



ATRC ADVANCED TECHNOLOGY PIONEERS 2026 · ENEC TRACK

The plant keeps running. The sea keeps living.

Not a concept. A system.

A one-button response to jellyfish blooms at coastal nuclear-plant seawater intakes, after the early warning: guide, lift and return the jellyfish to the sea alive. No boats. No nets.

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TRY IT LIVE ► jazr.vercel.app

Proposal deck · 11 Oct 2026 · 01/10

The world has the warning. JAZR is the response.

When the early-warning alert arrives, the operator presses **one button**. In about **10 minutes** JAZR lowers a **moving-belt angled screen** into each intake lane. The belt carries jellyfish to entrances, a second **water-jet layer** (no air) catches leakers, and water-only **HydroLift** chambers float the animals into an **oxygenated gravity pipe**. A drift forecast picks the outlet, and the animals are **released alive** at sea. The plant's own screens stay untouched, and any failure falls back to today's plant, never worse. Our evidence today is a validated digital twin, ~600 engineering checks and 112 automated tests. The tank test is the next step.

~10 min

One button to deploy

Auto-deploy on red alerts with operator veto. Two protective layers per lane.

~99%

Kept out of the plant

Leakage ~1% in simulation (0.4% best case) vs 100% today.

76–98%

Released alive

Survival: two estimates; design target $\geq 95\%$. No live animal killed.

–60–90%

Crew-hours per bloom

No boats, nets or night raking at the intake.

Plant's own screens untouched

Any failure = today's plant, never worse

AI advisory only, air-gapped

Next step: tank test

A warning is not a response.

91

jellyfish intake incidents
catalogued worldwide

19

countries and
territories

81 of 91 rows verified (68 at primary source). Reactor trips, pumps stopped, baskets bent:

- **Hanul, Korea 2021:** net tore, reactor trip, >400 t removed by hand
- **Ohi-4, Japan 2024:** 17 screen baskets bent, a cooling pump off 6 weeks
- **Hongyanhe, China 2014 & 2023:** units shut down or cut
- **Az-Zour, Kuwait 2017:** pumps paused for multiple days

Capacity gap: hand methods vs one unit's bloom



TODAY'S ANSWER

Boats, nets and crews

The global default is still screens + people raking, hand-picking and trucking. A boat handles ~1 t/h. Bubble curtains: no plant has published performance data. Shredding robots never passed field trials, and they kill.

