Dynamic Shield with Drone Swarm: AEROPVS05

Dynamic Shield with Drone Swarm is a tactical simulation framework featured by **vsTASKER** that evaluates how autonomous drone swarms act as an interactive, protective barrier against incoming aerial threats. It tests how swarms intercept and neutralize hostile UAVs or bombers before they reach a designated area.

Key Features of the Simulation

The vsTASKER Dynamic Shield uses complex, multi-agent logic to optimize swarm defense. Core elements of the system include:

- **Probability of Kill Calculations:** The simulation continuously modifies the interception success rate of each drone based on its distance to the target or randomized probability functions.
- **Batch Mode Testing:** vsTASKER runs thousands of attack scenarios to find the optimal number of suicide drones required to defeat varying threat types and massed wave attacks.
- **Autonomous Coordination:** The drones communicate internally within the swarm, testing different algorithms for threat interception without needing constant ground radar oversight.

How the Shield Operates in vsTASKER

- **Early Detection:** The simulation highlights that the earlier ground radar detects the incoming threat, the further out the drone swarm can deploy to intercept it.
- **Resource Management:** Since a defensive or "suicide" drone is typically destroyed during a successful intercept, the algorithm computes how many drones are needed to overwhelm or destroy heavily armored/fast-moving targets.
- **Zone Coverage:** vsTASKER evaluates various spatial formations and arrangements to ensure maximum area protection and prevent leaks in the defensive shield.

For a look at how anti-drone and mobile vehicle defense shields operate in real-world scenarios:

Would you like to explore:

- How to set up a specific **drone swarm scenario** or algorithm?
- The different **vsTASKER features** like 2D/3D visualization?
- Other defense applications like **convoy protection** or **ISR coordination**?

"Dynamic Shield with Drone Swarm" is a prominent simulation project developed by **VirtualSim** to demonstrate the tactical capabilities of their C++ scenario generator and simulation software, vsTASKER. The simulation models a decentralized, self-healing aerial defense shield composed of autonomous "suicide" interceptor drones reacting to incoming threats.

- **Core Simulation Mechanics**
- The scenario evaluates how a network of low-cost, single-use drones can protect an area against incoming UAV bombers or fast, armored air threats.
- **Early Detection & C2**: A ground radar tracks incoming hostile bombers and relays initial target data. Early detection directly correlates to higher intercept success.
- **Transition to Decentralized Autonomy**: Drones launch under remote control, but once they deploy into the swarm, they become fully autonomous. They drop ground communication and rely strictly on **peer-to-peer (P2P) data exchange** inside the swarm to coordinate interception paths.
- **Probability of Kill (Pk)**: The "shield" effectiveness is evaluated by dynamically altering individual drone kill probabilities based on speed, target armor, and proximity. Hardened targets may require multiple drones to break through.
- **Key vsTASKER Software Features Utilized**
- The project serves as a showcase for several advanced components of the vsTASKER simulation suite:
- **Batch Mode Testing**: Used to run thousands of parallel variations of an attack configuration. This helps defense planners find the exact, optimal number of interceptor drones required to neutralize specific threat sizes without wasting resources.

