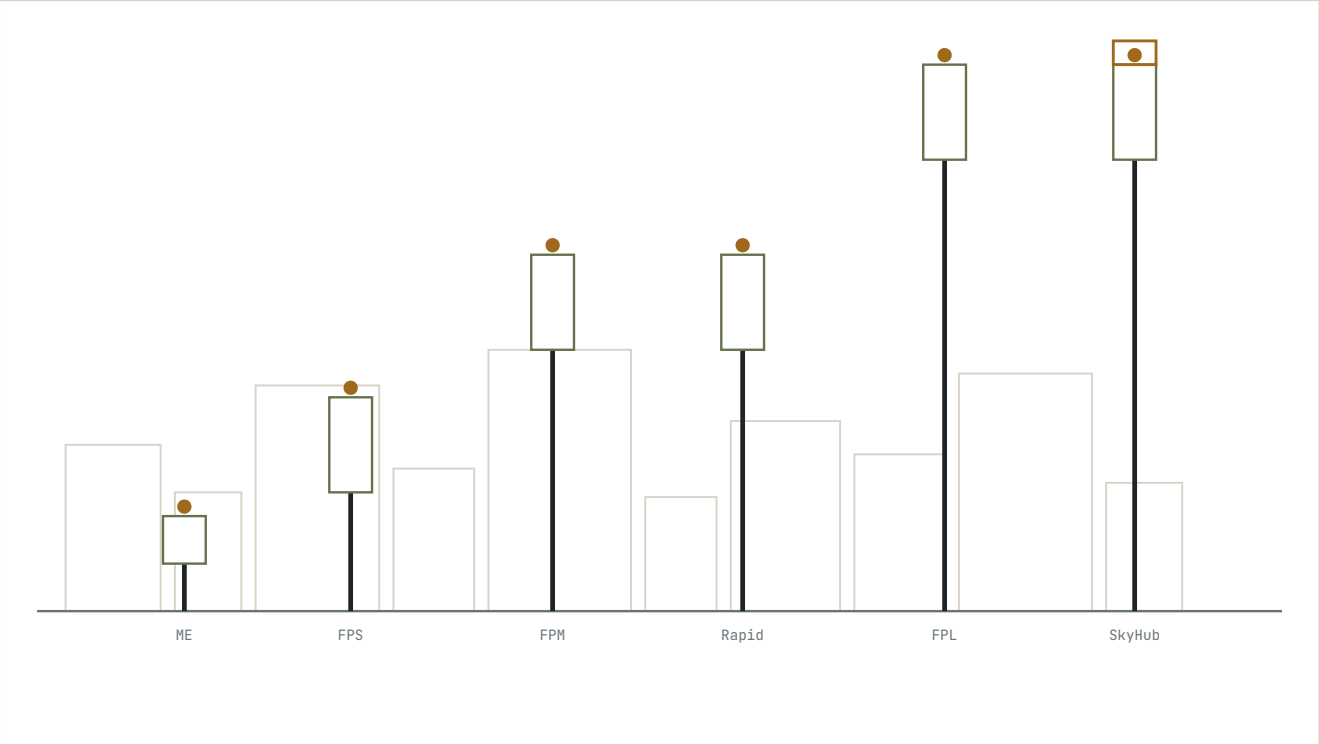
SOLARTODO Sentinel

Engineering Technical Brochure — Sovereign Physical AI Infrastructure for Solar Security, Wildlife, Edge Autonomy and City-Scale Operations



6	116	8	275 TOPS	0 SMask
POLE FAMILIES	CAPABILITIES	VOICE LANGUAGES	EDGE COMPUTE	MOBILE-SAFE

> A solar-powered physical-AI pole platform: six families from a 1.6 m bollard to a 12 m air-ground SkyHub, all running local Jetson inference with data kept on-site.

ABOUT THE COMPANY

SOLARTODO LIMITED

Yangzhou-based manufacturer of solar street-lighting, smart-city poles, energy storage and physical-AI security infrastructure since 2014. Eight product lines, eight UI languages, exporting to Europe, the Americas, the Middle East and East Asia.

Sentinel is the company physical-AI security pole platform: solar-powered, edge-inferring, data-sovereign nodes for perimeter, wildlife and city-scale operations.



