

Grok Scout: Your AI Carrier Pigeon

An autonomous scout quad that flies a plain-English mission over Max's own lots, records what it sees, and comes home on its own. Minimal about \$495, nicer about \$590, thermal add-on \$249, cellular alerts add-on about \$50, hot-swap brain battery add-on about \$45.



COPPER GATOR AERO

Grok Scout: Your AI Carrier Pigeon

Give it a mission in plain English. It flies the route, photographs anything unusual, and comes home to roost.

Concept render

Why you'll love it

Flies itself

No stick flying. Grok turns your words into waypoints, you approve the plan, and ArduPilot flies it.

Always comes home

Return-to-launch on mission complete, low battery or lost link. Like a homing pigeon.

Fenced to your land

A geofence locked to the Sundown Dr lots. It will not plan or fly outside them.

Brings back the footage

12 MP photos and video saved onboard, reviewed after landing, with Grok flagging what changed.

Pick your build

MINIMAL SCOUT

~\$495

7-inch LR, Pi Zero 2 W recorder, 20-25 minute patrols. Under the \$500 target.

NICER SCOUT

~\$590

Radxa Zero 3W onboard detection, wide camera, spare pack, strobe.

THERMAL ADD-ON

+\$249

InfiRay P2 Pro (9 g, 256x192, USB-C) for dusk and night-time heat spotting.

CELLULAR ALERTS ADD-ON

+\$50

LTE-M module, nano SIM and flex antenna. Texts Max mid-flight with a snapshot. Plan about \$1.50-5 a month.

HOT-SWAP BRAIN BATTERY

+\$45

A small 2S pack keeps the brain running while you swap the motor pack. No reboot. About 115 g and about 2 minutes of flight.

Staged Build: pay as you go

Buy it in phases, cheapest first. Each stage flies real autonomous missions. Your Raspberry Pi 4B and 10-inch touchscreen are the mission desk: Grok plans the route with you there, and you approve it before upload. Prices are estimates as of 23 Oct 2026 (SpeedyBee stack \$75.99, Matek M10Q \$42.99, InfiRay P2 Pro \$249 verified).

STAGE 1

Autonomous flyer

\$436 Running total \$436

Unlocks: Flies an approved waypoint mission over the lots, stays inside the geofence, and returns to launch on its own.

- Light 7-inch LR frame + 4x 2807 1300KV motors + bi-blade props, \$122
- SpeedyBee F405 V4 stack (ArduPilot), \$76
- Matek M10Q-5883 GPS/compass, \$43
- ELRS override radio + receiver (safety only), \$80
- 6S1P Molicel P45B Li-ion pack, \$65
- Remote ID module, \$35
- Wire, XT60, strobe LED, printed mast, \$15

Reuses: Pi 4B + touchscreen mission desk; robot Stage 2 balance charger (add \$55 if not)

STAGE 2

Carrier-pigeon recorder

\$58 Running total \$494

Unlocks: Records 12 MP photos and video for review after landing, with Grok flagging what changed. This is the full Minimal Scout.

- Pi Zero 2 W + 64 GB microSD + 5V 3A BEC, \$33
- Pi Camera Module 3 in a TPU pod, \$25

Reuses: Stage 1 airframe

STAGE 3

STAGE 4 (OPTIONAL)

Patrol kit

\$80

Running total \$574

Unlocks:

Back-to-back patrols and a strobe visible for 3 miles.

• Spare 6S Li-ion pack, \$65

• Anti-collision strobe, \$15

Onboard detection

\$75

Running total \$649

Unlocks:

Spots people and vehicles in flight with a wider 120 degree view.

• Radxa Zero 3W 2GB (NPU), \$40

• Camera Module 3 Wide, \$35

Reuses: Pi Zero 2 W and Camera Module 3 become spares

ADD-ON: CELLULAR ALERTS

+\$50

LTE-M texts with a snapshot mid-flight. Any stage from 2 on.

ADD-ON: HOT-SWAP BRAIN

+\$45

2S brain pack; pairs best with the Stage 3 spare pack.

ADD-ON: THERMAL

+\$249

InfiRay P2 Pro for burn piles and dusk checks. Buy last.