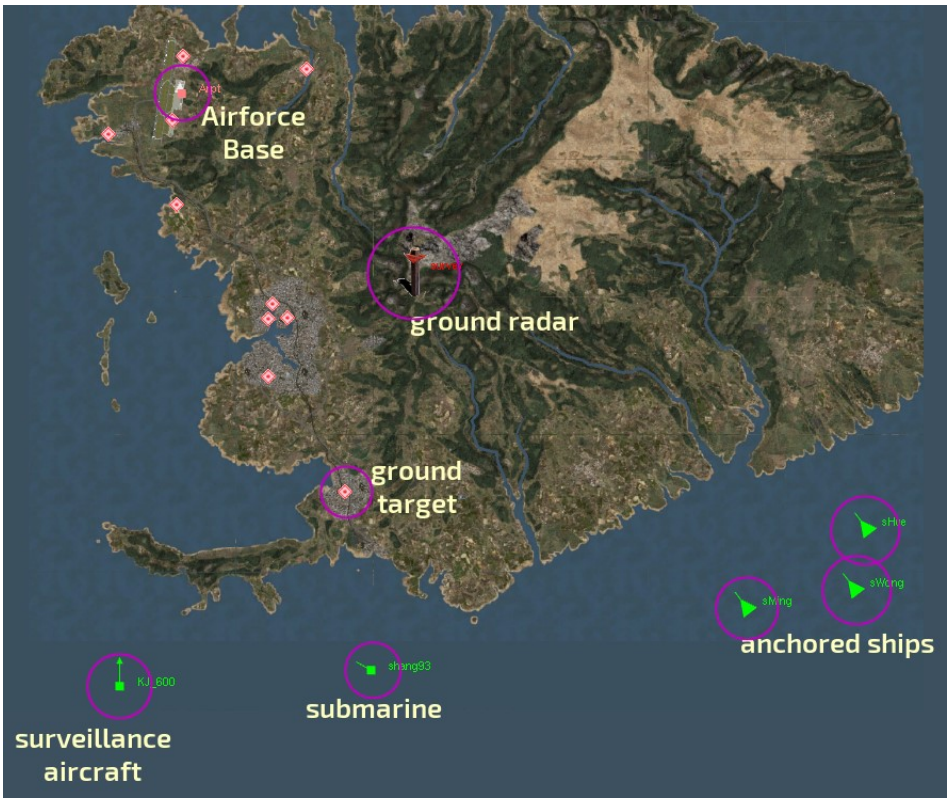
- **Algorithm Optimization**: Developers use the visual programming environment to design, test, and compare different swarm intelligence behaviors to see which layout minimizes defensive blind spots.
- **Real-time Proximity Mesh**: The system handles massive entity counts without performance lag, allowing the swarm to dynamically recalculate collision and interception trajectories in real time.
- Would you like to know more about **how to configure batch mode** in vsTASKER, or are you looking for details on **specific swarming algorithms** used in defense simulations?

Against a remote controlled or self operated intruder (like a UAV), an efficient and cost effective way to intercept and destroy such threat is by using another remote controlled or self operated flying device, such as a kamikaze drone.

When several intruders are coming at the same time, and to increase the interception effectiveness, a swarm of explosive drones may provide better result at still a low cost. In the following example, we are testing two strategies against a threat consisting of a wave of several UAV bombers.

- Drone swarm **remote controlled** from a radar position
- Swarm using **data-link** and **onboard sensors** to share targets

