WHITE PAPER

Safety Constraints in Weather Routing

Routes that respect your vessel's limits by design, and show how each recommendation was reached.

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01

SUMMARY

Introduction

Before a route can save fuel or time, it has to respect the vessel's limits, the charter party and the areas the operator will not enter.

Weather limits, latitude bounds, war-risk and sanctions areas, draft and ECA exposure: VesselFront applies them to every route and every re-route, and shows them with the recommendation. If no route fits the limits as set, the platform reports which limit is binding, ensuring strict adherence to your defined safety standards.

The constraints come in two types:

Safety limit

A boundary the route does not cross. It is never traded against time, distance or fuel.

Routing preference

An area the route avoids where a reasonable alternative exists, and passes through where one does not.

CERTIFICATION

VesselFront's routing is SMART EnE3-Em-W certified by Bureau Veritas (2026). Each recommendation is presented with the limits and forecast it was generated under.

02

THE CONSTRAINT SET

Smart Routing Parameters

Constraint	What the user sets	Type
Max wave height	Maximum significant wave height (Hs), in metres	SAFETY LIMIT
Max wind speed	Maximum wind speed, in knots	SAFETY LIMIT
Northern latitude	Northernmost permitted latitude	SAFETY LIMIT
Southern latitude	Southernmost permitted latitude	SAFETY LIMIT
Draft	Vessel draft, in metres (mandatory)	SAFETY LIMIT
Avoid zones	Zones from the catalogue the route must not enter	SAFETY LIMIT
ECA minimisation	Whether to minimise miles inside Emission Control Areas (on / off)	PREFERENCE
Distance from coast	Set once for your deployment; no entry per voyage	PREFERENCE

Eight constraints are available on every voyage; only draft is mandatory. They apply to the initial route, to routes with intermediate waypoints and to every re-route.

03

WEATHER LIMITS

Wave height and wind speed

Limits are checked against the forecast for each point at the time the vessel is expected to be there, not the forecast at departure.

A position that is acceptable on Tuesday and outside limits on Thursday gives two different options, so a change in departure time changes the routes available. Where the route would exceed a limit, the engine compares two responses and recommends one:

Deviation

The route passes around the weather system. The extra distance shows in the reported distance and ETA.

Weather hold

The vessel waits in acceptable conditions until the system passes. Position and duration appear in the voyage report; the decision stays with the master and operator.

Routes are re-evaluated as new forecasts arrive.

The wave limit uses significant wave height (Hs). Where a vessel's limit is written as a maximum individual wave height, agree the equivalent Hs value with its technical team.

04

POSITION, DEPTH AND ZONES

Defining the Optimal Navigable Path

Latitude bounds

The user sets the northernmost and southernmost latitude the route may reach, typically from an ice-risk policy, trading limits or a charter-party clause. The bound holds for the whole voyage, including every re-route.

Draft

The engine excludes water shallower than the draft plus a 10% screening margin.

EXAMPLE For a draft of 12 m, the route uses only water of at least **13.2 m**.

Clearly unsuitable water is filtered out before the route reaches the bridge. The margin screens; it does not replace the under-keel clearance check in the passage plan.

Avoid zones: a firm exclusion

The user selects zones (war-risk, sanctions, piracy high-risk or the operator's own) from a catalogue that includes customer-defined areas. The route never enters a selected zone. If the origin or destination lies inside one, the user receives a message and no route is generated. Section 06 shows an avoid zone applied to a real voyage.

05

ROUTING PREFERENCES

ECAs and coastal distance

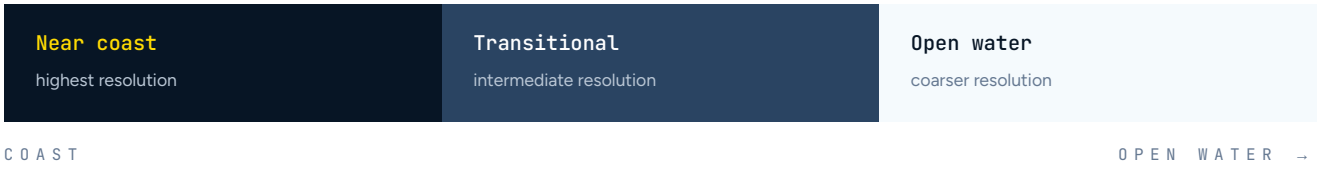
ECA minimisation

When switched on, the route leaves an Emission Control Area sooner where the extra distance is small, and passes through where the detour would be disproportionate, so ports inside an ECA remain reachable. Since 1 May 2025 the Mediterranean Sea is an ECA, so every voyage to or from a Mediterranean port includes ECA miles.

Distance from the coast

Routes keep off the coast where a reasonable alternative exists, and approach it where needed: port approaches and straits. The setting is fixed once for your deployment.

Figure 1. The routing grid adapts its resolution to the operating area



Illustrative. Exact settings depend on the deployment.