SCALE PER UNIT

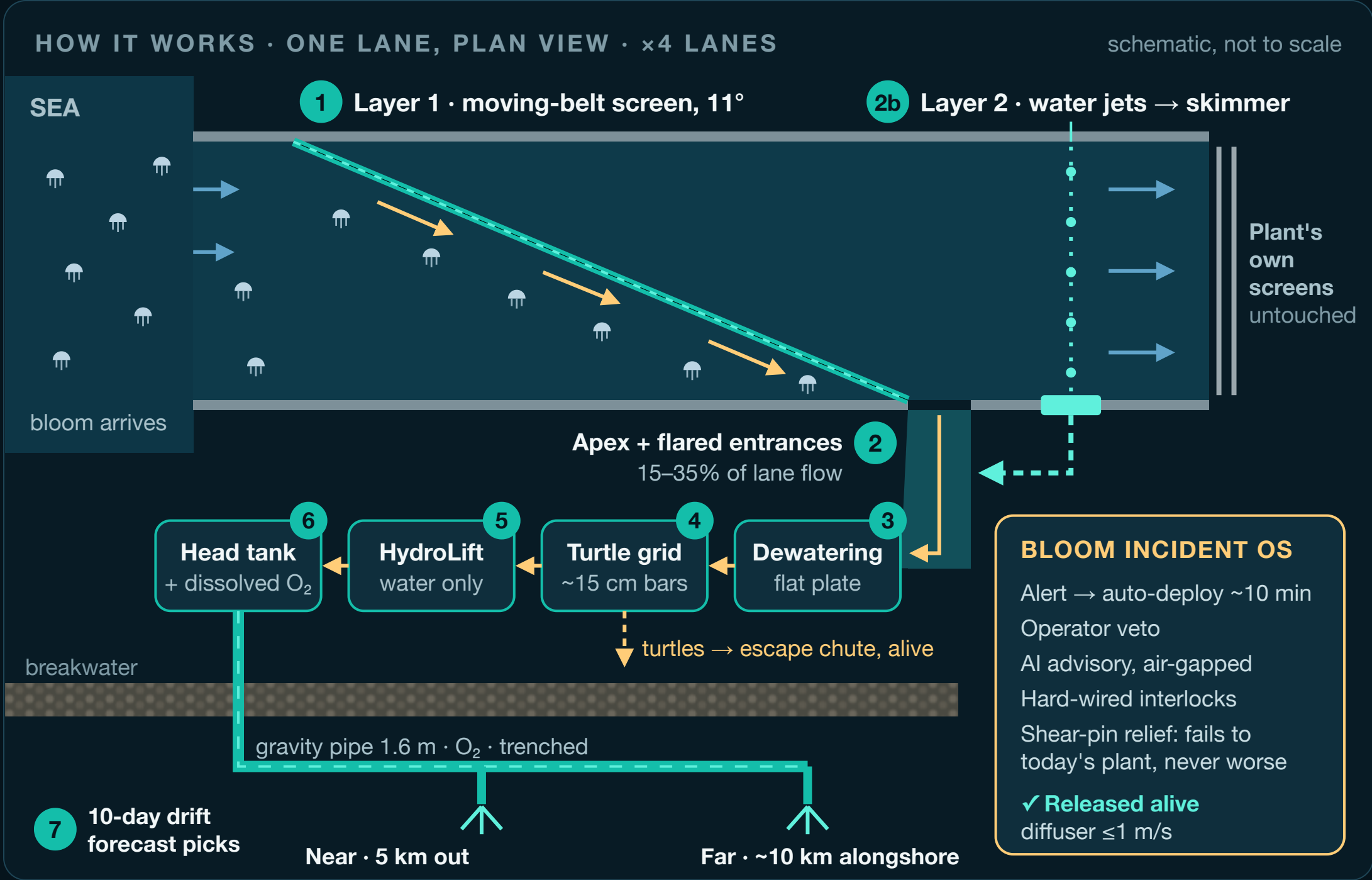
~108 t/h ~100 m³/s

jellyfish in a bloom cooling water
≈2,600 t/day: more than Hongyanhe's whole 2023 season (2,420 t).

WHAT ENEC ASKED

After the early warning: guide, redirect, collect, move or release jellyfish, **cut manual work** and **protect marine life**, with no plant redesign.

One button. Two layers. Released alive.



! Alert → Bloom Incident OS auto-deploys (operator veto)

1 Layer 1 belt screen 11°, belt runs to the apex

2 Apex + flared entrances draw 15–35% of lane flow

2b Layer 2 hydro-jet curtain, no air, to a skimmer

3 Flat-plate dewatering, no sharp edges

4 Turtle-excluder grid ~15 cm bars, open escape chute

5 HydroLift water-only float chambers

6 Dissolved-O₂ gravity pipe 1.6 m ID, no bubbles

7 Forecast picks near (5 km) or far (~10 km) outlet

✓ Released alive via diffuser ≤1 m/s, matched water

Proven parts. A combination nobody runs today.

TYPICAL APPROACH	WHAT HAPPENS
Screens + crews	Overload: Ohi-4 bent 17 baskets
Booms, nets, boats	Nets tear (Hanul trip); a boat ~1 t/h
Bubble curtains	No plant data; air under the bell kills
Robots / shredders	Never past field trials; lethal
JAZR	Continuous, crew-light, no killing: animals released alive

No plant anywhere reports releasing jellyfish alive.



① Moving belt along the face

Bells ride to the apex; nothing sticks.
Virtual tank: 900/900 guided.
Precedent: Bates 1970, 97–100% of fish diverted.

② Layer 2 without air

Low-velocity water jets lift leakers to a skimmer. Bubble curtain rejected: air under the bell kills.

③ HydroLift

Water-only float chambers: animals rise with the water, nothing touches them. Screws rejected (13–24% blade contact).

④ Forecast-chosen live release

A 10-day drift forecast picks the near or far outlet, so released animals don't drift back.

