INTERTIDAL 2026 FORD FIESTA

A Technical Manual

TIDE TOGETHER

How to Turn a Car Into a Tide

01. INTERTIDAL

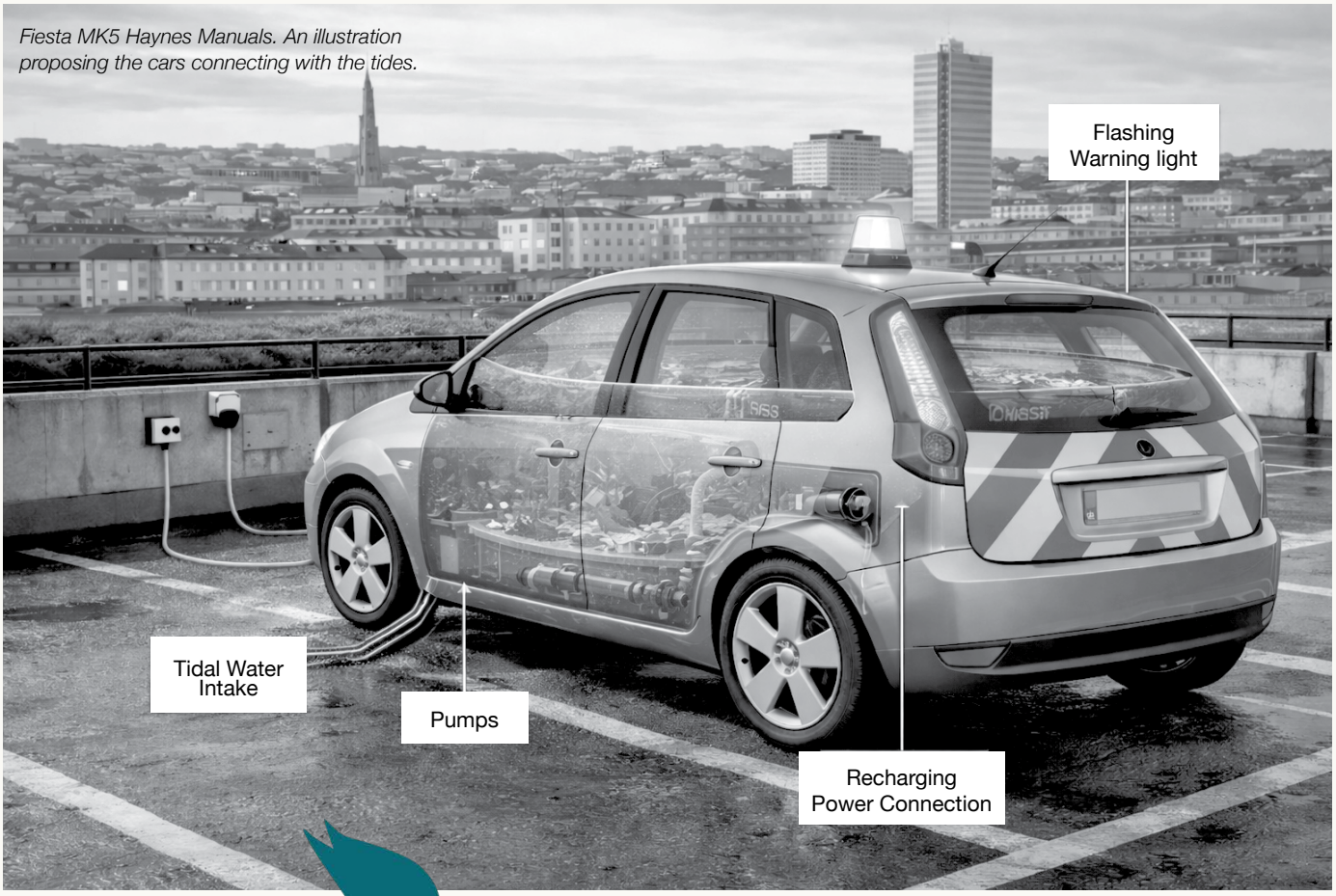
At first glance, Intertidal still looks unmistakably like a Ford Fiesta. The body shell, doors, windows and familiar proportions remain, but almost everything that once defined the vehicle's purpose has changed.

The car has become a machine for making the tide visible. The vehicles were stripped back to their shells before being rebuilt with tanks, pumps, batteries, sensors, filtration systems and custom electronics. They no longer transport people. Instead, they transport an idea.

Powered by live tidal data rather than fuel, the water inside each car rises and falls with the changing tide, transforming an ordinary vehicle into a machine that makes the invisible visible.

Cars are among the most familiar objects in everyday life. Intertidal deliberately reimagines that familiarity, inviting us to look again at something we think we know.

The project began not with an engineering drawing, but with a simple question from artist David Cotterrell: Could the changing tide be made visible inside an object everyone recognised?



Fiesta MK5 Haynes Manuals. An illustration proposing the cars connecting with the tides.

02. THE SYSTEM

The original mechanical systems have been removed and replaced with a purpose-built network of electrical, hydraulic and environmental systems. Together they allow the vehicle to respond to live tidal information, move and filter water, support marine planting and operate safely in public spaces.

The engine bay had to accommodate an eclectic array of pumps, electrical systems, power supplies, valves, and switches. ©David Cotterrell

Every element has been designed around the Fiesta's existing structure, balancing weight, power, water management and accessibility. The following chapters strip each system back to reveal how Intertidal works beneath the bodywork.

