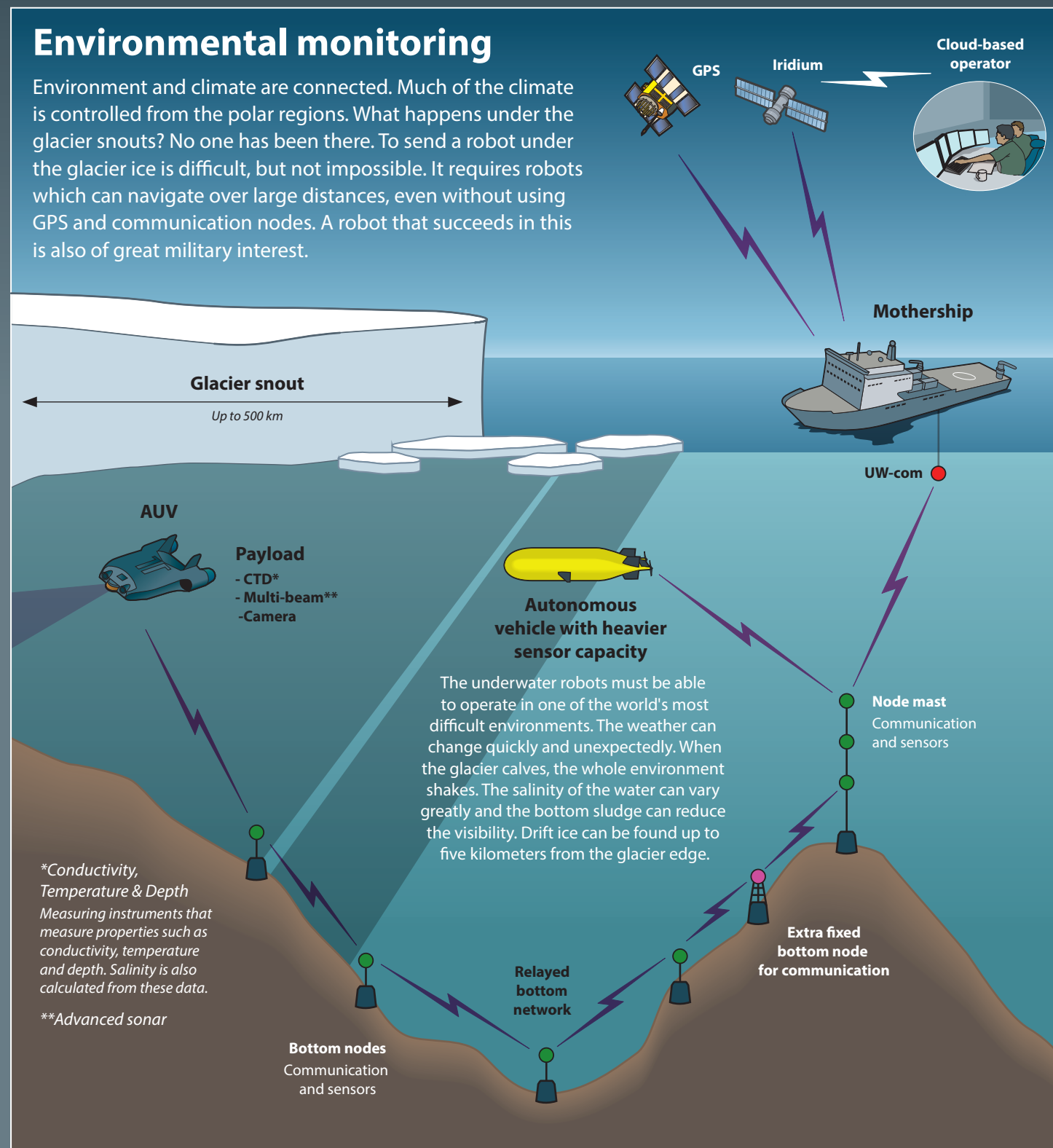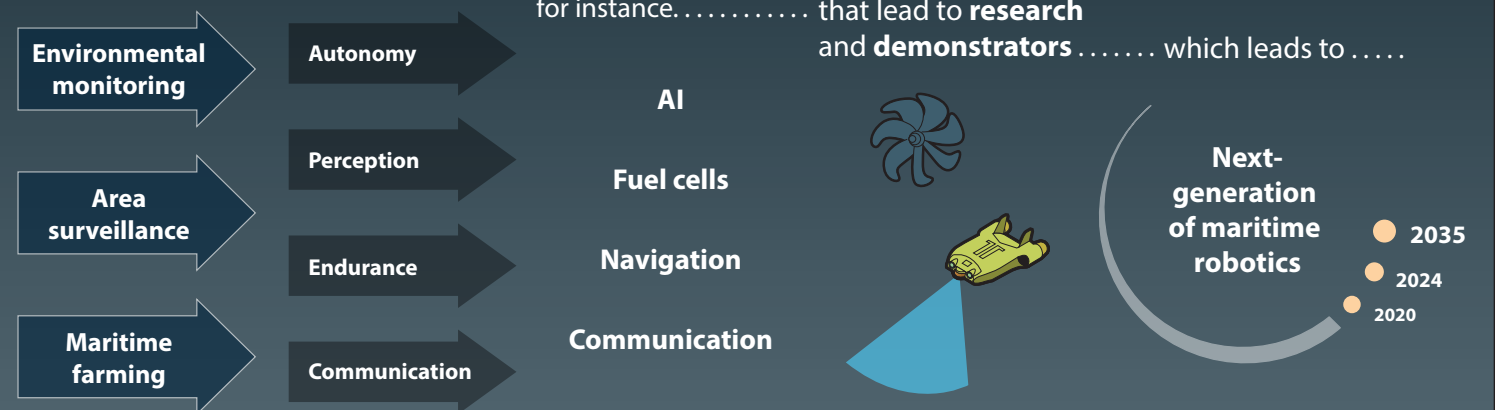# Total research in depth

