Communications, Avionics and Power Architecture

Atılım UAV Team · Atılım University — Avionics Subteam Technical Documentation · SUAS 2026

ABSTRACT

This document describes the communications, avionics, and power architecture of the Atılım UAV quadcopter developed for the 2026 Student Unmanned Aerial Systems (SUAS) competition. A Cube Orange Plus flight controller coordinates navigation and safety functions, while a Jetson Orin NX companion computer performs onboard perception and mission processing. A CUAV Neo3 Pro Global Navigation Satellite System (GNSS) receiver provides standalone positioning, and the SIYI HM30 carries MAVLink telemetry and SIYI A8 Mini video over one digital link. The 6.7 kg operational platform is powered by four T-Motor U7 Lite V2.0 490 KV motors through an RTF 80 A 4-in-1 ESC. Six 2S 13,000 mAh batteries form a 6S2P power system, leaving sufficient mass and energy capacity for both delivery payloads.

1 DESIGN CHOICES

The avionics architecture follows three system-level decisions. First, telemetry and video share one long-range digital link instead of using separate radios. Second, real-time flight control and onboard perception run on separate computers connected through MAVLink. Third, propulsion and avionics power are distributed through dedicated high-current and regulated branches, with power and signal cables routed separately to reduce electromagnetic interference.

Table 1 summarizes the principal hardware used by the system.

2 DATALINK AND GROUND SEGMENT

Heavy-lift UAVs commonly use separate radios for telemetry, RC control, and video. That approach adds receivers, antennas, connectors, and wiring to an aircraft whose mass budget is already committed to payload and energy. The Atılım UAV therefore uses the SIYI HM30 to carry the MAVLink stream, HD video, and RC control on one digital link.

2.1 One Link Instead of Separate Radios

The HM30 Air Unit receives the SIYI A8 Mini video stream and the flight-controller telemetry stream. Both are carried to the ground segment through one RF link, reducing duplicated communication hardware and simplifying installation.

Table 1. Principal avionics, communication, and power components.

Subsystem	Component	Section
Air datalink	SIYI HM30 Air Unit	2.1
Ground datalink	SIYI HM30 Ground Unit	2.2
RC transmitter	Radiolink T12D	2.3
Flight controller	Cube Orange Plus	3.1
GNSS receiver	CUAV Neo3 Pro	3.2
Mission computer	NVIDIA Jetson Orin NX	3.3
Camera and gimbal	SIYI A8 Mini	3.4
Onboard network	SwitchBlox Ethernet switch	3.4
Motors	Four T-Motor U7 Lite V2.0, 490 KV	4.1
Motor controller	RTF 80 A 4-in-1 ESC	4.1
Battery system	Six 2S 13,000 mAh packs in a 6S2P arrangement	4.2
Payload release lock	Servo-actuated spool lock	4.2
H-bridge driver	HW-231 dual-channel motor driver	4.2

2.2 Ground Unit and Stream Separation

The HM30 Ground Unit is the common arrival point for air-to-ground data. Telemetry and video are then presented to the Ground Control Station (GCS) computer through separate physical interfaces, as summarized in Table 2.

Table 2. Ground-station telemetry and video paths.

Stream	Carries	Physical interface	Application
Telemetry	Attitude, GNSS position, mission state, and battery status	USB serial interface	Mission Planner
Video	SIYI A8 Mini live feed	Ethernet interface	Operator monitoring and software tools

This arrangement allows the operator to monitor the live video while Mission Planner receives telemetry and mission updates from the flight controller.

2.3 Safety-Pilot Override and Link Configuration

A Radiolink T12D transmitter is connected to the ground unit for safety-pilot operations and manual override. The HM30 uses omnidirectional antennas selected for stable communication across the competition area. Any long-range firmware profile is treated as a configuration setting rather than a demonstrated mission range.

3 ONBOARD AVIONICS

Figure 1. Ground-segment communication arrangement. The HM30 Ground Unit provides separate interfaces for telemetry and video while the Radiolink transmitter supports safety-pilot control and manual override.

