# *ECLIPSE & AIOS*

## From Simulation Tools to Simulation Teammates

An Agentic AI Framework for Wargaming Synthetic Environments

20-minute technical narrative



# ELTGROUP : 75 YEARS OF Electronic Warfare

Defence
Cyber
Homeland
Security
Biodefence
Space

## COUNTERMEASURES & SELF PROTECTION



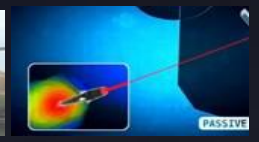


## SIGNAL INTELLIGENCE





## INFRARED


## C-UAS




## EDUCATION TRAINING & OPERATIONAL SUPPORT

EWACADEMY



## HOMELAND SECURITY & LAW ENFORCEMENT





## SPACE EW



## TEST, EVALUATION & SIMULATION




## NEW TECH LAB RESEARCH & DEVELOPMENT




---

CY4GATE
Part of ELT Group

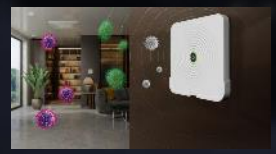
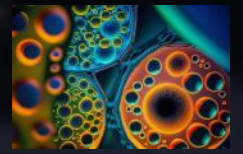
## CYBER SECURITY &



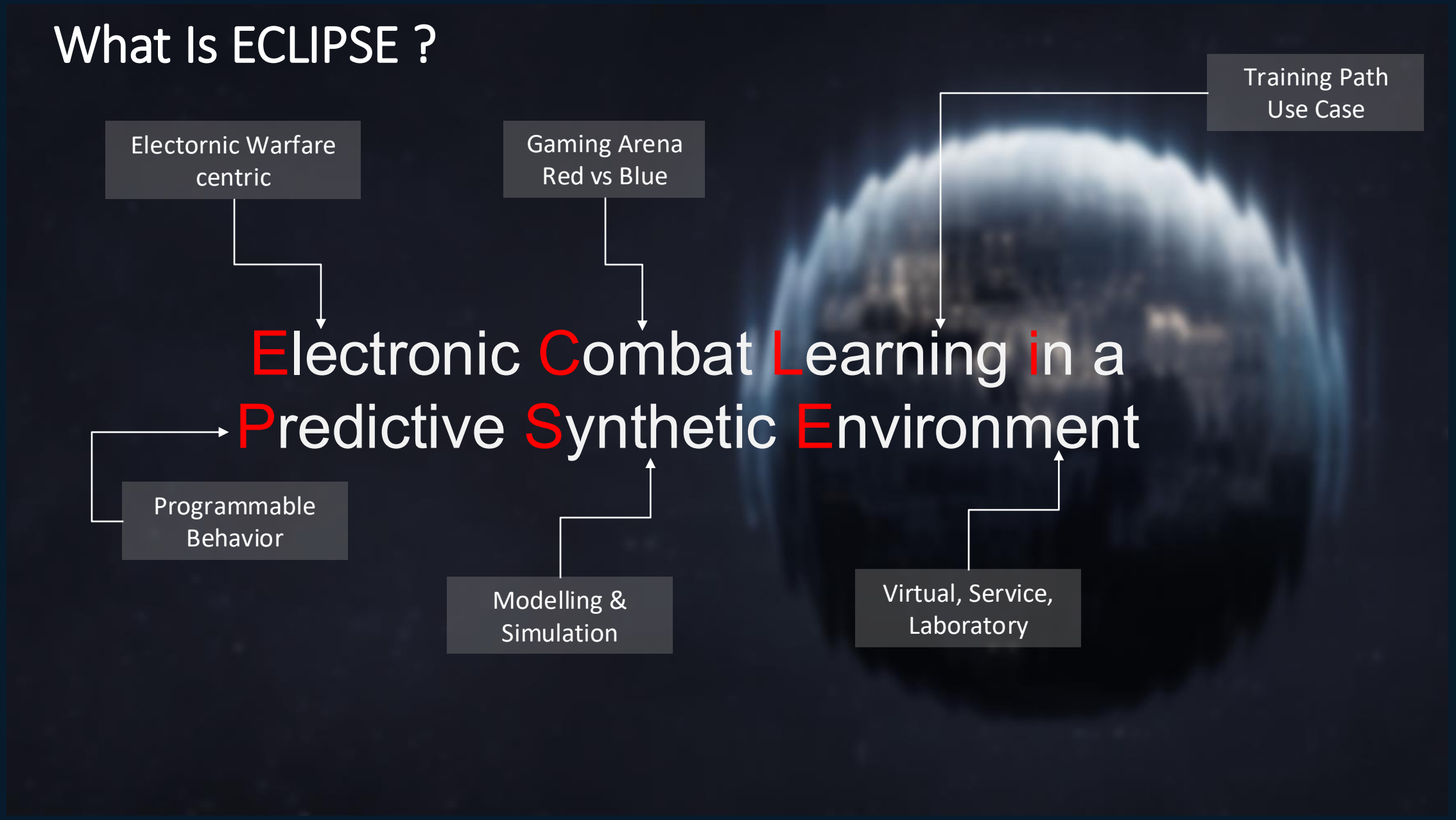


E4 SHIELD
Part of ELT Group

## BIODEFENCE SOLUTION


# What Is ECLIPSE ?



# ECLIPSE Lifecycle




Define the Use Case:

