Swarm-Based Shahed Interception: Multi-Sensor, Multi-Altitude, Real-Time Coordination

Bullet Systems, Ukraine
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Scenario Overview

This report demonstrates a modern anti-drone operation in a 500x500 m zone using a three-UAV swarm:

- **Recon High:** 2 km altitude, thermal + mmWave + LiDAR + camera
- **Recon Low:** 50 m altitude, same sensors
- **Strike:** Standby outside area, receives real-time cues, executes precision attack

Recon UAVs coordinate to detect, classify, and guide the strike UAV. Only the camera (100 m range) can visually confirm the target type, but thermal/mmWave/LiDAR cover the entire search area. Sensor fusion and vertical separation (high/low) minimize blind spots and maximize kill probability.

## Phase 1: Detection & Tracking (3D)
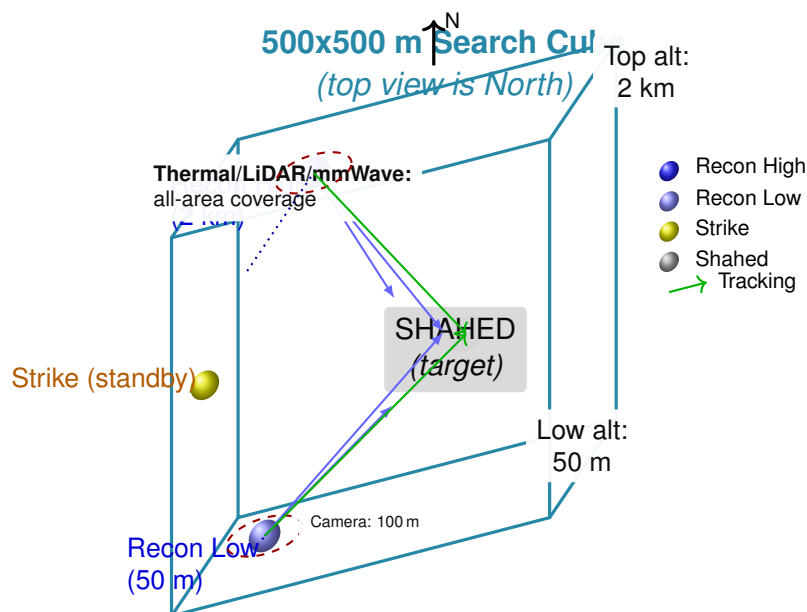
Both recon UAVs simultaneously cover the full area at different altitudes; camera confirmation possible only within 100 m. Vertical separation (2 km / 50 m) maximizes detection probability and reduces blind spots.
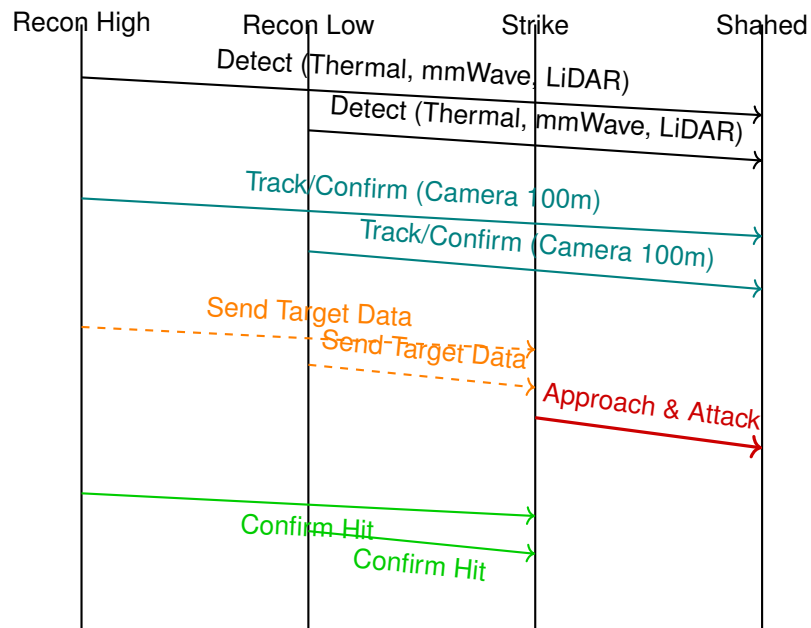
Phase 2: Data Transfer & Assignment
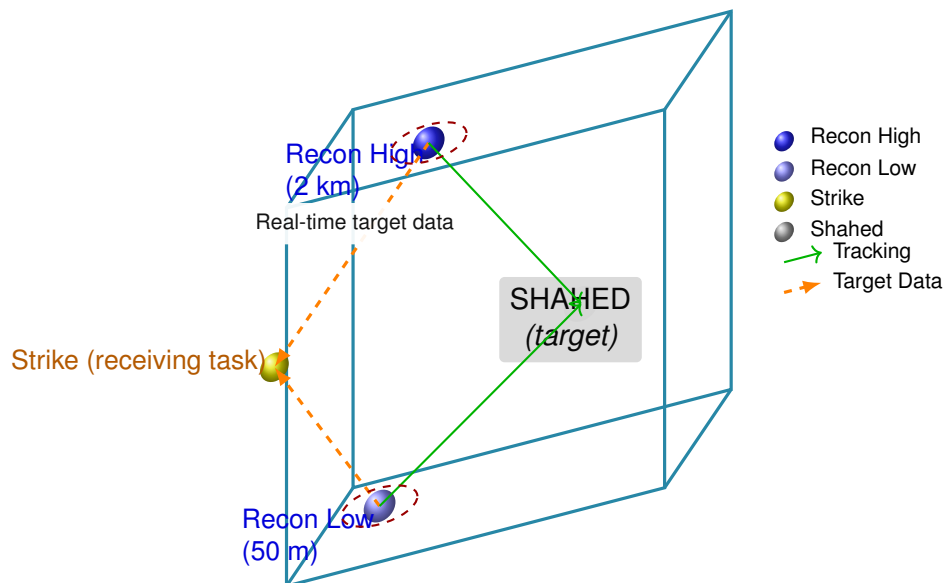
Both recon UAVs send real-time position and confirmation to the strike UAV, which is now inbound for attack. Vertical separation and sensor fusion maximize reliability.

