Ultrabeam Uses Applanix to "Map the Gap!"

Map the Gap: Creating an Autonomous Marine Survey Vehicle to find crossing points of a river.

A competition was launched by the UK's Defence Science and Technology Laboratory (DSTL) in an effort to develop an autonomous survey vehicle which could survey rivers and river banks to find sites for troops to cross. Ultrabeam met the challenge.

Solution

POS MV

POS MV™ blends GNSS data with angular rate and acceleration data from an IMU and heading from GAMS to produce a robust and accurate solution.
applanix.com/products/posmv.htm

POSPac MMS

POSPac Mobile Mapping Suite™ is industry-leading software for Direct Georeferencing of mobile mapping sensors using GNSS and inertial technology.
applanix.com/products/pospac-mms.htm

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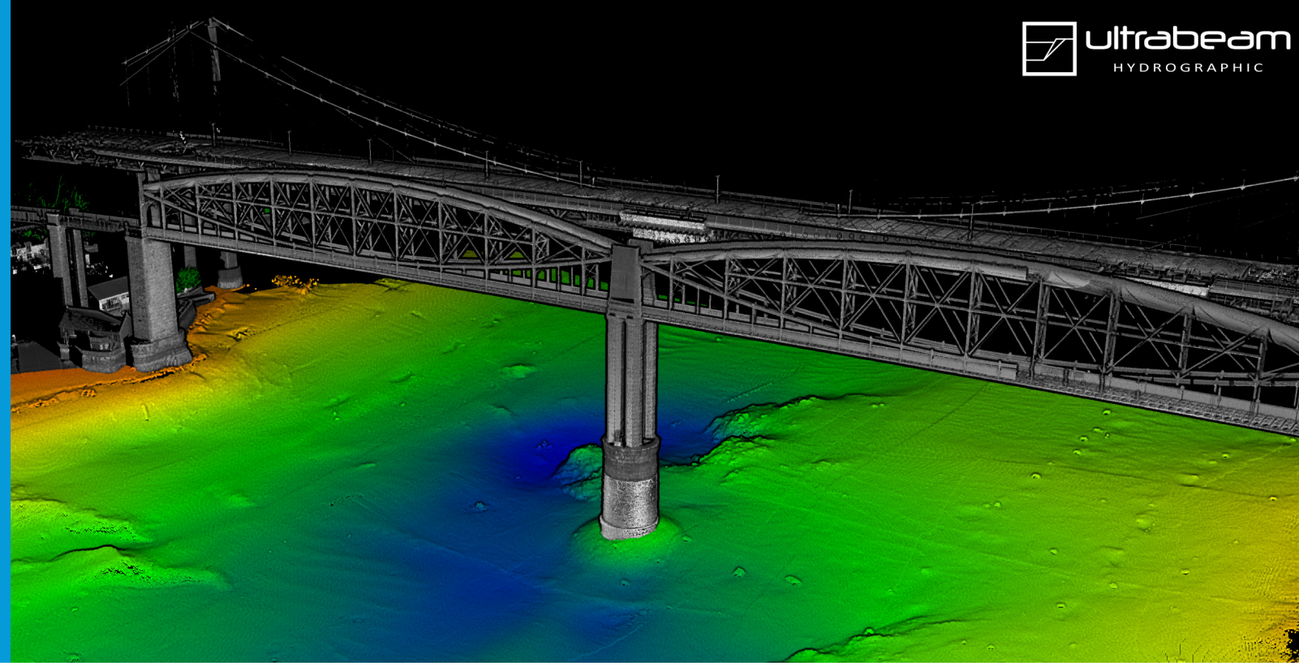
OVERVIEW

Ultrabeam Hydrographic was awarded one of five contracts by the Ministry of Defence - Defence and Security Accelerator (DASA) to develop a remotely operated reconnaissance survey system to help troops safely and stealthily advance into enemy territory across water obstacles such as rivers.

