User Requirements Document (URD)

Project: Track Surveillance Drone

Version: 1.0

Environmental Conditions

UR-01: The drone shall fly at a maximum of 2000 m above sea level.

UR-02: The drone shall be able to operate in temperatures between –20 °C and +50 °C.

UR-03: The drone shall be able to fly in light rain and moderate wind conditions up to 40 km/h.

UR-04: The drone shall withstand storage temperatures from –40 °C to +60 °C.

UR-05: The drone shall include weather monitoring sensors to assess flight safety.

Hardware

UR-06: The HW shall comply with directive 2011/65/EU (RoHS).

UR-07: The drone shall include replaceable battery packs for extended operations.

UR-08: The HW shall have protective housing with a minimum IP54 rating.

UR-09: The drone shall have visible markings for safe handling and transport.

UR-10: The drone shall include an easily accessible emergency shut-off switch.

Functional Requirements

UR-11: The drone shall detect any defect to the tracks in sight.

UR-12: The drone shall be capable of autonomous navigation along predefined track sections.

UR-13: The drone shall provide real-time transmission of video and sensor data to the control center.

UR-14: The drone shall support manual remote control for special inspection tasks.

UR-15: The drone shall record geo-referenced inspection data.

UR-16: The drone shall have automatic return-to-home functionality in case of low battery or signal loss.

System Architecture

UR-17: The system shall support redundant controller levels for availability.

UR-18: The transport protocol for communication with the interlocking shall be RaSTA.

UR-19: The system shall support remote diagnosis for any component fault.

UR-20: The system shall include redundant communication links to prevent data loss.

UR-21: The system shall support secure over-the-air updates.

UR-22: The system shall comply with railway cybersecurity requirements (EN 50701 if applicable).

Maintenance and Diagnosis

UR-23: No periodical or preventive maintenance shall be necessary under normal conditions.

UR-24: All relevant information related to asset management shall be accessible remotely by a centralized asset management system.

UR-25: The system shall log all flight and inspection data for at least 12 months.

UR-26: The system shall generate automatic diagnostic reports.

UR-27: The system shall provide alerts for upcoming component replacements.

Safety

UR-28: The drone shall include obstacle detection and collision avoidance.

UR-29: The drone shall land safely in case of major system fault.

UR-30: The drone shall have geofencing to prevent entry into restricted airspace.

UR-31: The system shall comply with aviation safety regulations for unmanned flights.

Human Interface

UR-32: The operator shall be provided with a user-friendly interface for mission planning and monitoring.

UR-33: The interface shall show live status and alerts (battery, weather, obstacles).

UR-34: The system shall log operator actions for traceability.

UR-35: The interface shall support multi-user access with role-based permissions.

Verification

UR-36: All requirements shall be verifiable by test, analysis, or inspection in compliance with the V-Model (EN 50126).

UR-37: The supplier shall deliver a Verification and Validation plan.