

Floating PV

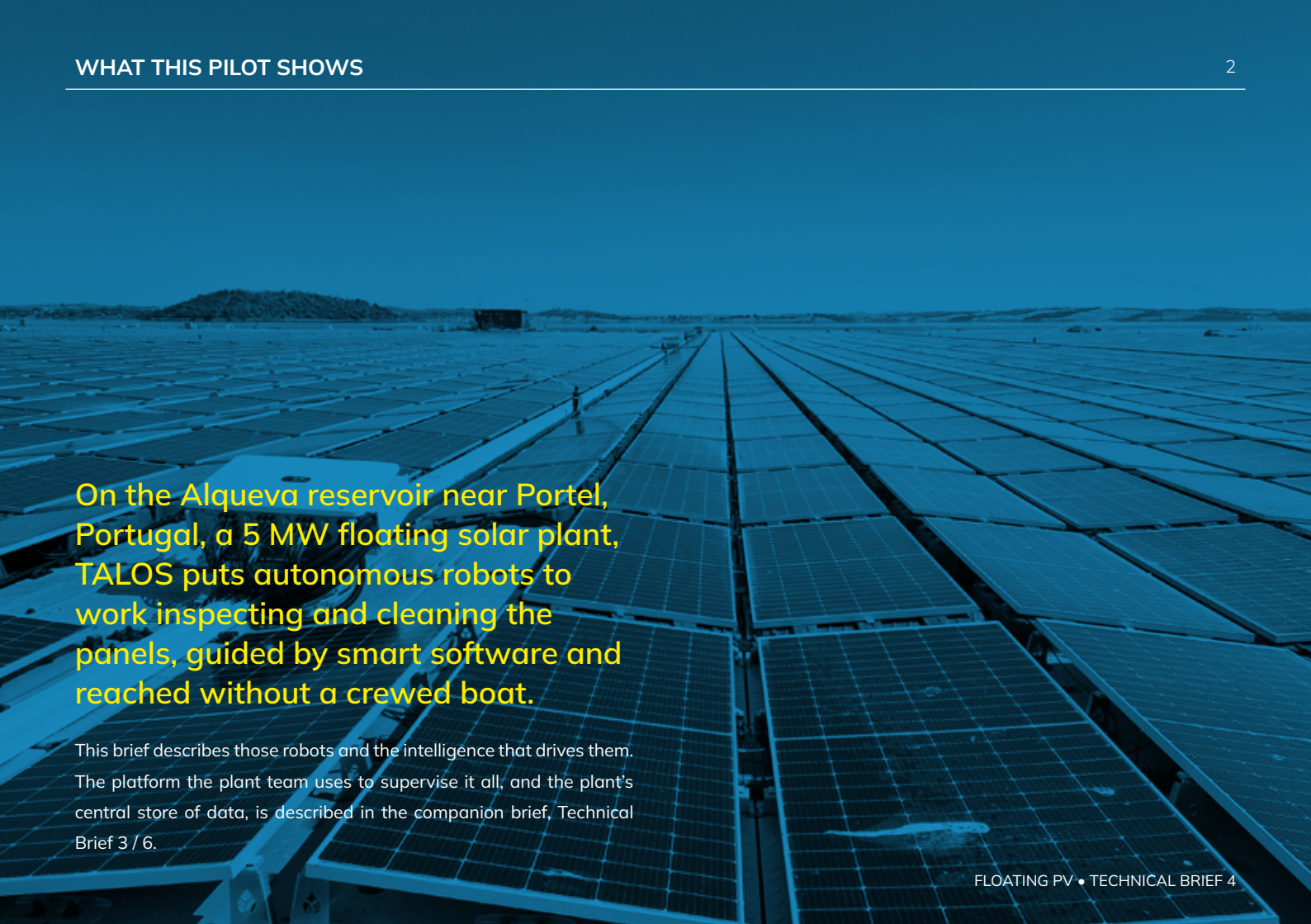


The Robots and the Intelligence Behind Them

The self-driving machines that inspect and clean a solar plant on water, and the smart tools that decide what needs doing and when.