The onboard architecture separates flight-critical control from perception and mission computing. The Cube Orange Plus handles navigation, stabilization, flight modes, and failsafe behavior. The Jetson Orin NX runs the detection, mapping support, geolocation, and guidance software.

3.1 Flight Controller

The 11 kg maximum takeoff weight propulsion system produces vibration that requires redundant, temperature-controlled inertial measurement and mechanical isolation. The Cube Orange Plus meets this requirement with triple-redundant heated inertial measurement units and native ArduPilot support. MAVLink provides the command and telemetry interface between the flight controller, the Jetson, and the GCS.

3.2 GNSS Receiver

Waypoint navigation and release positioning must remain available without a ground correction link. This set a standalone positioning requirement for the navigation receiver. The CUAV Neo3 Pro was selected for field reliability and cost while providing the accuracy required for autonomous waypoint tracking and target approach.

3.3 Mission Computer

The detection and guidance pipelines require more compute and memory than earlier Jetson Nano and Xavier platforms can sustain within the available power budget. The Jetson Orin NX was therefore selected for onboard real-time image processing and mission logic.

3.4 Camera Feed Distribution

The SIYI A8 Mini provides stabilized nadir imagery for detection, target geolocation, mapping, and operator monitoring. A SwitchBlox Ethernet switch distributes the RTSP video stream to the Jetson Orin NX and the HM30 Air Unit. The Jetson processes the most recent available frame to avoid queue latency, while the operator receives the live stream through the ground link.

4 PROPULSION AND POWER

The aircraft weighs 6.7 kg with both delivery payloads installed. Propulsion and battery capacity are sized around this operational mass and the autonomous maneuvering required by the mission.

4.1 Powertrain

Four T-Motor U7 Lite V2.0 490 KV motors provide a combined static thrust of 22.5 kg. This gives a 3.36:1 thrust-to-weight ratio at the 6.7 kg operational weight and 2.05:1 at the 11 kg maximum takeoff weight. The RTF 80 A 4-in-1 ESC was selected above the maximum-thrust current requirement so transients remain within the controller rating. Using one 4-in-1 unit also removes duplicated housings, connectors, and wiring from the mass budget.

4.2 Power Distribution and Regulation

Six Leopard Power 13,000 mAh 25C 2S LiPo batteries are connected in a 6S2P arrangement. Each 2S pack stores 96.2 Wh at its 7.4 V nominal voltage, remaining below the 100 Wh per-battery limit. The propulsion branch feeds the 4-in-1 ESC, while regulated step-down converters supply the flight controller, companion computer, communication hardware, camera, servo-actuated spool locks, and HW-231 H-bridge motor driver.

4.3 Electrical Safety and Cable Routing

High-current propulsion wiring is routed separately from avionics power and signal lines to reduce electromagnetic interference. Wire sizes are selected according to the expected current of each subsystem to limit voltage drop and prevent excessive heating. A hardware kill switch allows the propulsion system to be shut down immediately during an emergency.

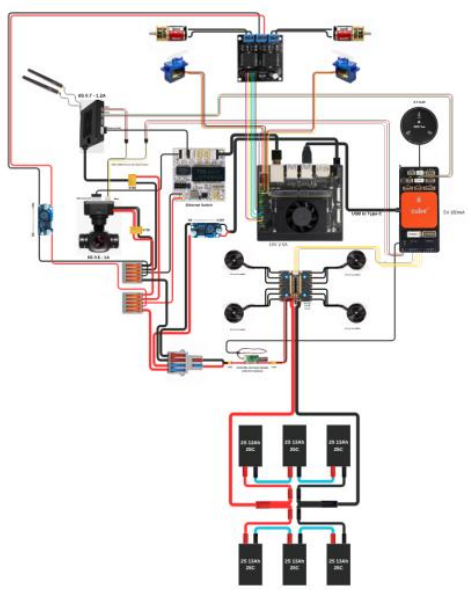

Figure 2. The power and data tree. The six 2S packs form the 6S2P battery system, the high-current propulsion branch feeds the 4-in-1 ESC, and regulated branches supply the avionics and payload-control hardware.