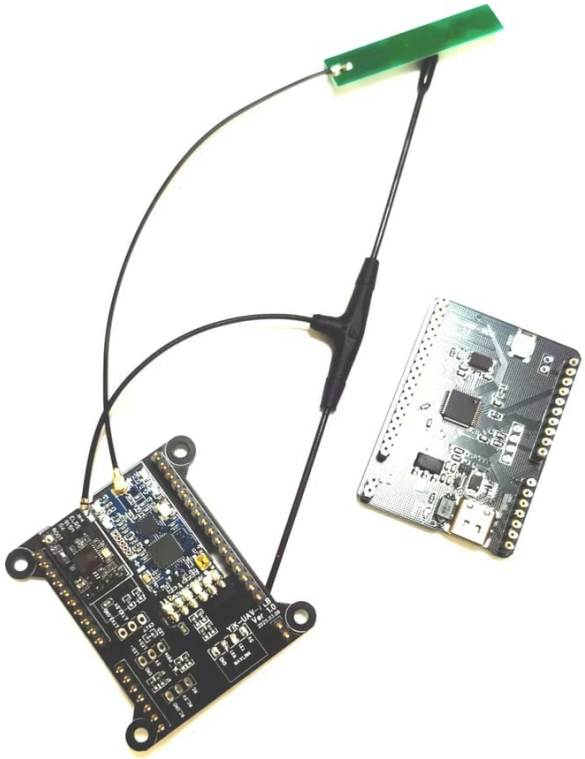


PRODUCT MANUAL V2.0

蜂群控制模块

Swarm Control Module · 产品说明书 V2.0 · 2026 年 2 月

集成智能决策、抗干扰通信与多模制导单元的集群协同任务系统

A swarm coordination mission system integrating intelligent decision-making, anti-jam communications and multi-mode guidance units

模块化设计即插即用，支持 50~200 架规模动态组网，实现饱和攻击、协同突防与自主目标分配。

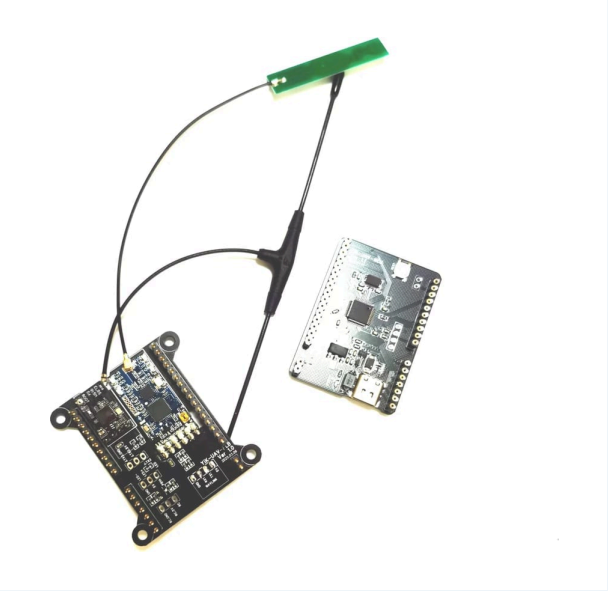
A modular, plug-and-play design supporting dynamic networking of 50 to 200 aircraft, enabling saturation attack, coordinated penetration and autonomous target assignment.

50 架	50 km	< 3 s
集群规模 Swarm size	点对点通信 Point-to-point link	集群反应时间 Swarm reaction time

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01 产品概述 Product overview



蜂群攻击模块是一款为攻击型无人机设计的集群协同任务系统，通过集成智能决策、抗干扰通信与多模制导单元，使普通无人机具备蜂群作战能力。模块化设计即插即用，支持 50~200 架规模动态组网，实现饱和攻击、协同突防与自主目标分配。

The swarm attack module is a coordinated mission system designed for attack UAVs. By integrating intelligent decision-making, anti-jam communications and multi-mode guidance units, it gives standard UAVs swarm combat capability. The modular, plug-and-play design supports dynamic networking of 50 to 200 aircraft, enabling saturation attack, coordinated penetration and autonomous target assignment.