Stage	Cost	Running total	Unlocks
1 Autonomous flyer	\$436	\$436	Waypoints, geofence, return-to-launch
2 Recorder	\$58	\$494	Footage review after landing (Minimal Scout)
3 Patrol kit	\$80	\$574	Back-to-back patrols, strobe
4 Detection (optional)	\$75	\$649	Onboard person/vehicle spotting

Three ways to get here

Path	Spent before	Scout step	Running total
Scout on its own (above)	\$0	Stages 1-2, \$494	\$494
From the companion drone (its Stage 3 becomes the Scout)	\$605 after companion Stages 1-2	About \$300; reuses about \$200 of Stage 2 parts (GPS, ELRS radio, Remote ID, Pi Zero + camera)	\$905, companion included
From the GPS drone (same 7-inch airframe)	\$549 after GPS drone Stages 1-2	\$77: 6S Li-ion pack + bi-blade props	\$626 for both roles

Cheapest overall: build one 7-inch airframe once and give it both GPS-drone and Scout roles. Do not buy a second frame, flight controller, GPS, radio or Remote ID module.

Missions

Perimeter patrol

'Patrol the north fence line of Lot 6, photograph anything unusual, return to base.'

Burn pile check

Fly over the pile after a burn and look for smoke or hot spots (thermal add-on).

Lot boundary survey

A grid of overlapping photos along the property lines for a simple map.

Structure check

Orbit sheds and outbuildings after a storm and compare against the last flight.

Burn Ban Tracker tie-in: when that bot reports the ban has lifted, it can queue a scout mission over the cleared lots for Max to approve.

Optional: cellular alerts in flight

Without cellular, Grok Scout tells you what it saw after it lands. With the cellular add-on it tells you while it is still flying. When onboard detection flags something, the scout sends Max a text with a snapshot right away and keeps flying the approved mission.

'Burn pile smoking'

Smoke or a hot spot over the pile gets a text and photo within seconds (best with the thermal add-on).

'Unknown vehicle on Lot 5'

Person or vehicle detection on the Radxa sends a snapshot and GPS pin to Max's phone.

Small and light

A matchbook-size LTE-M board, a nano SIM and a flexible antenna. About 25-30 g, about a minute of flight time.

Pennies of data

Alerts are a few kilobytes plus a compressed photo. An IoT data SIM runs about \$1.50-5 a month.



Concept render: LTE-M module with nano SIM on the top plate, flex FPC antenna run out along an arm away from the GPS mast

Honest fine print: coverage around Caddo Lake and the Mooringsport lots can be spotty. If there's no signal, the alert waits in a queue and goes out as soon as the drone reconnects, at the latest when it lands. Cellular never flies the drone, and Max still watches it the whole time.

Optional: hot-swap brain battery

Back-to-back missions without a reboot. A small permanent "brain" pack keeps the flight controller, GPS, companion computer, camera and LTE running while you swap the motor pack. GPS lock, the cellular link and the mission queue stay up, so the scout is ready to fly again in under a minute.

No reboot on swaps

No 1-2 minute wait for boot, GPS fix and LTE reconnect between patrols.

State persists

The approved mission, logs and the detection model stay loaded across pack changes.

The honest catch

It adds no safety in flight. If the motor pack dies, the drone still comes down. The motor pack's failsafe is still what brings it home.

Cost of comfort

About +\$45 and about 115 g, which costs about 2 minutes of flight. Worth it for back-to-back patrols, not for occasional flights.

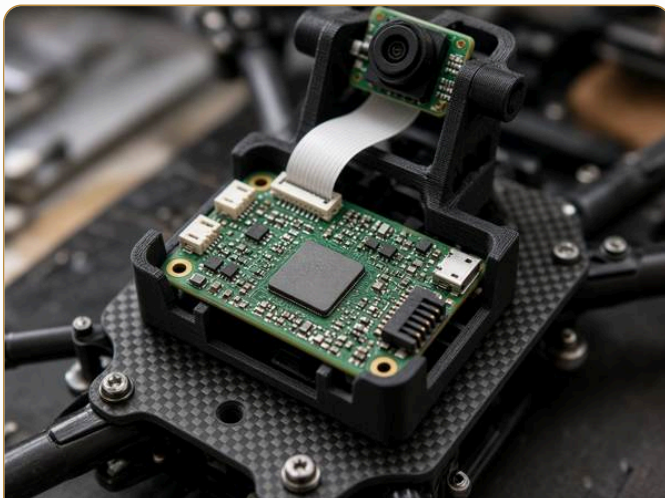


Concept render: 2S 18650 brain pack with switch and charge port on the top plate; motor pack on the quick-swap under-sled

