

# Driving a New Era of Hydrographic Surveys in Indonesia with HydroBoat 1200 USV



## Background

As the world's largest archipelagic nation, Indonesia grapples with the intricate challenges of managing its vast and varied water resources. Traditional hydrographic survey techniques, while effective in the past, have proven to be slow, laborious, and often prone to inaccuracies, particularly in demanding aquatic environments. The evolution of unmanned surface vehicle (USV) technology has introduced a groundbreaking solution, transforming how water surveys are conducted.



## *Traditional Survey Methods*

For decades, hydrographic surveys were dependent on manual efforts. Surveyors frequently faced perilous water conditions and inclement weather, leading to both inefficiencies and safety hazards. In addition, the cumbersome nature of traditional survey equipment made it difficult to deploy in complex or remote areas, often resulting in suboptimal data quality.



## *Innovation with USV Technology*

SatLab leads the way in hydrographic surveying with its cutting-edge products, the HydroBoat 1200 USV, when paired with the HydroFlow 1200 ADCP, ushers in a new era of precision and efficiency for hydrographic surveying. This intelligent USV solution boasts several key advantages:

- ***Fully Automated Operations***

The HydroBoat 1200 autonomously navigates pre-set routes, utilizing its high-precision ADCP sensor to gather real-time water depth and flow velocity data, significantly reducing human intervention.

- ***User-Friendly Interface***

Through a simple Android remote controller, operators can monitor and control the USV in real time, eliminating the need for bulky shore-based equipment or extensive technical training.

- ***Unmatched Data Accuracy***

Equipped with cutting-edge sensors and advanced data processing algorithms, the HydroBoat 1200 guarantees reliable, high-quality survey data.

- ***Unrivaled Versatility***

The system features a 240mm moon pool that accommodates a variety of ADCPs, allowing for easy customization to meet specific environmental needs. Its compact design further enhances its versatility, making it highly adaptable to a broad spectrum of aquatic conditions.



## A Streamlined Solution

During a hydrographic survey project in Indonesia, the HydroBoat 1200, alongside the HydroFlow 1200 ADCP, showcased its remarkable efficiency. The solution provides:

- **Seamless Operation**

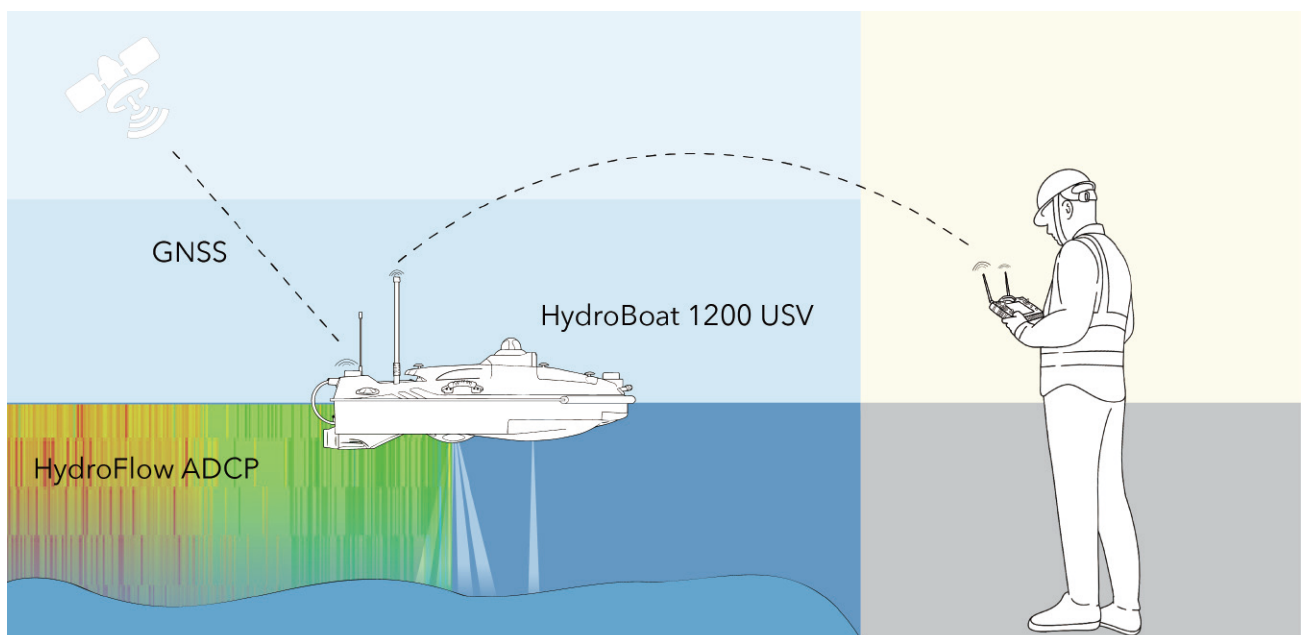
Its intuitive Android interface requires no specialized training, allowing for ease of deployment.

