

Design of WARPAUV2: an Improved Small Vision Guided Underwater Robot

Motivation

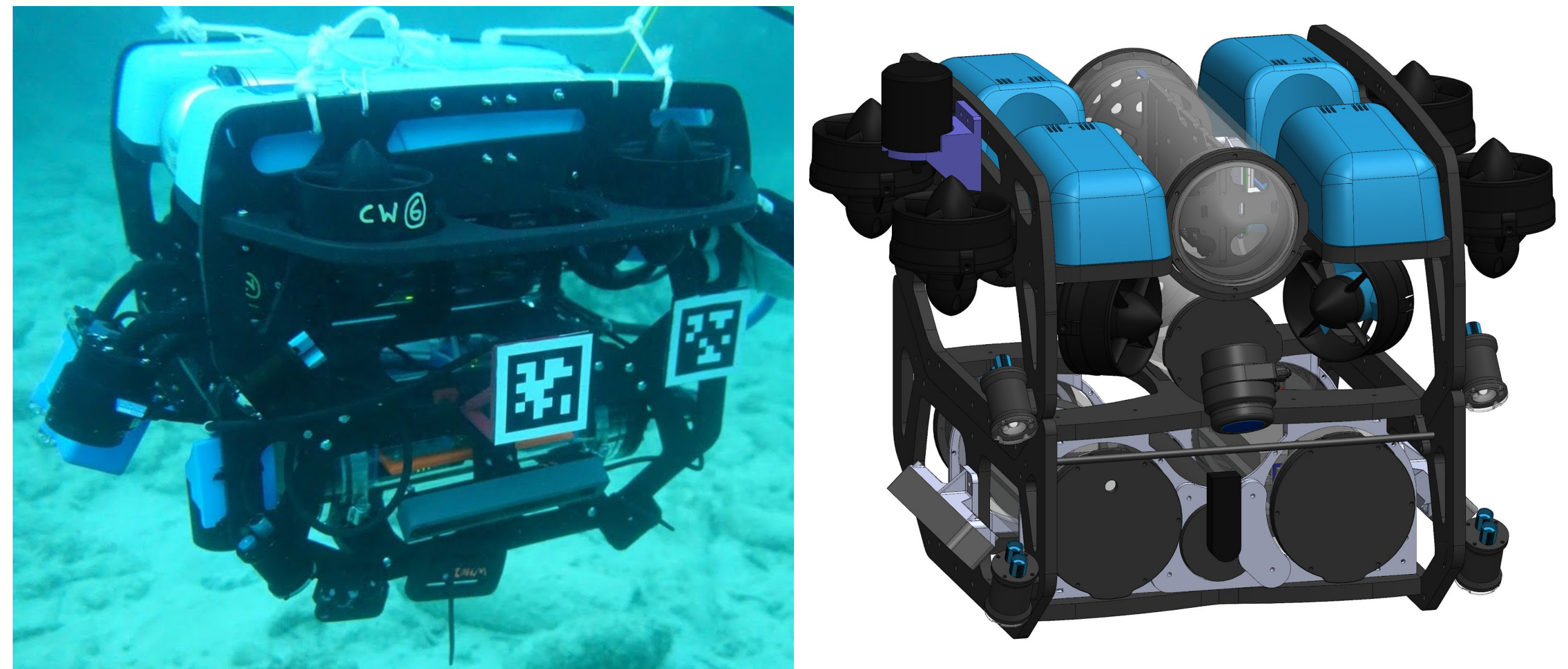
AUV platform to develop and test vision guided autonomous behaviors

- Target applications:
 - Visually explore & map unknown environments
 - Communicate with scientists over low bandwidth acoustic comms
 - Track slow moving animals
- Open source hardware & software
- Capable of multi-robot operations

