SPARTAN CORP PRODUCT BRIEF

Wraith C3

Contested-Environment Resilient Command, Control & Communications for Autonomous Maritime Operations

PATENT PENDING • U.S. Provisional Patent Application Filed December 2025

The Challenge

Autonomous maritime systems in contested environments face a fundamental problem: maintaining reliable C3 when adversaries actively jam, spoof, and interfere with RF links. Conventional systems treat platform dynamics, emission constraints, and cyber threats as separate concerns—resulting in brittle architectures that fail under combat conditions.

Our Solution

Wraith C3 is purpose-built for contested maritime operations. It integrates predictive link assessment, autonomous multi-path routing, mission-aware emission control, and embedded intrusion detection into a unified system that anticipates failures and adapts in real-time.

The architecture runs on dual redundant compute modules with safety-first arbitration—when systems disagree, the more conservative decision always wins. Every decision is logged for after-action reconstruction.

Designed for integration with third-party AUSV platforms, Wraith C3 provides a complete C3 software stack that transforms capable hardware into operationally resilient autonomous systems.

Wraith AUSV
Wraith C3 Reference Platform

Key Capabilities

✓ **Predictive Link Assessment:** Anticipates degradation 30-120 seconds before failures

✓ **Platform-Aware Geometry:** Motion dynamics inform all routing decisions

✓ **Mission-Profile EMCON:** Emission control integrated into path selection

✓ **AI Intrusion Detection:** Distinguishes jamming from platform-induced anomalies

✓ **Dual-Compute Arbitration:** Safety-first redundancy

✓ **Explainable Autonomy:** Full black-box logging for OT&E

Supported Mission Profiles

Blue-Water ISR	Littoral Interdiction	Covert Approach	High-Speed Intercept
Extended Loiter	Distributed Loiter	Contested Autonomy	Fleet Operations

Why It Matters

Operational Trust

Every decision logged, explainable, and reconstructable for after-action analysis.

Mission Continuity

Predictive failure handling ensures mission continues when links are compromised.

Combat Survivability

Purpose-built for contested environments where attacks are expected, not exceptional.

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Core Architecture Components

1. Predictive Link-State Assessment (PLSAE)

Rather than reacting to link failures, Wraith C3 anticipates them. The PLSAE computes short-horizon predictions (30-120 seconds) of path availability, quality-of-service, and degradation causes for every communication path. Predictions incorporate platform dynamics, environmental conditions, and electromagnetic context to enable pre-emptive traffic re-routing.

2. Platform-Aware Geometry Modeling

A Maritime Link Geometry and Sea-State Model continuously fuses platform state, vessel motion, environmental parameters, and geospatial context. The model computes obscuration probability, multipath risk, elevation margins, and environmental confidence for each path—factors that directly shape routing decisions. The geometry model adapts to host platform physical characteristics during integration.

3. Mission-Profile EMCON & Power (EPAPE)

The Emission and Power-Aware Policy Engine encodes detailed mission-profile templates into quantitative emission limits and power budgets that directly feed path weighting and selection. This tight integration establishes cross-layer control from mission profile through emission and power policies to per-path scoring and mode management.

4. AI-Driven Intrusion Detection (AI-IDS)

An embedded AI-driven Intrusion Detection System uses platform-motion-conditioned baselines to distinguish electronic warfare effects from motion-induced anomalies. The system evaluates both communication paths and distributed mesh nodes using physics-based checks including traffic shape analysis, protocol sanity checking, kinematic plausibility, and cueing consistency verification.

5. Autonomous Multi-Path Routing (AMPRE)

The Autonomous Multi-Path Routing Executive computes path weights as functions of predicted availability, geometry state, emission/power scores, and risk/trust levels. The Communications Path Abstraction Layer (CPAL) presents logical channels independent of underlying transports, supporting JAUS, STANAG 4586, and UMAA protocols.

