REMOTELY OPERATED VEHICLE (ROV)

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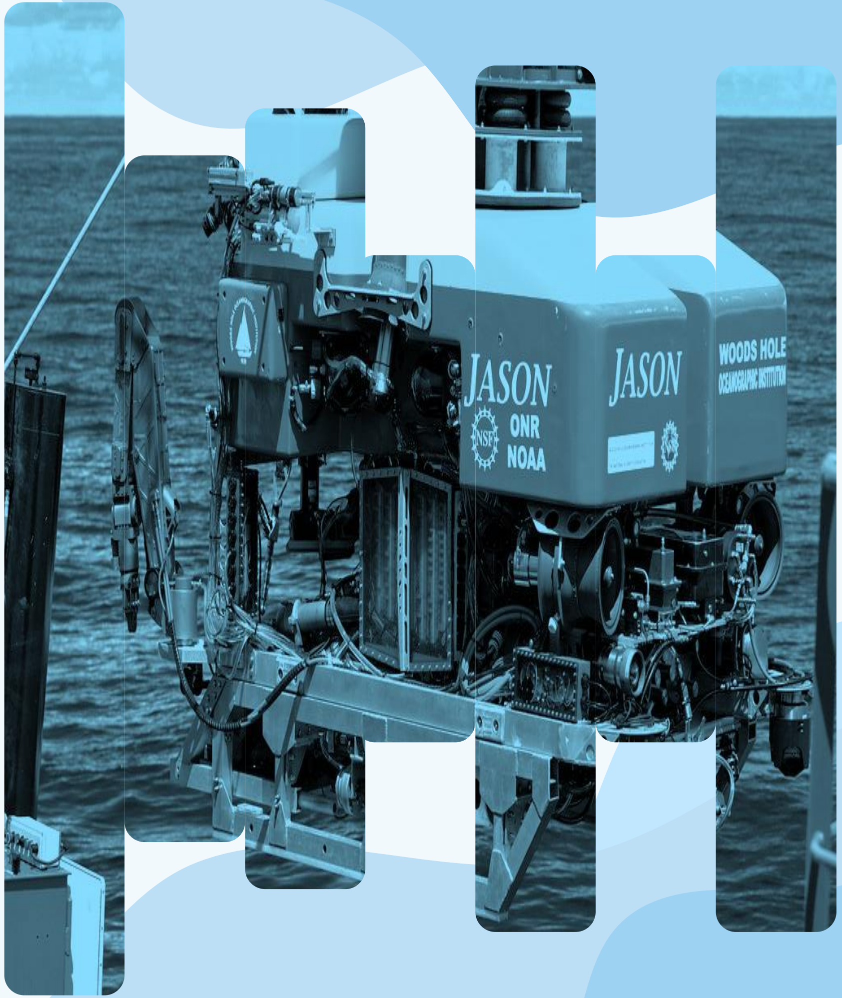

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History of ROV

History of ROV

1950s-1970s	Early Development	- The early purpose of ROVs is for the deep-sea exploration and offshore oil drilling operation - simple, tethered machines with basic mechanical arms and cameras
1980s-1990s	Digital Revolution	- With the advancement of computer technology that led to the development of digital control system, ROVs become more precise and manoeuvrable - Able to carry out more complex task (eg: maintainence and repair ops)

History of ROV

2000s	Advancements in Imaging	- ROVs are cable to be intergarted with enhance imaging technologies with high-definition cameras and 3D mapping capabiliies - ROVs now capable for the do underwater explorartion in details for scientific research
2010s-present	Miniaturization and Autonomy	- Small, lightweight ROVs that can be launched from ships or even from the shore are becoming increasingly common

2

Type of ROV

Observation ROVs

- These are the most basic ROVs and are used for simple underwater inspections and monitoring.
- Eg: BlueROV2, SeaPerch, VideoRay Pro4, Oceaneering Millennium Plus ROV and Aquabotix SwarmDiver

BlueROV2

- A small, lightweight ROV that is easy to transport and operate
- Depth rating = 100m
- Equipped with high-definition cameras

VideoRay Pro 4

- A compact and portable ROV
- Depth rating = 4000m
- Equipped with a range of sensors and tools for complex underwater tasks

Workclass ROVs

- These are larger and more complex ROVs and are designed for more challenging tasks, such as underwater construction and repair work.
- Eg: Schilling HD, SMD Quantum, Saab Seaeye Jaguar, Forum Energy Technologies Perry XLX and Fugro FCV3000

Schilling HD

- This work class ROV is designed for deepwater offshore operations
- Depth rating = 4000m
- It is equipped with multiple manipulator arms, high-definition cameras, and a range of sensor.