- EW Training Path
- System Validation
- CONOPS/TTP
- Mission Reharsal

# ECLIPSE Lifecycle

USE CASE → DESIGN → PRE MISSION → EXECUTION → POST MISSION → EVALUATION

Model System needed Entities:

- Equipment
- Threats
- Platforms

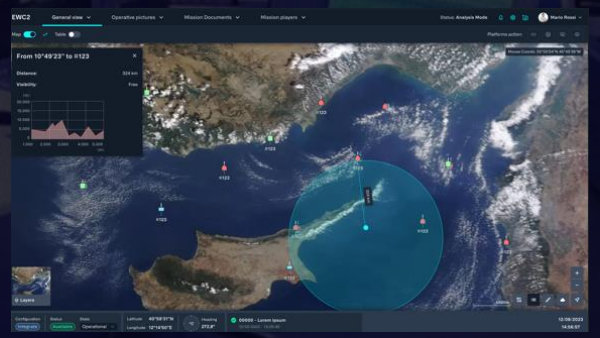


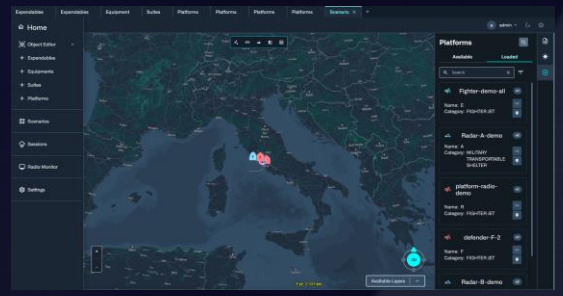
# ECLIPSE Lifecycle

USE CASE → DESIGN → PRE MISSION → EXECUTION → POST MISSION → EVALUATION

Configure the Simulated Scenario

- EOB
- Teams
- Behaviour





# ECLIPSE Lifecycle




Operational Support Activities

- Analyze Mission Documents
- Prepare and Plan the Mission
- Analyze Intelligence Data
- Prepare Libraries

# ECLIPSE Lifecycle

USE CASE → DESIGN → PRE MISSION → EXECUTION → POST MISSION → EVALUATION

Execute the Mission

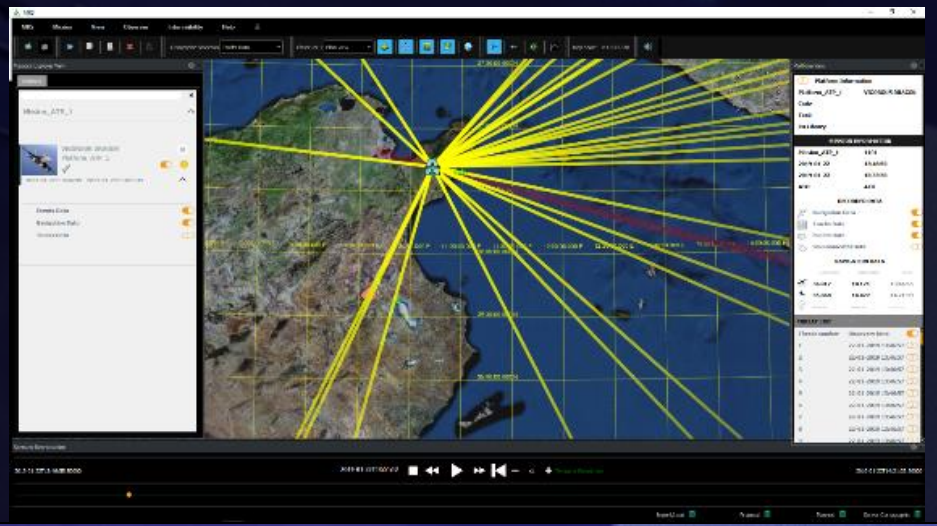
- Operate Workpost
- Coordinate with the Team
- Accomplish Mission Task
- Complete the Mission