Scenario Description



Scenario Map

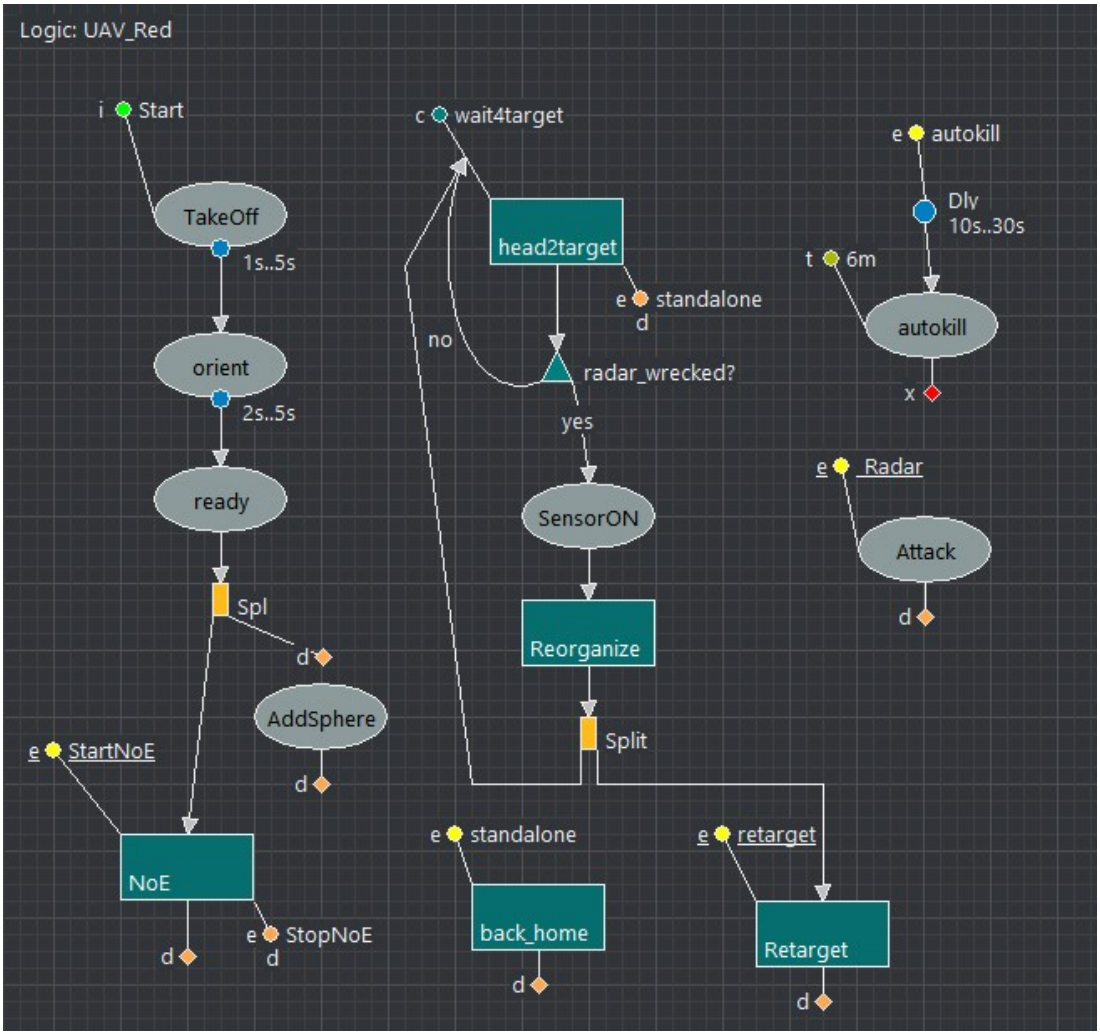
A surveillance aircraft is flying over the island. Whenever a target (missile launcher) is detected by the mounted radar, the aircraft sends the information to one of the three ships anchoring at a few kilometers from the coast.

Upon target position reception, the ship sends two UAV bombers and computes for each the best trajectory to reach the target according to the opponent radar coverage and the terrain profile. The UAV then follows terrain at 40m height to keep unnoticed.

Eventually, the ground radar detects the intruding UAVs and informs the Airforce base located on the north of the island. A swarm of 30 drones is launched, under the control of the radar which distributes drones against intruders.

Each drone is capable of flying above the terrain autonomously. In close vicinity of the UAV, it explodes, damaging the target with projectiles and a choc wave.

In the second scenario, the surveillance aircraft detects the swarm and inform the submarine which destroys the radar using a cruise missile. As soon as the radar data link is lost, drones are switching on their embedded sensors and start sharing between themselves every detected targets. According to several criteria, drones automatically reassign themselves to the best target around.



Conclusion

When remote controlled by the ground radar, all UAV bombers are intercepted and destroyed by the drones. By playing with probability of kill for each drone (according to distance or randomly) the shield effectiveness of the swarm can vary. As a drone can only be used once, against a armored or fast target, several might be needed to get through it.

Also, drones can only protect areas they can reach before the bombers. The earlier the detection of the UAV by the ground radar, the better the defense will be.

vsTASKER can take advantage of its batch mode to determine the optimal number of suicide drones to send according to a given attack configuration, or according to the physical type of threat. The same goes for the arrangement of drone swarms to best cover an area or respond to successive wave attacks.

The coordination of the drones once autonomous and relying only on the data exchanged inside the swarm, is crucial for effectiveness of the shield. Several algorithms must be tested and compared against others to get the most success on a given situation.

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