2014	8	8	Large scale	ME-15 bollard
ESTABLISHED	PRODUCT LINES	LANGUAGES	POLE PROGRAMMES	IOT MONITORING NODE

> Engineering depth: large-scale monitoring-pole deployments and the ME-15 IoT bollard line anchor Sentinel in oilfield, desert and border environments.

How this brochure is organised

PART I — PLATFORM FOUNDATION

Pole families, dimensions, sections, devices, energy, edge architecture, present-day functions, Wildlife AI and moats. P9-P52.

PART II — INTEGRATED CAPABILITY DOMAINS

Twelve engineering domains, 72 optional and project-scoped configurations as a Configurable Capability Atlas. P53-P82.

PART III — SKYHUB AIR-GROUND OPERATIONS

Battery-swap hangar, persistent drone net, logistics and evidence loops. P83-P88.

PART IV — REGULATED CONFIGURATIONS

Counter-UAS, acoustic evidence, boundary verification, data sovereignty. P89-P94.

PART V — COMMERCIAL PACKAGING

L1-L4 transition, product and strategic packages, family-by-capability matrix, partner authorization, contact. P95-P102.

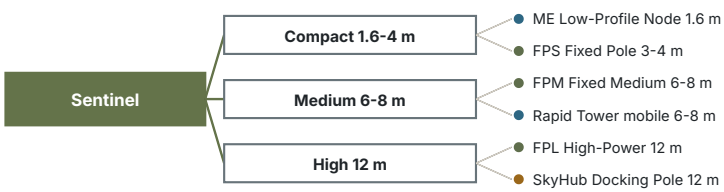
Read Part I for what ships today, Part II for the configurable capability atlas, Parts III-IV for air-ground and regulated configurations, Part V for commercial structure.

Four configuration labels

STANDARD	OPTIONAL	PROJECT	REGULATED
Pure software / AI / OS Runs on existing poles or via subscription Low marginal cost	Adds sensor / acoustic / radar / mast / screen hardware (BOM) Chosen per industry pack	System integration City-scale orchestration Drone / robot coupling Custom engineering	Airspace / policing / medical / energy trade Local authorization Sense + evidence + handoff

> Every capability in this brochure carries one of four boundary labels, so a buyer can separate what runs today on a standard pole from what needs hardware, integration or local authorization.

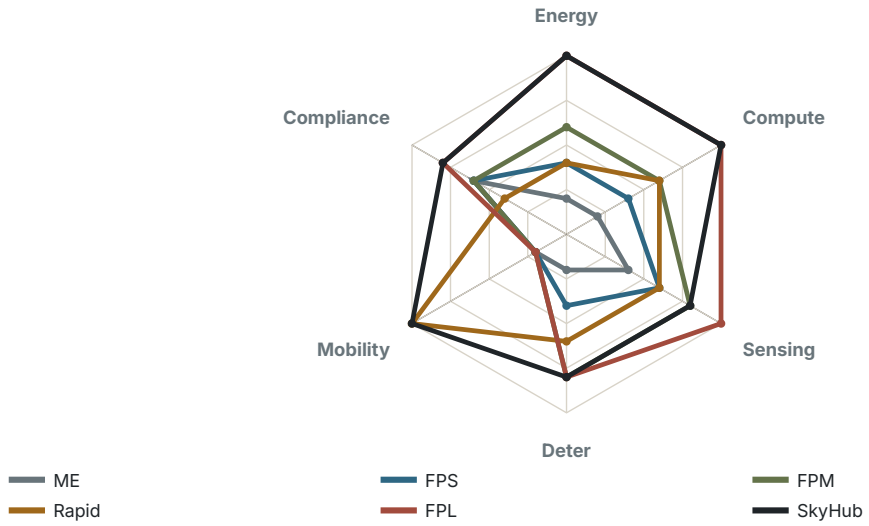
Six product families, one architecture



FAMILY	HEIGHT	SECTION	COMPUTE	STORAGE	ROLE
ME	1.6 m	CIGS Ø200 · OCT250	MCU	0.5-1.5 kWh	Bollard IoT sensing
FPS	3-4 m	SQ250 · HEX250 · CIGS Ø315	Orin Nano 40T	1.5-3 kWh	Standard security pole
FPM	6-8 m	OCT250 · HEX480 · CIGS Ø400	Orin NX 100T	3-8 kWh	Full active-defence pole
Rapid	6-8 m	SQ480 guided	Orin NX 100T	3-6 kWh	Mobile rapid deployment
FPL	12 m	OCT480 · CIGS Ø600	Orin AGX 275T	8-15 kWh	High-power foundation pole
SkyHub	12 m	OCT480 · CIGS Ø600	Orin AGX 275T	20-60 kWh	Air-ground battery-swap hub

> One pole architecture scales continuously from a 1.6 m bollard to a 12 m air-ground hub. A competitor mobile tower cannot span bollard mesh, fixed high-power and battery-swap roles at once.

