

# NEMO LYAPAS (SLAP) -R5

## AUTONOMOUS RIVER FRONTIER SURVEILLANCE NODE

NEMO LABS  
Independent Research Initiative

CONCEPT DESCRIPTION / R5  
Autonomous River Persistent Surveillance Node

## 01. PURPOSE

Rivers, channels, distributaries, and deltas form a natural network of waterways while also creating a complex environment for continuous surveillance. Branched geography, islands, dense vegetation, shallow waters, and numerous passages make it difficult to establish continuous coverage using shore-based fixed positions alone.

Continuous patrolling requires crews, watercraft, fuel, and substantial operational resources.

LYAPAS-R5 is being developed to establish an autonomous, continuously present surveillance layer directly within the river system.

**PRIMARY MISSION**  
**persistent autonomous surveillance of selected waterways**  
**and early detection of enemy infiltration by water**

The system's primary state is not movement, but presence. The platform occupies its assigned area, conducts surveillance, detects an event, generates an information report, and remains on the frontier.

**DO NOT PATROL THE FRONTIER CONTINUOUSLY.**  
**MAINTAIN A CONTINUOUS PRESENCE ON THE FRONTIER.**

## 02. OPERATING PRINCIPLE

LYAPAS-R5 is a low-profile, unmanned platform designed for persistent presence. Once deployed, it occupies an assigned section of the river system and transitions to autonomous surveillance mode.

**DEPLOYMENT → POSITION → SURVEILLANCE → DETECTION**  
**→ CLASSIFICATION → ALERT → RESPONSE**

Platform mobility is used for deployment, position correction, and redeployment. LYAPAS-R5 is not intended to replace a patrol boat or a conventional unmanned craft; its task is to turn a selected waterway into a continuously monitored space.

## 03. THE RIVER DELTA AS A SYSTEM

The core idea of LYAPAS-R5 becomes fully apparent when a network is formed. A delta is viewed not as a continuous area requiring uniform surveillance everywhere, but as a system of waterways: the main channel, distributaries, channels, passages, and critical sections.

Each LYAPAS-R5 becomes an autonomous point of presence. One node monitors a specific section. Multiple nodes form a distributed surveillance layer. As conditions change, the configuration of this layer can be altered without constructing new fixed infrastructure.

**THE PATROL DOES NOT MOVE.**  
**THE SURVEILLANCE FRONTIER ITSELF MOVES.**

## 04. FUNCTIONAL ARCHITECTURE

LYAPAS-R5 is conceived as a modular sensor-and-compute node. Its specific configuration is determined by site conditions and mission requirements.

**PLATFORM LAYER** — Hull, power system, positioning and mobility systems, technical-condition monitoring, and core autonomous-operation systems.

**SENSOR LAYER** — A suite of observation and measurement systems. Its task is to obtain sufficient information for detection, tracking, and initial classification of an object.

**COMPUTE / AUTONOMY LAYER** — The onboard computing layer provides platform control, initial processing of sensor data, and execution of predefined autonomous-operation scenarios.

**COMMUNICATION LAYER** — Provides transmission of event information to the control layer and data exchange with compatible external systems.

**MISSION LAYER** — Defines the node's operating mode, monitored sector, and software logic for a specific mission.

## 05. FROM OBJECT TO EVENT

The river environment is dynamic: currents, vegetation, wildlife, civilian watercraft, floating objects, and weather conditions constantly generate change. The system's task therefore cannot be reduced to registering every movement.

**DETECTION → TRACKING → CLASSIFICATION → EVENT ASSESSMENT**

A key research objective is to distinguish routine activity from an event requiring operator attention. The actual capability of such classification must be determined by sensor performance and test results rather than claimed in advance.

## 06. NEMO NET

A single LYAPAS-R5 provides surveillance of an individual section. To monitor a complex river system, multiple nodes are integrated into NEMO NET. Each platform retains its own autonomy, while information from distributed points forms a common river-operating picture.