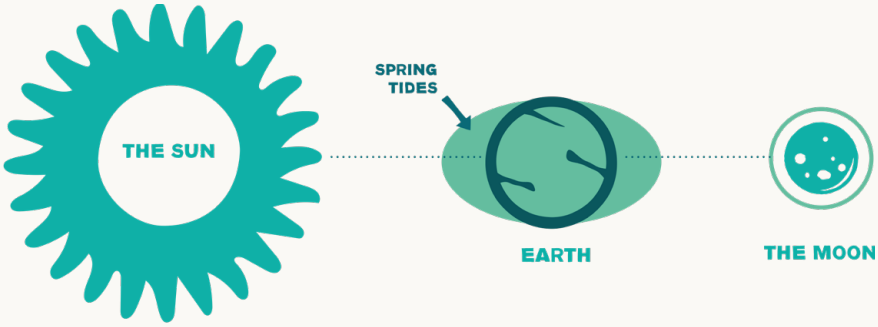
Why the tide?

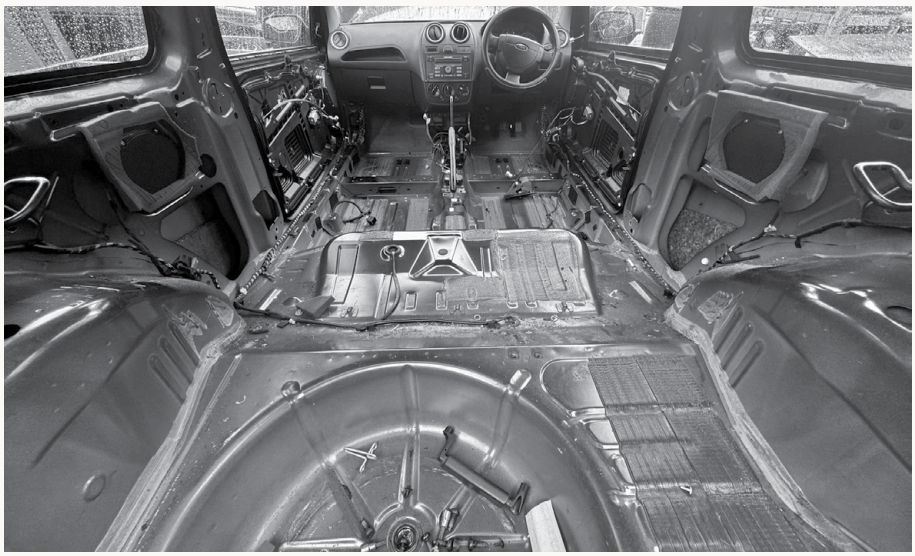
Twice a day, Plymouth's shoreline changes but the tide doesn't stop there. It encroaches deep under the city, below our feet. Intertidal captures that constant movement, using live tidal data to transform a familiar car into a marker of the sea's rhythm. The Fiesta draws attention, but the tide is the real subject; inviting us to see Plymouth Sound National Marine Park with fresh eyes.

03. THE BLUEPRINT

An idea beneath the surface

Intertidal began with a question, not a blueprint. David Cotterrell wanted to challenge the way we think about the intertidal zone. While most of us see the coastline as the point where land ends and water begins, the tide continues beyond the shore, flowing beneath Plymouth through hidden waterways, drains, geology and infrastructure. The challenge was to make this unseen movement visible in a place where people would least expect to encounter it.





The prototype car was first stripped of its interior to make the structure visible and ready for reinforcement. ©David Cotterrell

Struggling to overcome disbelief in the first design meeting at Blackwater Marina. ©David Cotterrell

Drawing the impossible

The first ideas emerged through sketches, conversations and experiments. David explored how an ordinary Ford Fiesta might become a vessel for the tide, testing how water, light and movement could occupy a familiar object without losing its identity. The first car at Blackwater Marina in Maylandsea, Essex and his studio in Deptford, London became a working prototype, allowing ideas to be tried, adapted and refined as new technical challenges emerged.

From concept to construction

As the artistic vision evolved, so did the engineering. Using the first prototype, artists, engineers, fabricators and technical specialists from TR2 in Plymouth worked together to solve each challenge while staying true to the original idea. Every tank, pump, battery and control system was developed to serve a single purpose: making the hidden movement of Plymouth's tide visible beyond the water's edge; revealing that the sea is part of the city, not separate from it.

04. STRIP DOWN AND START AGAIN

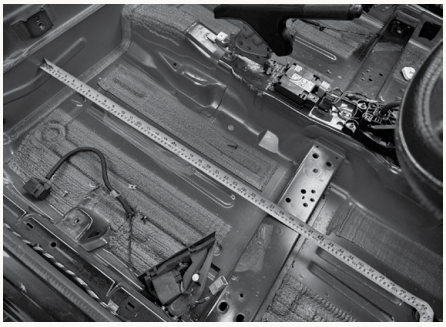
Removing the Original Systems

Every transformation begins by understanding what already exists. Before any new technology could be installed, each Ford Fiesta was stripped back to its bare structure. The engine, interior, fuel system and mechanical components were carefully removed, revealing the space that would eventually house the artwork.

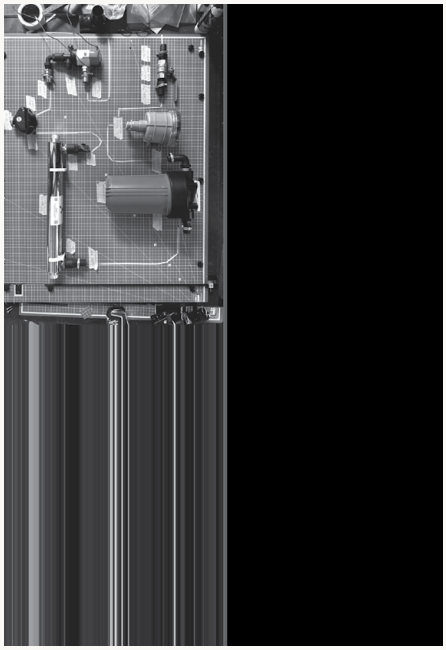
The team deliberately chose high-mileage Mk5 Ford Fiestas with strong bodywork. While the engines were no longer needed, the cars structural integrity was essential. Many original components, including the dashboard, seats, wiring looms, window motors and windscreen wipers, were carefully retained. Although their future role wasn't yet known, preserving them kept open the possibility of reusing or reactivating parts of the original vehicle.