Phase 3: Strike
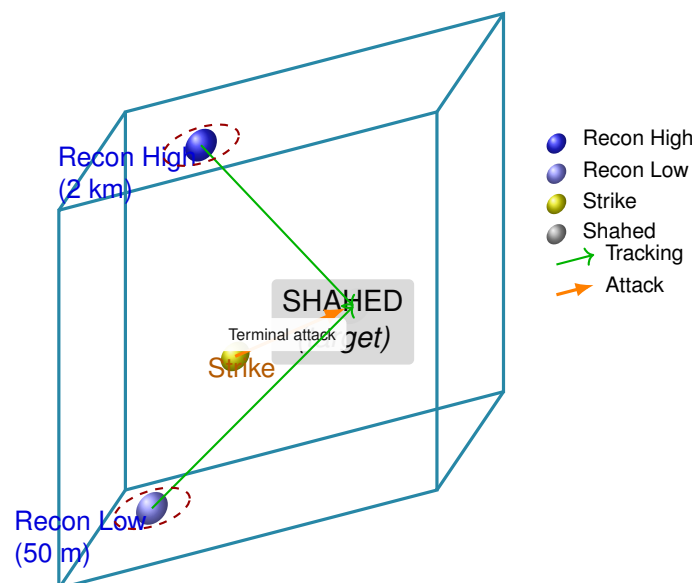
Strike UAV executes terminal intercept with continuous support from both recon UAVs. All sensors (except camera) cover the full 500x500 m; only camera confirms form at 100 m. Full real-time sensor fusion.

Swarm Algorithm: Sequence Diagram

Recon High	Recon Low	Strike	Shahed

Detect (Thermal, mmWave, LiDAR)

Detect (Thermal, mmWave, LiDAR)

Track/Confirm (Camera 100m)

Track/Confirm (Camera 100m)

Send Target Data

Send Target Data

Approach & Attack

Confirm Hit

Confirm Hit

Legend:
Recon UAVs perform vertical separation and redundant coverage to guarantee detection and kill probability. All comms encrypted and real-time. Full 3D sensor fusion.