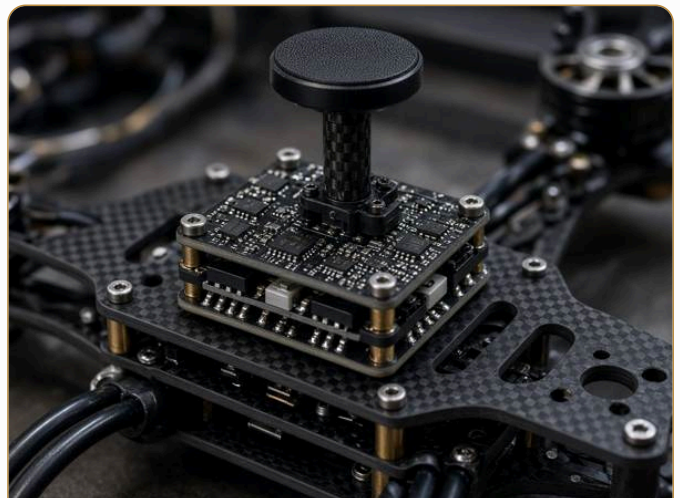
What it's for

- Property monitoring: routine look-arounds of Max's own Sundown Dr, Mooringsport lots.
- Land surveys: boundary and clearing progress photos.
- Checking remote lots: see the far lot without walking it, with Max on site within sight of the drone.
- Security patrols: spot gates left open, vehicles, or fallen trees on his own land.

Up close



Concept render: companion computer (Pi Zero 2 W) in printed mount



Concept render: SpeedyBee F405 FC/ESC stack with M10 GPS mast



Concept render: 6S 21700 Li-ion pack (XT60) and 2807 motor with 7-inch prop



Concept render: recording pod, Camera Module 3 plus optional thermal module

What's the difference

	Minimal (~\$495)	Nicer (~\$635)	+ Thermal (+\$249)
Brain	Pi Zero 2 W: records, bridges MAVLink	Radxa Zero 3W: adds onboard detection	Same as either
Camera	Camera Module 3, 12 MP	Camera Module 3 Wide	Adds 256x192 heat image
Alerts	After landing; add cellular (+\$50) for in-flight texts	Detection flags; add cellular (+\$50) for in-flight texts with snapshot	Hot-spot alerts (texted mid-flight with cellular)
Flight time	20-25 min, one pack	Back-to-back with a spare pack	About 1 min less (cellular: about 1 min more)
Dual battery (optional)	+\$45: brain stays on during swaps; about 115 g, about 2 min less flight	+\$45: most useful here, with back-to-back packs and LTE	Same; thermal also stays warm and calibrated
Best for	Daylight patrols and surveys	Regular patrols with alerts	Burn piles, dusk checks

Under the Hood: full specs, parts and build plan

Why a 7-inch, not a 3-4 inch or cinewhoop

A 3-4 inch LR4 flies 15-20 minutes but only with a tiny camera; it cannot also lift a companion computer, a recording camera and a Li-ion pack. A cinewhoop's ducts are safer and sound softer, but the ducts cost efficiency and cut flight time roughly in half. A light 7-inch with slow-spinning bi-blades is the smallest frame that carries the Pi, camera and a 6S 21700 pack for 20-25 minutes, and big slow props are quieter than small fast ones. Expect an all-up weight around 850-950 g, so it needs FAA registration and Remote ID.