Fugro FCV3000

- A work class ROV designed for use in shallow water and nearshore operations
- Depth rating = 300m
- It is equipped with multiple manipulator arms, high-definition cameras, and a range of sensors

Inspection ROVs

- These are specialized ROVs that are used for inspecting pipelines, underwater structures, and other equipment.
- Eg: Deep Trekker DTG3, VideoRay Mission Specialist Series, Saab Seaeye Falcon, ECA Group Inspector MK2 and Blueye Pioneer

VideoRay Mission Specialist Series

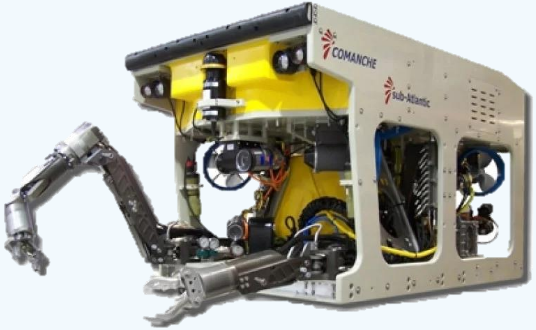
- A range of inspection ROVs that can be configured for different tasks, such as search and recovery, hull inspections, and aquaculture monitoring.
- Depth rating = 305m

Saab Seaye Falcon

- An inspection ROV that is highly maneuverable and suitable for use in tight spaces.
- Depth rating = 10000m
- Equipped with high-quality cameras, sonar, and other sensors for a range of inspection tasks.

Hybrid ROVs

- These are a combination of AUVs (Autonomous Underwater Vehicles) and ROVs. They are used for both autonomous and remote-controlled underwater missions.
- Eg: Forum Energy Technologies Comanche, Saab Seaeye Sabertooth, Ocean Infinity Armada, Saipem Hydrone-R and ECA Group H3000-V6



Forum Energy Tech Comanche

- A hybrid ROV that can operate as a workclass ROV and also as an autonomous underwater vehicle (AUV).
- Depth rating = 4000m
- Equipped with multiple manipulator arms, high-definition cameras, and a range of sensors.

Saipem Hydrone-R

- A hybrid ROV that can operate as both a tethered ROV and an autonomous underwater vehicle (AUV).
- Depth rating = 3000m
- Equipped with high-quality cameras and sensors for a range of underwater tasks.

3

Main Components of ROV

i. Hull Design

SPHERICAL HULL ROV

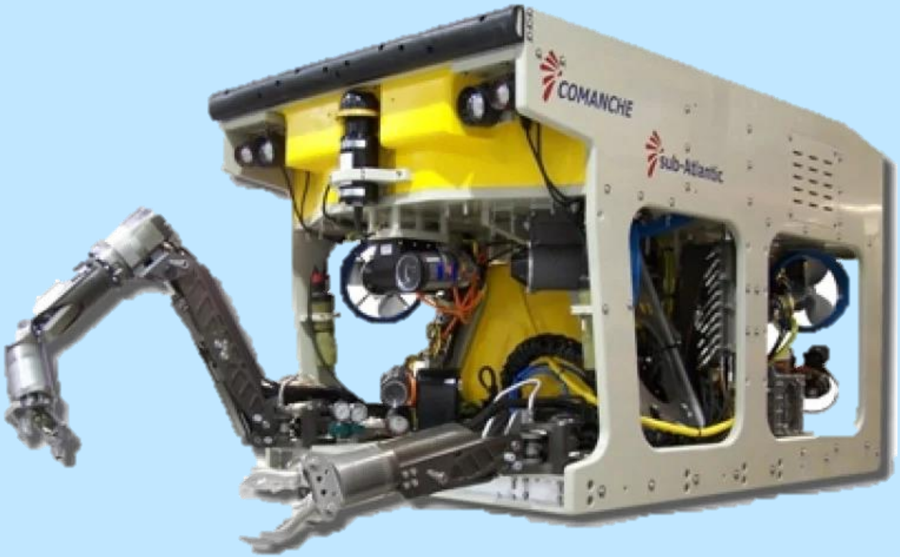
Advantages

- High maneuverability
- Good stability in currents
- Compact size, making it easy to transport and launch