The underwater robots of the future can revolutionize research. The robots will be able to explore the world's last white spots - the great depths of the sea. To succeed with this, smarter, cheaper, more sustainable and independent robots are required.

Three utility areas . . . . focus on **four abilities** . . . . via **key technologies,** for instance . . . . that lead to **research** and **demonstrators** . . . . which leads to . . . . .

Three utility areas	four abilities	key technologies
Environmental monitoring	Autonomy	AI
Area surveillance	Perception	Fuel cells
	Endurance	Navigation
Maritime farming	Communication	Communication

Next-generation of maritime robotics

2035
2024
2020

Environmental monitoring

Environment and climate are connected. Much of the climate is controlled from the polar regions. What happens under the glacier snouts? No one has been there. To send a robot under the glacier ice is difficult, but not impossible. It requires robots which can navigate over large distances, even without using GPS and communication nodes. A robot that succeeds in this is also of great military interest.
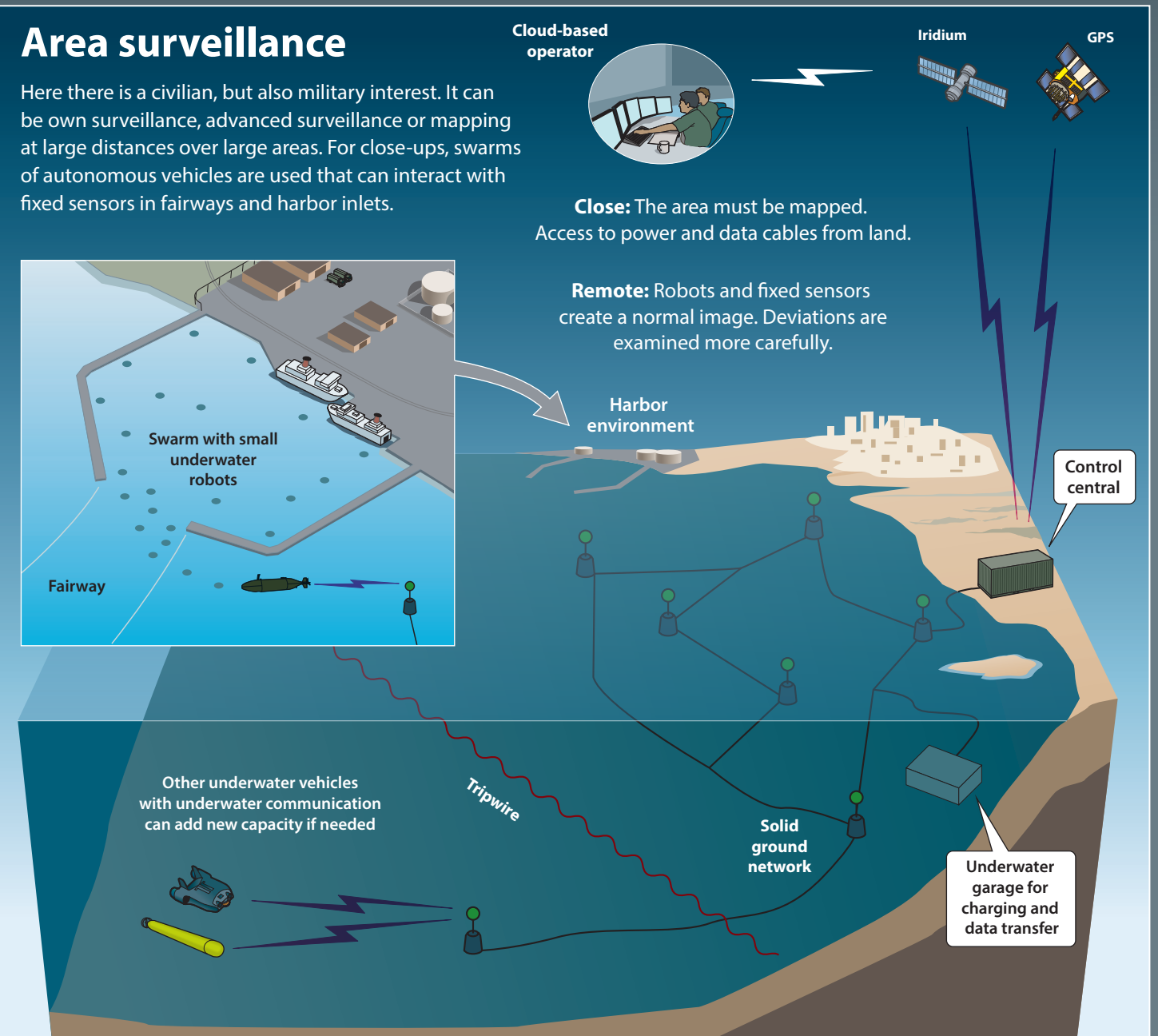
GPS
Iridium
Cloud-based operator

Mothership

UW-com

Glacier snout
Up to 500 km

AUV

Payload
- CTD*
- Multi-beam**
- Camera

Autonomous vehicle with heavier sensor capacity

The underwater robots must be able to operate in one of the world's most difficult environments. The weather can change quickly and unexpectedly. When the glacier calves, the whole environment shakes. The salinity of the water can vary greatly and the bottom sludge can reduce the visibility. Drift ice can be found up to five kilometers from the glacier edge.

Node mast
Communication and sensors

*Conductivity, Temperature & Depth Measuring instruments that measure properties such as conductivity, temperature and depth. Salinity is also calculated from these data.

**Advanced sonar

Bottom nodes
Communication and sensors

Relayed bottom network

Extra fixed bottom node for communication

Area surveillance

Here there is a civilian, but also military interest. It can be own surveillance, advanced surveillance or mapping at large distances over large areas. For close-ups, swarms of autonomous vehicles are used that can interact with fixed sensors in fairways and harbor inlets.

Cloud-based operator
Iridium
GPS

Close: The area must be mapped. Access to power and data cables from land.

Remote: Robots and fixed sensors create a normal image. Deviations are examined more carefully.

Harbor environment

Swarm with small underwater robots

Fairway

Control central

Other underwater vehicles with underwater communication can add new capacity if needed

Tripwire

Solid ground network

Underwater garage for charging and data transfer

Graphics: MARTIN EK