Parts list

Minimal Nicer

Category	Part	Price
Frame	Light 7-inch long-range carbon frame (iFlight Chimera7 class or AliExpress 7in LR clone)	\$40 (approx.)
Motors	4x 2806.5 / 2807 1300KV, 6S, efficiency-wound	\$70 (approx.)
Props	7-inch bi-blade LR props (quieter and more efficient than tri-blade), 3 sets	\$12 (approx.)
FC + ESC	SpeedyBee F405 V4 BLS 60A 30x30 stack, flashed with ArduPilot	\$76
GPS/compass	Matek M10Q-5883 (M10 GNSS + QMC5883 compass)	\$43
Companion computer	Raspberry Pi Zero 2 W + 64 GB microSD + 5V 3A BEC (MAVLink bridge and recorder)	\$33 (approx.)
Recording camera	Raspberry Pi Camera Module 3 (12 MP, autofocus) in a printed TPU pod, records to SD	\$25
Safety override	RadioMaster Pocket ELRS radio + BetaFPV ELRS Lite receiver (override only, not for flying)	\$80 (approx.)
Battery	6S1P 21700 Li-ion pack (Molicel P45B, about 4500 mAh), XT60	\$65 (approx.)
Remote ID	Standard Remote ID broadcast module from the FAA-accepted list	\$35 (approx.)
Misc	Silicone wire, XT60, straps, standoffs, LED strobe, printed GPS mast and pod	\$15 (approx.)

Verified 23 Oct 2026: SpeedyBee F405 V4 60A stack \$75.99, Matek M10Q-5883 \$42.99, InfiRay P2 Pro \$249. Radxa Zero 3W sells for about \$28-43 depending on memory. Prices marked approximate are estimates. Assumes the balance charger from the Grok Wings build; add about \$55 if not.

Cost totals

Build	Total	Notes
Minimal	\$470 to \$520 (about \$495)	Meets the under-\$500 target
Nicer	\$555 to \$635 (about \$590)	Detection, spare pack, strobe
Nicer + thermal	about \$839	InfiRay P2 Pro on the companion USB port

Cellular add-on (any build)	+\$45 to \$55 (about \$50); SIM7600 option +\$95 to \$120	Plus about \$1.50-5 a month data plan
Nicer + thermal + cellular	about \$889	The full-alert scout
Hot-swap brain battery add-on (any build)	+\$40 to \$55 (about \$45)	Uses the existing balance charger; not in any base build
Nicer + thermal + cellular + dual battery	about \$934	Everything

Cellular add-on: details

Module option	Weight and price	Verdict
Waveshare SIM7080G Cat-M/NB-IoT HAT (LTE-M)	about 20 g (approx.); \$31.99 (Waveshare, verified)	Recommended: light, low power, plenty for texts and snapshots
Quectel EG25-G mini PCIe + USB adapter (LTE Cat-4)	about 20 g with adapter (approx.); \$45-65 (approx.)	Faster; good if you want a low-rate video stream
LILYGO T-SIM7080G / T-SIM7600 board (LTE-M or Cat-4 on ESP32)	about 25-35 g (approx.); \$35-60 (approx.)	Works but adds a second microcontroller
Waveshare SIM7600G-H 4G USB dongle (LTE Cat-4, global)	134 g listed package weight, about 148 g in case (about 40 g stripped, approx.); \$76.99-101.99 (Waveshare listings vary)	Easiest setup, but heavy unless you take it out of the case

Wiring	USB from the module to the Pi Zero 2 W / Radxa Zero 3W (a USB OTG pigtail on the Pi), or UART TX/RX plus ground to spare companion pins with the Pi's main UART kept for MAVLink. Power from the 5V 3A BEC, not the Pi's 5V pin.
SIM	The module's nano SIM slot. Use a data-only IoT SIM: Hologram (\$3 per SIM, \$1 a month, \$0.03 per MB, verified) or Soracom plan-US (10 MB bundle \$1.30 a month, 50 MB \$3, verified).
Monthly estimate	About 30 alerts a month at about 100 KB per snapshot plus heartbeats is about 5-10 MB: about \$1.15-1.30 on Hologram or \$1.30-1.50 on Soracom. Budget \$1.50-5 a month including the occasional low-res clip.
Antenna	A flexible FPC LTE antenna (about \$8, approx.) taped flat under an arm or on the top plate, at least 10 cm from the GPS mast and set at right angles to the ELRS antennas. LTE harmonics can desensitize GPS, so check the GPS satellite count and HDOP with the modem transmitting before the first mission.
Weight and flight time	LTE-M board + antenna + cable is about 25-30 g, which costs about 1 minute. A cased SIM7600 dongle (about 134-148 g) would cost about 5-6 minutes and push the build past 1 kg, so don't fly it in the case.
Power draw	LTE-M modules idle in tens of mA with transmit peaks around 0.5 A. Cat-4 modules like the SIM7600 or EG25 can spike to about 2 A at 3.8 V during transmit bursts. Put a 470-1000 uF capacitor at the module and keep the BEC at 3 A or more so the Pi doesn't brown out.
Software	A small alert service on the companion. Detection hits are rate-limited (one per object per minute), then sent with a JPEG snapshot, GPS pin and time over HTTPS or SMS through the IoT provider to Max's phone. Alerts are queued if there's no signal. The cellular link is alerts only, never commands to the flight controller.
Airborne use	Check the carrier's terms first. FCC rules restrict airborne use of some cellular bands, and consumer phone plans often exclude drones. Verizon and AT&T sell drone and IoT plans, and IoT SIM providers publish their own terms. Use a plan that permits UAS use.
Coverage	Expect spotty signal around Caddo Lake and low-lying wooded lots. Do a walk test with a phone on the same carrier first. Alerts that can't send wait for signal or for landing.