# ECLIPSE Lifecycle

USE CASE → DESIGN → PRE MISSION → EXECUTION → POST MISSION → EVALUATION

Mission Debriefing
Analyse Mission Recorded Data
Process, combine and produce Post Mission Results



# IOS – Instructor Operating Station

The operational hub connecting simulation services, trainee workstations and supporting tools

### Unifed Interface

Provides the instructor with a unified interface to configure, control and monitor training/simulation sessions

### Scenario Configuration

Enables scenario preparation, definition of operational context, participating entities, threats, events and mission parameters

### Control

Supports real-time exercise control, allowing the instructor to start, pause, resume, modify or stop the simulation

### Monitoring

Monitors trainee actions, system status and scenario evolution through situational awareness displays

### Adaption and Interaction

Allows dynamic injection of events during execution to increase realism and adapt the training flow

### Assessment

Supports assessment and debriefing by collecting exercise data, logs, timelines and performance indicators

# What's Next? AI+IOS

From manual simulation configuration to an AI-enabled simulation ecosystem

### Agents to support Humans

Faster preparation of EMSO-oriented synthetic scenarios, helping exercises and experimentation move from concept to executable configuration with less manual friction.

### Synthetic Environment Integration

The solution is designed as a modular set of agents integrated with the existing ECLIPSE and its Instructo Operating System for Object editing, Scenario configuration , and cartographic services.

### Data, Interoperability & Standards

The architecture relies on structured outputs, internal schemas, geospatial formats and traceable knowledge retrieval to improve consistency across scenario elements.

### AIOS Mission

Turn high-level training intent into validated simulation objects and scenarios through a cooperative agent ecosystem, while preserving human-in-the-loop control in the Operational environment.



# Starting point: the ECLIPSE Baseline

A mature digital training environment, but with configuration-intensive workflows

CURRENT BASELINE

EMSO-oriented training system focused on EW and SIGINT tactical tasks
Supports EMSO CAX exercises, mission rehearsal, individuals, units and staff training
Instructor workflows include scenario definition, object creation, platform deployment and evaluation setup

## Where the pain appears

### Manual georeferencing

Coordinates, areas, routes and spatial constraints are often configured through direct map interaction or manual entry.