With the shell exposed, every corner of the car was measured and reimagined. Wheel arches, door openings and structural supports would dictate where tanks, pumps, batteries and electrical systems could be installed.

Unlike a traditional restoration, the goal was not to return the Fiesta to the road, but to give it an entirely new purpose. By carefully working within the existing structure, the familiar family car became the foundation for a machine capable of revealing the hidden movement of the tide.

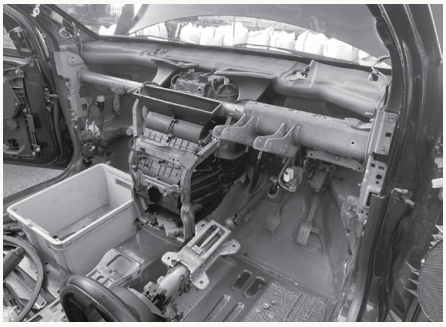


As each section of the car was exposed, measurements could be taken to help design the steel reinforcements and the internal tanks. ©David Cotterrell



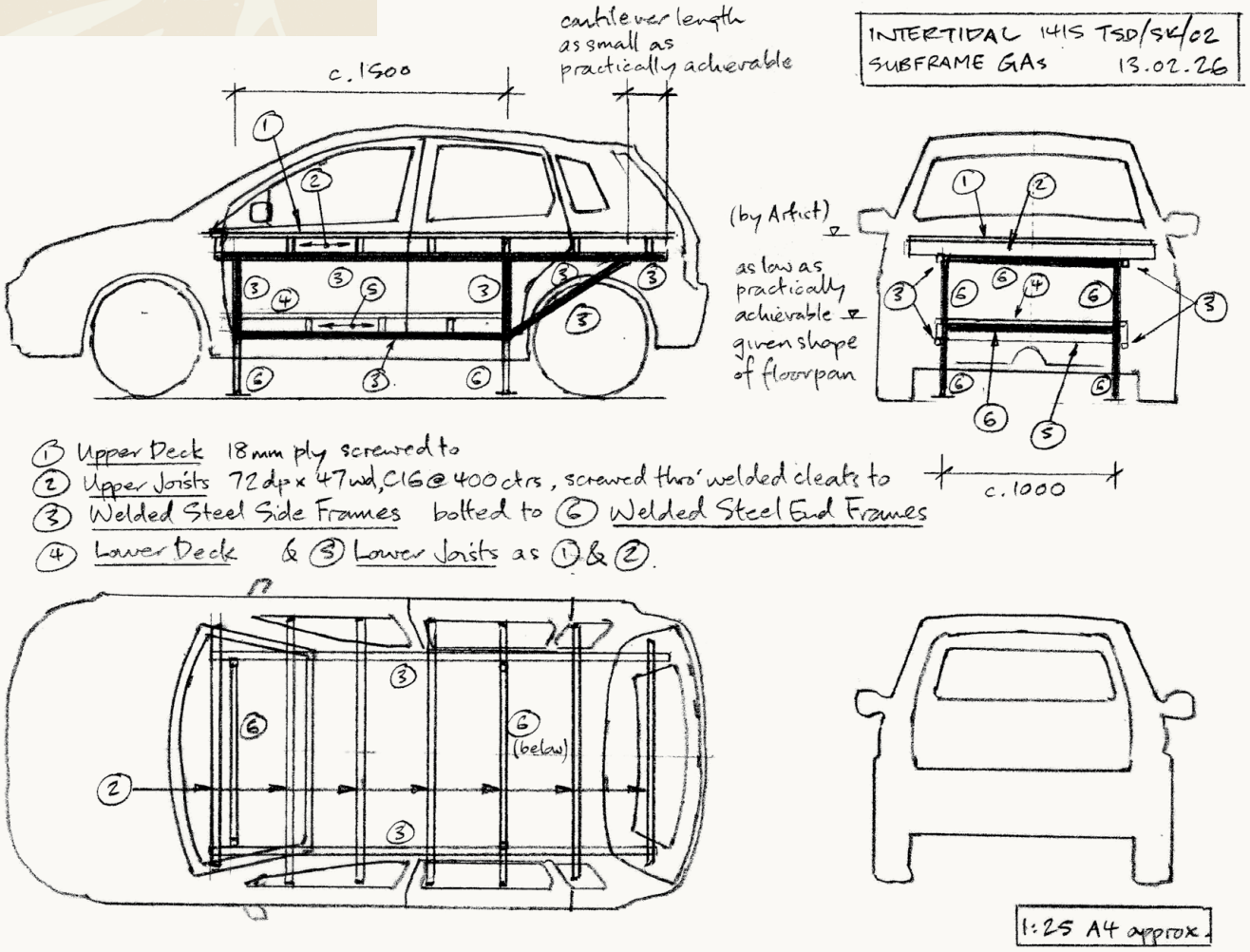
Designing a hydrology system compact enough to eventually fit within the Fiesta engine bay. ©David Cotterrell

The prototype car's engine and fuel system were removed before any construction could begin. ©Pia Watson



Piece by piece, the car's complex systems were dismantled, revealing the core structure and the structural supports. ©David Cotterrell