Hot-swap brain battery: details

Load	Typical power	Notes
Flight controller + M10 GPS/compass	about 1 W	Steady
Pi Zero 2 W / Radxa Zero 3W	1.5-3 W	Radxa higher while running detection
LTE-M module (optional)	about 0.5 W average	Transmit peaks around 0.5 A at 3.8 V; Cat-4 peaks about 2 A
Camera Module 3 (+ thermal)	about 1 W (+ about 0.5 W)	Recording
ELRS receiver, Remote ID, strobe	under 0.5 W	
Total	about 4-6 W	Plan on 6 W, plus converter losses

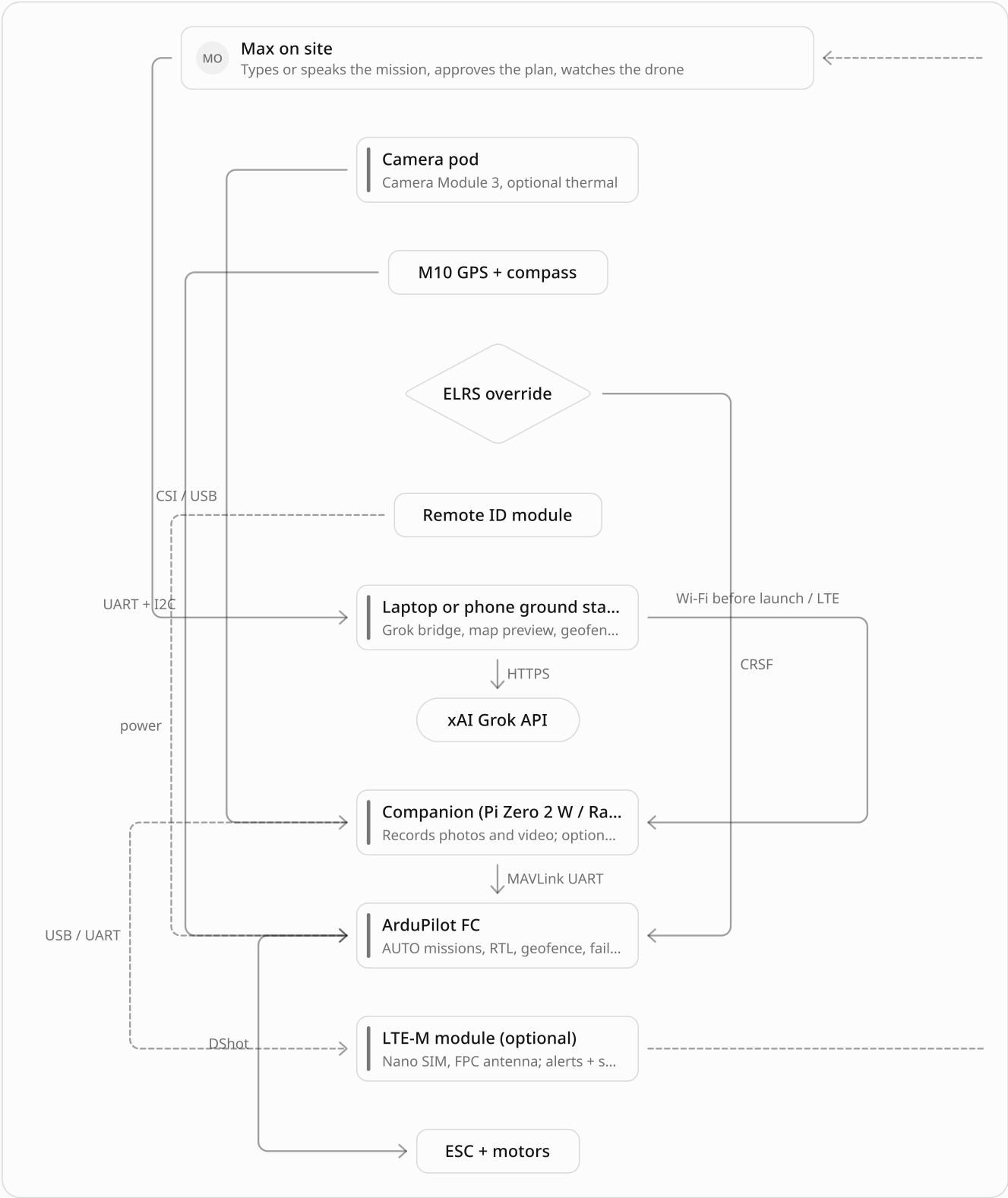
Brain pack option	Energy and weight	Price	Verdict
2S Molicel P28A 18650 (2 cells, 2800 mAh each) + 2S BMS holder	about 20 Wh; cells 46 g each (Molicel datasheet), about 110 g with holder and BMS (approx.)	cells \$5.99 each (18650BatteryStore, verified) + holder about \$8 (approx.)	Chosen: about 3 hours at 6 W, so it covers several missions plus ground time; Li-ion lasts many more cycles
2S 1000-1300 mAh LiPo	about 7-10 Wh, about 60-80 g (approx.)	\$12-20 (approx.)	Lighter, about 1 hour at 6 W; wears faster and needs balance charging more often

