Technical Documentation

Specifications • Integration Guides • Operational Whitepapers

WakeVolt situational awareness and collision-risk alert stack

Prepared for engineering evaluation and pilot planning

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Document Control

This pack contains a website-ready technical specification excerpt suitable for publication on the WakeVolt marketing website. It provides an overview of system capabilities, interfaces, deployment options, and commissioning steps. Vendor-specific details (radar/camera/autopilot models, network diagrams, and port mappings) are supplied in an Integration Pack upon request.

Version	Date	Change summary	Owner
v1.0	04 Jan 2026	Initial website-ready technical documentation pack.	WakeVolt Engineering

Contents

Note: Values shown as ranges are typical. Final specifications depend on selected compute hardware, enclosure, and sensor suite.

1. Downloads

Publish the following items as downloadable resources on the Technical Documentation page. File names below are recommended for clarity and versioning.

Document	Description	Recommended file name
Technical Specification (Situational Awareness Stack)	Engineering datasheet covering architecture, interfaces, deployment profiles, and requirements.	`WakeVolt_Technical_Spec_SituationalAwarenessStack_v1.0.pdf`
Integration Guide (ROS 2 / MAVLink / Marine Data)	Step-by-step integration guidance for sensors, autopilots, and operator consoles.	`WakeVolt_Integration_Guide_v1.0.pdf`
Operational Whitepaper (Collision-Risk Alerts and Smart Cueing)	Operator-facing overview: alert logic, recommended SOPs, and tuning guidance.	`WakeVolt_Operational_Whitepaper_CollisionRiskAndCueing_v1.0.pdf`
API and Data Formats (Telemetry, Events, Logs)	Reference for dashboard integration and exports (REST/WebSocket schemas).	`WakeVolt_API_DataFormats_v1.0.pdf`
Sensor and Compute Options (Bill of Interfaces)	Quick selection guide for pilots and deployments.	`WakeVolt_SensorCompute_Options_v1.0.pdf`

Request Integration Pack: For a vendor-specific pack (your radar model, camera/PTZ, AIS receiver, autopilot, and network topology), contact WakeVolt to receive validated wiring diagrams, port mappings, sample configs, and acceptance tests.

2. System Overview

WakeVolt is a modular situational awareness and collision-risk alert stack designed for patrol craft, ferries, workboats, and ports. The system fuses sensor inputs into a unified target picture (tracks), generates configurable alerts, and provides operator workflows through a web-based dashboard and integration APIs.

- **Multi-sensor ingestion:** radar/AIS/cameras/GNSS/IMU (sensor-dependent).
- **Target tracking:** track management and association across inputs.
- **Risk engine:** configurable CPA/TCPA-style metrics, geofences, and zone-based rules.
- **Operator UI:** map overlay, target list, event timeline, replay, and health monitoring.
- **Export and audit:** structured logs and incident bundles for review and training.

3. Architecture

WakeVolt follows a pipeline architecture that separates ingestion, analytics, tracking, and alerting for reliability and ease of integration.

Stage	Purpose	Typical components
Inputs	Acquire sensor feeds and vessel state.	Radar/AIS gateway, RTSP cameras, GNSS/IMU, autopilot telemetry
Perception	Extract detections from sensor data (as applicable).	Vision analytics, sensor adapters, calibration modules
Tracking	Associate detections into consistent target tracks.	Track manager, filtering, association logic
Risk Engine	Compute collision risk and rule-based alerts.	CPA/TCPA, zones/geofences, thresholds and priorities
Outputs	Deliver UI overlays, alerts, and integration data.	Dashboard, REST/WebSocket API, log bundles

Smart cueing is supported when the camera system provides PTZ control. In this mode, a track of interest (from radar/AIS/vision) can trigger a camera focus suggestion or automatic camera pointing based on configured policy.

4. Interfaces and Protocols

Interfaces are modular and enabled per deployment. The following are supported integration patterns.

Category	Interface / Protocol	Usage
Robotics	ROS 2 (DDS)	Internal modules and external autonomy stacks; topics/services for telemetry and tracks.
Autopilot	MAVLink 2	Vehicle state ingest and optional command routing (deployment-dependent).
Marine data	NMEA 0183 (and NMEA 2000 via gateway)	Instrument feeds such as AIS and navigation sentences (via adapter).
Video	RTSP	Camera streaming into analytics and operator UI.
Camera control	ONVIF / vendor SDK	PTZ control and presets (camera-dependent).
Web integration	REST + WebSocket	Tracks, events, health, and log management for dashboards and third-party tools.
Time sync	NTP (recommended)	Clock alignment for event ordering and log integrity.

Typical Network Ports (deployment-dependent)

Service	Direction	Transport	Default	Notes
Web UI	Inbound	HTTPS	`443`	TLS recommended; reverse proxy supported.
API (REST)	Inbound	HTTPS	`443`	Typically co-hosted with Web UI.
Events stream	Inbound	WebSocket	`443`	Real-time tracks and alerts.
ROS 2	Bidirectional	DDS/UDP	`Configurable`	Depends on DDS vendor and network settings.
RTSP ingest	Outbound	TCP	`554`	Camera streaming (camera-dependent).
MAVLink	Bidirectional	UDP/TCP	`14550/5760`	Common defaults; configurable.
NTP	Outbound	UDP	`123`	Use local NTP source where possible.

5. Data Outputs and APIs

WakeVolt publishes a consistent set of track objects, events, and health metrics. Exact schema depends on enabled modules.