05. THE TANK



The original engineer's proposal. The project began with the involvement of the engineer, Toby Savage, who worked to develop a structure that could support the additional tonne of water that the car would need to carry. ©Toby Savage

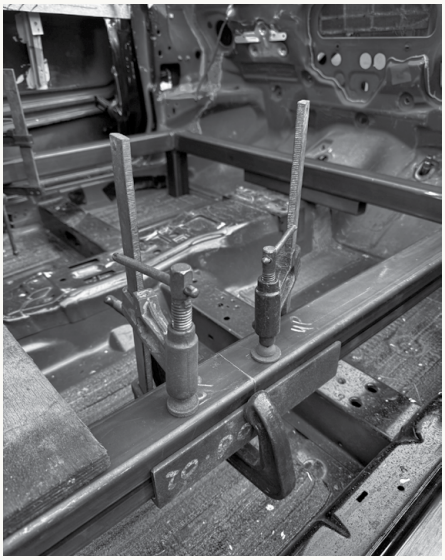
The Heart of the System

At the centre of every Intertidal car are two purpose-built tanks that transform an ordinary Ford Fiesta into a living artwork. Hidden beneath the vehicle is a fibreglass-reinforced plywood reservoir, while the passenger cabin has been carefully stripped, sealed and lined with fibreglass to create the visible tidal terrarium.

The original concept was developed by engineer Toby Savage before being refined and built by carpenters Dave and Dan Churchward. Together, the system holds around 900 litres of water, weighing almost one tonne when full.

Designing the tanks presented an unusual engineering challenge. Cars are built to keep water out, not hold it in. Hundreds of openings for wiring, drainage and ventilation had to be sealed, effectively transforming the Fiesta from a road vehicle into something that behaved more like a boat.

To support the additional weight, an internal steel frame was welded into the car's original chassis, creating a reinforced skeleton to which the tanks could be securely fixed. During transport, internal baffles slow the movement of water, reducing the forces created as the vehicle accelerates, brakes and turns.



Welding the subframe. Skilled craftsman, Mick Bennett, at Blackwater, welded a new 40mm box section steel chassis to the existing folded steel monocoque structure. ©David Cotterrell

Hidden beneath the bonnet, a three-stage filtration system removes debris, filters fine particles and uses ultraviolet light to help any algae bloom. Although many of these systems remain invisible, they are essential to keeping the artwork alive and functioning.

Like any carefully engineered machine, Intertidal still contains a few secrets. Some of the Fiesta's original mechanisms, including the handbrake and bonnet release, have been discreetly relocated, ensuring that the transformed vehicle remains practical as well as poetic.

06. DATA IS THE ENGINE

Unlike a conventional car, Intertidal is not powered by petrol. It is powered by information.

Hidden inside each vehicle, a small onboard computer uses GPS and an internet connection to receive live tidal data from the Admiralty UK Tidal API. Every few minutes it compares the predicted tide with the water already inside the car and calculates what should happen next.

Pumps, sensors and control software then work together to move seawater between the hidden reservoir and the cabin terrarium, allowing the water level to rise and fall with the changing tide. Digital information is transformed into physical movement, enabling the artwork to mirror the rhythm of Plymouth Sound wherever it is displayed.

The system is also designed to be resilient. Stored tidal data, backup batteries and remote monitoring help the cars continue operating safely if power or communications are interrupted.

Most visitors will never see the technology hidden beneath the bodywork, but it is this invisible network of data and engineering that allows Intertidal to make the movement of the tide visible.

System Check

The cars receive live tidal information every few minutes and automatically adjust their water levels to reflect the changing state of the sea.