### Manual entity modelling

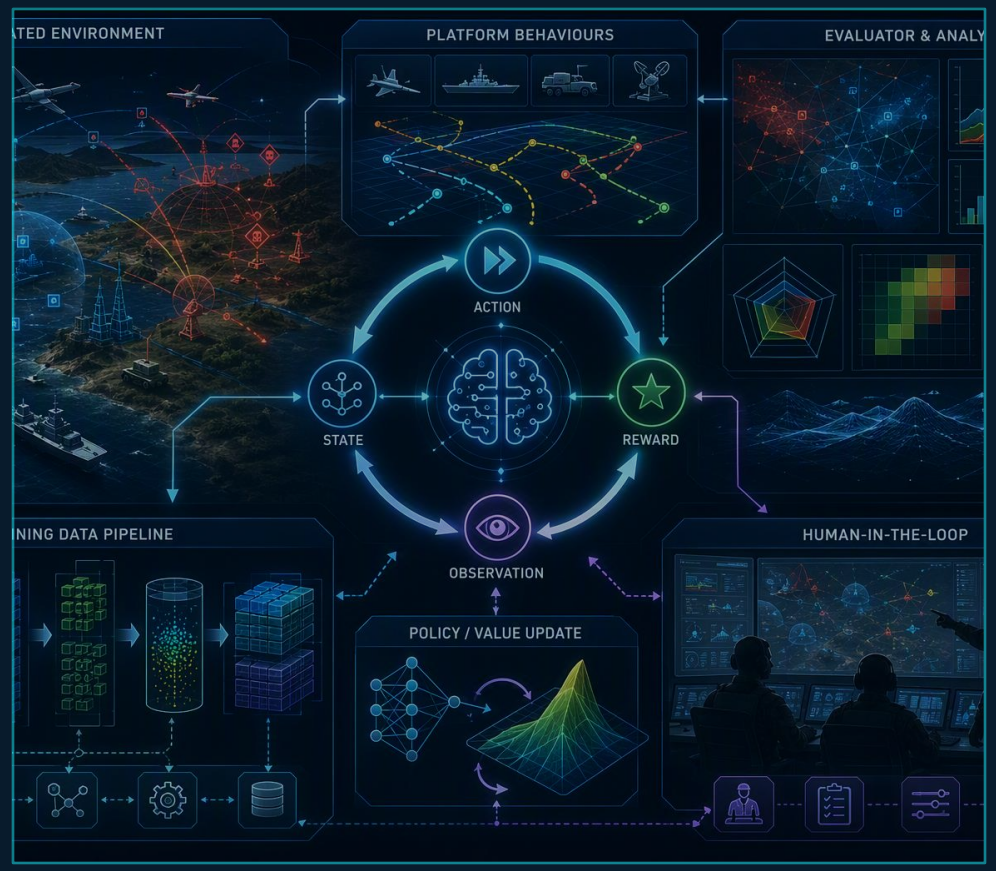
Platforms, sensors and equipment may require engineers to read documentation and manually populate object parameters.

### Actions/Reactions and KPI complexity

Constructive behaviours and evaluator KPIs are based on low-level measures, events and mathematical conditions that can become difficult to scale.

# System architecture: an agentic ecosystem

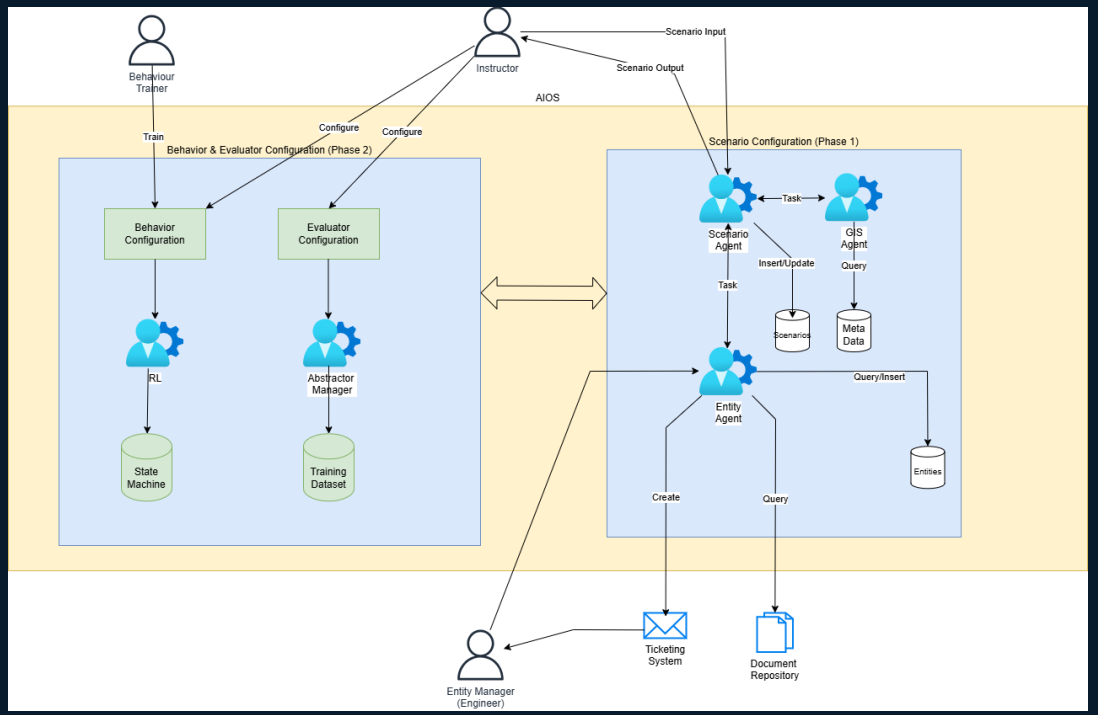
Specialized agents cooperate around the Instructor and the IOS