⑤ Model-checked fail-safe + Bloom Incident OS

Control logic deadlock-free across 26,633 states. Shear-pin relief, 2-of-3 voting, hard-wired interlocks. AI is advisory only and air-gapped.

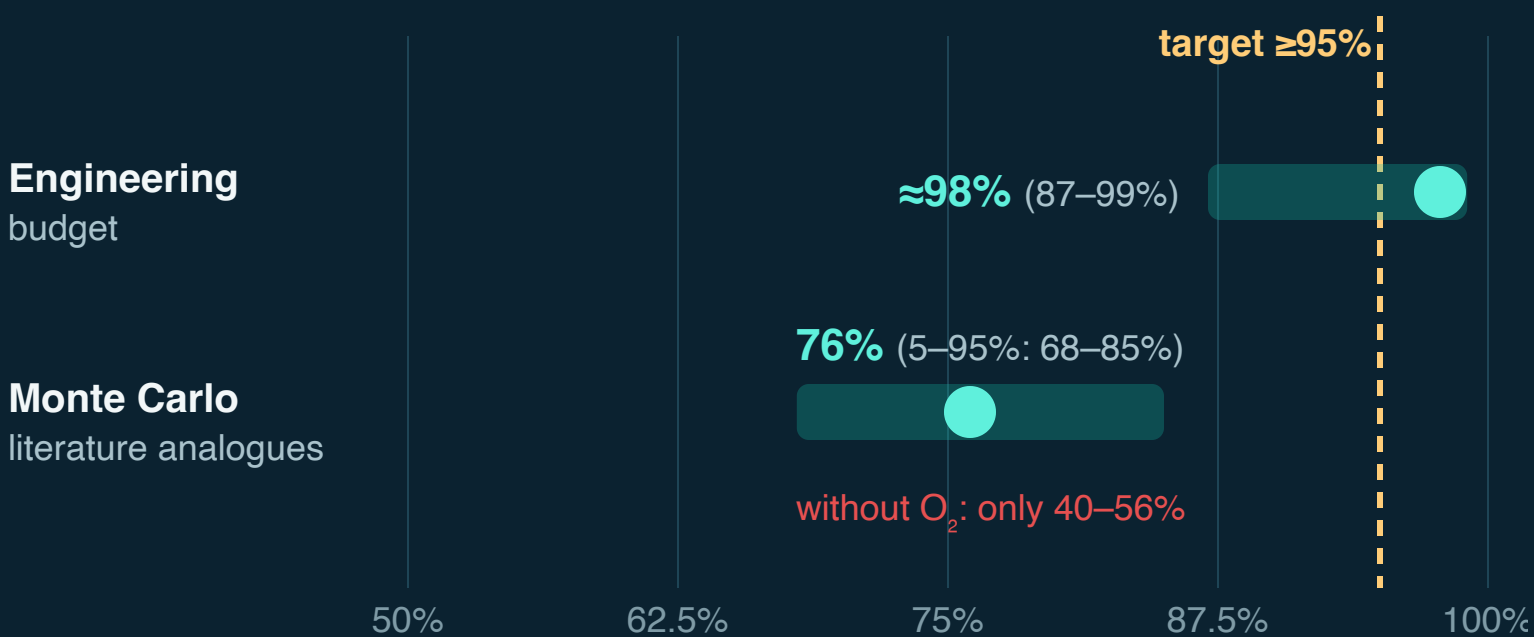
Designed around the animal. No harm by rule.

- No air under bells**
Hydro-jets, not bubbles
- O₂ dosed by biomass**
Dissolved, 75–99% saturation
- No nets, no killing**
No live animal killed
- No acoustics, no electric fields**
Dark at night, no light lures
- Turtle-excluder grid**
Air-reachable escape chute
- Released alive**
Temp & salinity matched, away from reefs



End-to-end survival, shown honestly

Two independent estimates disagree. We show both.

