LanderPick

OCEANOGRAPHIC TOOLS

LANDERPICK ROTV

DEPLOY & RECOVER OCEANOGRAPHIC LANDERS

LanderPick ROTV: A REMOTLY OPERATED TOWED VEHICLE TO DEPLOY AND RECOVER LIGHT OCEANOGRAPHIC LANDERS

Product: DEEP OCEAN 4K VIDEO CAMERA SYSTEM, LOAD RELASER, THRUSTERS, INERTIAL SENSOR, LIGHTS AND LASER BEAMS, MARINE BATTERIES, PILOTING SOFTWARE

Abstract

Deploying and retrieving modestly-sized low-cost benthic landers

LanderPick´s ROTV ambition is to collect "more with less" using benthic landers in-situ observation technologies, delivering ocean observation technologies that contribute to the needs of the marine and ocean community (scientists, policy makers, marine industry) to provide essential information from the ocean floor.

LanderPick consists of a cost-effective **system to deploy and pick-up lightweight oceanographic landers in a controlled manner**, without built-in expensive recovery elements, but instead equipped with a simple structure that facilitates their hitching (a capture mesh). The LanderPick vehicle is a **Remote Operated Towed Vehicle (ROTV) with real time visual feedback** specifically designed to operate a mechanical release that allows the placement at the sea bottom of benthic landers, carried as a payload, as well as their recovery. The vehicle takes advantage of modern vessels dynamic positioning systems, underwater acoustic positioning systems and winch capabilities to get close to target, while the final precision approach manoeuvres is achieved through the real time control of the LanderPick's own propellers and actuators, assisted by the inertial data and the 4K visual feedback of the operation.

Contents

Deep ocean observation with benthic landers and ways to deploy them

BACKGROUND: Benthic Landers

The Ocean covers more than 70% of the Earth's surface and has an average depth of more than 3,500 m. It plays a major role as a modulator of the global climate system, hosting invaluable resources and supporting key ecosystems on which we depend. However large knowledge gaps exist of essential ocean variables, especially in the subsurface and deep ocean, beyond the reach of common Earth observation efforts.

While some of the latest advances in floating Langrangian observatories allow to monitor submarine environments on the move, there are important advantages in improving the technologies that allow monitoring fix points creating **Eulerian observatories**.

Eulerian or long-term fixed-point observations can be achieved using oceanographic landers, which offer unique capabilities to collect samples in hard-to-reach marine spaces, support sensors with strict power demands and make sustained measurements where other ocean observing platforms falter. In particular, to **achieve the observation and study of hard-to-reach, near-bottom marine ecosystems** the oceanographic community have developed the concept of "**autonomous benthic landers**".

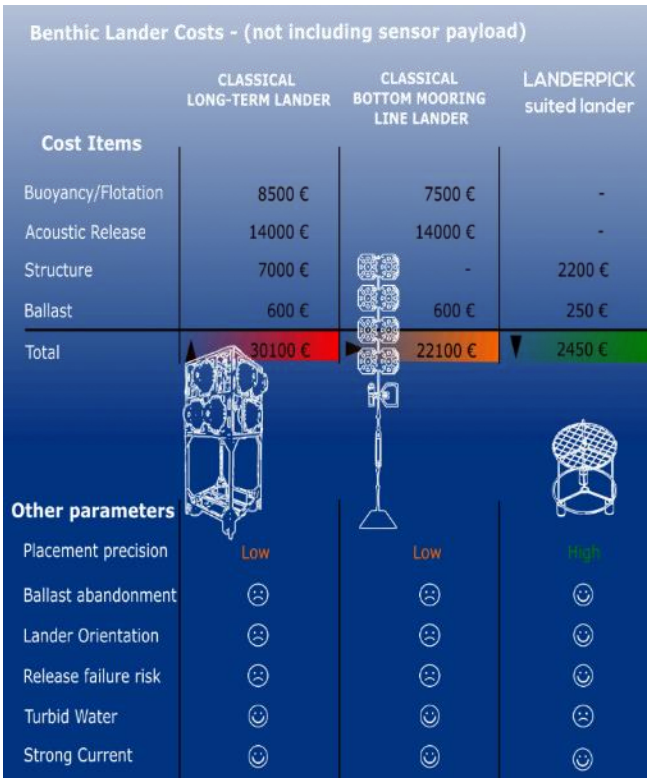
An autonomous benthic lander is a frame equipped with modular systems sitting on the seafloor. These may integrate a number of physical, chemical and biological sensors that operate autonomously for a defined timeframe. The use of lander systems is far from novel with examples of deep landers in use since the mid-20th century.

CHALLENGES: Cost & Operations

The major problem for the use of landers has been, and continues to be, devising a **cost-effective, efficient deployment and recovery system**.