## Architecture principles

- Each AI capability is **encapsulated** in a specialized agent
- Agents coordinated through an **Agentic-AI framework**
- The **Operators remains the decision authoritis** and can refine manually



# Design roadmap: incremental capability growth

BASE product first, ADVANCED product after deeper investigation

ROADMAP

## Phase 1 | BASE Product

Fast, feasible, integrated in the current EW BattleLab

- **Prototype**
- **Specifications**
- **MVP**
- **Base Product**

## Phase 2 | ADVANCED Product

Higher value, higher uncertainty, research-driven

- **Proof of Concept**
- **R&D**
- **Cost & Benefit Analysis**
- **Specifications, MVP, Product**

**Decision logic** Prioritize ready-to-proof agents for near-term productization; reserve high-uncertainty agents for dedicated research, validation and partnership-driven development.

# Identified agents and their contribution

A phased architecture: configure first, learn and assess later

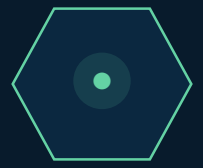
AGENT MAP



## GIS Agent

Geospatial intelligence: natural language to coordinates, zones, routes and map layers.

PHASE 1



## Scenario Agent

Orchestrates scenario creation from high-level instructor intent and delegates subtasks.

PHASE 1



## Entity Agent

Ingests documents and structures platform, sensor, equipment and weapon data.

PHASE 1



## Behaviour Agent

Phase 2 adaptive constructive behaviours through RL and reward configuration.

PHASE 2



## Evaluator Agent

Phase 2 dynamic performance assessment, similarity, metrics and reporting.

PHASE 2

Optional extensions: Assistant Agent and Mission Document Agent can be investigated as transversal user support capabilities.

PHASE 1

# From natural language to Scenario Configuration

Instructor intent is decomposed into agent tasks and validated scenario updates

PHASE 1 WORKFLOW




1. **Instructor prompt**
   High-level scenario description, constraints and updates
2. **Task decomposition**
   Scenario Agent splits geography, entities, weather, time and platform tasks
3. **Agent execution**
   GIS and Entity Agents resolve spatial and object information
4. **Scenario update**
   Configuration file is updated, validated and reflected in IOS/cartography
5. **Human refinement**
   Instructor reviews, adjusts warnings and finalizes the scenario

*"Create a RED coastal air defence scenario on the north-east coast of [...] at 04:30 local time in late autumn. Use overcast weather with light rain, 15-knot winds from the north-west, and sea state 3. Deploy a complete IADS consisting of 12 GBAD shelters [...] , 4 early-warning radars [...] , and 2 command-and-control nodes [...] . Position all assets between 10 and 20 nautical miles inland, avoiding urban areas"*

# GIS Agent: geospatial intent resolution

Turning human geographic intent into simulation-ready spatial objects

PHASE 1 AGENT

## Purpose

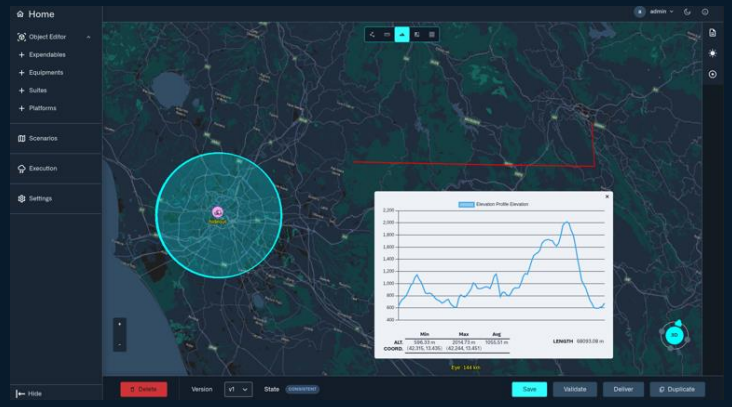
Provide structured, offline-capable access to geographic information from preloaded metadata sources and expose NLP-driven geospatial query services.

## Core services

Geocoding, reverse-geocoding, topology queries, distance and bearing computation, buffering, routing, zone generation, validation and layer caching.

## Operational value

Eliminates manual coordinate lookup and ad-hoc digitization by producing coordinates, routes and polygons in standardized formats.