- **Instant Insights**

Real-time ADCP data recording enables immediate data analysis and on-the-spot decision-making.

- **Fully Integrated System**

The streamlined connection between device control, data display, acquisition, processing, and export minimizes the need for manual intervention, boosting overall operational efficiency.



## Implementation: A Step-by-Step Overview

### Equipment



HydroBoat 1200 USV



HydroFlow 1200 ADCP

### Software



SLHydroUSV



SLHydroFlow

### Specification

| HydroBoat 1200 USV Specification  |                                                 |
|-----------------------------------|-------------------------------------------------|
| Vehicle Specifications            |                                                 |
| Hull dimension (L × W × H)        | 1185 mm*593 mm*397 mm                           |
| Weight                            | 25kg(No Battery)                                |
| Max Load                          | 25kg                                            |
| Anti-wave & Wind                  | 3rd Wind Level & 2nd Wave Level                 |
| Waterproof                        | IP67                                            |
| Anticollision sensor              | Detection distance 10-30 meters                 |
| Propeller                         | 2*Brushless Propeller                           |
| Maximum speed                     | 6m/s                                            |
| Battery endurance                 | One battery 4.5h with 1.5m/s, total 2 batteries |
| Controller                        |                                                 |
| System                            | Android System                                  |
| Software                          | SLHydro USV                                     |
| Control range                     | 1.3km on 2.4GHz; Unlimited on 4G                |
| GNSS Performance                  |                                                 |
| Satellite system                  | GPS, BDS, GLONASS, Galileo                      |
| RTK Positioning accuracy          | H: ±8mm + 1 ppm RMS V: ±15mm + 1 ppm RMS        |
| Heading accuracy                  | 0.2° @1 m baseline                              |
| INS accuracy                      | 2.1°/h, <1m/20s                                 |
| Refresh Rate                      | 200Hz                                           |
| Built-in Single Beam Echo Sounder |                                                 |
| Depth range                       | 0.15m - 200m                                    |
| Accuracy                          | ±0.01 m + 0.1% × D (D is the Depth of Water)    |
| Frequency                         | 200 kHz                                         |
| Beam angle                        | 5±0.5°                                          |

During the survey, the HydroBoat 1200 navigated autonomously in the designated area, while the HydroFlow 1200 ADCP continuously collected river velocity data. Operators kept a vigilant eye on the USV's navigation status and the ongoing data acquisition using an Android remote control, ensuring that the survey was conducted with precision and efficiency.

## Key Steps:

### 1. Deployment of the USV



### 2. Equipment Connection

Connection Methods

Network Bridge Connection >

Boat Control: HydroBoat1200 [Reboot](#)

Serial Number: 16691073

Firmware Version: 1.0.6 [Update](#) [Detail](#)

Expiration Date: 2024-07-26 [Register](#)

Control Version: 202309101443\_2.1.3 [Update](#)

GNSS Board: R4.10Build7650 [Reboot](#)

Echo Sounder: V1.1.2

Adcp: iFlow RP1200 5.24 [Reboot](#)