The usual deployment operation consists of free-fall process of a ballasted lander in an area of interest. The recovery process is attained by triggering an acoustic transponder that releases the expendable clump-weight used as ballast. Then, the lander and payload would hopefully soar up through the water column and reach the ocean surface due to positive buoyancy.

This procedure has caveats and is limited in several aspects. For one, **landers are not always positioned accurately nor in the desired position/orientation**. Secondly the recovery relies on a complex apparatus that makes the platforms **expensive**. In addition, the ballast is always left behind, incrementing our **footprint** on the ocean. Such recovery systems force the landers to be **oversized and costly**: the heavier the payload, the stronger the positive buoyancy needed, which in turn requires a heavier, expendable ballast and robust releaser.



LANDERPICK accurately deploying and retrieving modestly-sized low-cost benthic landers

The new oceanographic tool, called "**LanderPick**" is developed to **help address cost-effective, massive, in-situ eulerian deep-ocean observations**. LanderPick is a ROTV designed in partnership with the Spanish Institute of Oceanography. LanderPick's **prime target** is to **deploy and recover lightweight benthic landers without the need for acoustic releasers**.

The vehicle takes advantage of modern vessels dynamic positioning systems (DP), underwater acoustic positioning systems and winch capabilities to get close to target. While the final precision approach manoeuvres is achieved through the real time control of the LanderPick's own thrusters and actuators, assisted by the inertial data and the feedback of the operation.

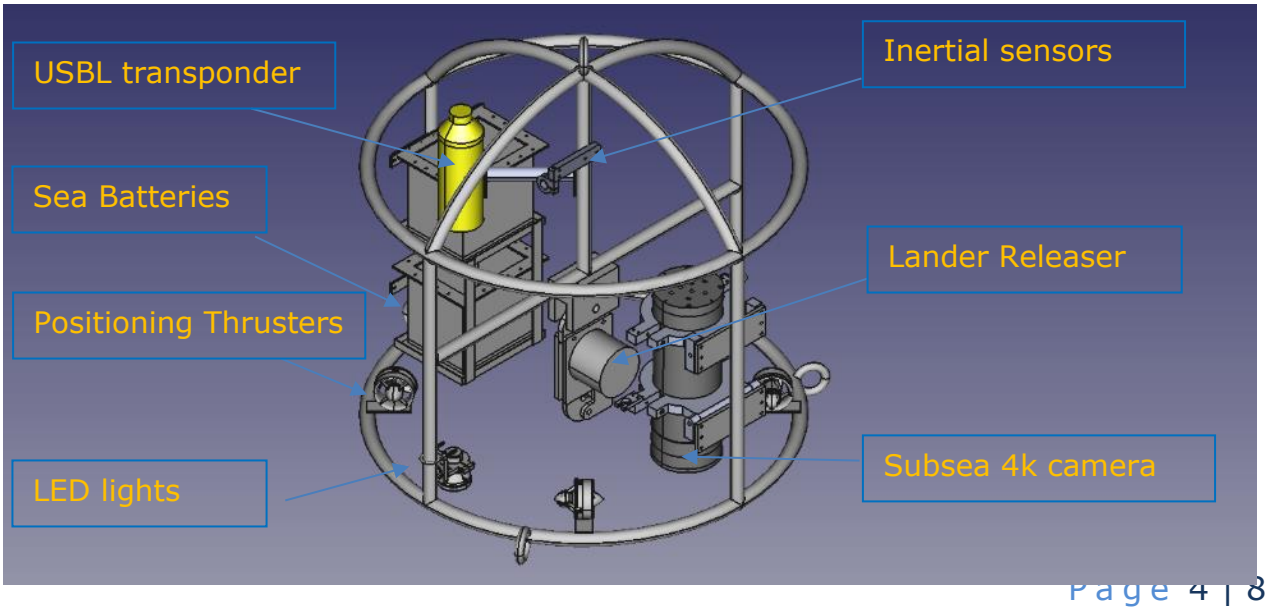
Vessel Requirements

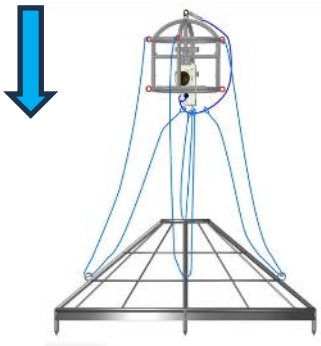
- DP (Dynamic Positioning)
- Winch with Power/ Optical Fibre Tow Cable
- USBL (Ultra Short Base Line) positioning system