**1 LYAPAS-R5 → POINT OF PRESENCE  
MULTIPLE LYAPAS-R5 NODES → DISTRIBUTED FRONTIER  
NEMO NET → COMMON OPERATING PICTURE**

Nodes can be positioned along different routes within the delta and can reshape the geography of the surveillance layer according to mission requirements.

**LYAPAS OBSERVES LOCALLY.  
NEMO NET BUILDS THE COMMON PICTURE.**

## 07. MOBILE SYSTEMS AND DRONES

LYAPAS-R5 is a persistent sensor-and-information node around which mobile autonomous assets can operate. When an event is detected, the system transmits information to the external control layer, after which mobile platforms can be tasked for additional surveillance or response.

- reconnaissance UAVs for additional observation and situational clarification;
- compatible aerial and surface autonomous systems;
- strike drones as separate mobile effectors.

In the baseline concept, LYAPAS-R5 itself is not considered a weapons carrier. Its primary function is persistent presence, detection, information support, and data transmission.

After mobile assets complete their task, LYAPAS-R5 remains in position and continues monitoring the assigned section. Thus, the responding element may change while the surveillance frontier remains in place.

## 08. WHY THE DELTA

A river delta is a representative environment for this architecture. The large number of routes complicates continuous area-wide surveillance, yet the geography itself structures movement through channels, distributaries, and passages. This makes it possible to form a network of autonomous points of presence along selected routes.

The fundamental unit of the system becomes not an individual platform, but a monitored water route. A network of LYAPAS-R5 nodes forms a distributed sensor frontier.

## 09. ENGINEERING LOGIC

The key value of the concept does not lie in any single hull, sensor, or computing module. The NEMO Labs research objective is to verify whether existing technological components can be integrated into a compact autonomous architecture for persistent river presence.

At the current stage, NEMO Labs deliberately does not specify unverified values for detection range, autonomous endurance, speed, classification accuracy, or communications resilience.

Key parameters must be determined through engineering modelling and experimental validation:

- energy autonomy and actual power balance;
- platform stability under current, wind, and wave conditions;
- station keeping and position correction;
- sensor-suite performance by day and night;
- equipment resistance to prolonged exposure to the river environment;
- quality of onboard data processing and event-driven information transmission;
- coordinated operation of multiple NEMO NET nodes;
- required maintenance intervals.

## 10. TECHNOLOGY DEMONSTRATOR R5

The next logical stage of the program is the development of the LYAPAS-R5 Technology Demonstrator. Its purpose is not to demonstrate the maximum number of functions, but to validate the underlying physical and architectural hypothesis.

The experimental program must establish whether a compact autonomous platform can remain in a real river environment for extended periods, maintain its assigned operating area, provide reliable surveillance, and function as an element of a distributed network.

Test results must determine the subsequent hull geometry, power architecture, equipment configuration, and operational configurations of the system.

## 11. RESEARCH HYPOTHESIS

The project is based on a fundamental question: can a complex river system be transformed into a continuously monitored space without requiring the permanent presence of crews and continuous patrolling of every route?

**ONE LYAPAS-R5 — A POINT OF PRESENCE.  
MULTIPLE NODES — A MONITORED FRONTIER.  
NEMO NET — AN INFORMATION PICTURE OF THE RIVER SYSTEM.**

# **NEMO LYAPAS-R5 AUTONOMOUS RIVER PERSISTENT SURVEILLANCE NODE**

**It does not patrol the river. It takes its position on the frontier and stays there. An enemy entering the protected area gets a slap — LYAPAS!**

**LYAPAS-R5 is a distributed architecture for persistent surveillance of river approaches. LYAPAS is a frontier that does not announce its presence. An intruder becomes aware of it only after the system has already detected the intruder.**

**NEMO LABS**

**Autonomous Systems / Distributed Infrastructure / Experimental Engineering**







