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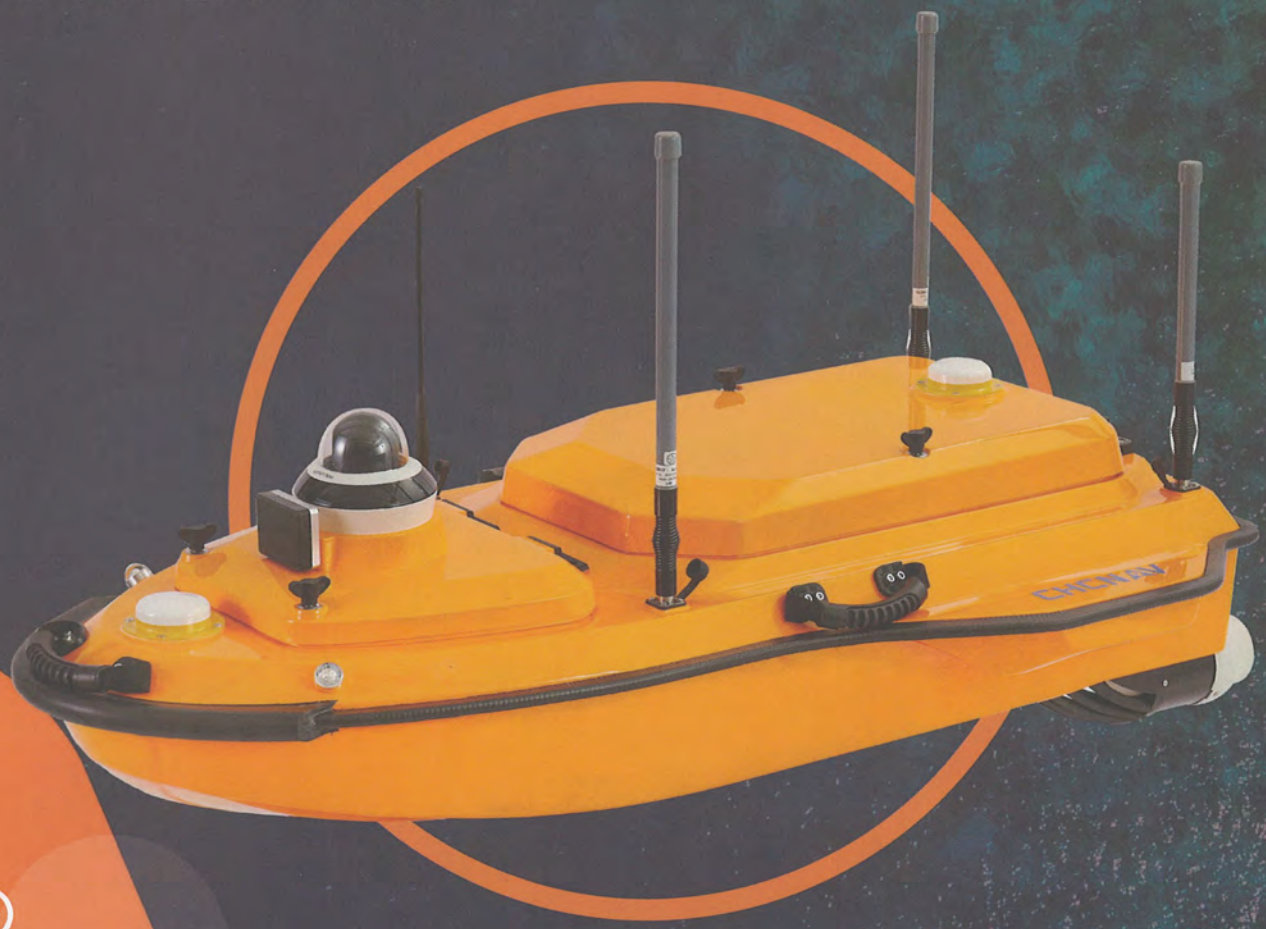
# APACHE 4

## AUTONOMOUS HYDROGRAPHIC SURVEY USV

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## MARINE SURVEY & CONSTRUCTION

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# AUTONOMOUS HYDROGRAPHIC SURVEY USV

The APACHE 4 is an Unmanned Surface Vessel (USV) that supports a wide variety of Acoustic Doppler Current Profiler (ADCP) systems available on the market. It offers an unmanned operation solution with a shallow draft, high navigational accuracy and stable hovering for hydrologists when measuring water flow velocity and discharge of a current section. Very compact, it enables easy handling at the mission site, facilitates safe launching and convenient transportation by car.

The APACHE 4 USV brings together the best of high-accuracy positioning and automated navigation control technology, built around the operator's habits when conducting ADCP hydrographic cross-section flow measurements. The built-in adaptive water flow and hovering navigation technology significantly improves the accuracy of flow estimation. Even when GNSS positioning might be degraded by obstructed environment, the internal GNSS+IMU module continues to provide reliable position and heading for the ADCP and autopilot controller.

The APACHE 4 is a perfect solution for obtaining high quality data for flow and velocity measurements in water where manned boat access is impractical, such as in front of dam structures, or where safety is a concern, such as during flood level measurements.

## ADVANCED NAVIGATION CONTROLLER

**Integrated adaptive water flow straight-line and hovering technology**

The autonomous control system enables APACHE 4 to navigate straight along the cross-section according to the profile view when the flow rate, turbulence, etc. changes. The hovering technology can make APACHE 4 hover stably in the turbulent flow at the start and end points of ADCP observation, thereby improving the accuracy of flow estimation.

