CHALLENGES (UR): FUTURE CAPABILITIES, ETHICS, AND SUSTAINABILITY ISSUES.

SAAB SEAEYE FALCON

Future Capabilities:

- Currently reliant on manual operation, limiting mission scope and endurance.
- Needs advancement in AI integration for autonomous inspections, especially in offshore energy and deep-sea exploration.
- Potential for real-time machine vision and object recognition to assist pilots in identifying defects or marine objects.

Ethical Challenges:

- Often used in offshore oil & gas industries. Raises ethical concerns over enabling further fossil fuel exploitation.
- Dual-use risk: Can be equipped for covert surveillance or military reconnaissance.

SAAB SEAEYE FALCON

Sustainability Issues:

- Deployment may disturb benthic habitats (e.g., seabed ecosystems).
- Electronic waste from outdated models or harsh underwater failures could contribute to marine pollution if not recovered properly.

BLUEROV2

Future Capabilities:

- Designed to be modular and programmable, but lacks native AI-driven autonomy.
- Major challenge: Upgrading low-cost sensors for precise navigation without increasing cost.
- Scope to develop real-time data streaming and cloud-based mission control for citizen science and academic use.

Ethical Challenges:

- Being open-source and accessible, BlueROV2 can be repurposed for unethical use, such as unauthorized surveillance or illegal fishing.
- Risk of violating marine protected areas due to operator inexperience.

BLUEROV2

BLUEROV2

Sustainability Issues:

- Prone to plastic hull and tether degradation in saltwater over time.
- Shipping lithium batteries to remote deployment areas raises carbon footprint and hazardous material handling concerns.

REMUS 600 (HYDROID/KONGSBERG)

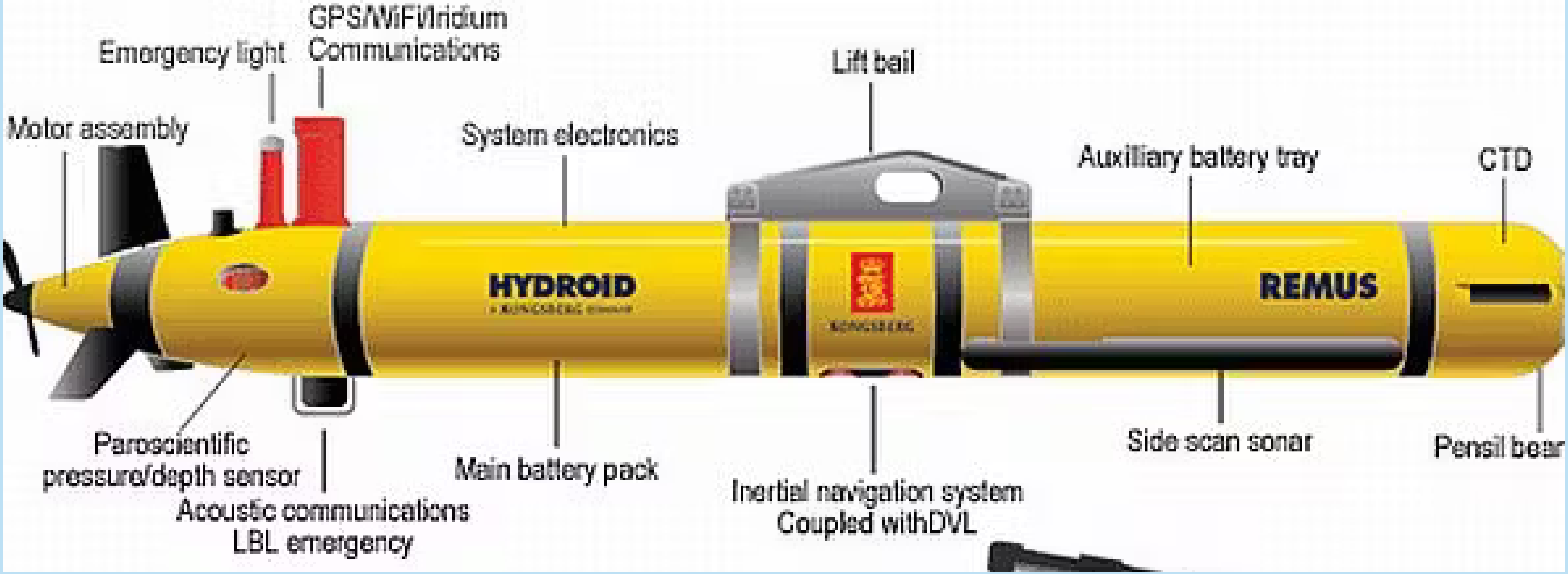
Future Capabilities:

- Already highly autonomous, but mission durations are limited by energy capacity.
- Future development is needed in hybrid power systems, possibly nuclear microgenerators for ultra-long missions.
- Enhancing onboard AI decision-making and self-repair algorithms remains a challenge.

Ethical Challenges:

- Widely used by navies (e.g., mine detection), creating concern around the militarization of ocean robotics.
- Ethical issues around privacy, sovereignty, and marine life disruption in sensitive geopolitical waters.