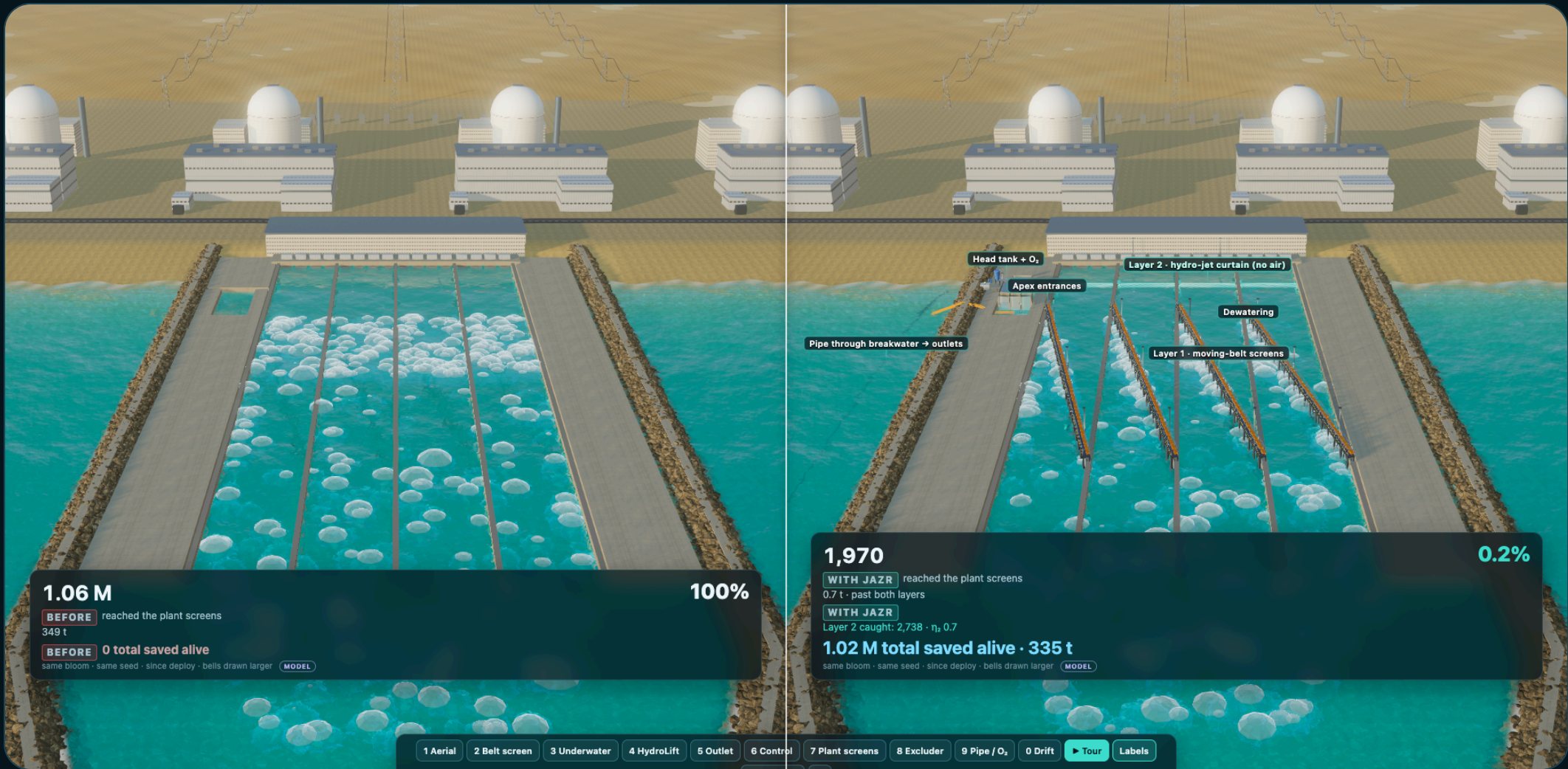


Released alive: 76–98% (two estimates; target ≥95%). Dewatering and the 3 h pipe dominate the uncertainty, and O₂ control is essential.