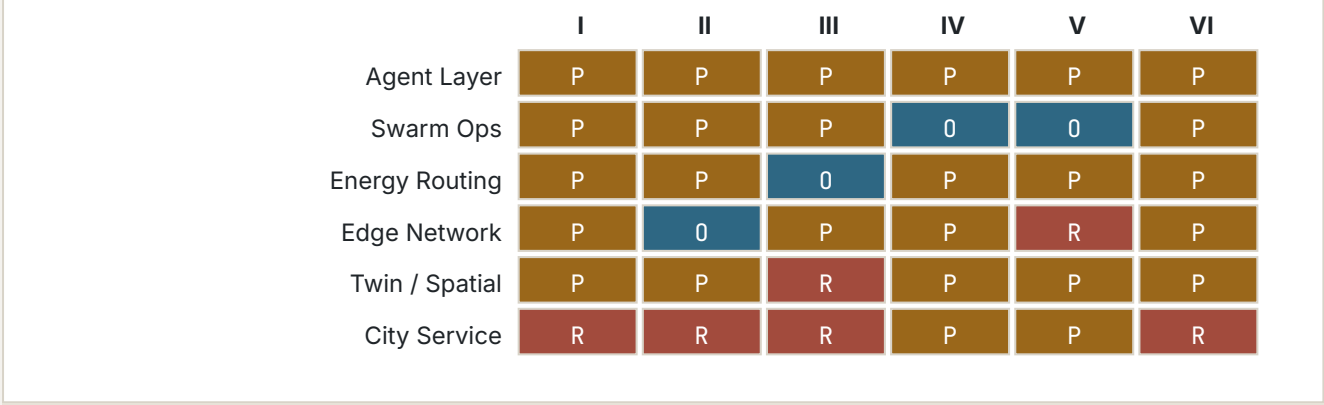
Six families across six engineering axes



1.6-12 m	0.5-60 kWh	40-275 TOPS	45 m/s	6
HEIGHT SPAN	STORAGE SPAN	COMPUTE SPAN	WIND CLASS	FAMILIES

Energy, compute, sensing, deterrence, mobility and compliance scale with height and mission. ME leads density and low cost; SkyHub leads mobility and air-ground reach; FPL leads fixed energy and compute.

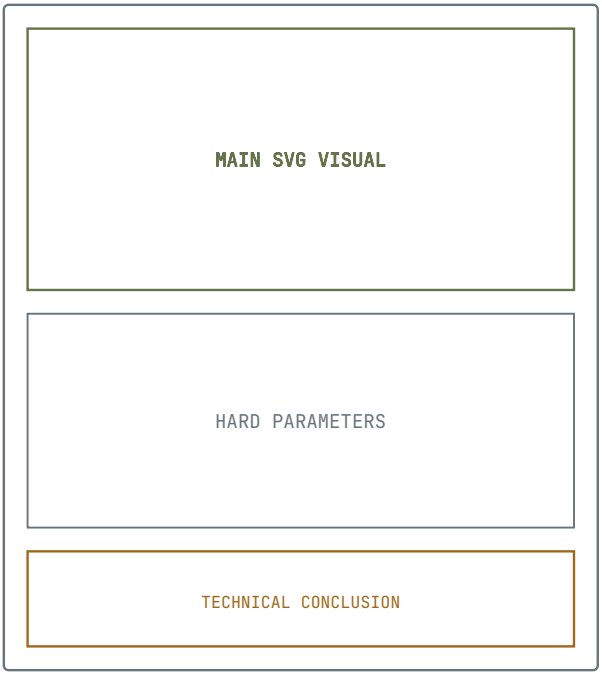
Twelve domains, 72 configurations



DOMAIN (PART II)	PAGES	ITEMS
Agent Layer	P53-55	#1-6
Swarm Ops	P56-58	#7-12
Energy Routing	P59-61	#13-18
Edge Network	P62-64	#19-24
Twin / Spatial	P65-66	#25-30
City Service	P67-68	#31-36
Maintenance	P69-70	#37-42
Civic Interface	P71-72	#43-48
Safety	P73-75	#49-54
Revenue	P76-77	#55-60
Climate / MRV	P78-79	#61-66
Extensions	P80-82	#67-72

The 72 optional and project-scoped configurations are indexed across twelve engineering domains, each detailed later with a seven-field card: what, how built, stack, moat, best-fit family and boundary.