Adcp SN: 1319

Connected successfully

Disconnect

Data

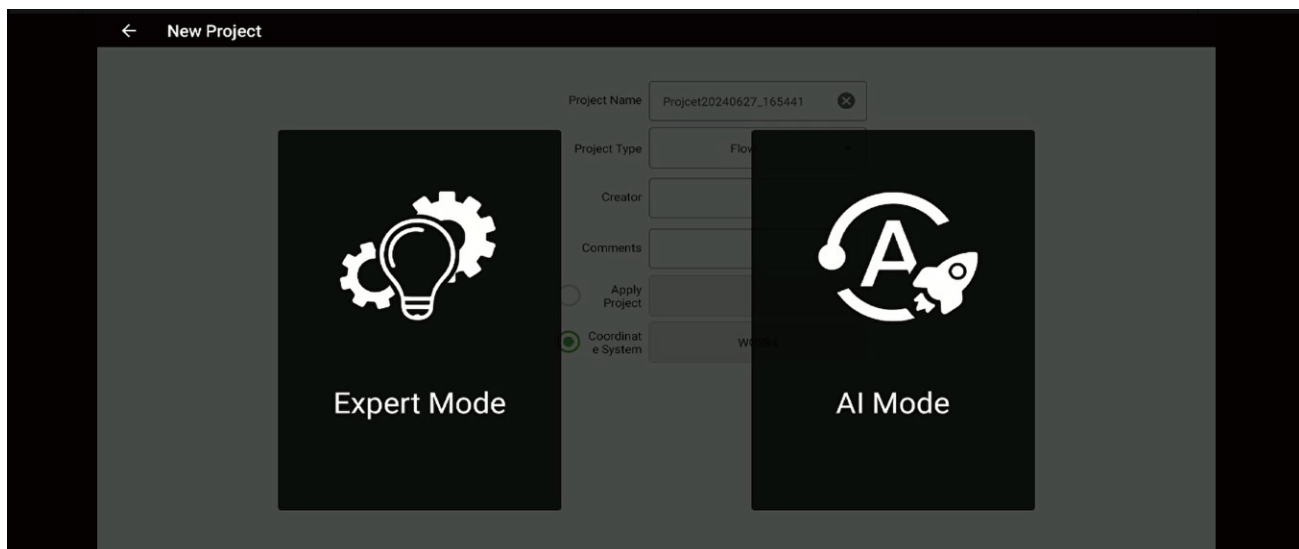
Command

DistanceSensorInfo(mTargetPointDistance=22.2, mTargetPointNumber=8, mIsValid=true, mCmd=msgName:ReportRangeFinder MSG\_ID\_56 - sysid:1 compid:200 distance:22.2 azimuth:11 type:0 state:1 num:8 id:3)  
Date:2024-06-27 15:54:13  
Latitude:06:10:36.06024S  
Longitude:106:37:43.78296E  
Solution State:Auto  
Speed:0.2  
MultiBatteryInfo(mCmd=msgName:ReportMultiBattery MSG\_ID\_19005 - sysid:1 compid:200 total:1 index:[5@18020b, mList=[com.zhd.comm.info.boat MultiBatteryInfo\$BatteryContent@8dcada6])  
DistanceSensorInfo(mTargetPointDistance=23.5, mTargetPointNumber=8, mIsValid=true, mCmd=msgName:ReportRangeFinder MSG\_ID\_56 - sysid:1 compid:200 distance:23.5 azimuth:33 type:0 state:1 num:8 id:9)  
WorkModeInfo(mWorkMode=1, mCurrentTask=2, mIsTrackTaskPause=false, mIsLock=false, mPosEnable=true, mIsAvoidObsRun=false, mIsHoverRun=false, mCmd=msgName:ReportControlStateInfo MSG\_ID\_49 - sysid:1 compid:200 horizontalDistance:0 environmentalState:0 runTime:3 nHzDistance:0 deviceState:0 modeTaskInfo:33 runState:0 stateInfo:27)  
NavInfo(mHeadingDir=177.8, mRollDir=0.6, mScanDir=-0.2, mCmd=msgName:ReportNavigationInfo MSG\_ID\_51 - sysid:1 compid:200 fuseHeight:0 yawDeg:177.8 rollDeg:6 pitchDeg:-2 velN:0 velE:0 velD:0 coefficient:0)  
GNSSStatusInfo(mSpeedN=0.066, mSpeedE=0.023, mPosSol=SW\_2D, mDirSol=SW\_FLOAT, mCmd=msgName:ReportGnssPvtInfo MSG\_ID\_1025 - sysid:1 compid:200 date:14520758 lon:1066288306 lat:-61766783 ellipsoidHeight:28843 hmsl:11151 velN:66 velE:23 velD:16 primaryANT:16412 secondaryANT:32768 year:2024 typeCode:0)  
Date:2024-06-27 15:54:14  
Latitude:06:10:36.05988S  
Longitude:106:37:43.78296E  
Solution State:Auto  
Speed:0.2  
BatteryInfo(mVoltage=31.799999237060547, mElectricPercent=75, mMavlinkData=msgName:ReportBatteryInfo MSG\_ID\_1538 - sysid:1 compid:200 current:-800 voltage:3180 temperature:3100 type:0 percent:75 code:0)  
ItemInfo(mIsEEPROM=true, mIsEMMCOCK=true, mIsTFCK=true, mTempStatus=0, mIsStatus=1, mTempValue=58.4, mCmd=msgName:ReportSystemStateInfo MSG\_ID\_57 - sysid:1 compid:200 systemTemperature:584 systemState:32)