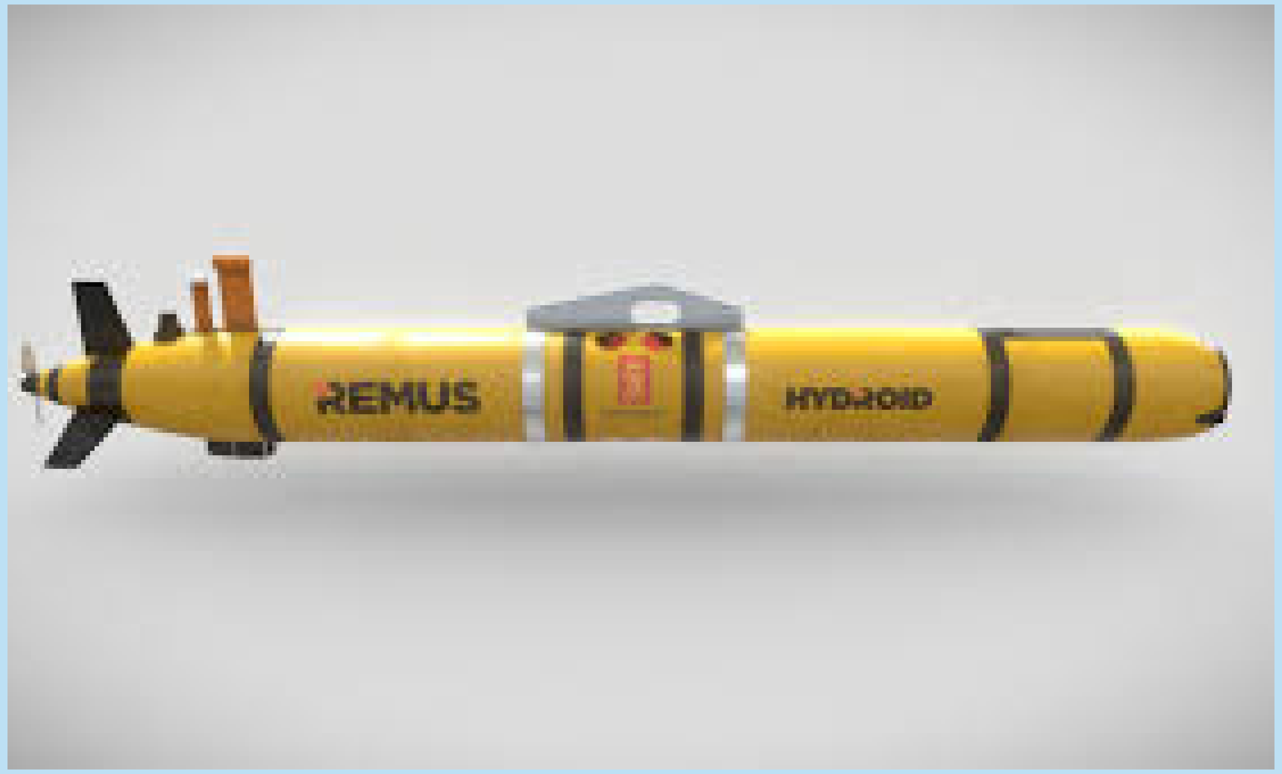
REMUS 600 (HYDROID/KONGSBERG)



REMUS 600 (HYDROID/KONGSBERG)

Sustainability Issues:

- Deployed in deep-sea mining prospecting, which could lead to irreversible ecosystem destruction if commercialized.
- Use of exotic materials (e.g., titanium hulls) may have unsustainable extraction costs.



HUGIN (KONGSBERG/OCEAN INFINITY)

Future Capabilities:

- Top-tier AUV with advanced autonomy, but requires complex pre-mission setup.
- Limitations in real-time adaptation to unforeseen events, like under-ice entrapments or dynamic terrain shifts.
- Potential to integrate underwater wireless communication networks (e.g., optical/acoustic) for better swarming and navigation.

Ethical Challenges:

- Deployed for subsea pipeline and seabed surveys, raises concerns of aiding in marine resource extraction in protected zones.
- Risk of AI bias in terrain recognition algorithms if trained on limited seafloor datasets.

HUGIN (KONGSBERG/OCEAN INFINITY)

HUGIN (KONGSBERG/OCEAN INFINITY)

Sustainability Issues:

- Highly resource-intensive to manufacture and operate.
- Challenge of designing sustainable disposal methods for electronics and carbon-fiber composite parts after end-of-life.

DEEP TREKKER DTG3

Future Capabilities:

- Currently lacks autonomous capabilities; needs evolution into AI-assisted visual analysis and navigation.
- It could evolve into a low-cost swarm system for lake and coastal monitoring with modular sensors.
- Limited computing power onboard hinders the future integration of real-time data processing.

Ethical Challenges:

- Accessible platforms may be misused for spying in civilian ports, aquaculture sabotage, or wildlife harassment.
- Lack of user licensing requirements makes traceability of operators difficult.

DEEP TREKKER DTG3

DEEP TREKKER DTG3

Sustainability Issues:

- Short battery cycles → frequent charging → energy inefficiency.
- Improper disposal of tether cables and enclosures may lead to plastic entanglement risks for marine animals.

CONCLUSION

Robot	Future Capabilities	Ethical Concerns	Sustainability Issues
Saab Falcon	AI-assisted inspections, real-time vision	Oil industry use, military dual-use	Marine habitat disruption, electronic waste
BlueROV2	AI autonomy, cloud control, better sensors	Misuse for illegal fishing, data misuse	Battery shipping footprint, tether degradation
REMUS 600	Long missions, hybrid power, self-repair AI	Militarization, deep-sea mining ethics	Ecosystem damage from exploration
HUGIN	Real-time path correction, underwater networks	AI bias in mapping, aiding oil industry	Unsustainable material sourcing, disposal waste
DTG3	Swarming, AI navigation for inspection	No traceability, possible misuse	Low power efficiency, marine plastic risks

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THANK YOU