Published by :
https://www.ijert.org/
An International Peer-Reviewed Journal

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 09 , September - 2026

EXVER-UGRA: Ultra-Precision Guided Reactive Armament - A Turbojet-Powered, Radar-Stealth Kamikaze Loitering Munition Swarm

Archit Saxena
Team Lead, Team EXVER | Co-Founder & Lead Engineer, EXVER Aviation
Noida, Uttar Pradesh, India

Abstract **-** This paper presents EXVER-UGRA (Ultra-precision Guided Reactive Armament), a single-turbojet, radar-stealth kamikaze loitering munition interlinked with the HARRIER-AWAC sensing swarm. When HARRIER-AWAC detects an incoming threat, it hands UGRA the threat's point-of-origin, and UGRA rounds strike back at that location rather than searching blindly. Each round confirms the specific target with a front camera payload and relays live video to a mobile command center, which must approve the strike before terminal engagement proceeds. This AWACS-cued, human-approved sequence is intended to make EXVER-UGRA an ultra-precision guided munition that avoids collateral damage, rather than a fire-and-forget round. This paper gives a concise overview of the AWACS interlink, target confirmation and engagement-authorization sequence, swarm coordination, and concept of operations.

Index Terms - Loitering munition, kamikaze drone, UAV swarm, AWACS-cued strike, visual target confirmation, mobile command center, engagement authorization, proportional navigation, Raft consensus, collateral-damage avoidance.

I. INTRODUCTION

Loitering munitions - “kamikaze” unmanned systems that loiter over an area, search for a target, and then perform a terminal, single-use attack - are an increasingly significant precision-strike category. Most existing systems are flown as single independent rounds, search a general area on their own, and commit to terminal guidance as soon as a target is detected. EXVER-UGRA takes a more deliberate approach: it is interlinked with the HARRIER-AWAC sensing swarm, which detects an incoming threat and hands UGRA a specific point-of-origin to strike back at, rather than an open-ended search area. UGRA then separates that cued detection from specific-target confirmation and engagement authorization by a mobile command center, so that a high precision strike rate can be maintained while avoiding collateral damage.

II. SYSTEM OVERVIEW

Each EXVER-UGRA round is a self-contained, single-turbojet airframe carrying its own flight controller, thermal and front-camera sensors, and swarm-communications payload. Rounds are cued by the HARRIER-AWAC swarm with the location the threat is coming from, launch from a common catapult, and transit to that point-of-origin, holding station there as an autonomous swarm while searching for the designated target. A Raft-consensus protocol running over the swarm's mesh datalink elects a coordinating leader round that aggregates detections and routes confirmation and approval traffic; if the leader is lost, a new leader is elected automatically.

III. INTEGRATION WITH THE HARRIER-AWAC SENSING SWARM

EXVER-UGRA is designed to work as the engagement arm of the companion HARRIER-AWAC early-warning swarm described in a separate paper. When HARRIER-AWAC's equidistant radar ring detects and classifies an inbound threat, it fuses the detection into a track that includes the threat's predicted point-of-origin - the location the threat is coming from - and hands that location to the UGRA swarm as a cueing message over the shared datalink. Rather than searching an open-ended area, UGRA rounds are launched and vectored directly to that point-of-origin, where they begin their own local search, confirmation, and engagement sequence. This interlink lets UGRA strike back at the source of an inbound threat rather than only at the threat itself, and lets the two swarms share a single sensing-to-engagement chain.

IV. TARGET CONFIRMATION AND ENGAGEMENT AUTHORIZATION

At the cued point-of-origin, a nose-mounted LWIR thermal seeker scans for candidate target signatures. A thermal detection alone is treated only as a cue, not as authorization to engage: once a candidate is flagged, the round's front camera payload visually locks and tracks the specific target, and the live video and target data are relayed to a mobile command center over the swarm datalink. The round then requests strike approval, and terminal engagement proceeds only after the mobile command center grants it. This confirm-then-approve sequence - thermal cue, visual lock, human approval - is what makes EXVER-UGRA an ultra-precision guided munition rather than a fire-and-forget round: it is designed to prevent an unconfirmed or misidentified contact from ever being struck, directly reducing the risk of collateral damage. Once approved, the round transitions to a proportional-navigation terminal guidance law for final closure and impact.

V. SWARM CONSENSUS ARCHITECTURE

Each round carries an indigenous flight-control stack, an onboard compute module for perception and coordination, an encrypted frequency-hopping mesh radio for inter-round

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communication, and a GNSS receiver for positioning. Coordination uses a Raft-style leader–follower consensus protocol: one round is elected leader and aggregates detections and confirmation/approval requests from all units, while followers replicate the leader's log and acknowledge heartbeats. If the leader is lost, the swarm automatically elects a new one and continues the mission, so no single round's loss can stall target confirmation or coordination.

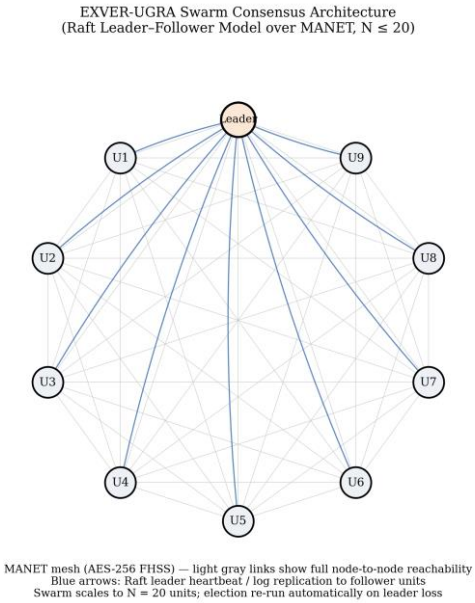

Fig. 1. EXVER-UGRA swarm consensus architecture: a Raft-elected leader round coordinates detection, confirmation, and approval requests across follower rounds over a meshed network; the swarm re-elects automatically on leader loss.