即插即用
Plug and play

标准接口适配各类中小型无人机，无需改动飞控（配制定飞控）

Standard interfaces fit a wide range of small and medium UAVs with no flight-controller modification (custom flight controllers available)

集群智能
Swarm intelligence

AI 自主协同，反应时间 < 3 秒，损失 30% 仍能完成任务（定制）

AI-coordinated autonomy, reaction time under 3 seconds, and continued mission completion with 30% losses (custom version)

全场景适应
All-environment adaptation

复杂电磁环境丢包率 < 1%，GPS 拒止下自主导航（定制）

Packet loss below 1% in complex electromagnetic environments and autonomous navigation under GPS denial (custom version)

02 技术规格 Technical specifications

物理参数 / Physical

项目 Item	规格 Specification
模块尺寸 Module dimensions	**150 mm × 80 mm × 40 mm**
重量 Weight	**120 g**
安装接口 Mounting interface	**通用快拆挂架** Universal quick-release mount
供电要求 Power supply	**12~24 V DC，最大功耗 15 W** 12–24 V DC, maximum 15 W

数据链路参数 / Data link

项目 Item	规格 Specification
工作频段 Operating bands	**2.4G / 5.8G / 军用数据链（可定制）** 2.4G / 5.8G / military data link (customizable)
调制方式 Modulation	**COFDM / DS-SS**
发射功率 Transmit power	**最大 1 W（可调）** 1 W maximum (adjustable)
接收灵敏度 Receiver sensitivity	**-105 dBm**
数据速率 Data rate	**上行：100 kbps，下行：2 Mbps** Uplink 100 kbps, downlink 2 Mbps

02 技术规格（续） Technical specifications (cont.)

性能参数 / Performance

指标 Metric	参数 Parameter	备注 Note
集群规模上限 Maximum swarm size	**50 架（动态组网）** 50 aircraft (dynamic networking)	支持蜂王-工蜂分层架构 Supports a layered queen–worker architecture
集群反应时间 Swarm reaction time	**< 3 秒（目标锁定至攻击）** Under 3 seconds (target lock to attack)	基于 AI 目标分配算法 Based on an AI target-assignment algorithm
通信距离（点对点） Communication range (point to point)	**50 km（视距）** 50 km (line of sight)	数据链 + 定向天线，可中继扩展 Data link with directional antenna, extendable by relay
抗干扰能力 Anti-jam capability	**阻塞干扰下维持链路 > 95%** Link retention above 95% under barrage jamming	智能跳频 + 冗余信道 Smart frequency hopping with redundant channels
导航精度 Navigation accuracy	**组合导航：±3 m（GPS 拒止）** Integrated navigation: ±3 m (GPS denied)	视觉 / SLAM 辅助定位 Vision / SLAM aided positioning
制导精度（CEP） Guidance accuracy (CEP)	**≤1.5 m（激光半主动）** ≤1.5 m (laser semi-active)	图像匹配末端制导≤2 m Image-matching terminal guidance ≤2 m
目标识别距离 Target identification range	**可见光：≥3 km，红外：≥2 km** Visible: ≥3 km, infrared: ≥2 km	基于深度学习的目标检测 Deep-learning-based target detection
战斗部接口 Warhead interface	**通用电气接口，支持 2~5 kg 载荷** Universal electrical interface, 2–5 kg payload	破甲 / 杀伤 / 燃烧 / 烟雾模块可选 Armour-piercing, HE, incendiary or smoke modules
环境适应性 Environmental tolerance	**-20 ℃ ~ 60 ℃，IP67 防护** -20 °C to 60 °C, IP67 rated	防沙尘、防盐雾 Dust-proof and salt-spray resistant
加密等级 Encryption level	**军用级国密算法** Military-grade national cryptographic algorithms	防劫持、防欺骗 Anti-hijack and anti-spoofing

导航与制导单元 / Navigation and guidance

组件 Component	规格 Specification
GNSS 接收机 GNSS receiver	**GPS / 北斗 / GLONASS 三模，10 Hz 更新** GPS / BeiDou / GLONASS tri-mode, 10 Hz update
惯性测量单元 Inertial measurement unit	**工业级 MEMS，零偏稳定性 < 0.5°/h** Industrial-grade MEMS, bias stability below 0.5°/h
视觉处理器 Vision processor	**1.2 TOPS，支持实时图像识别** 1.2 TOPS, real-time image recognition
激光导引头 Laser seeker	**兼容 1064 nm 波长，探测距离≥5 km** Compatible with 1064 nm, detection range ≥5 km

03 系统组成 System composition

1. 机载核心模块
1. Airborne core module

智能处理单元 Intelligent processing unit
4 TOPS AI 算力，负责集群协同算法、目标识别与任务决策
4 TOPS of AI compute for swarm coordination algorithms, target recognition and mission decisions