6. Dual-Compute Arbitration (D-COMM)

The architecture executes redundantly on dual compute modules. The Dual-Compute C3 Orchestrator compares per-cycle decisions, classifies disagreements by severity, and selects the more conservative decision according to an explicit safety ordering that preferentially reduces autonomy authority, emissions, and dependence on compromised nodes.

7. Explainable Autonomy & Black-Box Logging

A logging subsystem persistently records geometry states, link predictions, emission/power usage, intrusion detection decisions, dual-compute disagreements, and mode transitions. This comprehensive record enables reconstruction of C3 behavior for Navy after-action analysis and OT&E.

Operational Mode Management

Wraith C3 implements a Communications and Control Finite-State Machine with five operational modes. Transitions are driven by combined triggers across predicted availability, zero-trust risk levels, GNSS trust, distributed mesh health, energy margins, and dual-compute disagreement patterns.

Mode	Description
PRIMARY	Full capability with preferred links. All paths nominal, full autonomy envelope.
ALTERNATE	Reduced capability with secondary links. Some path degradation, adjusted routing priorities.
DEGRADED	Limited capability with minimal links. Tightened autonomy envelope, local navigation priority.
EMERGENCY	Safe fallback with pre-planned behaviors. Mission-defined drift envelopes, safety priority.
RECOVERY	Transitional state for link reacquisition. Gradual capability restoration with validation.

Mode transitions are triggered by geometry marginality, soft-limit pressure, intrusion detection severity, GNSS trust degradation, and compute disagreement—always erring toward the safer operational state.

Integration Architecture

Wraith C3 is designed for integration with third-party AUSV platforms through well-defined interfaces:

Hardware Requirements

- Dual redundant compute modules (edge-compute class)
- Multi-path RF transport suite (satellite, cellular, mesh, legacy bands)
- Platform motion telemetry (IMU, stabilization data)
- Navigation stack interface (GNSS, inertial, radar/AIS)
- Power management interface (battery state, generator status)
- Autonomy stack interface (mission planner, safety systems)

Software Interfaces

- CPAL abstraction layer for transport-agnostic channel management
- Standard protocol support: JAUS, STANAG 4586, UMAA
- REST/gRPC APIs for autonomy stack integration
- Configurable mission-profile templates
- Black-box data export for external analysis tools
- Platform-specific calibration during deployment

Competitive Differentiation

Wraith C3 delivers capabilities not found in conventional C3 systems:

✓ **Cross-layer integration:** Platform dynamics, emissions policy, intrusion detection, and mode management operate as a unified system

✓ **Predictive rather than reactive:** Anticipates failures 30-120 seconds ahead, enabling pre-emptive adaptation

✓ **Maritime-physics-aware security:** Distinguishes electronic warfare from environmental anomalies

✓ **Safety-first arbitration:** Conservative decisions selected automatically under uncertainty

Engagement Options

Spartan X is actively developing Wraith C3 and seeking strategic partners for technology maturation and transition:

Technology Demonstration

Participate in Wraith C3 capability demonstrations and experimentation events. Evaluate architecture performance against your specific mission requirements and platform configurations.

Co-Development Partnership

Collaborate with Spartan X on architecture refinement and platform-specific adaptation. Ideal for AUSV manufacturers and program offices seeking early influence on C3 capabilities. Joint development agreements and IP arrangements available.

R&D Collaboration

Engage through SBIR/STTR, OTA, or direct R&D contracts to accelerate specific capability areas—predictive link assessment, AI intrusion detection, or mission-profile optimization for your operational environment.

About Spartan X Corp

Spartan X Corp is a veteran-founded, Service-Disabled Veteran-Owned Small Business (SDVOSB) headquartered in Austin, Texas. We specialize in autonomous systems, AI-driven solutions, edge computing, and cybersecurity for defense and intelligence customers.

Our team brings deep expertise in maritime operations, autonomous systems, and contested-environment C3 architecture. We hold Seaport NxG contract vehicle access and maintain active relationships with Navy program offices, combatant commands, and defense primes.

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