Location
Cornwall, UK

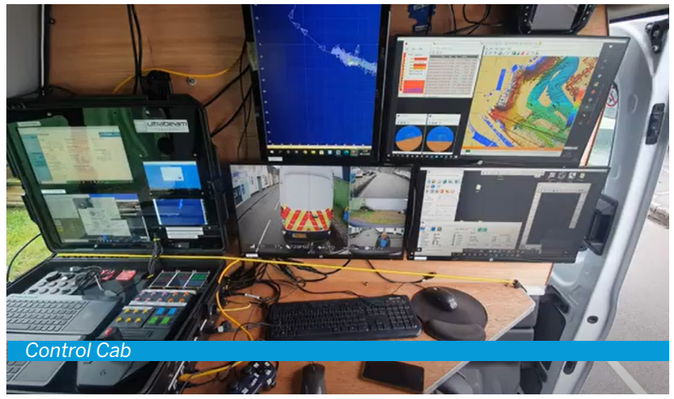


CHALLENGE

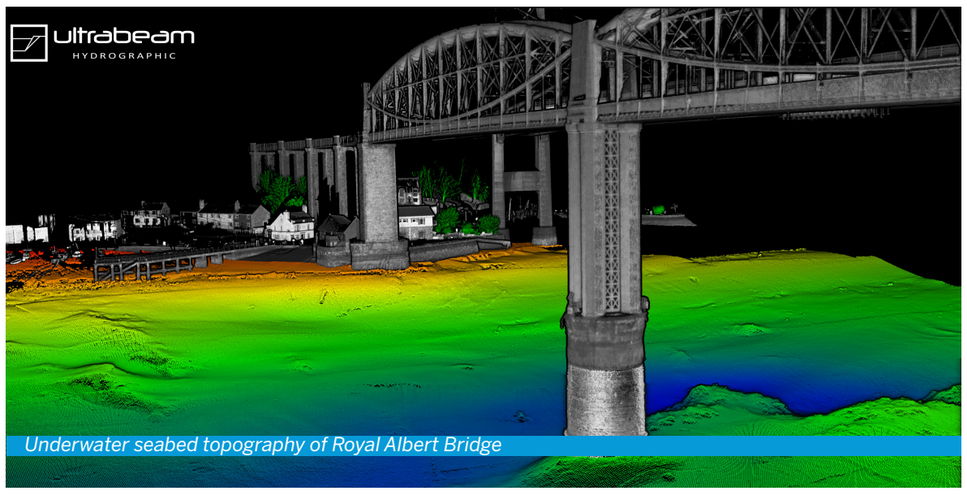
When advancing into enemy territory, the UK military needs to be able to cross obstacles, such as rivers. Currently, the only way to identify suitable crossing points is to send Royal Engineer reconnaissance troops to survey both banks of the river. This exposes them to danger at the battlefield and risks compromising the location by signalling interest in it.

The goal is to remove personnel from this potentially dangerous and compromising task using a semi-autonomous remote system that will be able to take measurements without needing personnel at the location.

There are currently sensors that can take the needed measurements and a variety of delivery platforms; however, there is not a combined system to gather all the required data.



Control Cab



Underwater seabed topography of Royal Albert Bridge

SOLUTION

Five small and medium-sized businesses were awarded Phase 1 funding (£177,789) by the Defence and Security Accelerator (DASA), to fast-track their innovative solutions and test with the British Army.

Ultrabeam Hydrographic was one of the companies awarded the contract to demonstrate an amphibious, autonomous hydrographic survey vehicle, using novel techniques tools and Sonar and LiDAR (Light Detection and Ranging).

To design the perfect solution, Ultrabeam selected Applanix.

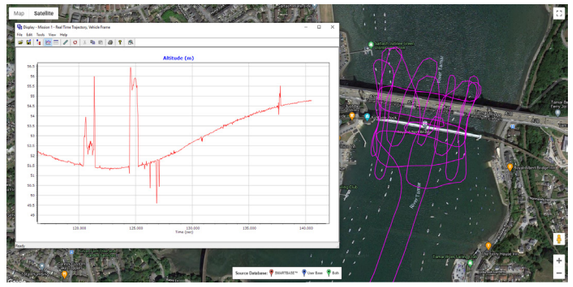
Ultrabeam created a rugged eight-wheeled, unmanned vehicle that is three metres long, fully amphibious, and boasts electric thrusters for advanced in water maneuverability. The vehicle has an ultra-high resolution 360-degree coverage Scanner, a Norbit Multi-beam system, and the **Applanix POS MV OceanMaster system** (Position and Orientation System for Marine Vessels), for directly georeferencing the data collected. This data could then be used to create very high accuracy maps of the terrain, both above and below the waterline.