## COMPATIBLE WITH MOST COMMON ADCPS

**Versatile. Carries up to 35 kg of payload**

The APACHE 4 central access shaft design provides unmanned cross-sectional flow measurement solutions for the leading ADCPs on the market. The APACHE 4 is particularly suited for hydrologists using ADCP sensors such as the M9, RTDP 1200, RiverPro, and RiverRay who are looking for an integrated, portable, and affordable unmanned solution. It does not only carry the ADCP, but also provides its positioning, orientation, power, waterproofing, network and 4G transmission solutions.

## BUILT-IN SINGLE-BEAM ECHO SOUNDER

**Expand your unmanned survey capability**

Single beam sounding data can be used to verify the accuracy of ADCP bottom tracking data, and even fed directly into the ADCP flow measurement software to compensate for the unavailability of ADCP data, and at the same time provides water depth profile data associated with the flow velocity profile measurement.

## SMART POSITIONING AND NAVIGATION

**Interrupted positioning with GNSS+IMU**

APACHE 4 provides stable position and heading to the ADCP and autopilot. Its IMU sensor ensures the availability of position data even during momentary GNSS signal loss. The obstacle avoidance radar system and live video feed ensure safe operations in case of loss of visibility or difficult environmental conditions. Completely autonomous, the APACHE 4 is safely operated from the shore. The AutoPlanner and HydroSurvey software suite allows the operator to define the entire mission, from the survey area to the export of the results.

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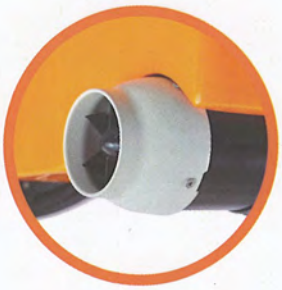
# EFFICIENT HYDROGRAPHIC SURVEY USV

Millimeter wave radar

SBES Transducer

ADCP access shaft



Semi-embedded motor

# SPECIFICATIONS

| Physical | |
|---|---|
| Hull dimension (L × W × H) | 1200 mm x 750 mm x 400 mm |
| Material | Macromolecule polyester carbon fiber |
| Weight (w/o instrument and battery) | 13 kg |
| Maximum payload | 35 kg |
| Anti-wave & Wind | 3rd wind level and 2nd wave level |
| Hull design | Triple-hull vessel |
| Water proof | IP67 |
| Draft | 12 cm |
| Indicator light | Two-color light (Display satellite and positioning status) |
| Camera | 360° omnidirectional video |
| ADCP mounting hole | 240 mm |
| ADCP Compatibility | Compatible with M9, RiverPro, RiverRay, RioGrande, RCP and other navigable ADCP |
| Mounted device | ADCP and sounder fitted as standard. Optional sampling, water quality measurement, side scan. |
| Safety | Shoal automatic astern, millimeter-wave radar automatic obstacle avoidance, low battery auto-return, signal loss auto-return |
| Obstacle avoidance distance | 0.2 - 40 m |

| Power | |
|---|---|
| Type | Electric |
| Propeller type | Brushless DC |
| Direction control | Veering without steering engine |
| Maximum motor power | 800 W |
| Maximum motor speed | 7200 rpm |
| Li-ion battery capacity | 5 x 32.4 V, 23.1 Ah |
| Battery endurance | 2 x 3 hours @ 2 m/s (running on 2 battery sets, support hot-swap) |
| Maximum speed | 6 m/s |

| Communication | |
|---|---|
| Data communication | Network bridge: 1 km and 4G: unlimited |
| R/C communication | 2.4 GHz |
| Remote control range | 1 km |
| SIM Card slot | Nano SIM |

| Interface | |
|---|---|
| Interface | 2 x RJ45 port<br>3 x RS232 serial port<br>1 x PPS |
| Navigation mode | Manual or Auto-Pilot |
| Water proof of master control | IP67 |
| Data storage | Local multi-sessions and FTP push |

| Positioning | |
|---|---|
| Satellite system | BDS B1/B2, GPS L1/L2, GLONASS L1/ L2, Galileo E1/E5, QZSS |
| Channel | 432 |
| Single point position (RMS) | Horizontal: 1.5 m<br>Vertical: 2.5 m |
| SBAS Positioning accuracy | Horizontal: 0.5 m<br>Vertical: 0.85 m |
| DGNSS positioning accuracy | Horizontal: 0.4 m + 1 ppm<br>Vertical: 0.85 m + 1 ppm |
| RTK Positioning accuracy | Horizontal: ±8 mm + 1 ppm<br>Vertical: ±15 mm + 1 ppm |
| Heading accuracy | 0.2 ° @1 m baseline |
| Inertial navigation accuracy | 6 °/ h |
| IMU update rate | 200 Hz |

| D270 Single Beam Echo Sounder | |
|---|---|
| Data type | CHCGD (1) , NMEA SDDPT/SDDBT, original waveform |
| Weight | 0.84 kg |
| Sounding range | 0.15 m to 200 m |
| Sounding accuracy | ±0.01 m + 0.1% x D (D is the depth of water) |
| Resolution | 0.01 m |
| Frequency | 200 KHz |
| Beam angle | 6.5° ± 1° |
| Supply voltage | 10-36 V DC/ 100-20 V AC |
| Waterproof | IP67 |

| Software | |
|---|---|
| Hydro survey | Data collection and post-processing. Support coordinate conversion, trajectory, water depth, waveform real-time display, post-processing support waveform overlay and attitude correction. |
| Auto planner | Route planning, autonomous navigation, hull parameter control, multi-angle video display, and system self-test at power-on. |

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* Specifications are subject to change without notice.

(1) CHCGD is CHCNAV format.

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