DRONESYSTEMS

Funded by the European Union

Riverbed Geometry Survey

Full river cross sections: LiDAR above the water, radar or sonar below it

WHAT IT IS

Two UAV payloads give one continuous cross section. Near-infrared LiDAR (DJI Zenmuse L2) maps the exposed riverbed and banks. The submerged part is mapped with a water-penetrating radar (Radar Systems Zond AERO LF) or a tethered echosounder (Echologger ECT 400s), flown a few decimetres above the water with true terrain following. The two datasets are merged into one cross section.

TYPICAL USES

- **Hydraulic models:** riverbed geometry is the main input that sets the relation between discharge and water level.
- **Regulativ and maintenance control:** re-surveying cross sections after erosion and sedimentation. Denmark spends in the order of 200 million DKK per year on river geometry surveys.
- **Flood forecasting and infrastructure planning:** current geometry at the reaches that matter.

WHAT YOU GET

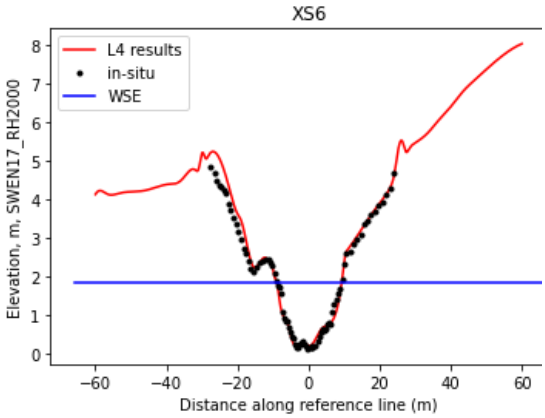
- Bare-earth DTM of the banks and floodplain (vertical accuracy 10 cm or better), point cloud in LAS.
- Bathymetry points per cross section (10 cm or better), radargram or sonargram on request.
- Merged cross sections at regular spacing (CSV), in your horizontal and vertical reference system.

HOW IT IS FLOWN

- LiDAR: 50–120 m altitude, lawnmower pattern with 50 % overlap. Radar: within 0.5 m of the water, max 2 m/s, two passes. Sonar: 2 m above the water on a cable, max 1 m/s, one pass.
- Limits: water-penetrating radar works up to about 300–400 µS/cm conductivity; the tethered sonar suits slow-flowing rivers and is sensitive to submerged vegetation.
- Flown VLOS in the 'open' category. The low-altitude bathymetry flights are not offered BVLOS: they need true terrain following, which is not yet operational on the BVLOS platform.

PRODUCTIVITY

- **LiDAR:** 1–4 km of river per hour.
- **Bathymetry:** 0.75–2 cross sections per hour. Flight time per section is a few minutes; access and endpoint adjustment take the rest.



Example output: merged LiDAR and water-penetrating-radar cross section (Rønne Å, XS6). Black dots are in-situ RTK checks, blue line is the water surface.

KEY FACTS

LiDAR	DJI Zenmuse L2, DTM 10 cm or better
Bathymetry	Zond AERO LF water-penetrating radar or Echologger ECT 400s sonar, 10 cm or better
Terrain following	SPH Engineering true terrain following kit
Positioning	RTK (NTRIP) or PPK
Platform	DJI M300 RTK, VLOS
Output	DTM, LAS, cross-section CSV, merged profiles

WHAT A QUOTE COVERS

- Planning and preparation (cross-section placement, access, permits)
- Survey days, crew of two
- Transport and accommodation
- Data processing: LiDAR, bathymetry, merged sections

Prices depend on reach length, number of cross sections, access and VLOS/BVLOS. Quote on request.

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Workflow developed in UAWOS – Unmanned Airborne Water Observing System, Horizon Europe grant agreement 101081783 · uawos.dtu.dk · Technical basis: UAWOS surveying protocol D3.2 (Riverbed Geometry Surveying Protocol) · Version 1.0, November 2026