"All of our high accuracy surveys use POSPac to post process the POS MV files to provide the highest accuracy solution possible. We deploy a Trimble base station as close to the site as possible and log base data at 1Hz. We then use this base station to post process the POS data to produce the SBET for import into our survey processing software QPS Qimera," says Gabriel Walton.

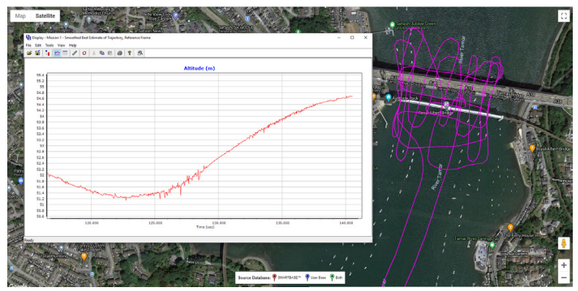
The vehicle also has a portable control station, mobile command centre and real-time 3D navigation and data display.

"POSPac greatly improves the navigation solution allowing us to increase our accuracy. We perform bridge surveys and close passes to high quay and port walls which reduces our view of the satellites. Errors are often visible in the real time solution but once POSPac'd we improve the final solution," says Gabriel.

Ultrabeam will be participating in phase 2 of Map the Gap and will use this as part of its fleet moving forward.



Before POSPac SBET altitude and map



After POSPac SBET altitude and map

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SOLUTION SPECIFICATIONS

The vehicle's autopilot capabilities:

- auto heading
- route following
- position hold
- auto speed
- strafe movements

Weight	450 kg
Length	3.0 m
Width	1.45 m
Height	1.8 m
Load	100 kg

On land, this vehicle's performance:

- 8 mph vehicle speed at 3000RPM
- motors capable of 6000RPM to give 16mph
- 8x8 wheel drive with high torque motors and gearbox
- maximum incline over 45 degrees
- gearboxes can be adjusted to give higher top speed

On water, this vehicle's performance:

- 4mph water speed
- 8hp equivalent bow thruster allows perfect heading control and ability to perform strafe movements
- shallow draft
- 48V Torqeedo Cruise 4.0 8hp equivalent thrusters giving a total of 16hp forward thrust

Endurance

- 48V 21.2kWh Tesla batteries
- Over 12 hour endurance
- estimated range of 20-60 miles depending on terrain and speed
- charging time from 10% to 90% is 2 hours

Telemetry and Control Range

- main control telemetry range 10km direct LOS
- low resolution camera and data acquisition available at this range
- high resolution camera transmitter range is 500m
- Dynautics autopilot capable of following a route or programmed commands beyond telemetry range

POS MV OCEANMASTER ACCURACY AND PERFORMANCE SUMMARY

	DGPS	Fugro Marinestar®	IARTK	POSPac MMS PPP	POSPac MMS IAPPK	Accuracy During GNSS Outage
Position	0.5 - 2 m[2]	Horizontal: 10 cm 95% Vertical: 15 cm 95%	Horizontal: +/- (8 mm + 1 ppm x baseline length)[3] Vertical: +/- (15 mm + 1 ppm x baseline length)[3]	Horizontal: < 0.1 m Vertical: < 0.2 m	Horizontal: +/- (8 mm + 1 ppm x baseline length)[3] Vertical: +/- (15 mm + 1 ppm x baseline length)[3]	~ 6 m (DGPS) ~ 3 m (RTK) ~ 2 m (PPDGNSS) ~ 1 m (IAPPK)
Roll & Pitch[4]	0.02°	0.01°	0.01°	< 0.01°	0.008°	0.03°
Heading[4]	0.01° with 4 m baseline 0.02° with 2 m baseline	0.01° with 4 m baseline 0.02° with 2 m baseline	0.01° with 4 m baseline 0.02° with 2 m baseline	0.01° with 4 m baseline 0.02° with 2 m baseline	0.01° with 4 m baseline 0.02° with 2 m baseline	1° per hour degradation (negligible for outages <60 s)
Heave TrueHeave™	5 cm or 5%[5] 2 cm or 2%[6]	-5 cm or 5%[5] 2 cm or 2%[6]	5 cm or 5%[5] 2 cm or 2%[6]	-	-	5 cm or 5%[5] 2 cm or 2%[6]

RESULTS

"We needed to produce very high accuracy data for this project. And that's why we chose Applanix. The Applanix POS MV and POSPac post-processing software produce the very best results in the industry."

Gabriel Walton
Technical Director at Ultrabeam

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