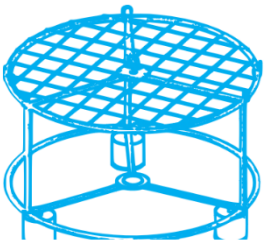
LanderPick Description

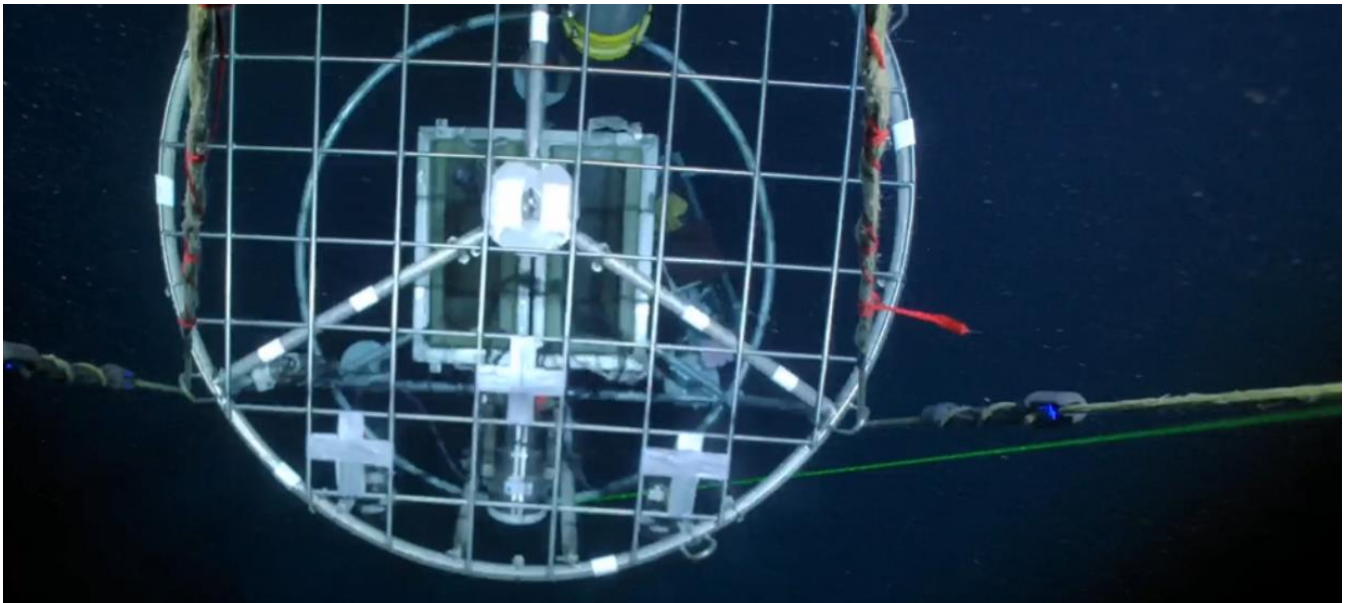
LanderPick is designed with a simple and robust stainless steel cylindrical frame, specifically designed to deploy, carry and retrieve landers. It includes a **subsea pod** that hosts the central processing unit, power and communication electronics, as well as providing a high definition (4K) video feedback of the payload and surroundings.

The **remotely operated releaser** allows for the pilot to control the mechanical action of liberating the payload. The auxiliary systems include the **inertial sensors**, the **light systems**, the approximation **laser beams**, and the positioning **thrusters** that allows for the controlled action of accurately targeting the desired location.









Accurate deployments are achieved by hauling the landers onto the LanderPick, while the static vessel lowers the set to the sea bottom with the tow cable, and the LanderPick ´s pilot fine maneuvers it to the end location.

The retrieval operation is based on hitching the benthic landers from a simple built-in capture mesh.