*"Create a RED coastal air defence scenario on the north-east coast of [...] at 04:30 local time in late autumn. Use overcast weather with light rain, 15-knot winds from the north-west, and sea state 3. Deploy a complete IADS consisting of 12 GBAD shelters [...], 4 early-warning radars [...], and 2 command-and-control nodes [...]. Position all assets between 10 and 20 nautical miles inland, avoiding urban areas*

# Entity Agent: knowledge ingestion and object structuring

From documents to validated platforms, sensors, actuators and weapons

PHASE 1 AGENT

**User need: avoid manual parsing of technical documentation to create database entities.**

### Inputs

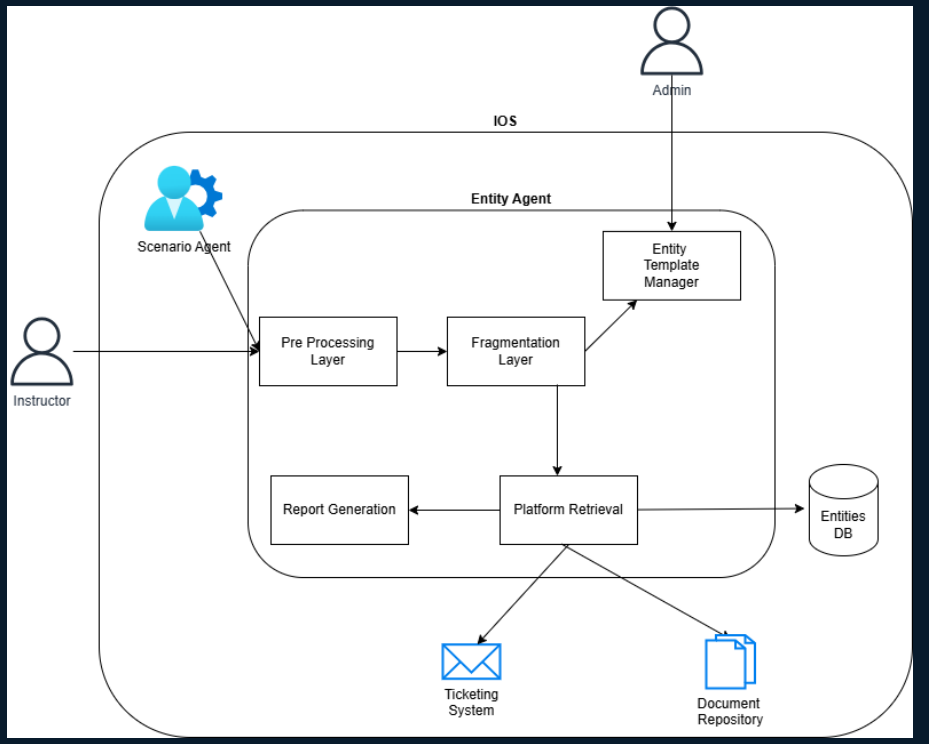
Technical manuals
Specifications
Operational documents
Text, tables, diagrams

### Processing

NLP extraction
Ontology alignment
Template filling
Confidence scoring

### Outputs

Structured entities
DB / Knowledge updates
Ticketing interaction




Human-in-the-loop is used when available information is missing, ambiguous or not sufficient for a validated entity.

*"Create a RED coastal air defence scenario on the north-east coast of [...] at 04:30 local time in late autumn. Use overcast weather with light rain, 15-knot winds from the north-west, and sea state 3. Deploy a complete IADS consisting of 12 GBAD shelters [...], 4 early-warning radars [...], and 2 command-and-control nodes [...]. Position all assets between 10 and 20 nautical miles inland, avoiding urban areas*

