

# Sparrowhawk

## Air-Launched Automated Interception System

Sparrowhawk is an air-launched interceptor platform that leverages the Sentinel mothership's radar advantage to deliver precision-guided interceptions. Deployed from a Sentinel UAV, it receives radar track handoff for high-confidence mid-course guidance and transitions to automated visual tracking during the terminal phase.

By combining radar-guided flight with AI-powered visual homing, Sparrowhawk eliminates the need for external targeting infrastructure and enables operation in contested environments. The system delivers precise interception capability with minimal operator workload and high flexibility for rapid engagement.



## System Architecture

### Core Components

Sparrowhawk consists of two integrated subsystems working together to provide robust interception capability:

#### Terminal Guidance Module

The guidance module combines airborne radar tracking with last-mile visual tracking to achieve a high interception probability. Radar tracks are handed off via a radar-equipped Sentinel UAV, enabling long-range target tracking.

After release, Sparrowhawk uses a monocular optical system with onboard computing running deep-learning-based detection and tracking algorithms. This ensures reliable target acquisition and stable tracking from detection to final intercept. Proportional navigation algorithms control the terminal engagement phase.

#### Air-Launch Capability

Sparrowhawk is a fixed-wing interceptor optimized for rapid deployment from a Sentinel UAV. Optional ground launch further increases flexibility. Airborne launch enables extended loiter times (approx. 3 hours) and significantly increases interception range.

## Sensor Suite

- **Monocular Camera System:** High-resolution visual detection and tracking sensor
- **Onboard Computing:** Dedicated ML processing unit for real-time detection, tracking, and guidance computation
- **IMU & Barometer:** Inertial measurement and altitude reference
- **GPS/GNSS Receiver:** Position fixing and navigation in standard GPS environments
- **Pitot Tube:** Airspeed measurement for enhanced state estimation
- **Communication Link:** Low-bandwidth LoRa-based telemetry for robust command link and distance measurement

# Performance Specifications

## Endurance and Engagement

PARAMETER	SPECIFICATION
Battery System	6S LiPo configuration
Failsafe	Timer-based failsafe if target not acquired/hit within mission parameters
Engagement Method	Kinetic with optional remote abort signal
Control Bandwidth	Telemetry uplink for mission monitoring and abort capability

## Flight Performance

PARAMETER	SPECIFICATION
Maximum Velocity	60 m/s (216 km/h / 134 mph)
Operational Velocity	45–60 m/s (optimal intercept speed range)
Flight Time	10 minutes (air-launched configuration)
Operational Range	Minimum 5 kilometers from launch point
Launch Method	Air-launched from mothership

## Guidance and Targeting

PARAMETER	SPECIFICATION
Detection Range	500+ meters (depending on weather and light conditions)
Tracking Performance	Stable monocular tracking through terminal intercept phase
Guidance Algorithm	Proportional Navigation (proven intercept algorithm)
Terminal Guidance Phase	Within 500 meters (visual acquisition to intercept)
Intercept Mode	Fully automated (“fire-and-forget”) with manual mission abort



# Operational Details

## Automated Interception Workflow

1. Mothership acquires radar track or receives external targeting data (ground radar, secondary platforms)
2. Mothership maneuvers to firing position
3. Operator initiates launch sequence; interceptor deploys from mothership
4. Vehicle achieves cruise velocity and navigates to target coordinates provided by radar track
5. Visual target acquisition occurs at 500 meters+; monocular camera locks onto target
6. Proportional navigation algorithm engages; Sparrowhawk automatically corrects intercept geometry
7. Terminal guidance phase: automated homing to target within 500-meter final approach
8. Impact on target; failsafe timer triggers if no contact is achieved
9. Mothership supports mission assessment



## Integration Architecture: Sentinel-Centric Design

- ▶ **Sentinel Radar Link:**  
Direct integration with Sentinel's radar system; native track handoff capability eliminates external targeting dependency
- ▶ **Radar Track Translation:**  
GCS converts Sentinel radar tracks to Sparrowhawk navigation waypoints and velocity vectors for mid-course guidance
- ▶ **Air-Launch Advantage:**  
Deployment from Sentinel provides inherent radar cueing advantage; interceptor launches with known target track reducing search time and increasing hit probability >80%
- ▶ **Telemetry Feedback:**  
Bi-directional LoRa link maintains contact with mothership during flight; Sentinel operator monitors intercept progress and retains abort authority
- ▶ **Visual Handoff Protocol:**  
System automatically transitions from radar-guided to visual-guided at optimal acquisition range; operator maintains situational awareness throughout engagement
- ▶ **GPS-Denied Resilience:**  
Radar track combined with inertial navigation and LoRa distance measurement enables intercept in contested GNSS environments

# Terminal Guidance Showcase

The AI detector isolates the target from the background clutter.  
Our tracker is then able to preserve identity and outputs a stabilized position/velocity, enabling precise guidance to close in.