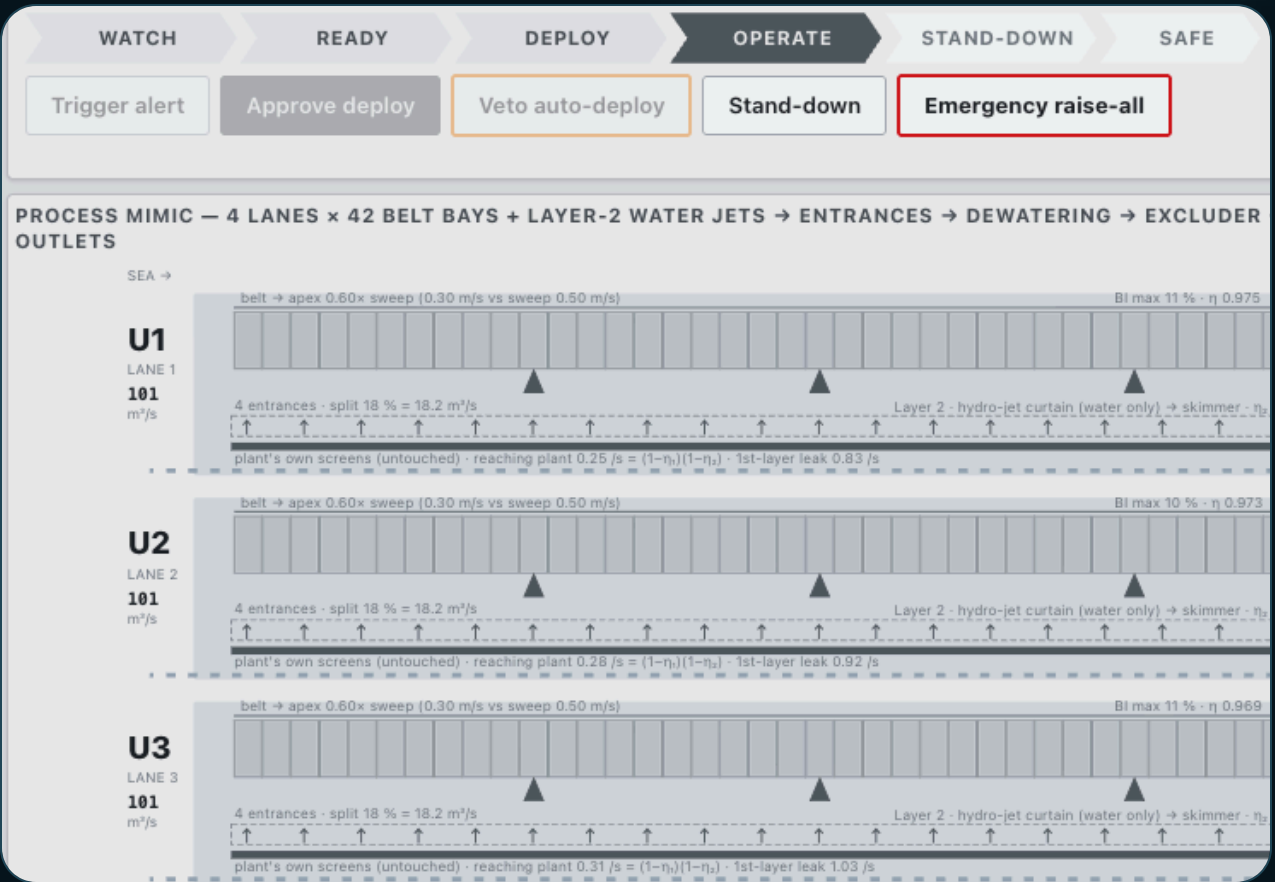
Next: a 3 h recirculating pipe loop with 96 h scoring decides it. Fallback: shorter near route and a gentler dewatering ramp.

A working digital prototype. Not slides.

OPEN IT ► jazr.vercel.app



3D digital twin · same bloom, same seed: **BEFORE** vs **WITH JAZR**. Live simulation, runs in a browser.



Bloom Incident OS · watch → deploy → operate → stand-down, interlocks, alarms, advisory AI.

Physical prototype: next step. 16 tank, 8 flume and 5 pilot protocols are pre-registered with data sheets ready.

