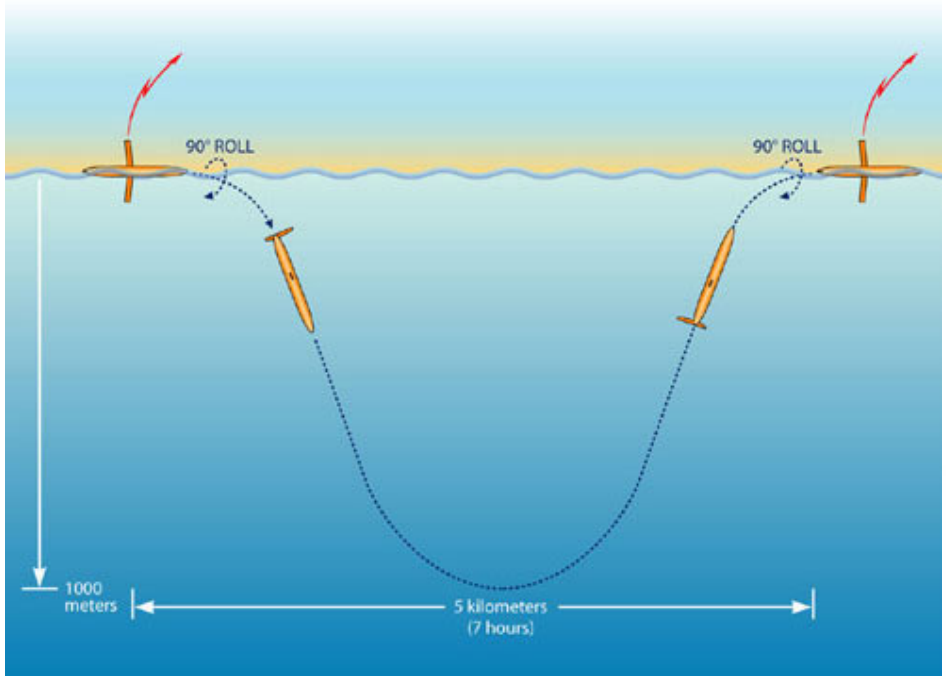
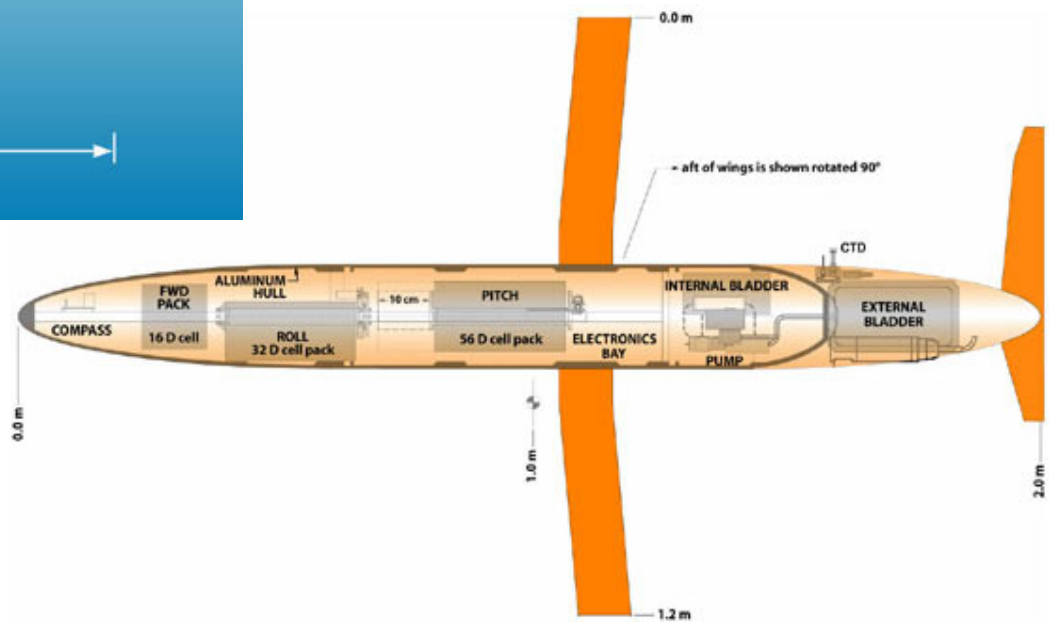
AUVs – Spray Glider





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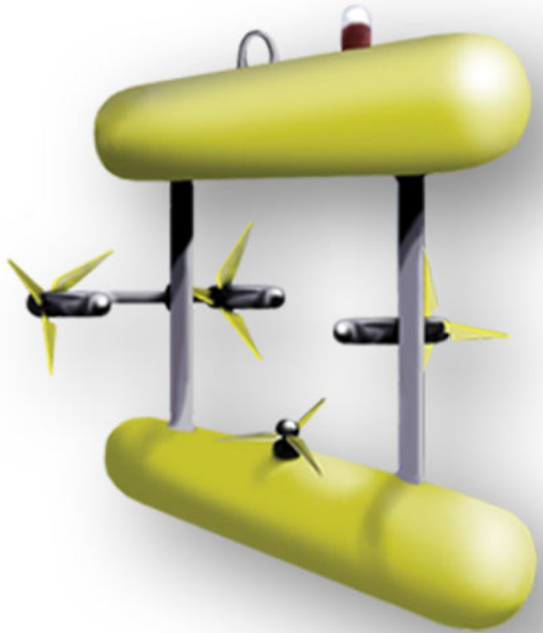
AUVs