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On the Alqueva reservoir near Portel, Portugal, a 5 MW floating solar plant, TALOS puts autonomous robots to work inspecting and cleaning the panels, guided by smart software and reached without a crewed boat.

This brief describes those robots and the intelligence that drives them. The platform the plant team uses to supervise it all, and the plant's central store of data, is described in the companion brief, Technical Brief 3 / 6.

Instead of sending people and inspecting and cleaning equipment out by boat, TALOS builds a live digital model of the plant.

The digital model spots underperformance automatically, works out the most worthwhile jobs, and sends autonomous robots to do them, an uncrewed boat even carries the inspection drone out to the plant. Across the project, this is expected to improve resource efficiency in maintenance work by around 10%, cut lost production by up to 10%, and save around 35% of the water used in cleaning.

This brief focuses on the smart tools that analyse the plant, and the three robotic solutions that do the work. The features of the digital platform the team uses, and the central data store, are covered in Technical Brief 3 / 6.

Three connected tools turn plant data into a shortlist of worthwhile jobs.



A LIVE DIGITAL MODEL OF THE PLANT

A constantly-updated digital model (a 'digital twin') mirrors how the plant should be performing, so the system can pinpoint where output is lower than expected.



AUTOMATIC FAULT AND UNDERPERFORMANCE DETECTION

Software watches the plant's data and flags anomalies, together with an estimate of how much energy each one is costing. It also estimates how much dirt has built up, so cleaning can be timed well.



WORTHWHILE-JOB SUGGESTIONS

Drawing on all of the above, and only when the weather on the water is within safe limits, the system proposes cleaning and inspection jobs and ranks them by the value they bring, before they reach the plant team for approval.

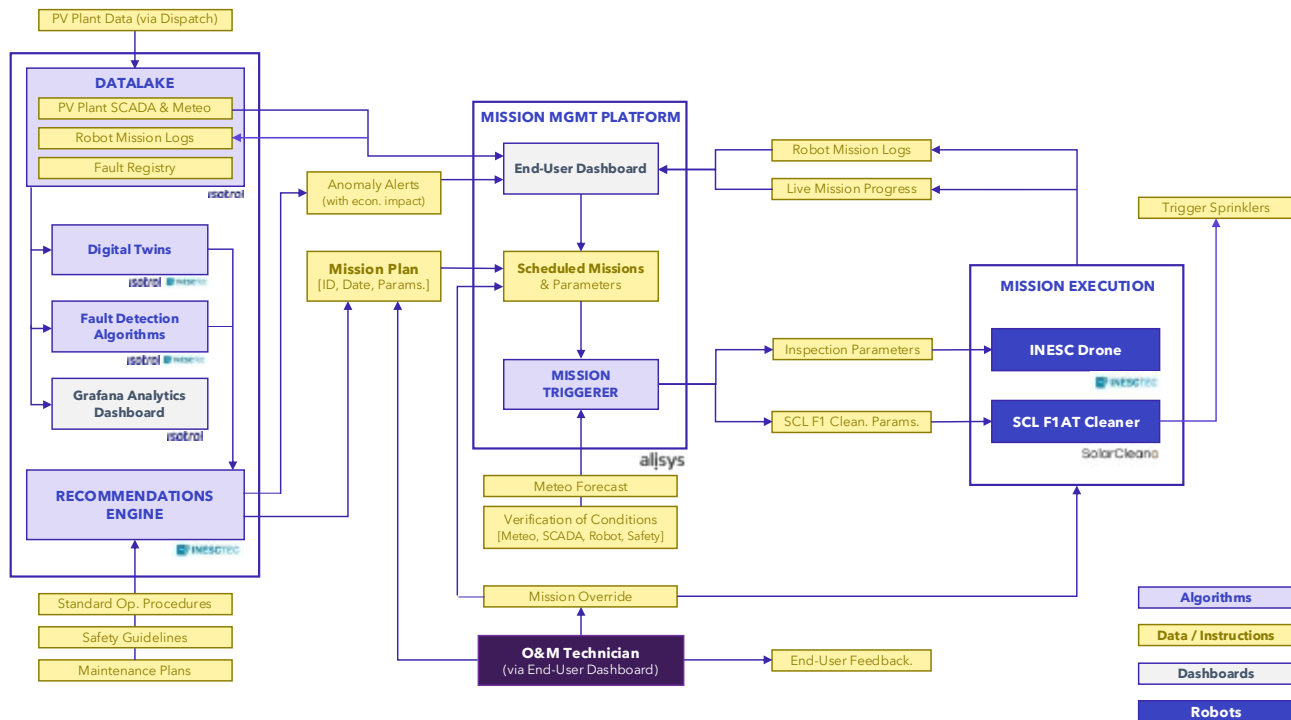


Figure 1. From plant data to robot missions: how the smart tools and the robots work together in the Floating PV pilot.