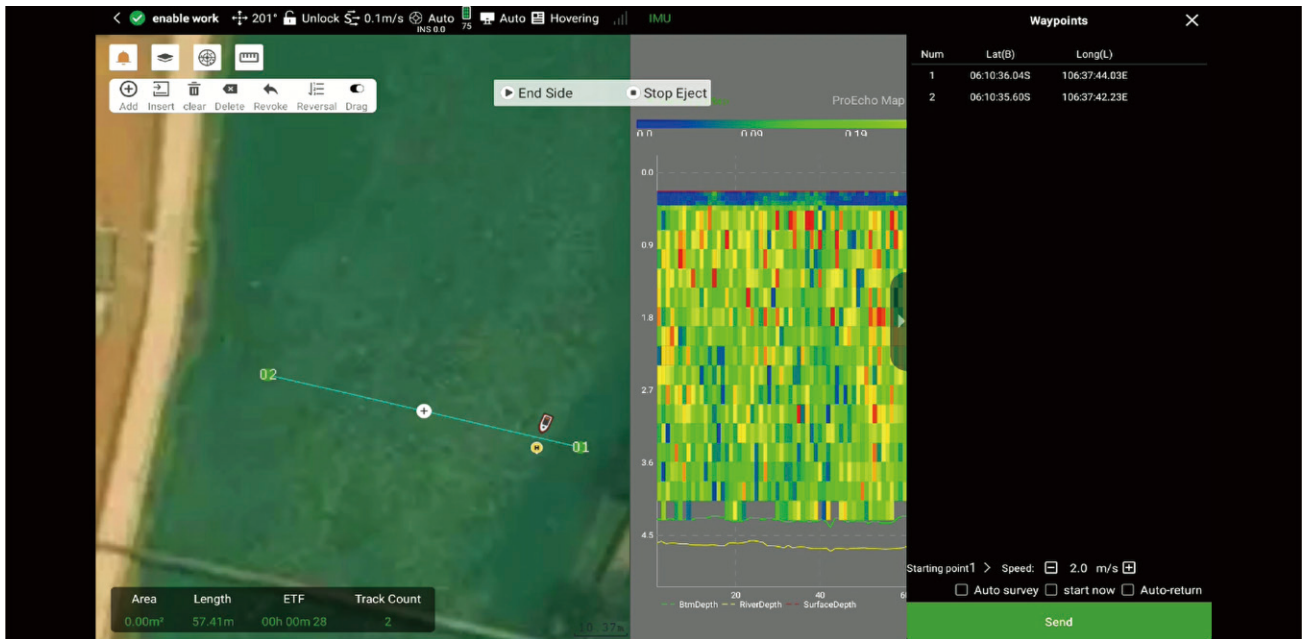
Refresh

Save

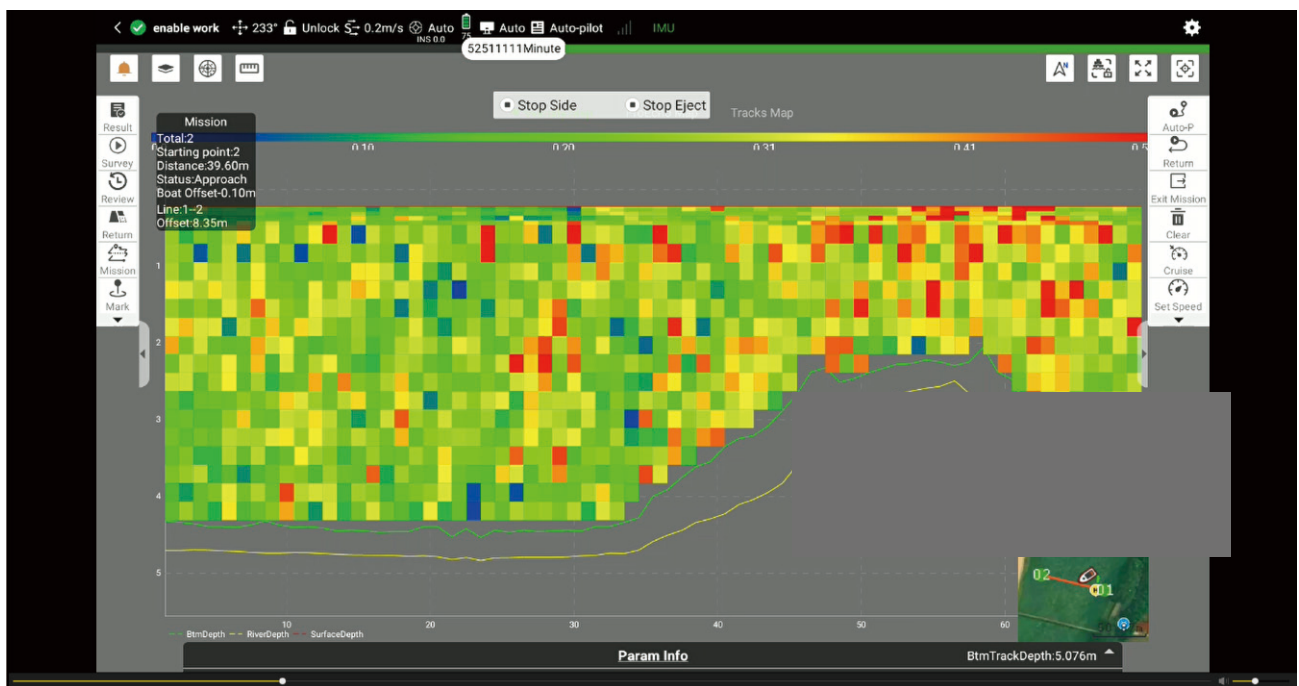
### 3. Select Measurement Mode



#### 4. Set up the Automatic Navigation Mission



#### 5. Data Acquisition



### Results

In contrast to traditional survey methods, the HydroBoat 1200 USV delivered a dramatic improvement in both speed and accuracy. Tasks that previously took days were completed in mere hours. The ease of operation, combined with real-time data capabilities and broad system compatibility, sets the HydroBoat apart from other solutions on the market. The Android-powered remote control allowed for real-time data recording, making the entire operation more accessible and intuitive.