Disadvantages

- Limited internal space for equipment and instrumentation
- Limited payload capacity
- Reduced performance at deeper depths due to increased pressure on the spherical hull

i. Hull Design



BOX-SHAPED HULL ROV

Advantages

- Large internal space for equipment and instrumentation
- High payload capacity
- Well-suited for heavy-duty tasks such as construction and maintenance

Disadvantages

- Limited maneuverability
- Increased drag due to larger size
- May be less stable in currents compared to other hull designs

i. Hull Design

TURPEDO HULL ROV

Advantages

- High speeds and long-range travel capabilities
- Low drag and efficient performance
- Well-suited for AUVs and tasks that require long-range travel

Disadvantages

- Limited internal space for equipment and instrumentation
- Limited maneuverability compared to other hull designs
- Not well-suited for tasks that require stability or carrying heavy payloads

ii. Propulsion

ELECTRIC THRUSTER

Advantages

- Efficient and reliable
- Can be easily controlled for precise maneuvering
- Minimal maintenance required

Disadvantages

- Limited speed and range compared to other propulsion types
- Requires a power source, which may limit operating time
- May produce electrical interference that can affect sensors and other equipment

ii. Propulsion

HYDRAULIC THRUSTER

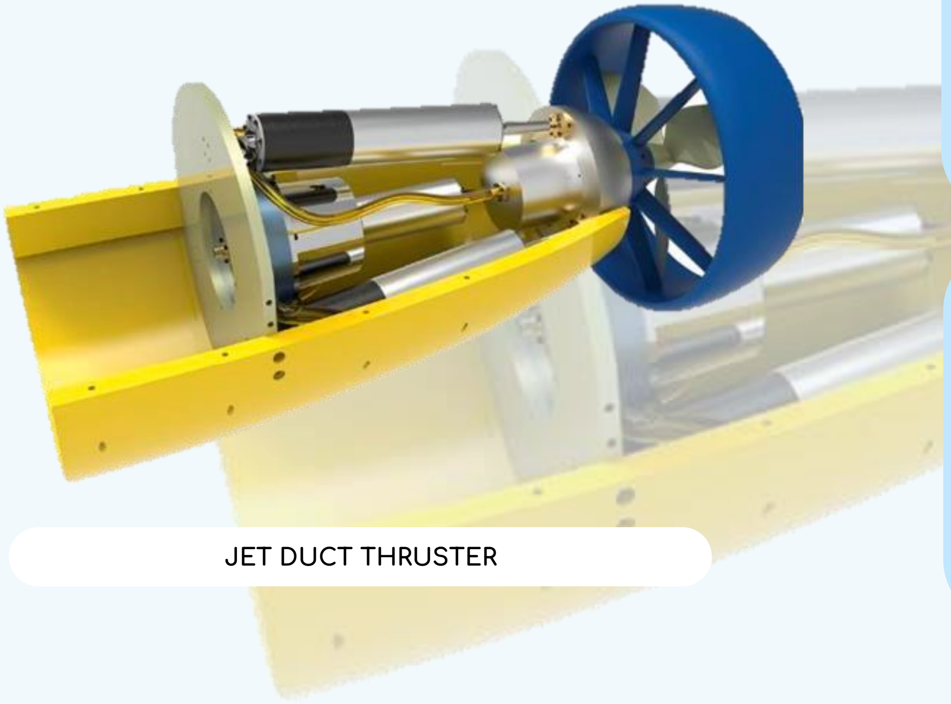
Advantages

- High power and speed capabilities
- Well-suited for heavy-duty tasks
- Can be operated at greater depths than electric thrusters

Disadvantages

- More complex and expensive than electric thrusters
- Require a hydraulic power source, which may increase weight and complexity
- Higher maintenance requirements than electric thrusters

ii. Propulsion



JET DUCT THRUSTER

Advantages

- Improved maneuverability
- Increased efficiency
- Reduced noise
- Improved safety

Disadvantages

- Higher cost
- Increased weight
- Reduced speed
- Increased complexity

iii. Navigation System & Control

Inertial Measurement Unit (IMU)

Measures the ROV's orientation, velocity, and acceleration.

Depth sensors

These measure the depth of the ROV.

NAVIGATION SYSTEM

Sonar

This can be used to provide a 3D map of the ROV's surroundings.

Global Navigation Satellite System (GNSS)

This can be used to determine the ROV's location on the surface.

iii. Navigation System & Control

Joystick

This allows the operator to control the ROV's movements, such as forward/backward, left/right, up/down.

Camera

This allows the operator to see what the ROV is seeing.