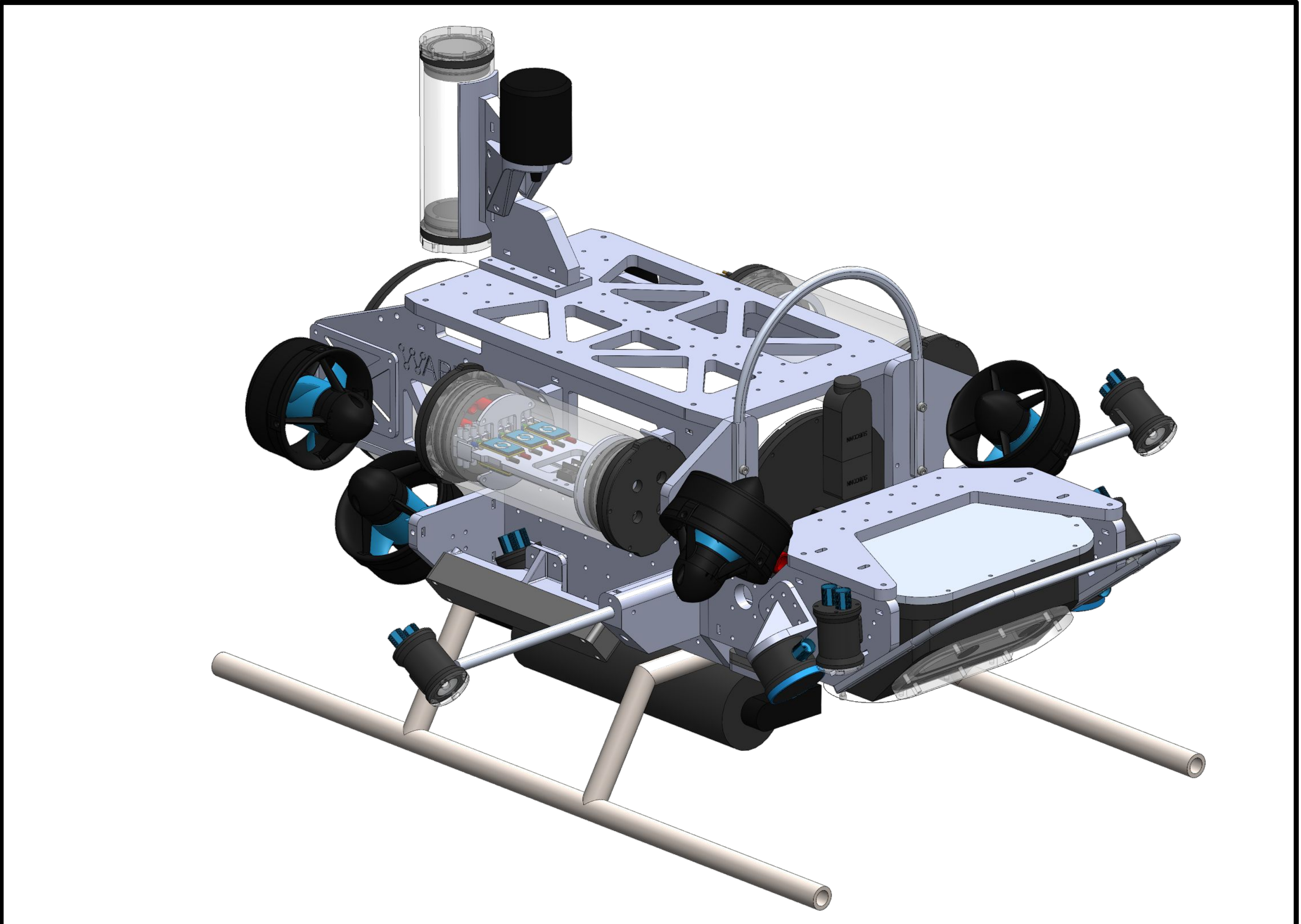
Previous vehicle: Modified BlueROV

Field trials demonstrated several shortcomings with our old vehicles

- The robot was difficult to ship
- Limited dive time
- Issues navigating near ledges
- PX4 autopilot was difficult to modify
- Not a stable sidescan sonar platform
- Not enough computational power



WARPLab BlueROV



Comparison of small autonomous robotic platforms

Robot	Hovering capability	Dive time	Stereo cameras	Vision computer	Stable forward motion (for SS Sonar)
Desired spec	Yes	4+ hrs	2 pairs	NVIDIA Jetson	Yes
WARPAUV 2	Yes	4+ hrs expected	Yes (x2)	Jetson Xavier	Yes
Stock BlueROV	Yes	~2 hrs	No	None	No
WARPLab BlueROV	Yes	~ 1 hr	Yes (x1)	Jetson TX2	No
Sandshark	No		No	None	Yes
OpenROV Trident	No		No	None	No
Aqua	Yes		Yes	Atom	No

Hardware Design Improvements

- Longer dive time
 - Hydrodynamic shape
 - Thruster placement minimizes power draw
 - 500Wh battery pack
- Allows transport on commercial flights
 - Fits in checked luggage
 - Flight legal batteries
- Batteries charge inside robot
- Custom front housing with forward & downward stereo cameras and Jetson Xavier
- 2 echosounders for better bottom following
- Sensors and motors connect through side housings
 - Frees up space in the main housing
 - Makes servicing the vehicle and adding features easier

Control Architecture Improvements

- Software completely implemented in Robot Operating System (ROS)
 - ROS based sensor fusion: GPS + USBL + Visual Odometry + IMU for localization
- Raspberry Pi handles low level robot control and localization
- Jetson Xavier handles mission planning and visual processing
- Realsense camera for odometry + closed loop position/velocity control

Conclusion

- WARPAUV2 is a novel robot design for vision based autonomy research, with open hardware and software architecture.
- Assembly and field trials are in progress