Source: TALOS project.

The pilot uses three robotic solutions: an inspection drone, an autonomous support boat, and a floating-panel cleaning robot.



INSPECTION DRONE

A drone inspects the panels from the air using ordinary and **heat-sensing (thermal) cameras**, which reveal problems the eye cannot see: hot spots, soiling and bird-droppings. It flies **pre-planned routes** on its own and delivers its images and a **map of located faults** automatically.



AUTONOMOUS SUPPORT BOAT

A high-endurance **uncrewed boat carries the drone from shore out to the floating plant and back**, so inspections can happen without a crewed vessel. It also means the **drone no longer spends its battery flying to and from shore**, so more of each charge goes into inspecting the panels, and **each flight covers more of the plant**.



FLOATING-PANEL CLEANING ROBOT

A cleaning robot moves along the rows of floating panels. **A rail system built into the platform guides it** and lets it move automatically from one row to the next; **a sprinkler system on the platform supplies the water it needs** for wet cleaning; and a docking point on the rails recharges it wirelessly. On-board sensors keep it aligned and stop it safely if conditions are not right.

A typical cleaning job follows a simple chain:

- 1

The digital model sets the expected performance.
- 2

The detection tools identify where output is dropping and how dirty the panels are.
- 3

The system schedules a cleaning job that gives the best return.
- 4

When the time comes, the platform first checks the weather and water conditions are safe and then sends the robot out.
- 5

The plant team can watch progress live and pause or stop the job at any moment.
- 6

When it finishes, a short report, which rows were cleaned and whether it succeeded, is saved back to the platform.

THE ROBOTS AT A GLANCE	
ROBOT	WHAT IT DOES
Inspection drone	Photographs the panels with normal and thermal cameras to find faults.
Autonomous support boat	Carries the drone from shore to the floating plant and back, no crewed boat needed.
Floating cleaning robot	Cleans the panels row by row on a rail system, with water supplied on-platform and wireless charging.

This part of TALOS is aimed at floating-PV operators, robotics providers and technology partners who want to combine smart analysis with self-driving machines.

The benefits it targets are:

Access to the plant without a crewed vessel, making inspection and cleaning far safer.

Faster, fuller inspection coverage than occasional manual checks.

Lower water use in cleaning (around 35% saving targeted), thanks to well-timed, optimised jobs.

Longer time in the field thanks to on-platform water supply and wireless charging.

Recommendations from the TALOS Floating-PV experience

- **Supervise autonomy, especially during early roll-out:** keep operator validation of scheduling and execution to reduce risk and build confidence.
- **Plan the logistics that make autonomy work:** robots need upkeep and support such as water availability and charging to run reliably.
- **Adapt roles, procedures and training:** teams need updated safety rules and new skills to supervise the robots effectively.
- **Refine the intelligence over time:** new or improved algorithms can be added to automate further O&M tasks.

GLOSSARY	
Digital twin	A live software model of the plant used to see how it should be performing.
Thermal camera	A camera that sees heat, revealing hot spots and hidden panel faults.
Drone (UAV)	A small uncrewed aircraft used to inspect the panels from the air.
Support boat (USV)	An uncrewed surface vessel that carries the drone to the floating plant.
Soiling	Dust, dirt or droppings on the panels that reduce their output.

PROJECT PARTNERS BEHIND THE ROBOTS AND INTELLIGENCE	
	Digital model, fault detection, job suggestions, the inspection drone and the support boat.
	The floating-panel cleaning robot.
	The platform and data store that connect and run the fleet (see Brief 3 / 6).



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