≈600 engineering checks

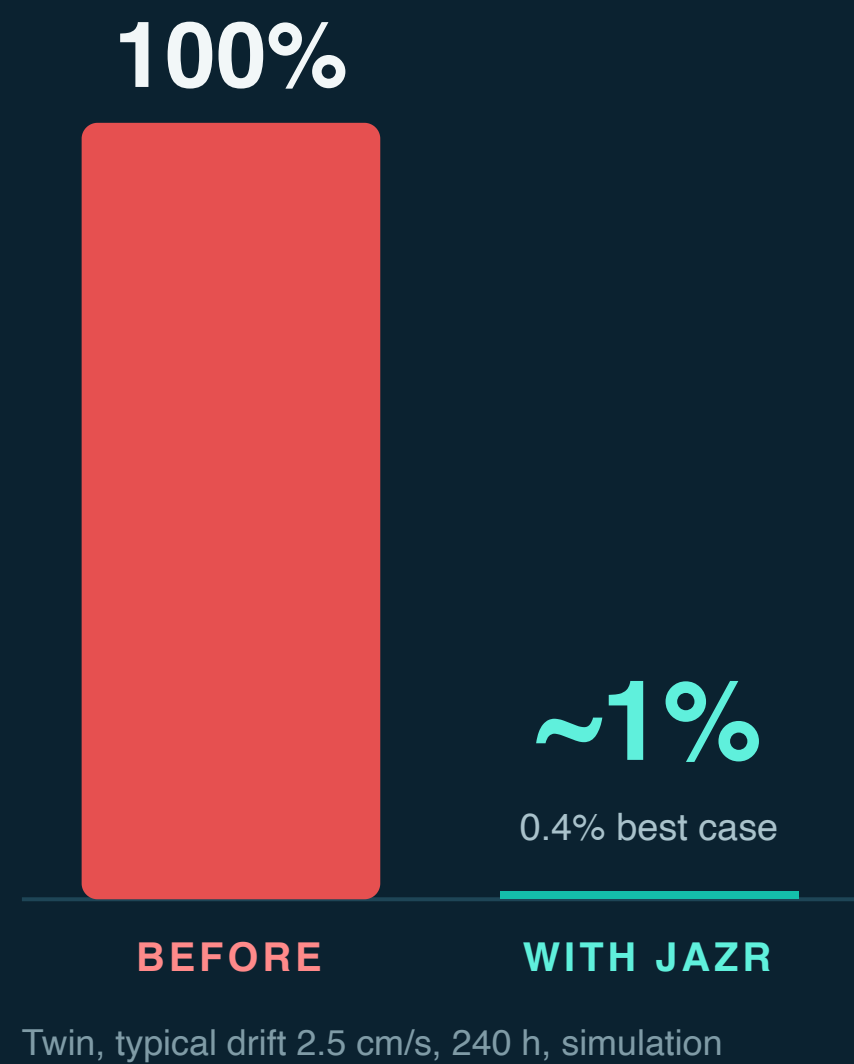
112 automated tests passing

292 real alert windows replayed

≤1.4 pt JS twin vs Python model

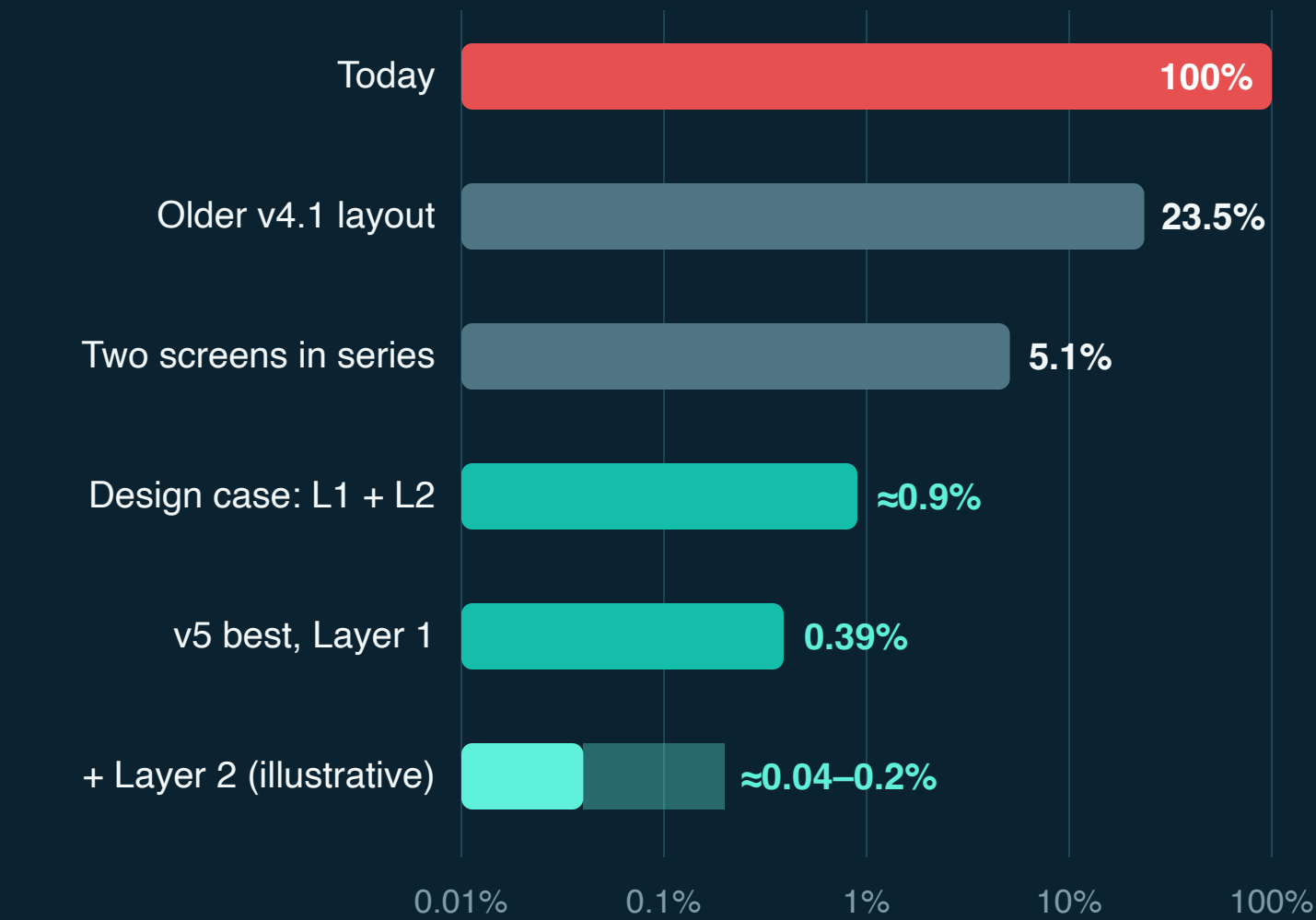
From 100% of the bloom at the screens to ~1%.

Reaching the plant's screens



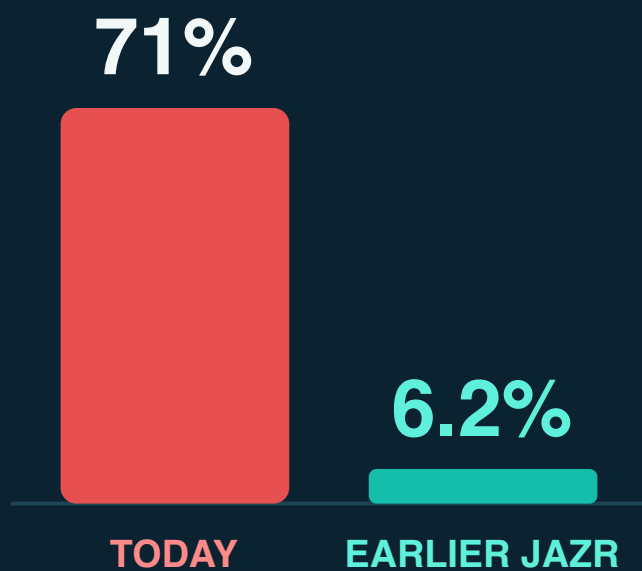
Layer by layer: share still reaching the plant

Log scale · 240 h · same twin and bloom



Real-data hindcast

292 real alert windows, real Gulf currents



Measured on an earlier, weaker design (v3). The ordering holds in 99% of windows.

THE NUMBER TO MEASURE

Belt guidance efficiency η_r . We claim 0.95–0.99 for design; the tank test decides.