多模通信链路 Multi-mode communication link
集成跳频电台与定向天线，支持自组网与中继
Integrated frequency-hopping radio and directional antenna, with ad-hoc networking and relay

组合导航单元 Integrated navigation unit
GPS / INS / 视觉深度融合，提供高可靠性定位
Deep fusion of GPS, INS and vision for highly reliable positioning

安全加密芯片 Security encryption chip
硬件加密，防止链路劫持与数据泄露
Hardware encryption preventing link hijacking and data leakage

战斗部驱动接口 Warhead drive interface
标准化电气连接，支持多种引信与起爆方式
Standardised electrical connection supporting multiple fuze and initiation methods

2. 地面指挥单元
2. Ground command unit

便携式控制终端 Portable control terminal
10 英寸加固平板，预装蜂群任务规划软件
10-inch ruggedised tablet with swarm mission-planning software preinstalled

手持数据链天线 Handheld data-link antenna
定向 / 全向可选，最远通信距离 50 km
Directional or omnidirectional, up to 50 km

任务规划软件 Mission-planning software
三维态势显示，支持 VR / AR 操控，可同时管理 50 架模块
3D situational display with VR / AR control, managing 50 modules at once

3. 可选扩展模块
3. Optional expansion modules

激光目标指示器 Laser target designator
用于半主动激光制导照射
Illumination for semi-active laser guidance

图像识别导引头 Image-recognition seeker
可见光 / 红外双光，自动锁定目标
Dual visible and infrared sensors with automatic target lock

电子干扰吊舱 Electronic jamming pod
挂载于部分无人机，实施区域电子压制
Mounted on selected UAVs for area electronic suppression

空中中继通信节点 Airborne relay node
扩展集群作战半径至 300 km 以上
Extends the swarm operating radius beyond 300 km

04 功能特点 Key features

1. 集群智能协同
1. Intelligent swarm coordination

动态角色分配 Dynamic role assignment
根据任务自动选举「蜂王」（指挥机）与「工蜂」（攻击 / 侦察 / 诱饵），任意节点损毁后其余节点自主重组。
Automatically elects a queen (command node) and workers (attack, reconnaissance or decoy) for the mission; the remaining nodes reorganise themselves after any node is destroyed.

饱和攻击算法 Saturation attack algorithm
多目标威胁评估，自动规划攻击时序与角度，实现同一目标多弹同时命中或分波次覆盖。
Multi-target threat evaluation and automatic planning of attack sequencing and angles, striking one target with several rounds simultaneously or covering it in waves.

协同突防策略 Coordinated penetration strategy
诱饵机模拟大编队信号吸引火力，电子战机实施干扰，真实攻击机利用空隙突入。
Decoys emulate a large formation to draw fire, electronic-warfare aircraft suppress, and the real strike aircraft exploit the gap to penetrate.

2. 复杂环境生存能力
2. Survival in complex environments

低可探测设计 Low-detectability design
模块外壳采用吸波材料与红外抑制涂层，配合无人机平台降低被探测概率。
The housing uses radar-absorbing material and infrared-suppression coating, lowering detection probability when carried on an airframe.

抗干扰通信 Anti-jam communications
智能跳频 + 定向天线，在敌阻塞干扰下自动切换频点，丢包率 < 1%。
Smart frequency hopping with a directional antenna switches channels automatically under barrage jamming, holding packet loss below 1%.

自主导航 Autonomous navigation
GPS 拒止环境下，基于视觉 / 惯性 / SLAM 融合定位，持续输出航向与位置。
With GPS denied, fused vision, inertial and SLAM positioning continuously outputs heading and position.

3. 高精度打击
3. Precision strike

多模制导 Multi-mode guidance
支持激光半主动、图像匹配、毫米波雷达制导，CEP≤1.5 m。
Supports laser semi-active, image-matching and millimetre-wave radar guidance, with CEP ≤1.5 m.

末端机动 Terminal manoeuvring
目标锁定后自动生成俯冲弹道，可进行大过载机动躲避拦截。
After target lock a dive trajectory is generated automatically, with high-g manoeuvres to evade interception.

毁伤评估 Damage assessment
攻击后通过图像回传进行毁伤效果评估，支持二次打击决策。
Imagery is streamed back after the attack for damage assessment, supporting follow-up strike decisions.