CONTROL

Display

This displays information about the ROV's status, such as depth, orientation, and battery level.

Manipulators

These allow the operator to manipulate objects with the ROV.

iv. Data Collection & Transmission

VIDEORAY PRO 4 ROV

Camera

High-definition camera that captures video and still images of the ROV's surroundings. The camera can be tilted and panned remotely to provide a better view of the environment.

Sensors

Equipped with various sensors, including a depth sensor, altimeter, and compass, which provide data on the ROV's position and orientation.

Lights

Equipped with high-intensity LED lights that illuminate the surrounding area, allowing the camera to capture clear images and video.

Tether

The tether is the cable that connects the ROV to the operator's console on the surface. It provides power to the ROV and allows data to be transmitted between the ROV and the operator.

v. Power Management

Power supply	The power supply can be a battery pack, a fuel cell, or an external power supply, depending on the type of ROV.
Power distribution system	Distributes power from the power supply to the various components of the ROV. It includes power cables, fuses, circuit breakers, and other components.
Power regulation system	Regulates the voltage and current of the power supply to ensure that it meets the requirements of the ROV's components. It includes voltage regulators, current regulators, and other components.
Power monitoring system	Monitors the power usage of the ROV's components and provides feedback to the power regulation system. It includes sensors, meters, and other components.
Power management software	Controls the power management system and optimizes power usage. It includes algorithms that prioritize power usage based on the ROV's mission objectives, power consumption, and available power supply.
Energy storage system	Stores excess energy generated by the ROV's components for later use. It includes capacitors, batteries, or other types of energy storage devices.

4

Advantages of ROV

Advantages

1

Safety

ROVs allow humans to carry out underwater activities without exposing them to the dangers of working in a hazardous underwater environment.

2

Flexibility

ROVs can be fitted with a wide range of sensors, tools and manipulators to carry out various tasks.

3

Efficiency

ROVs can work for extended periods of time without the need for rest, which can increase efficiency and reduce project time.

4

Cost-effectiveness

Using ROVs can be a cost-effective way of carrying out underwater activities, as they can eliminate the need for divers and manned submersibles.

5

Limitations of ROV

Limitations

1

Limited Range

ROVs are usually tethered to a support vessel or platform, which limits their range of operation.

2

Limited Manipulati on

While ROVs are equipped with manipulators, they are often limited in terms of dexterity and precision compared to human hands.

3

Dependence on Human Control

ROVs require a human operator to control their movements and tasks, which can lead to errors and limitations in certain tasks.

4

Limited Sensory Input

ROVs rely on sensors to navigate and carry out tasks, which can be limited by the quality of the sensor input and environmental conditions

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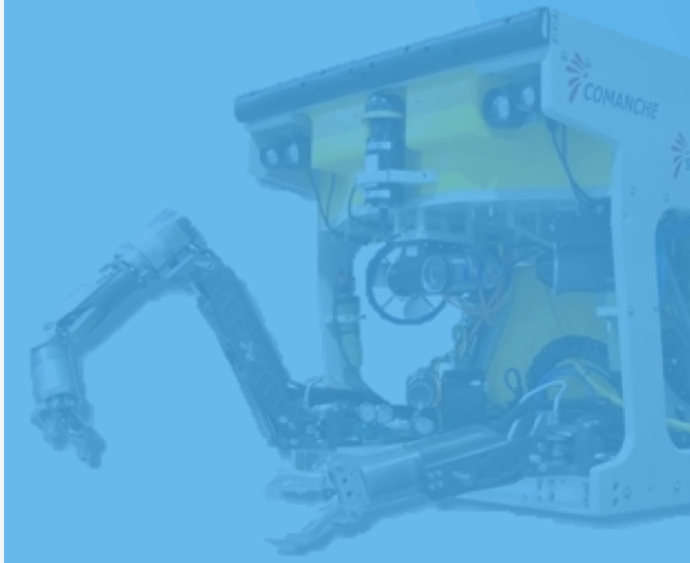
Conclusion

In conclusion, remotely operated vehicles (ROVs) are extremely sophisticated underwater craft that have completely changed how people explore and research the ocean's depths. They make it possible for scientists, researchers, and engineers to reach places that were previously too risky or challenging to visit. Oceanography, marine biology, underwater construction, and oil and gas exploration are just a few of the many uses for ROVs. With ongoing research and development, ROVs will undoubtedly continue to play a crucial role in expanding our knowledge and understanding of the oceans and the creatures that inhabit them.



Thank You