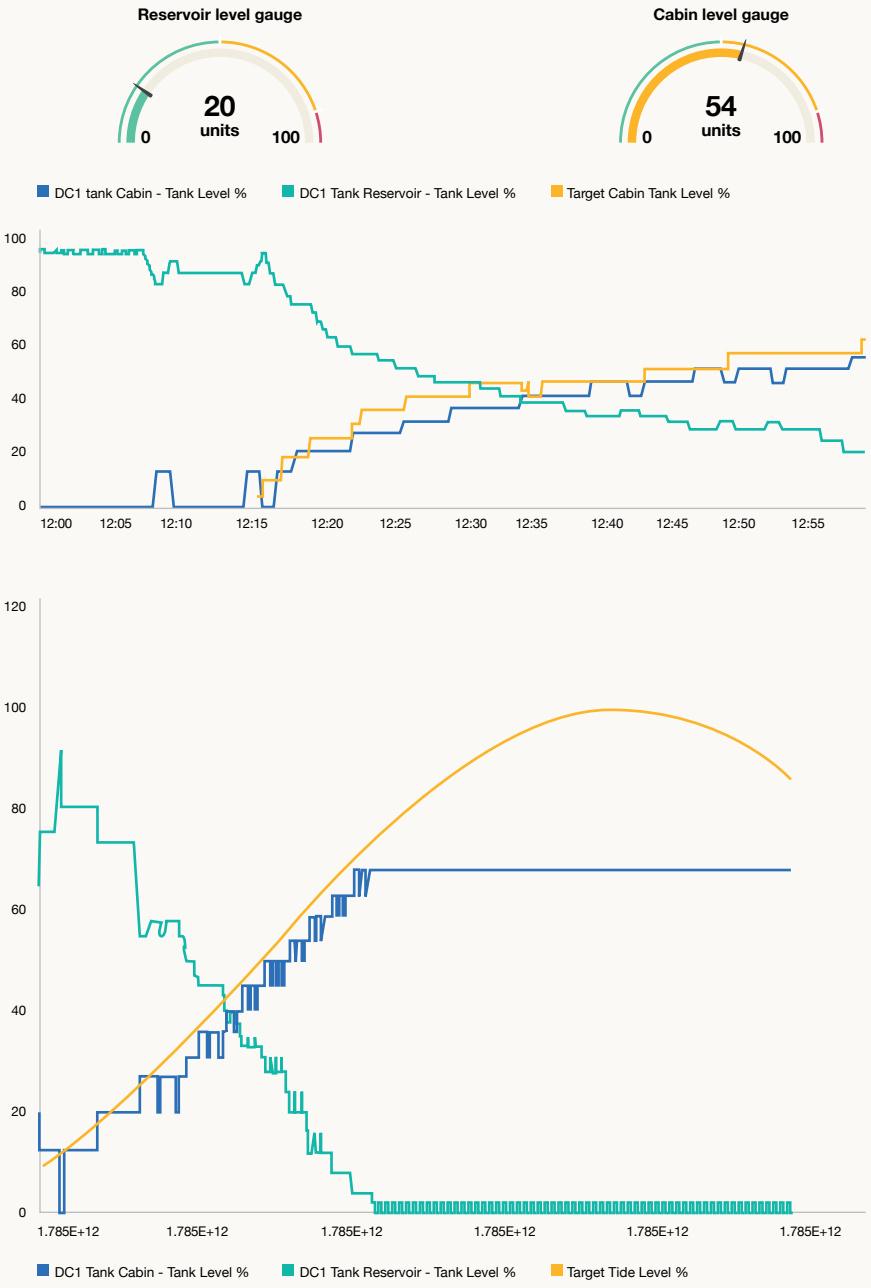
Under The Bonnet

The complete control system combines GPS, live internet data, onboard software, pumps, sensors, valves and filtration, all working together to recreate the movement of the tide.

Workshop Note

Unlike most digital artworks, Intertidal does not simply display information. It physically responds to it, allowing visitors to experience tidal change in real time.

Tank Levels



07. THE ELECTRICAL SYSTEM

Unlike the original Fiesta, Intertidal is powered by electricity rather than fuel. A custom-built 12-volt system provides energy for the pumps, sensors, computer and communications that keep the artwork running. When connected to mains electricity or an electric vehicle charging point, the batteries recharge continuously, but the cars are also designed to operate independently for more than a day if external power is lost.

Many of the electrical components are inspired by marine engineering, using robust systems normally found aboard working boats. Hidden inside the vehicle is a small onboard computer that constantly monitors battery levels, temperature, water levels and network connections while communicating with live tidal data.

Designing this system presented a significant challenge. Every component had to fit within the compact body of a Ford Fiesta while remaining reliable, serviceable and capable of operating in a water-filled environment. Alongside batteries and filtration equipment, the engineers also had to accommodate a programmable computer capable of controlling multiple electrical circuits and remotely reporting any faults.

The result is an electrical system that quietly powers the entire artwork, allowing Intertidal to function as a self-monitoring machine long after the engine has been removed.

System Check

Every electrical component inside Intertidal has to operate safely alongside water; one of the biggest engineering challenges in the entire project.

