

# In situ imaging-based tools for surveys of gelatinous macroplankton: insights from the PICASSO project.

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The untethered remotely-operated vehicle (uROV) PICASSO-1, controlled in real time from a surface support vessel via a  $\phi 0.9$  mm fibre optic cable, is capable of dives to 1000 m depth at a duration of up to 6 hours, and yet is deployable from ships of sizes as low as 17 tonnes. The vehicle was developed at JAMSTEC, has carried out 63 dives to date, and is now operable by a team of four biologists and one technician.

PICASSO-1 can collect video (HDTV  $\times 1$ , NTSC  $\times 3$ ) and environmental information (depth, temperature, salinity, dissolved oxygen concentration, fluorescence [chlorophyll a proxy], turbidity) concurrently and this is output with vehicle heading, camera zoom, and other vital statistics via Ethernet. Two of the NTSC cameras are forward-mounted and positioned for stereoscopic object scale estimation. Acoustically-obtained vehicle position information, deck and control room video and sound data streams are also output via Ethernet and the whole dive is recorded in a synchronous fashion on a logging/playback system that enables dives to be re-enacted in their entirety to facilitate analyses back in the laboratory. Operations have been successfully carried out

overseas using a chartered dive boat and the system represents a leap forward for exploration of the oceans to significant depths but at relatively low cost and with no loss in data quality.

The untethered nature and small size of the PICASSO-1 vehicle makes it an ideal tool for exploration of the ocean's deep-water ecosystems in hard-to-access localities. Perhaps the most revolutionary aspect of the PICASSO system is the logging and playback system, which allows both recreation of a dive during post-cruise analysis and data output that can be imported directly into JAMSTEC's Biological Information System for Marine Life (<http://www.godac.jp/bismal/e/>) and the Ocean Biogeographic Information System (<http://www.iobis.org/>).

In addition, an autonomous Visual Plankton Recorder, which is also deployable on the PICASSO-1 vehicle, has been used to investigate particle profiles and plankton distribution vs. depth. Results from these two systems from eastern Antarctica, the Coral Sea in Australia, the north-western Mediterranean and off Japan will be introduced