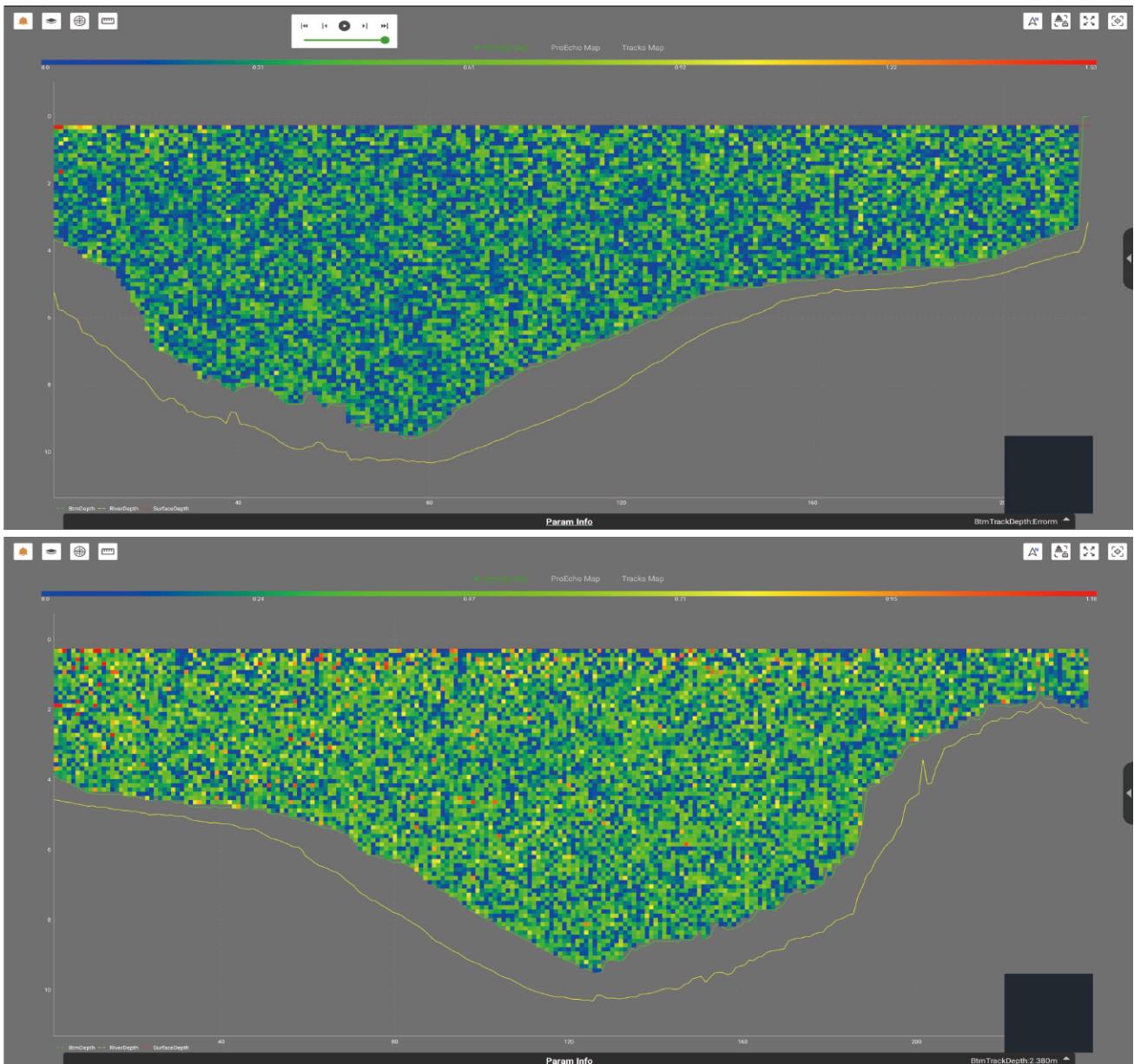


Figure - Velocity contour graph

Survey Result

AVAILABLE RECYCLE

| Name                  | Start | Ping Num | Start Time          | Total Flow | Relative | Total Area | Flow  | Max Flow | Length | Depth | Max Depth | Flow Refer |
|-----------------------|-------|----------|---------------------|------------|----------|------------|-------|----------|--------|-------|-----------|------------|
| 24-06-27 123227_RIGHT | Right | 239      | 2024-06-27 12:32:27 | 23.683     | 3.442%   | 314.174    | 0.079 | 1.375    | 50.74  | 6.77  | 10.32     | Bottom     |
| 24-06-27 123703_RIGHT | Left  | 217      | 2024-06-27 12:37:03 | 22.107     | -3.442%  | 323.732    | 0.077 | 1.039    | 49.46  | 7.42  | 10.32     | Bottom     |
| Avg                   |       |          |                     | 22.895     | --       | 318.953    | 0.078 | 1.207    | 50.10  | 7.09  | 10.32     |            |
| Standard              |       |          |                     | 1.114      | --       | 6.758      | 0.001 | 0.238    | 0.90   | 0.46  | 0.00      |            |
| Standard/Avg          |       |          |                     | 0.049      | --       | 0.021      | 0.018 | 0.197    | 0.02   | 0.06  | 0.00      |            |