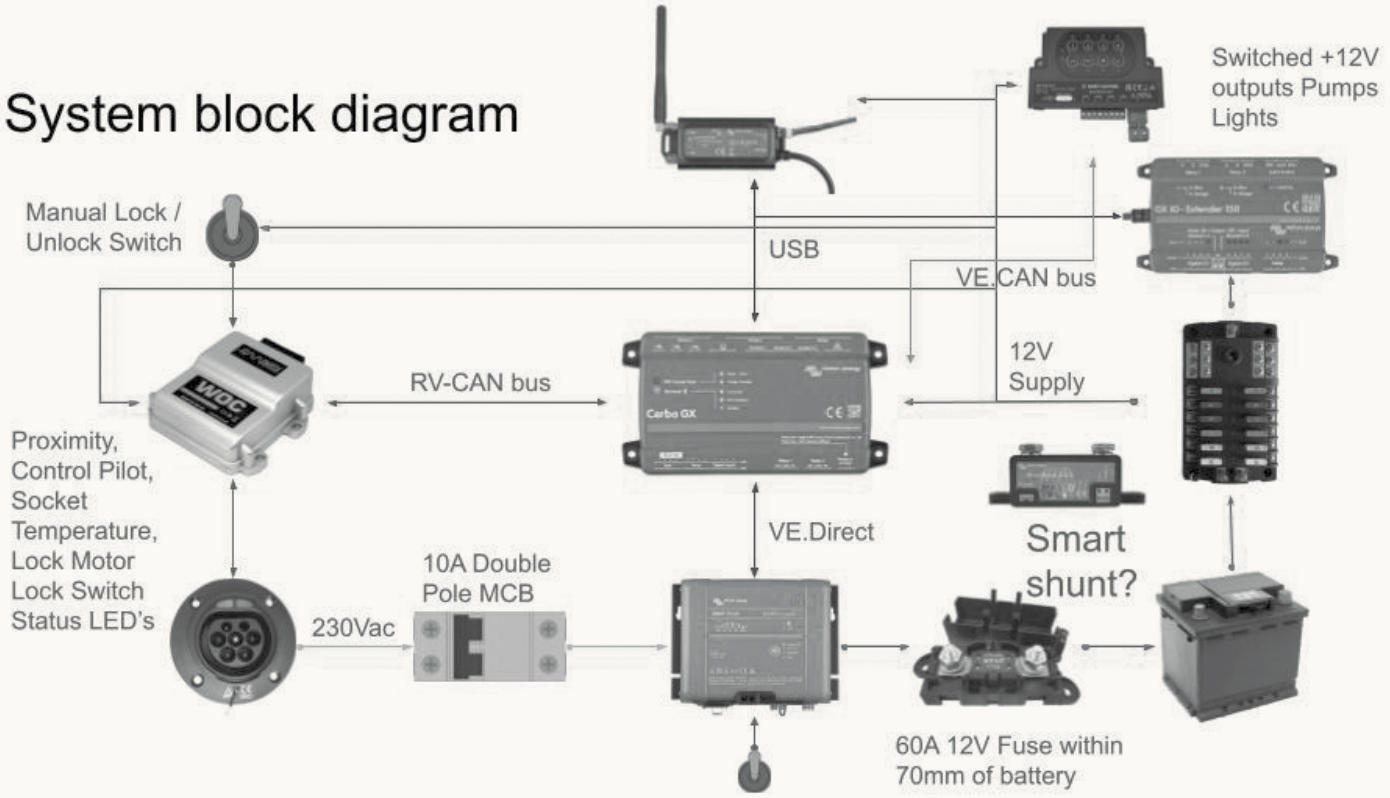
Under The Bonnet

Although the original engine has gone, the Fiesta still has a carefully organised network of systems hidden beneath its bodywork.

Workshop Note

Many of the engineering solutions were developed through testing and refinement rather than following a conventional vehicle design.

The batteries, sensors, fuses, circuit-breakers, and control interfaces were finally installed within the compact environment of the Fiesta engine bay. ©David Cotterrell



08. WATER MANAGEMENT

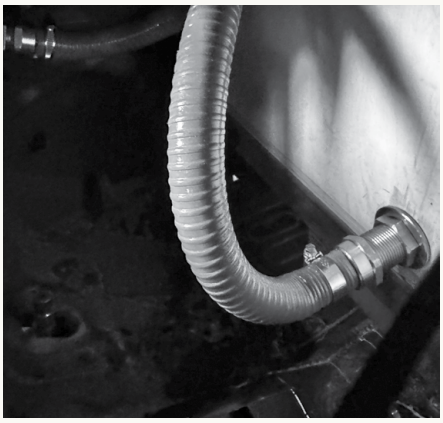
Moving almost a tonne of water requires far more than simply switching on a pump.

Intertidal uses compact marine pumps originally designed to keep live bait and fish healthy aboard fishing boats. These robust devices continuously transfer water between the hidden reservoir and the terrarium inside the passenger cabin, recreating the changing rhythm of the tide.

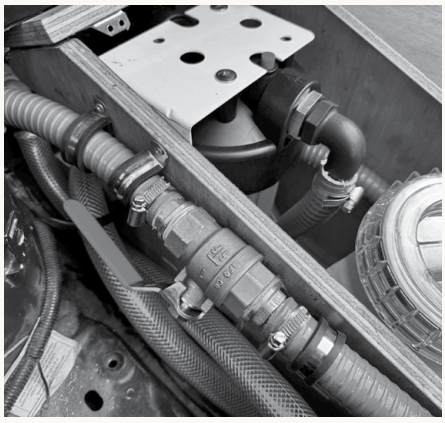
Unlike conventional pumps that simply turn on or off, these can be precisely controlled, allowing the flow of water to speed up or slow down as the tide changes. Together with valves and filtration, they create a carefully balanced system that keeps the artwork alive while accurately reflecting tidal movement.

Every connection within the plumbing system has been individually tested. Because each tank is unique, the entire installation had to be filled with almost a tonne of water to identify and eliminate even the smallest leak. Sensors constantly monitor water levels, and if the system detects an unexpected loss of water, it automatically alerts the team so any problems can be investigated.

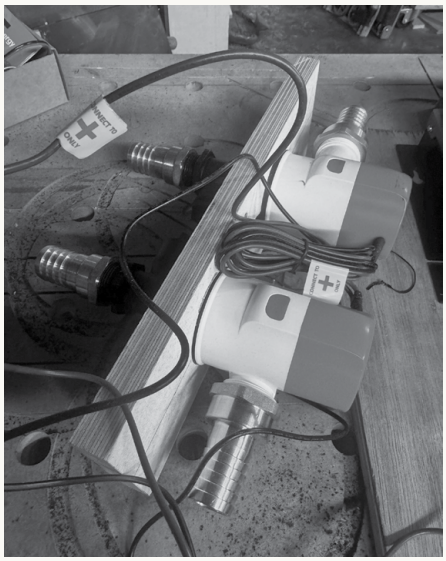
Behind the scenes, careful engineering ensures the water remains clean enough for the system to operate.



One of the many crucial DZR (Dezincification-Resistant) brass connections that allow the water to be safely drawn between environments with diverse materials and challenging access. ©David Cotterrell



A weed-filter and canister filter process the water as it is drained from the cabin to the reservoir. The final-stage UV filter is hidden behind the grill of the engine bay. ©David Cotterrell



Small but powerful 800gph pumps that would normally be used to maintain the bait and live catch tanks on fishing boats are the essential engine of the system. ©David Cotterrell