# Scenario Agent: the orchestration layer

Creating and Maintaining the Scenario Configuration

PHASE 1 AGENT

**NLP**
Instructor intent

**GIS**
Spatial tasks

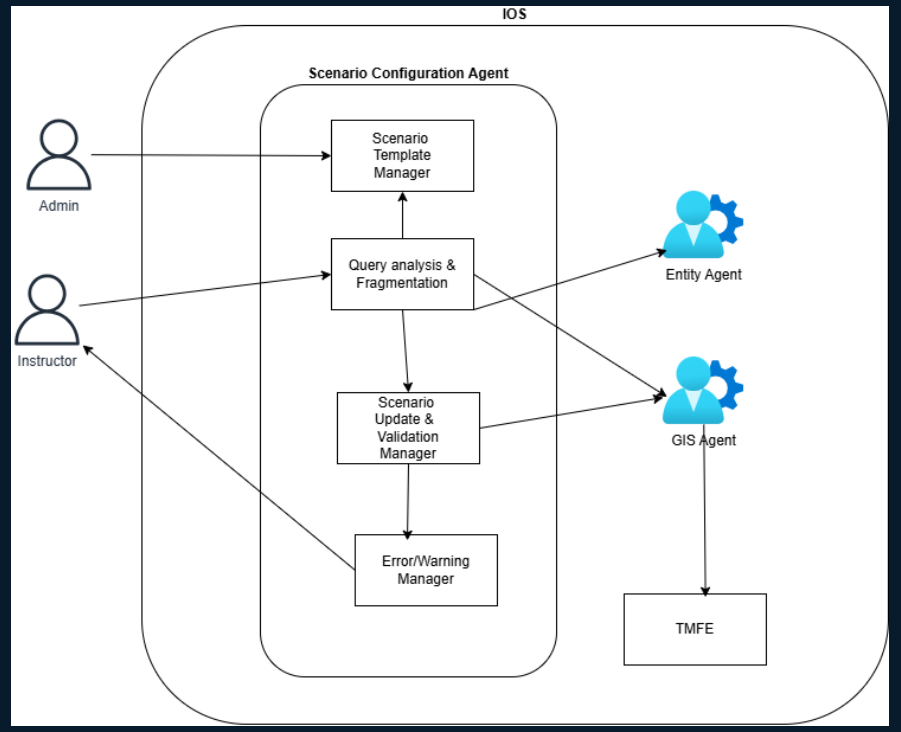
**DB**
Entity retrieval

**IOS**
Map feedback

## Scenario Configuration File

Loaded from a standard JSON/XML-like template
Updated after each inference step as platforms, weather, timing and geography are added
Validated for coherence and completeness before saving or sending to the map
Warnings and errors support operator correction while partial scenarios can still be visualized

*"Create a RED coastal air defence scenario on the north-east coast of [...] at 04:30 local time in late autumn. Use overcast weather with light rain, 15-knot winds from the north-west, and sea state 3. Deploy a complete IADS consisting of 12 GBAD shelters [...] , 4 early-warning radars [...] , and 2 command-and-control nodes [...] . Position all assets between 10 and 20 nautical miles inland, avoiding urban areas*