VI. LAUNCH, RECOVERY, AND PERFORMANCE

Operational rounds launch from a 4 m pneumatic catapult and, being single-use, carry no recovery system. Non-live demonstrator and flight-test articles instead substitute a return-to-base manoeuvre and a 3-stage BRS parachute recovery in place of terminal impact, allowing re-use across a test campaign. Performance figures below are proposal-stage design targets, to be refined through flight test.

TABLE I

PERFORMANCE DESIGN TARGETS

Parameter	Design Target
Service ceiling	≈ 30,000 ft
Range	≈ 100–120 km
Loiter endurance	≈ 6–9 h
Swarm size	Up to 20 units
Launch / recovery	4 m pneumatic catapult / 3-stage BRS (test articles)

VII. CONCEPT OF OPERATIONS (CONOPS)

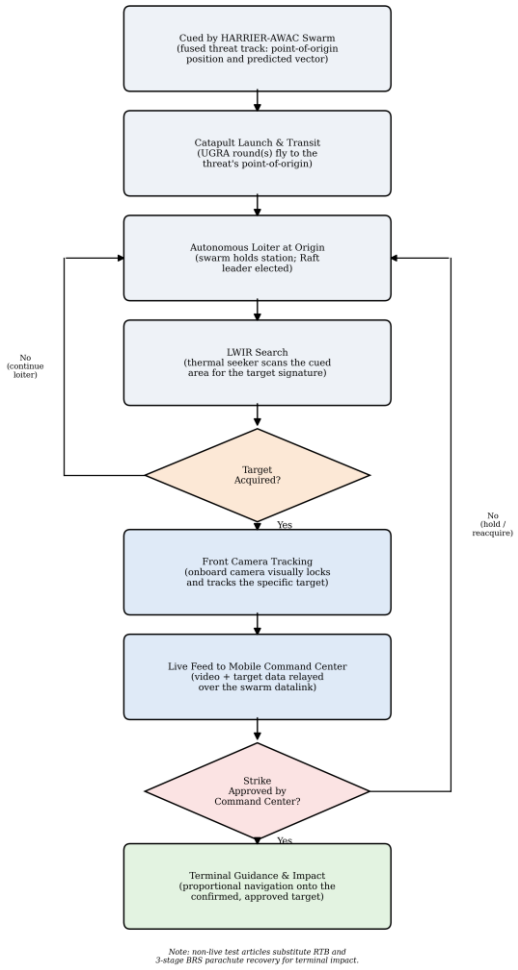

Fig. 2. EXVER-UGRA mission profile: cued by the HARRIER-AWAC swarm with the threat's point-of-origin, launch and transit, autonomous loiter and LWIR search, front-camera tracking of the specific target, mobile command center strike approval, and terminal guidance to impact. Non-live test articles substitute RTB and parachute recovery for the final step.

TABLE II

CONOPS PHASE SUMMARY

Phase	Action
1	AWACS cueing - HARRIER-AWAC hands UGRA the threat's point-of-origin location.
2	Launch & transit - catapult launch, fly to the cued point-of-origin.
3	Autonomous loiter - swarm holds station at the origin; Raft leader elected.
4	LWIR search - thermal seeker flags a candidate target signature.
5	Front-camera tracking - onboard camera visually locks the specific target.
6	Command center approval - live feed reviewed; strike authorized before commitment.
7	Terminal guidance & impact - proportional navigation onto the approved target.

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VIII. ADVANTAGES

- Strike at the source - AWACS cueing sends UGRA to the threat's point-of-origin instead of an open-ended search area.
- Confirm-then-approve sequence (thermal cue, front-camera lock, command center approval) reduces the risk of collateral damage from a misidentified target.
- Distributed swarm coordination - loss of the leader round does not stall confirmation or approval routing.
- Low radar signature complicates single-round point-defense intercept.

IX. LIMITATIONS

RCS, range, ceiling, and endurance figures are proposal-stage targets requiring dedicated ground and flight testing to confirm. The AWACS cueing link, the front-camera video feed, and the mobile command center approval loop all depend on the swarm's mesh datalink remaining available; behavior under jamming or partial network loss needs dedicated testing, and any latency in the approval loop trades off against how quickly a strike can be authorized. Any live-fire testing requires appropriate range clearance and regulatory authorization; this paper describes system architecture and CONOPS only, not weapon-effects data.

X. CONCLUSION

EXVER-UGRA closes the loop between the HARRIER-AWAC sensing swarm and a precision-strike round: AWACS hands UGRA the location a threat is coming from, and UGRA confirms the specific target with a front-camera payload before a mobile command center authorizes the strike. This AWACS-cued, human-approved sequence is what makes EXVER-UGRA an ultra-precision guided munition rather than a fire-and-forget round, aiming to minimize collateral damage while keeping a human decision in the loop before any strike. Future work includes RCS validation, flight-test characterization of range and endurance, and field trials of the AWACS-cueing and confirmation/approval sequence under realistic mesh-network conditions.

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