System Check

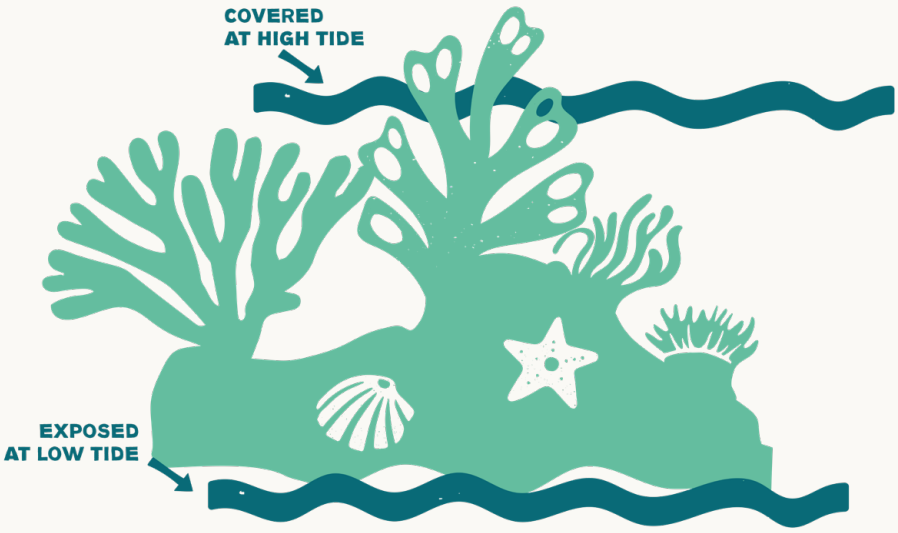
Unlike the tide, which is driven by the gravitational pull of the Moon, the water inside Intertidal is moved by a carefully controlled pumping system that responds to live tidal data.

Under The Bonnet

Although visitors see only the changing water level, a hidden network of pumps, pipes and valves is constantly working behind the scenes to make that movement possible.

Workshop Note

Every connection must remain watertight while allowing the system to be serviced, transported and operated safely in different locations. A pump has been designed to remove the water for transportation and then add it again.



09. TESTING & COMMISSIONING

Intertidal could never be built in a single step. Every stage required careful testing before the next could begin.

The process started with strengthening the vehicle itself, ensuring the modified chassis could safely support almost a tonne of water. Once the internal steel framework was complete, the bespoke tanks were tested for leaks before the electrical, plumbing and control systems were gradually introduced.

For David Cotterrell, testing became an essential part of the creative process. Ideas were continually refined, adjusted and improved as each system revealed new challenges. The final assembly took place at TR2, where the complete engineering, electrical and water management systems were brought together for the first time.

The last stage moved beyond engineering altogether.

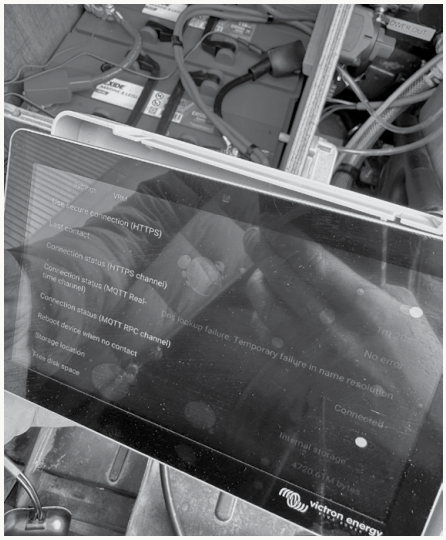
System Check

No single component makes Intertidal work. It is the interaction between many systems that allows the artwork to respond as one.

Under The Bonnet

Engineering rarely follows a straight line. Testing, adapting and trying again formed an essential part of developing Intertidal, helping transform an ambitious idea into a working artwork.

The novel challenge dictated that we subject the cars to continuous testing for weaknesses and vulnerabilities. In Blackwater, the steelwork, tanks, and deployability were tested and refined. ©David Cotterrell



Testing robust ways of monitoring each component's behaviour was essential for understanding ways to improve performance, manage remote installation, and build in safety measures. ©David Cotterrell

The final stage of testing at the Marine Biological Association not only defined the choice of species within the tidal vehicles but also informed the refinement of programming, and behaviour, of each of the onboard systems. ©David Cotterrell

Location testing at the Mount Batten Breakwater. Testing the resilience of the system being transported, filled and operated in the public domain was essential in refining the method for deploying the artwork more widely. ©David Cotterrell

10. ON LOCATION

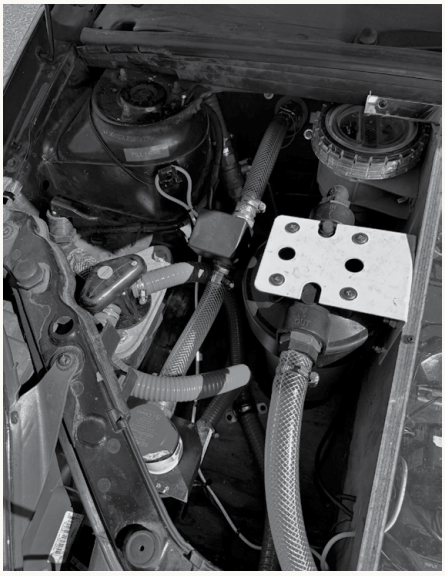
Although they no longer drive under their own power, the Intertidal cars have been designed to travel.

Each vehicle is transported on a low loader before being carefully positioned in its new location. A separate support vehicle carries around 900 litres of water, which is pumped into the car once it has been installed. After connecting the electrical supply and confirming communication with the live tidal data, the artwork begins responding to the sea once again.

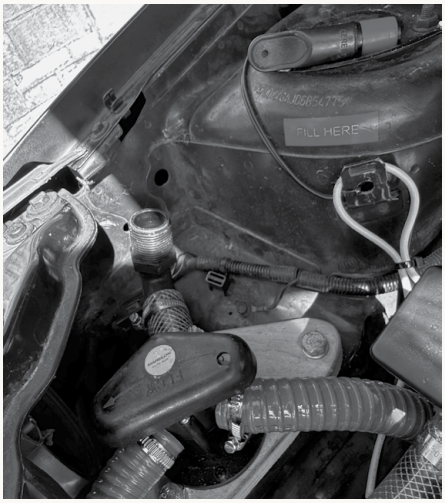
Installation typically takes between thirty and forty-five minutes. For David Cotterrell, however, the location is as important as the engineering. The same car can tell entirely different stories depending on where it appears. Outside a harbour it might seem practical. In a park it may feel poetic. On a city street it could appear abandoned, while beside the sea it becomes a quiet reminder of the tide that connects them all.