5.1 Track Object (logical fields)

Field	Type	Description
`track_id`	`string`	Stable identifier within the session and log bundle.
`timestamp`	`ISO 8601`	Event time aligned to system clock (use NTP/GNSS time).
`position`	`lat/lon or local XY`	Geodetic or local coordinate, depending on deployment.
`velocity`	`m/s + heading`	Optional; derived from sensor inputs and filtering.
`source`	`enum`	Radar, AIS, vision, fused.
`classification`	`string + confidence`	Optional; sensor/model dependent.
`risk`	`object`	Optional risk metrics (CPA/TCPA, proximity, zone breaches).

5.2 Alert / Event Types (examples)

- **Collision-risk:** risk score above threshold; includes CPA/TCPA estimates when available.
- **Proximity breach:** target enters a configurable safety radius or corridor.
- **Geofence violation:** entry into restricted zone or no-go area.
- **Sensor health:** camera stream loss, radar feed loss, AIS feed loss, time sync drift.
- **System health:** CPU/GPU load, temperature, disk utilization, process status.

> Log bundles include raw summaries and derived events required for incident review. Storage duration and retention policy are configurable per deployment.

6. Compute and Deployment

WakeVolt can be deployed onboard, shoreside, or in a hybrid configuration. Video analytics workloads generally benefit from GPU acceleration.

Profile	Where it runs	Best for	Notes
Onboard Edge	Vessel compute unit	Patrol craft, ferry operations	Lowest latency; resilient to connectivity loss.
Shore / Port	Dockside server	Harbor monitoring and multi-camera sites	Centralized management and storage.
Hybrid	Edge + shore aggregator	Fleet monitoring	Local decisions + centralized analytics and long-term archives.

Compute Tiers (guidance)

Compute tier	Recommended use	Notes
CPU-optimized	Ingestion, basic tracking, API/UI, low-rate analytics	Suitable when video analytics is limited or offloaded.
GPU-accelerated	Real-time multi-camera analytics and cueing	Recommended for operational demonstrations involving vision.

7. Power and Environmental

Final power and environmental ratings depend on selected compute hardware and enclosure. The following values represent typical ranges for pilot deployments.

Parameter	Typical range	Notes
DC input	9-36 VDC	Compatible with common marine DC buses via fused supply.
Compute consumption	25-120 W	Varies with CPU/GPU tier and peripherals.
Ingress protection	IP65-IP66 (enclosure)	Use marine-rated enclosure and sealed glands.
Vibration / mounting	Marine bracket with isolation	Follow enclosure vendor mounting guidance.
Operating temperature	0-50 C (typical)	Higher ranges available with suitable enclosure/thermal design.

8. Cybersecurity and Data Management

WakeVolt is designed for operational reliability and auditability, with configurable security controls appropriate for maritime environments.

- **Access control:** role-based access (operator/admin) for UI and APIs.
- **Transport security:** TLS for web UI and APIs; supports reverse proxy deployments.
- **Local-first operation:** core functions can operate without internet connectivity.
- **Logging and integrity:** timestamped event stream; optional encrypted archives for incident bundles.
- **Data retention:** configurable retention windows and export policies.

For deployments requiring compliance-specific controls (e.g., government/port IT policies), WakeVolt can supply a hardening checklist and network segmentation reference.

9. Installation and Commissioning

Commissioning typically completes in the steps below. Pilot deployments can often be completed within a single site visit once sensor feeds are available.

9.1 Installation steps

- Mount compute unit in a dry, ventilated location; install network switch/router as required.
- Connect sensor feeds (AIS receiver/gateway, radar gateway if applicable, camera Ethernet).
- Configure time sync (NTP recommended; confirm drift within acceptable range).
- Validate camera streams (RTSP) and PTZ control (if applicable).
- Set operating profiles: alert thresholds, zones/geofences, and target prioritization.

9.2 Acceptance checks (examples)

- Sensor feed stability: no dropouts during a defined soak period.
- Track continuity: targets remain stable through course changes and occlusions (as applicable).
- Alert correctness: sample scenarios trigger expected alerts and do not overwhelm the operator.
- Replay and audit: log bundles capture the incident timeline and can be replayed.

10. Integration Checklist

Use this checklist to plan an integration or pilot. Items marked optional depend on target use case and sensors.

Area	Checklist item
Connectivity	LAN plan defined (IP ranges, VLANs if used), switch/router installed and labeled.
Time	NTP server reachable; clock drift verified.
Video	RTSP URLs confirmed for each camera; bitrate/resolution agreed; optional PTZ control validated.
Radar/AIS	Data feed available via gateway; sentence/track format confirmed.
Autopilot (optional)	MAVLink endpoint confirmed; message rate and routing validated.
Operations	Alert thresholds and zones approved; operator SOP drafted for pilot.
Security	Accounts provisioned; TLS enabled; firewall rules documented.
Logging	Retention and export policy agreed; storage capacity verified.

Publishing note for website: If you plan to host these PDFs publicly, avoid including sensitive port mappings or customer-specific network diagrams. Place those items in the vendor-specific Integration Pack shared privately.

11. Support and Next Steps

For pilots and integrations, WakeVolt typically provides a vendor-specific Integration Pack that includes validated wiring diagrams, sample configurations, acceptance tests, and an operating profile template (zones, alert thresholds, and SOP suggestions).

- **Pilot scoping:** identify operating area, vessel class, sensor suite, and success metrics.
- **Integration Pack delivery:** network diagram, port mappings, sensor adapters, and sample configs.
- **Commissioning:** time sync verification, stream validation, alert tuning, and operator handover.
- **Operational support:** log bundle review, threshold adjustments, and release notes for updates.

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