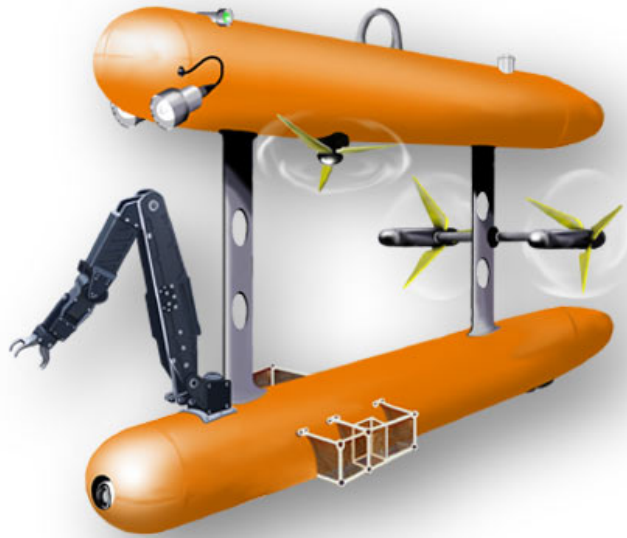
- ABE (Autonomous Benthic Explorer)
  - 5,000 m depth
  - 16-34 hours
  - Optimized for mapping
- Sentry
  - 2nd generation ABE
  - Optimized for sonar surveys in rugged terrain

image credit: WHOI

AUVs

- SeaBED
  - 2000 m depth
  - Can move slowly and hover
  - Optimized for imaging
- Puma & Jaguar
  - Exploration of vent fields under the Artic ice cap





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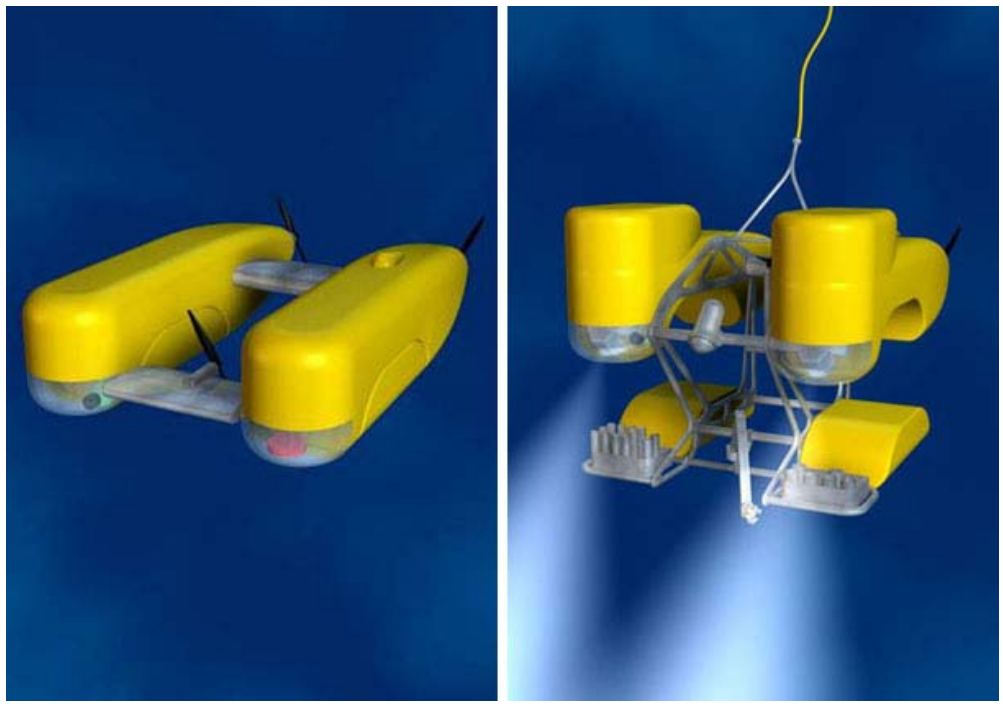
AUVs

- Capabilities
  - Free-swimming
  - Not dependent on surface weather
  - Can be optimized for particular missions
    - mapping
    - imaging
- Limitations
  - Battery power
  - No real-time communications
  - Payload limited

Future Trends

- Integratings AUVs and cabled observatories
  - AUV docking
  - Optical modem technologies
- Hybrid-ROV
  - Autonomous and tethered modes
  - Capable of 11,000 m
  - Will used an armored micro-fiber cable, no power from cable



HROV

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