Advantages

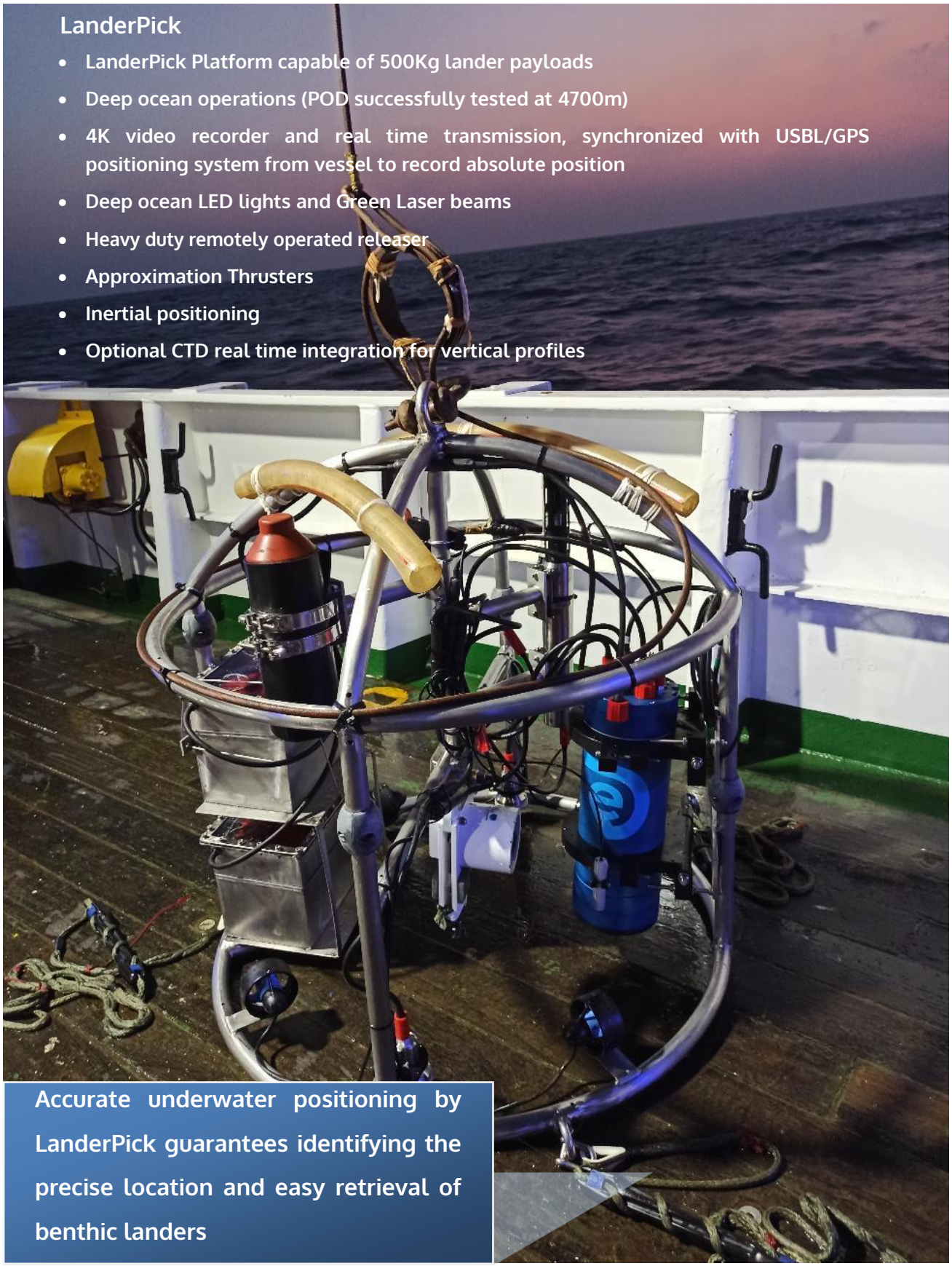
LanderPick allows to **lower the costs tenfold** for each measurement point and/or increase the deployment accuracy and duration. It achieves this by carefully controlling the end location and reducing the associated risks, the communication limitations and/or the acoustic releaser battery maintenance requirements.

The primary advantage of LanderPick is to **enable the routine operation of modestly-sized swarms of low-cost benthic landers**. The solution based on custom designed steel frames, makes it possible for the serial implementation of spatially spread units.

The initiative accommodates benefits and opportunities for deep-sea ocean exploration, both **systematic and purpose-driven**. LanderPick's innovative solution permits monitoring the benthic ocean with a multi-eulerian approach at very little marginal cost.

This results in detailed broad spatial and fine temporal improvement of observational coverage at hard-to-reach areas. Due to the extraordinary capabilities of modern underwater positioning systems, **benthic landers can be deployed and located with sub-meter accuracy** near artificial reefs, infrastructure moorings, shipwrecks or rocky ground in the continental shelf and upper slope or at relevant, small scale features such as hydrothermal vents, submarine volcanoes and vulnerable, unique habitats.

The resulting system performs accurate, reliable and more economic lander deployment and recovery operations. These achievements could previously only be attained by expensive, ROV/ROTV assisted systems.



LanderPick

- LanderPick Platform capable of 500Kg lander payloads
- Deep ocean operations (POD successfully tested at 4700m)
- 4K video recorder and real time transmission, synchronized with USBL/GPS positioning system from vessel to record absolute position
- Deep ocean LED lights and Green Laser beams
- Heavy duty remotely operated releaser
- Approximation Thrusters
- Inertial positioning
- Optional CTD real time integration for vertical profiles

Accurate underwater positioning by LanderPick guarantees identifying the precise location and easy retrieval of benthic landers

References

CSIC
Consejo Superior de Investigaciones Científicas

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