How to read every page



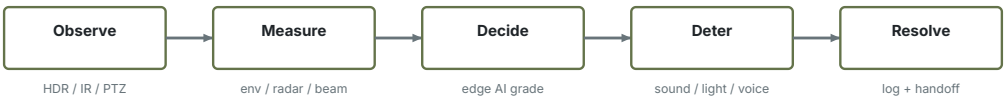
7-FIELD CAPABILITY CARD

- WHAT
- HOW BUILT
- SENSOR / ACTUATOR
- MOAT
- BEST-FIT FAMILY
- BOUNDARY
- CONCLUSION

LAYER	CONTENT	RULE
Top	SVG visual	Data-driven infographic
Middle	Parameters	Dense table or 7-field cards
Foot	Conclusion	40-80 word engineering note

> Every content page is three layers: a data-driven SVG visual on top, hard engineering parameters in the middle, and a 40-80 word technical conclusion at the foot. Each capability is a seven-field card, not a one-line entry.

Observe · Measure · Decide · Deter · Resolve



CLOSED TO EVIDENCE

Every action ends in a local, auditable record. Competitors stop at deter, and only deter people.

LOCAL JUDGMENT

Jetson edge inference decides on-pole; the loop runs off-grid and degrades soft when the network drops.

Sentinel extends the competitor observe-deter chain by two stages: a graded decision on the edge and a documented resolution, applied to both intruders and wildlife.

Three product lines across six families



LINE	BEST FAMILIES	BOUNDARY
Fixed Pro	FPS / FPM / FPL	STANDARD + OPTIONAL
Rapid Tower	Rapid	OPTIONAL
Wildlife AI	ME / FPS / FPM	STANDARD + OPTIONAL

> The same six families resolve into three go-to-market lines: fixed high-end security, mobile rapid deployment, and the Wildlife AI differentiator that manages animals as business objects, not noise.

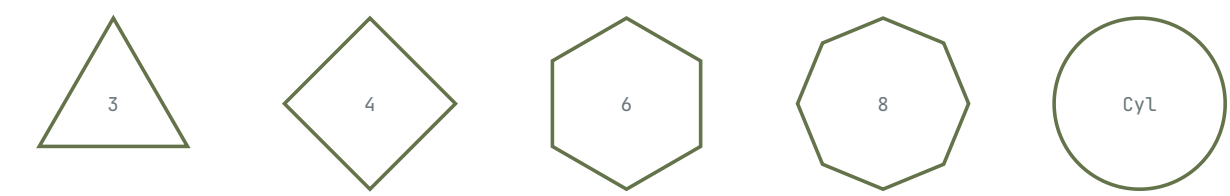
Pole dimension and structure master table

FAMILY	HEIGHT	SEGMENTS 20/70/10	SECTION	MATERIAL	FLANGE / ANCHOR	MASS	STORAGE	COMPUTE
ME	1.6 m	0.32 / 1.12 / 0.16	CIGS Ø200 · OCT250	6061-T6 4mm	Ø350×10	25-40 kg	0.5-1.5 kWh	MCU
FPS	3-4 m	0.6 / 2.1 / 0.3	SQ250 · HEX250 · CIGS Ø315	Al alloy / stainless steel	Ø400-500×16	120-220 kg	1.5-3 kWh	Orin Nano 40T
FPM	6-8 m	1.2 / 4.2 / 0.6	OCT250 · HEX480 · CIGS Ø400	Al alloy / stainless steel	Ø600×20	400-700 kg	3-8 kWh	Orin NX 100T
Rapid	6-8 m	telescopic	SQ480 guided	Al alloy / stainless steel	ballast / fork / trailer	mobile	3-6 kWh	Orin NX 100T
FPL	12 m	2.4 / 8.4 / 1.2	OCT480 · CIGS Ø600	SUS304/316L/2205	Ø850×25	900-1500 kg	8-15 kWh	Orin AGX 275T
SkyHub	12 m	2.4 / 8.4 / hangar	OCT480 · CIGS Ø600	stainless	Ø850×25	project	20-60 kWh	Orin AGX 275T