4. 快速部署与扩展
4. Rapid deployment and expansion

模块化安装 Modular installation
单兵可携带 6 个模块，5 分钟内完成挂载与系统自检。
One operator carries six modules; mounting and system self-test take under five minutes.

平台兼容 Platform compatibility
通过标准接口适配各类中小型无人机，无需改动飞控。
Standard interfaces fit a wide range of small and medium UAVs with no flight-controller modification.

固件升级 Firmware upgrades
支持远程或本地更新算法库，持续提升智能化水平。
Algorithm libraries update remotely or locally, keeping capability current.

05 操作指南 Operating guide

使用前准备 / Before a mission

01 检查模块电量、天线连接、战斗部保险状态。
Check module charge level, antenna connections and warhead fuze status.

02 将模块安装至无人机挂架，确认机械与电气连接牢固。
Mount the module on the UAV hardpoint and confirm the mechanical and electrical connections are secure.

03 在地面终端导入任务区域地图、目标坐标或图像特征。
Load the mission-area map, target coordinates or image features into the ground terminal.

04 设置集群规模、攻击模式（同时 / 分波次 / 巡飞待机）。
Set the swarm size and attack mode (simultaneous, wave-by-wave, or patrol standby).

注意事项 / Cautions

01 确保通信链路畅通，避免在强电磁干扰区使用。
Keep the communication link clear and avoid use in areas of strong electromagnetic interference.

02 攻击前确认目标属性，防止误伤。
Confirm target identity before an attack to prevent friendly damage.

03 战斗部为危险品，需专业人员安装与解除。
Warheads are hazardous items and must be fitted and removed by qualified personnel.

任务流程 / Mission flow

自检与起飞 Self-test and launch

上电后模块自动自检，通过后地面站发送起飞指令，各无人机按规划航线编队。
The module self-tests on power-up; once it passes, the ground station issues the launch command and the aircraft form up along the planned routes.

巡航与监控 Cruise and monitoring

地面站实时显示各模块状态（位置、电量、链路质量），可中途调整目标。
The ground station shows each module’ s status in real time — position, charge and link quality — and targets can be adjusted mid-mission.

目标锁定与攻击 Target lock and attack

> 自动模式：AI 根据预设规则分配目标并发起攻击。
> Automatic mode: the AI assigns targets by preset rules and initiates the attack.
> 手动模式：操作员在界面上框选目标，确认后攻击。
> Manual mode: the operator boxes a target on the display and confirms the attack.

毁伤评估与返航 Damage assessment and return

攻击后图像回传，幸存模块按指令返航或自毁。
Imagery is streamed back after the attack; surviving modules return or self-destruct as instructed.

06 安全与维护 Safety and maintenance

安全注意事项
Safety notices

01 使用前必须接受专业培训，遵守所在国法律法规。
Professional training is required before use, and the laws of the country of operation must be observed.

02 战斗部未安装时，严禁接通电源以防误触发。
Never power up with a warhead fitted, to prevent inadvertent initiation.

03 飞行中如遇失控，模块将自动执行预设返航或自毁程序。
If control is lost in flight, the module automatically executes the preset return or self-destruct sequence.

04 存放环境温度 -40 ℃ ~ 70 ℃，避免阳光直射和剧烈撞击。
Store between -40 °C and 70 °C, away from direct sunlight and severe impact.

维护保养
Maintenance

01 每次任务后清洁模块表面，检查天线及接口有无损坏。
Clean the module after every mission and check the antennas and connectors for damage.

02 每三个月进行一次系统自检，更新固件。
Run a system self-test and update the firmware every three months.

03 电池需定期充放电，长期存放保持 50% 电量。
Cycle the battery regularly and store it at 50% charge for long periods.

售后服务
Service

01 质保期：12 个月（不含战斗部及耗材）
Warranty: 12 months, excluding warheads and consumables

02 技术支持：7×24 小时热线 + 远程诊断
Technical support: 7×24 hotline plus remote diagnostics

03 软件升级：免费提供算法优化更新
Software updates: free algorithm-optimisation releases

04 配件供应：可快速订购替换模块
Spare parts: replacement modules available on fast order

以上功能仅适用特殊合法用户，如需接洽请提供合法准许文件。
The above capabilities are for authorised users only; please provide legal authorisation when enquiring.

标准蜂群模组仅具备《机间通信和编队飞行》。
The standard swarm module provides inter-aircraft communication and formation flight only.