Practical by design. Every part already exists.

NEXT 1 · Tank test Belt guidance, survival loop (3 h, 96 h scoring)	THEN 2 · Flume Excluder with real turtles, mesh friction	PILOT 3 · One-lane pilot JAZR Core: OS + twin + forecast + one lane	SCALE 4 · Rollout All 4 lanes, only if the pilot clears break-even
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Engineering checks

- Parts are proven: angled screens, NMFS bypass-pipe rules, gravity pipe, shear pins
- Energy $\approx 0.03\%$ of plant output
- Structure, 60-year fatigue, **0.3 g seismic**: pass
- Titanium / Cu-Ni / polymer wetted parts

Regulatory & cost

- FANR** review, seismic, cyber (IEC 62443)
- EAD** permit amendment for live release
- Start: **AED 4–11 M** Core pilot, one lane
- Lifetime: $\approx$ **AED 2–11 M per unit-year** over 60 years (current projection from 2026 market prices; final after site survey)
- Pays back at $\approx$ **0.5–2 avoided outage-days** a year ($\approx$ AED 5–6 M/day)

Risks → mitigations

Belt guidance at scale	Tank decides; design claim 95–99%
Survival below 95%	Shorter near route, gentler ramp
Live-release permit	EAD engaged early; outlets away from reefs
Unknown event rate	Core first: cuts downside $\sim 4\times$

Key assumptions & limitations

Public data only; no ENEC facility design used.

- Assumed:** 4 lanes, $\sim 100\text{ m}^3/\text{s}$ per unit, $\sim 108\text{ t/h}$ of bloom
- Assumed:** bells 6.5–12 cm, 0.33 kg; onshore drift 2.5 cm/s
- Assumed:** alert lead time $\geq 10\text{ min}$; plant's screens unchanged

- Limit:** all results are model-based; no physical test yet
- Limit:** CFD is 2D; Layer 2 η untested; survival 76–98%
- Limit:** plant event rate unknown; live release needs EAD permit

The plant keeps running. The sea keeps living.

PLANT AVAILABILITY

~32 GWh

output protected per avoided unit-day of outage

CLIMATE

≈13,000 t

CO₂ avoided per avoided unit-day of outage

MARINE LIFE

No kill

no live animal killed; turtles excluded alive

CREW SAFETY

–60–90%

crew-hours per bloom; no boats or hand-raking at the intake

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JAZR | جَزْر

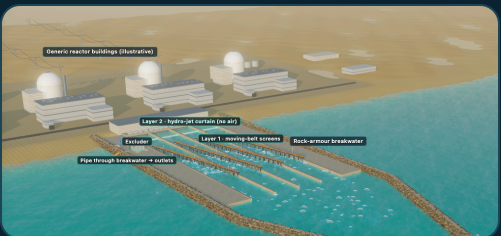
Not a concept. A system. Ready for the tank.

Demo-ready today: what we have built

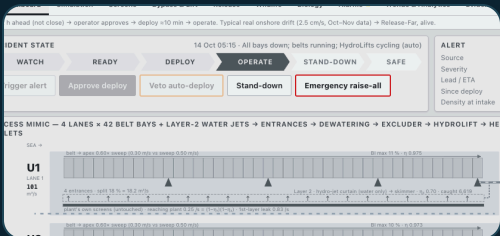
LIVE ► jazr.vercel.app



3D twin · before vs with



3D · whole system



Bloom Incident OS



3D · turtle escapes

- **3D digital twin:** every stage from alert to release, both layers, live "saved alive" counter
- **Bloom Incident OS:** 14-tab control dashboard with screens, lift, release, wildlife, alarms, compliance and reports
- **Live simulation tab:** runs in the browser, within 1.4 pt of our Python model
- **Physics twin + 11 test streams:** ≈600 checks, 112 automated tests

- **2 films:** 112 s launch film and a 116 s narrated 3D tour
- **Labelled renders** of the screen, turtle grid, HydroLift and outlet
- **Pre-registered tests:** 16 tank, 8 flume and 5 pilot protocols, data sheets ready
- **At Demo Day:** visitors trigger an alert, press deploy and watch jellyfish released alive