Flow Results Table

To Recycle

Figure - Data results of round-trip measurement

|                           |                                                    |                    |                             |                       |                               |                               |                       |     |
|---------------------------|----------------------------------------------------|--------------------|-----------------------------|-----------------------|-------------------------------|-------------------------------|-----------------------|-----|
| Date:                     | 2024                                               | y                  | 6-27                        | Weather:              | cloudy                        | Wind power and direction:     |                       |     |
| Measurement times:        |                                                    |                    |                             | Boat:                 | HydroBoat 1200                | Computer:                     | SM-G998B              |     |
| Start time:               | 2024-06-27 12:32:27                                |                    |                             | End time:             | 2024-06-27 12:40:37           |                               |                       |     |
| ADCP model:               | HydroFlow 1200 1319                                |                    |                             | Fire version:         | Soft version: V3.0.4-20240521 |                               |                       |     |
| Gnss model:               |                                                    |                    |                             | Compass:              | Echo Sounder:                 |                               |                       |     |
| Data file path:           | /storage/emulated/0/HIBOAT/Project/Project20240627 |                    |                             | Config file path:     | Project20240627_122944        |                               |                       |     |
| Transducer depth:         | 0.078                                              | m                  | Blanking Distance:          | 0.12                  | Depth cell size:              | 0.12                          | Number of depth cell: | 100 |
| Salinity:                 | 0                                                  |                    | Water tracking ping number: | 2                     | Bottom tracking ping number:  | 2                             | Exponent:             | 5   |
| Measurement Round         | Course                                             | Shore distance (m) |                             | Data file name        | Half round Q (m³/s)           | Average Q of one round (m³/s) | Remarks               |     |
|                           |                                                    | L                  | R                           |                       |                               |                               |                       |     |
| 1                         | Right                                              | 5.0                | 5.0                         | 24-06-27 123227_RIGHT | 23.7                          | 22.9                          |                       |     |
|                           | Left                                               | 5.0                | 5.0                         | 24-06-27 123703_RIGHT | 22.1                          |                               |                       |     |
|                           |                                                    |                    |                             |                       |                               |                               |                       |     |
|                           |                                                    |                    |                             |                       |                               |                               |                       |     |
|                           |                                                    |                    |                             |                       |                               |                               |                       |     |
|                           |                                                    |                    |                             |                       |                               |                               |                       |     |
| Measurement Result        |                                                    |                    |                             |                       |                               |                               |                       |     |
| Measure Items             | Round 1                                            |                    | Round 2                     |                       | Round 3                       |                               | Average of rounds     |     |
|                           | Forward                                            | Back               | Forward                     | Back                  | Forward                       | Back                          |                       |     |
| Gross-sectional Q (m³/s)  | 23.7                                               | 22.1               |                             |                       |                               |                               | 22.9                  |     |
| Gross-sectional Area (m²) | 314                                                | 324                |                             |                       |                               |                               | 319                   |     |
| Average current vel (m/s) | 0.08                                               | 0.08               |                             |                       |                               |                               | 0.078                 |     |
| Max current vel (m/s)     | 1.38                                               | 1.04               |                             |                       |                               |                               | 1.38                  |     |
| Average water depth (m)   | 6.8                                                | 7.4                |                             |                       |                               |                               | 7.1                   |     |
| Max water depth (m)       | 10.3                                               | 10.3               |                             |                       |                               |                               | 10.3                  |     |
| Water surface width (m)   | 51                                                 | 49                 |                             |                       |                               |                               | 50.1                  |     |
| start water level:        | m                                                  | end water level:   | m                           | average water level:  | m                             | corresponding water level:    | m                     |     |
| Remarks:                  |                                                    |                    |                             |                       |                               |                               |                       |     |
| Operation record:         |                                                    | On-site review:    |                             | Approved:             |                               |                               |                       |     |

Figure - Data report exported from SLHydro USV software

Feedback from users has consistently highlighted the HydroBoat 1200 and HydroFlow 1200 ADCP system as a game-changer in hydrographic surveys. Its ability to deliver precise data with unparalleled speed and safety has simplified complex operations, empowering users to achieve more with less effort.

## Conclusion

The pairing of the HydroBoat 1200 and the HydroFlow 1200 ADCP represents a leap forward in hydrographic surveying. This highly efficient, safe, and precise system is redefining how water resource management is approached in Indonesia. As USV technology continues to advance, its role in hydrographic surveys, water resource management, and environmental monitoring will undoubtedly expand, offering new possibilities for the future.