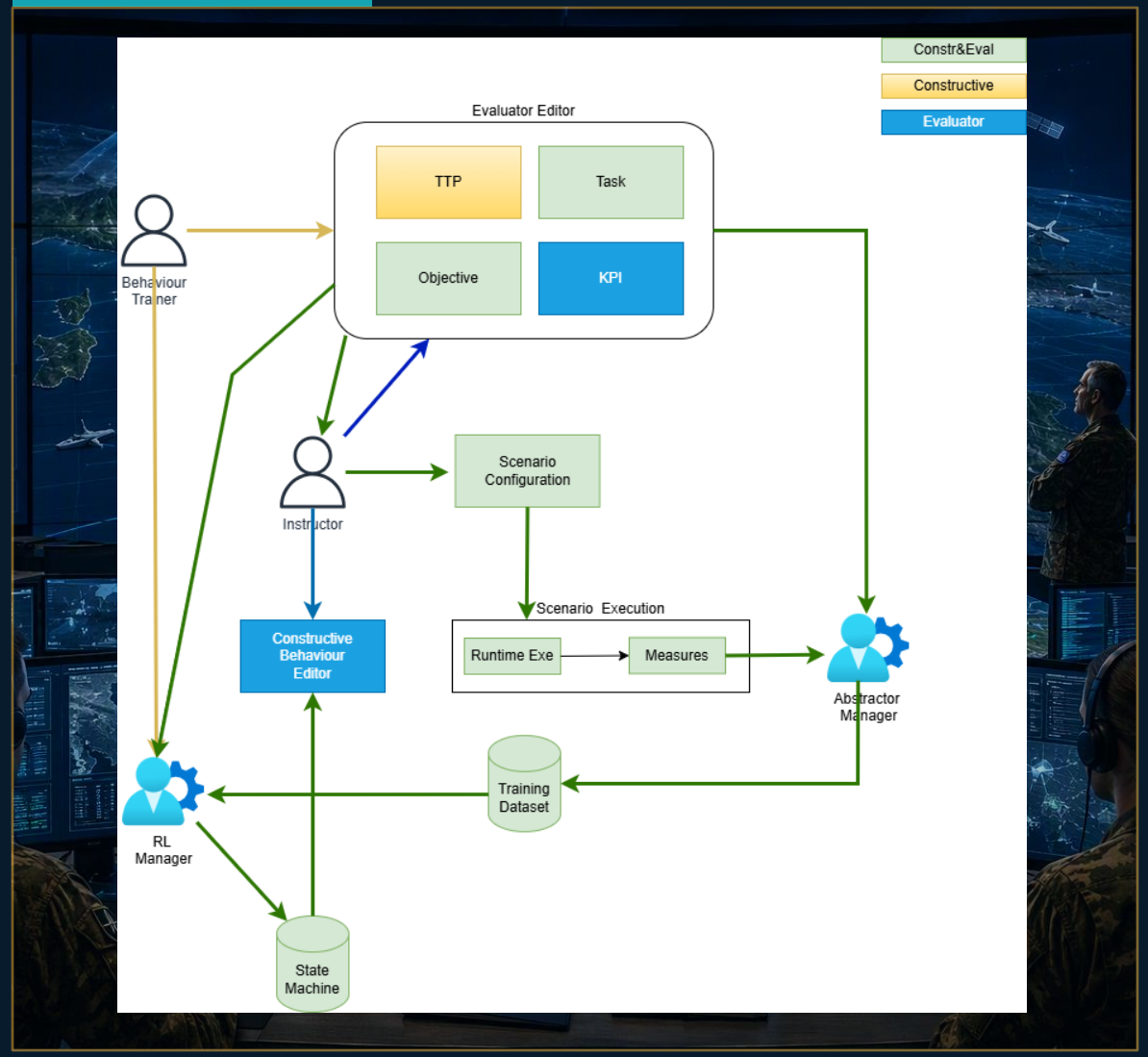


PHASE 2

# Adaptive behaviours and dynamic evaluation

Moving from configuration assistance to learning, assessment and feedback loops

PHASE 2




## Behaviour Agent

Uses Reinforcement Learning to replace fixed state-machine rules with adaptive, reward-driven constructive behaviours aligned with user-defined TTPs.

## Evaluator Agent

Moves beyond static Boolean KPIs toward configurable evaluation profiles, temporal analysis, similarity with historical data and performance dashboards.

**Synergy**: positive evaluations enrich training data; trained behaviours generate new examples for evaluation and benchmarking.

# Conclusions and way forward

A feasible path to AI-enabled EW simulation readiness, if developed incrementally

CLOSING

1 **Start narrow**

Define Phase 1 User and System Requirements and Internal detailed architecture for Scenario, GIS and Entity Agents.

2 **Preserve control**

Keep the Instructor and Engineer roles in the loop for refinement, approval and data quality.

3 **Build evidence**

Start Scenario Agenet Implementation with MVP and measurable results: configuration time, error rate, language portability and usability.

4 **De-risk Phase 2**

Treat Behaviour and Evaluator as R&D tracks with external competence, simulation data strategy and controlled validation.

# Development Roadmap

- Current Status: PROTYPE (TRL-5)
- Incoming Releases:
    - ECLIPSE MVP Product by Dec 2026
    - ECLIPSE-AIOS MVP with Scenario Agent Dec 2027
    - HWIL integration:  COMINT
- Ongoing Interoperability/Architecture activities
        - Full Support of NATO MSaaS
- Future EW integration capabilities:
    - Domain expansion:  Space (satellite constellations) and  Submarine ( underwater platforms )
    - New onboard Sensors Simulators:  Sonar and  DIRCM
    - HWIL integration: ECM
- Future AI Evolutions ( AIOS)
    - ECLIPSE Phase 1 Completion (Including GIS and Entity Agents)
    - ECLIPSE Phase 2 Investigation and Prototype

ELTGROUP

# Thank You

Alessandro Maraschini
HEAD of EMSO Simulation Product Line
ELTGroup

alessandro.maraschini@elt.it

eltgroup.net