Sizing	A 30-minute mission at 6 W needs 3 Wh. With twice that for margin plus swap and ground time, plan on about 8-10 Wh. The P28A pair gives 20 Wh, enough for 3-4 missions on one charge. It is heavier, but it lasts longer and stays put.
Recommended topology	Motor pack (6S) goes to the FC's current/voltage sensor (BATT1), then the ESC, plus BEC A at 5.0 V. Brain pack (2S) goes through a switch to its own BEC B at 5.2-5.3 V. BEC A and BEC B feed a dual ideal-diode ORing board (Pololu #5398, 6 A per channel, \$7.95, verified) onto one 5 V electronics bus: FC 5 V input, GPS, ELRS, Pi/Radxa, LTE and camera. The higher brain voltage makes the brain pack the normal source, and the motor pack's BEC is the backup.
Why this switch	An ideal diode (a MOSFET with a controller) drops only millivolts instead of the 0.3-0.5 V a Schottky drops, and blocks backfeed. The TI LM66100 chip (\$0.29-0.85 at Mouser) and the Adafruit LM66200 dual breakout (\$2.50, verified) are rated 1.5 A and 2.5 A, which is too tight for a Pi plus LTE peaks. LTC4412/LTC4359 controller boards or the Pololu pair give more headroom. Two separate regulators with no ORing don't work, because one bus would drop out on every swap.
Brownout	The ideal diode hands over in microseconds, but put 470-1000 uF of bulk capacitance on the 5 V bus, plus a cap at the LTE module, to ride through the gap and LTE spikes. Use a common ground between both packs. Only swap the motor pack when DISARMED and props are still.
CRITICAL: battery monitoring	The FC's current/voltage sensor stays on the MOTOR pack as BATT1, so ArduPilot's battery failsafe (RTL at 30%) still watches the pack that keeps it in the air. Add a voltage divider so the brain pack shows up as BATT2 with its own low-voltage failsafe (RTL at 6.8 V on 2S). The ESC runs only from the motor pack, and the brain pack never feeds the motors.
Charging	Recommended: charge the brain pack off the drone, or through its balance lead with the existing balance charger. Optional: an onboard 2S charger module fed from the motor pack. This tops it up in flight, but adds heat, another board and more ways to wire it wrong. Skip it unless the swaps are constant.
Sled and CG	The quick-swap motor-pack under-sled stays as it is. The brain pack mounts permanently on the top plate over the center of gravity, with a small power switch and a balance/charge port. Its weight sits high, so recheck the CG and re-run autotune.

