

## # Concept of Operations (CONOPS)

### ## 1. Introduction

#### ### 1.1 Purpose

This Concept of Operations (CONOPS) describes the operational use of the Autonomous Drone Delivery System (ADDS).

ADDS enables rapid delivery of small packages within metropolitan areas using autonomous multicopter aircraft.

#### ### 1.2 Scope

The CONOPS covers order intake, mission planning, flight execution, delivery confirmation, and return-to-base operations.

It also addresses operational constraints, stakeholders, and key risks.

#### ### 1.3 Document Relationships

This document defines the operational scenarios from which the Software Requirements Specification (SRS) and Software Design Description (SDD) derive their requirements and design decisions.

### ## 2. System Overview

#### ### 2.1 System Description

ADDS consists of three primary subsystems:

- **Aerial Vehicle Subsystem (AVS):** Autonomous drones with onboard flight control and payload handling.
- **Control Center Subsystem (CCS):** Cloud-hosted services for mission planning, telemetry monitoring, and exception handling.
- **User Interface Subsystem (UIS):** Web and mobile applications for customers and operations staff.

### ### 2.2 Operational Objectives

1. Deliver packages within **\*\*30 minutes\*\*** of order confirmation for destinations within a 15 km radius.
2. Maintain a landing accuracy of **\*\* $\leq 2$  meters\*\***.
3. Support **\*\*at least 50 simultaneously active drones\*\*** within a single metropolitan region.
4. Ensure all operational links are **\*\*encrypted\*\*** to protect command and control data.

## ## 3. Operational Scenarios

### ### 3.1 Normal Delivery Scenario

1. Customer submits a delivery request through the mobile application.
2. The CCS validates the address, calculates a route, and assigns the nearest available drone.
3. The drone departs the operations hub, navigates to the delivery location, lowers to a safe delivery altitude, and releases the package.
4. The drone returns to base and uploads mission logs upon landing.
5. Video of the delivery event is stored in the system for **\*\*24 hours\*\*** for customer support purposes.

### ### 3.2 GNSS Loss Scenario

If the drone loses GNSS (GPS) signal:

1. The drone immediately switches to **\*\*INS-based return-to-home (RTH)\*\*** mode using its last known home position.
2. The CCS logs the event and notifies the operator.
3. The operator can override and issue a terminate-flight command from the console.

### ### 3.3 Adverse Weather Scenario

- ADDS operations are **\*\*suspended\*\*** if:

- Sustained winds exceed **20 knots**, or
- Any form of precipitation (rain, snow, hail) is detected within the flight corridor.
- Drones in flight during a weather alert must execute an expedited RTH procedure.

## ## 4. Operational Constraints

- **Maximum payload:** **3 kg**
- **Maximum mission duration:** **30 minutes** per sortie
- **Maximum cruise altitude:** **400 ft AGL** (subject to local regulation)
- **Operating temperature range:** **-10 °C to +40 °C**
- **Minimum network coverage:** **95% LTE coverage** across target service area

## ## 5. Stakeholders

- **Operations Team:** Monitors live missions and approves exceptions.
- **Maintenance Crew:** Performs inspections, firmware updates, and repairs.
- **Customers:** Initiate delivery requests and receive notifications.
- **Regulators (FAA / civil authorities):** Oversee airspace usage and safety.
- **Cybersecurity Team:** Ensures secure operation of the CCS and data stores.

## ## 6. Assumptions and Dependencies

- BVLOS (Beyond Visual Line of Sight) waivers are granted for specific routes.
- A reliable weather API is available and updated at least every 5 minutes.
- LTE coverage is sufficient to maintain command and control throughout routes.

## ## 7. Operational Risks

Risk ID	Risk Description	Mitigation Measure	
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| R-01 | GNSS spoofing or jamming | INS fallback, geo-fencing, and RTH procedures |

| R-02 | Battery degradation leading to mission aborts | Predictive maintenance and pre-flight checks |

| R-03 | Data breach of mission logs | Encrypted storage and restricted access |

## ## 8. References

- FAA 14 CFR Part 107 – Small Unmanned Aircraft Systems
- ASTM F3178 – UAS Remote ID and Tracking
- ADDS SRS, current version
- ADDS SDD, current version