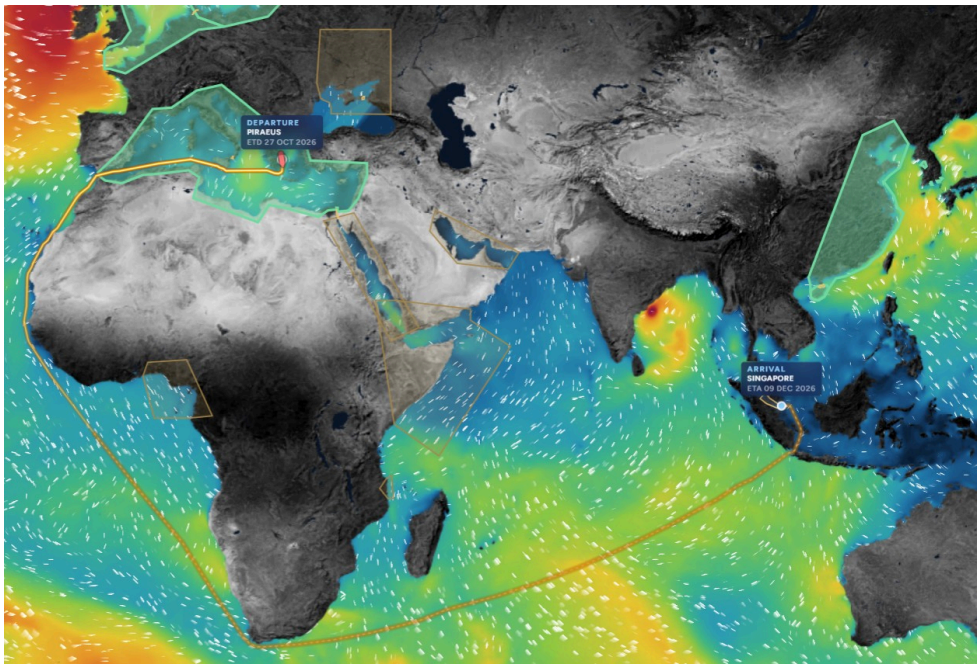
06

ON THE PLATFORM

A voyage example: Piraeus to Singapore

For instance, a voyage from Piraeus to Singapore, departing 27 October 2026, with the passage through Suez, the Red Sea and the Gulf of Aden selected as an avoid zone.

Figure 2. Piraeus → Singapore · ETD 27 Oct 2026 · ETA 09 Dec 2026



Recommended route Avoid zones Emission Control Areas

VesselFront platform view, October 2026

HOW THE RECOMMENDATION WAS REACHED

1 **The avoid zone removes the Suez route.**
With the Suez–Red Sea–Gulf of Aden passage excluded, the route runs west through the Mediterranean, past Gibraltar and around the Cape of Good Hope.

2 **ECA miles are shown, not hidden.**
Piraeus lies inside the Mediterranean ECA, so the leg to Gibraltar is inside an ECA. Those miles cannot be avoided, but they are never hidden: every route run on the platform produces a voyage report, and its executive summary states the distance, time and share of the passage spent inside ECAs. On this voyage: 1,548 nm and 5 days 9 hours, 12.6% of the passage.

Figure 3. Voyage report, executive summary · Piraeus → Singapore

01 | EXECUTIVE SUMMARY

PASSAGE		EMISSION CONTROL	
Departure (UTC)	27 Oct 2026 10:19	ECA Transit	12.6 %
ETA (UTC)	09 Dec 2026 04:45	ECA Distance	1,548 nm
Steaming Time	42d 18h	ECA Duration	5d 9h

3 **Weather is checked at the time of passage.**
Each point is checked against the forecast for when the vessel is expected there, and the route is re-evaluated as new forecasts arrive over the passage.

4 **The result shows how it was reached.**
Limits applied, ECA miles and any weather hold are shown with the recommendation.

If the limits as set leave no possible route, the engine reports which limit is binding rather than relaxing one.

07 FOR YOUR TEAM

What it means for your team

Commercial and operations managers

Limits, avoid zones and preferences are set once and applied to every route, every waypoint change and every re-route. When no route fits, the platform says which limit is binding.

Technical managers and superintendents

Wave height, wind speed and draft are applied as hard limits and are never traded against fuel or time. Depth screening uses draft plus 10%.

Charterers and claims teams

Each recommendation is presented with the limits and forecast it was generated under, giving a documented basis for routing decisions in charter-party and claims discussions.

Masters

Every output is a recommendation. Position and duration of any weather hold are reported; the decision stays with the master and operator.

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SCOPE

Scope

- **Supports passage planning; does not replace it.** Charts, tides, under-keel clearance and the passage plan remain with the bridge.
- **Works from forecasts.** Actual conditions can differ; routes are re-evaluated as forecasts update.
- **Applies the limits the operator sets.** Optional constraints left unset impose no limit.
- **Advises; the master and operator decide.** Every output is a recommendation.

→

IN SUMMARY

Key takeaways

Safety limits are fixed

Wave, wind, latitude, draft and avoid-zone limits are never traded against fuel or time.

Preferences are balanced

ECA and coastal preferences are weighed against distance: short detours are taken, disproportionate ones are not.

Forecast at time of passage

Limits are checked against the forecast for each point at the estimated time the vessel is there, and again on every re-route.

Results are shown in full

Each recommendation shows the limits applied, the miles inside ECAs and any weather hold. If no route fits, the binding limit is named.

See it on one of your own voyages

VesselFront is in closed beta with rolling admissions, working with Greek-owned fleets. Request a demonstration on a route you know.

vesselfront.com

SMART EnE3-Em-W · BV 2026

VesselFront is a routing-intelligence layer for commercial fleets. Its neurosymbolic route optimisation (USPTO patent-pending) combines learned routing patterns with the hard limits of physics, regulation and vessel capability, weighing weather, fuel, compliance and risk on every voyage. Routing certified to SMART EnE3-Em-W by Bureau Veritas (2026); weather models validated against hindcast data under an ESA research contract.

Mediterranean Sea ECA: IMO Resolution MEPC.361(79), sulphur limit applicable from 1 May 2025. Figures 2 and 3: VesselFront platform, October 2026. Platform behaviour as of October 2026; constraint availability and settings may vary by deployment.