Weight and flight time About 110 g pack + about 15 g BEC, ORing board, switch and wiring = about 115-125 g, on a roughly 900 g drone. It costs about 3 minutes, but the motor pack no longer powers the 5 W of electronics, which wins back about 1 minute. Net, about 2 minutes less (about 18-23 minutes).

Also applies to The same design works on the Grok Wings S500 GPS drone page and other ArduPilot builds. On the bigger S500 the weight hurts less.

Architecture



Mission flow	Max describes the mission. Grok on the ground station returns waypoints, altitude and photo points. The bridge checks them against the lot geofence, shows them on a map, and uploads only after Max approves. Max arms; ArduPilot flies AUTO, then RTL.
Why the ground station	Grok runs ground-side, not onboard, so the drone needs no cloud link in flight (the optional cellular add-on only sends alerts). Telemetry is MAVLink; review happens after landing when the SD card or Wi-Fi offload syncs.
Grok never does	Arm, disarm, stick control, or change the geofence.
Failsafes	RTL at 30% battery, on mission end, on geofence breach, and on ELRS link loss.
Software	ArduPilot 4.6 on the FC; MAVProxy or pymavlink plus a small Python bridge on the companion. PX4 plus ROS 2 works too but is heavier for a Pi Zero.

Build order

- 1 **Frame and motors**
Assemble the frame, mount motors, check screw length clears windings.
- 2 **Stack and power**
Solder the ESC to the XT60 pigtail and motors; smoke-stop the first power-up.
- 3 **ArduPilot and GPS**
Flash ArduPilot, wire GPS on a mast, calibrate accel and compass.
- 4 **Override link**
Bind the ELRS receiver; set a mode switch that always forces LOITER or RTL.
- 5 **Tune props-on**
Hover in LOITER, run autotune, test RTL and geofence by hand.
- 6 **Companion and camera**
Mount the Pi in its printed holder, wire MAVLink UART and the BEC, test recording.
- 7 **Remote ID and strobe**
Fit the broadcast module and strobe; register the drone with the FAA.
- 8 **Brain battery (optional)**
Mount the 2S pack on the top plate, wire BEC B and the ideal-diode ORing board, set BATT2 monitoring, and pull the motor pack while DISARMED to confirm nothing reboots.
- 9 **Cellular add-on (optional)**
Fit the module and SIM, route the FPC antenna away from GPS and ELRS, confirm the GPS sat count with the modem transmitting, send a test alert.
- 10 **Grok bridge**
Plan a short mission from text, approve it, fly it with Max watching.

FAA rules

- Over 250 g: register (\$5) and broadcast Remote ID. This build is about 900 g.
- Recreational: pass TRUST and follow community safety rules; any other use (like work for a business) needs Part 107.
- Visual line of sight always, and Max must be able to take control. Autonomous does not mean unattended; BVLOS needs an FAA waiver.
- Night flight under Part 107 needs anti-collision lighting visible 3 statute miles.

- Stay under 400 ft and check airspace near Shreveport Regional and Barksdale.

Privacy and Louisiana law

Only scout Max's own property and point the camera at his own land. Louisiana has drone-specific laws: La. R.S. 14:337 (unlawful use of an unmanned aircraft system, including surveillance of a targeted facility) and La. R.S. 14:283 (video voyeurism). Check the current text before flying near neighbors' homes, and keep the geofence inside the lot lines.

Gotchas

- Li-ion packs give long time but sag under punch; keep throttle gentle and RTL at 30%.
- Keep GPS 8-10 cm from the battery leads and the Pi; Pi Wi-Fi can jam GPS, so shield or disable it in flight.
- Heat: the Pi Zero throttles in a closed pod in Louisiana summer; give it airflow.
- Moisture: no rain flights; conformal-coat the FC and companion for humid evenings.
- Cellular: an LTE modem next to the GPS can cut its satellite count; antenna placement matters more than the module choice.
- Dual battery: never move the FC current sensor to the brain pack; ArduPilot must see the motor pack to trigger RTL.
- Weight creep: every 50 g costs a couple of minutes. Weigh the build before the thermal add-on.

	FAA recreational flyers	
	ArduPilot Copter docs	
	Waveshare SIM7080G HAT	
	Waveshare SIM7600G-H dongle	
	Hologram pricing	
	Soracom pricing	
	Pololu ideal-diode ORing pair	
	MoliceL P28A	
	InfiRay P2 Pro	