The cars were engineered to be liftable by hi-ab crane truck or transported by conventional flatbed breakdown vehicles. ©David Cotterrell

At each location, they are met briefly by a support van carrying an one tonne IBC full of seawater and a comprehensive set of maintenance tools. ©David Cotterrell



The cars are structurally designed to survive being transported with full water tanks. However, to avoid stress for the vehicle or drivers, they are moved with the minimum volume necessary to ensure that the filters remain submerged. ©David Cotterrell



Filling the tanks. Each car is equipped with attachment points and built-in diverter valves that enable the vehicle to fill and empty its tanks through its own pumps and power. ©David Cotterrell

Like scenery on a theatre stage, each location changes the way the artwork is understood.

System Check

Every location changes the way Intertidal is experienced. Light, weather, sound and the surrounding landscape all become part of the artwork.

Under The Bonnet

Although the engineering remains the same, every installation is unique. Each site brings different logistical, environmental and technical considerations.

Workshop Note

Preparing the cars for exhibition requires far more than simply transporting them. Every system must be checked, calibrated and ready before the public arrives.

12. FROM CURIOSITY TO ACTION

Intertidal began with a simple question: How can we make the invisible visible?

By revealing the hidden rhythm of the tide beneath Plymouth, the project invites us to see the city differently; not as somewhere separate from the sea, but as a place shaped by it every day.

Whether you've explored the artwork, read this manual or simply found yourself looking at the water a little differently, your journey doesn't have to end here. The cars may spark curiosity, but Plymouth Sound National Marine Park is where that curiosity can grow. Discover its places, stories and wildlife. Learn new skills. Join others in exploring and caring for this remarkable coastline.

If Intertidal has encouraged you to pause, ask questions or look again, then it has already done its job.

Now it's your turn to discover what lies beneath the surface.

System Check

The tide changes twice a day. Our relationship with it can change too.

Under The Bonnet

The greatest outcome of any engineering project isn't simply that it works; it's that it changes the way people think.

Your Next Step: Follow the Tide

Has Intertidal made you look at Plymouth Sound a little differently?

Scan the QR code on the back cover to:

- Discover more about Plymouth's tides and the intertidal world.
- Watch the Tide Together animation and explore how the tide works.
- Find activities, events and Tide Cafés across the city.
- Explore the Tide Together learning resources.
- Discover more Sea for Yourself commissions and creative projects.
- Find new ways to experience, explore and get involved with Plymouth Sound National Marine Park.
- And, if you're curious, discover just how salty you are on the Salty Scale.

"The tide never stops at the shoreline. Neither should your curiosity."

David Cotterrell

COMMISSIONED AND PRODUCED BY PLYMOUTH CULTURE AS PART OF SEA FOR YOURSELF, IN PARTNERSHIP WITH PLYMOUTH SOUND NATIONAL MARINE PARK AND PLYMOUTH CITY COUNCIL.

Look beneath the bodywork. Discover what powers the tide.

At first glance, Intertidal looks like four ordinary Ford Fiestas. Look a little closer and you'll discover a remarkable collaboration between art, engineering, marine science and digital technology.

This manual follows the transformation of each vehicle from everyday road car to electrically powered artwork, revealing the ideas, experiments and engineering that brought the project to life.

INSIDE YOU'LL DISCOVER:

- Why a Ford Fiesta became the starting point.
- How the cars were stripped back and rebuilt.
- The tanks, pumps, lighting and electrical systems hidden beneath the bodywork.
- How live tidal data controls the movement of water.
- The closed-loop water system.
- The engineering, fabrication and creative thinking behind every decision.
- How four separate vehicles work together as one artwork across Plymouth.

This isn't a guide to repairing a Fiesta.
It's a guide to reimagining one.

INTERTIDAL

An artwork by David Cotterrell
www.intertidal.city

A COLLABORATIVE MACHINE

Intertidal was made possible through the creativity, technical expertise, research, problem solving and support of an extraordinary team of collaborators. Special thanks go to:

- Blackwater Marina
- Fibreglass and Carpentry: Danny Halley and Dave Halley
- Steelwork: Mick Bennett
- Fabrication: Charlie Moore
- Project Management: Ian Wilson and Beccs Polden
- Toby Savage Design. Consultant Engineer: Toby Savage
- EVParts: System Design and Custom Electronics: Brad Bunyard
- Node RED Programming and Software Development: Nassir-Ali
- Ashley Hancock : API Interface Development and Web Programming: Ashley Hancock
- Plymouth Marine Laboratory: Oceanographic and Tidal Research: Lee de Mora, Yaru Li and Thecla Keizer
- Marine Biological Association: Marine Biology Research and Terrarium Testing: David Houghton, Alix Harvey, Katrina Houghton and Joe Feasey-Kemp
- TR2, Theatre Royal Plymouth: Seb Soper, Jason Steen, Matt Johns, Patrick Elliott, Brendan Cusack, Joe Marchant-Prouse, Ewan Thomas, and the TR2 Construction Team

Intertidal transforms a car into a mesmerising artwork, filling and emptying with sea water to reveal the hidden rhythm of the tide beneath our city.

FREE and open to all, it invites you to discover new connections between your National Marine Park and urban life, sparking curiosity, conversation and smiles.

TIDE TOGETHER

Discover more:
www.plymouthsoundnationalmarinepark.com/sea-for-yourself-tide-together

Commissioned and produced by Plymouth Culture as part of Sea for Yourself.
In partnership with Plymouth Sound National Marine Park and Plymouth City Council.

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