FAMILY	ACROSS-FLATS / CORNERS (MM)	WIND CLASS	TRANSPORT
ME	604	45 m/s	standard crate
FPS	250/480	45 m/s	standard crate
FPM	604 / 831	45 m/s	standard crate
Rapid	480	project	standard crate
FPL	1159	project	Ø600 = 3040 mm dia
SkyHub	1159	project	Ø600 = 3040 mm dia

> Every family holds the locked 20 / 70 / 10 segment ratio (base 20, PV 70, top 10), with the SkyHub hangar the only exception. Across-corners sets the transport envelope; the Ø600 cylinder ships at 3040 mm diagonal.

Section geometry comparison



Triangle
289 / 554

Square
250 / 480

Hexagon
433 / 831

Octagon
604 / 1159

Cylinder
Ø180-600

across-flats / across-corners (mm)

FORM	ACROSS-FLATS / CORNERS (MM)	PERIMETER (MM)	PV COLUMNS
Triangle	289 / 554	750 / 1440	1 / 2
Square	250 / 480	1000 / 1920	1 / 2
Hexagon	433 / 831	1500 / 2880	1 / 2
Octagon	604 / 1159	2416 / 4636	2 / 3
Cylinder CIGS	Ø180-600	565 / 1885	wrap 360

> Across-corners is the transport envelope. Octagon-480 spans 1159 mm flats and 4636 mm perimeter; the CIGS cylinder Ø600 unrolls to 1885 mm of wrap-around PV skin.

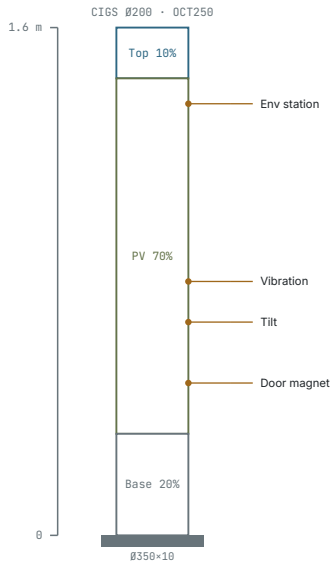
Device parameter master table

DEVICE	SIZE MM	PERFORMANCE	POWER	MOUNT	FAMILY
PTZ Camera	Ø239×291	30x zoom, IR 200m	12 W	0.9H	FPS+
Thermal Imager	244×360×582	640×512, 1.2 km	8 W	0.82H	FPM+
mmWave Radar	285×206×152	77 GHz, 400 m	10 W	0.78H	FPM+
Directional Hailer	365×365×160	Directional, 8-lang	40 W	0.62H	FPM+
Strobe Beacon	Ø170×66	2 Mcd flash	25 W	0.7H	4 m+
Bullet Camera	Ø132×260	4K, 50 m IR	8 W	1/3H	FPS+
IR Beam Pair	370×101×96	4-beam, 100 m	6 W	0.5-1.5 m	3 m+
Environment Station	Ø140×250	T / RH / PM / wind	4 W	0.9H	all

> Devices stage by pole height: bollard runs internal IoT only; 3 m adds PTZ, bullet and IR beam; 6 m adds thermal and radar; 8 m is full with the directional hailer; 12 m carries heavy bullet arrays.

ME Low-Profile Node — 1.6 m

Bollard IoT sensing



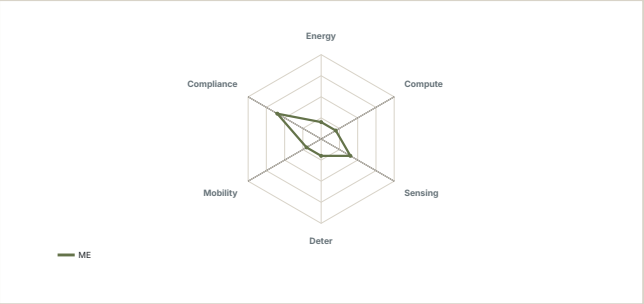
PARAMETER	VALUE
Height	1.6 m
Segments 20/70/10	0.32 / 1.12 / 0.16
Section	CIGS Ø200 · OCT250
Material	6061-T6 4mm
Flange / anchor	Ø350×10
Mass	25-40 kg
Storage	0.5-1.5 kWh
Compute	MCU
Wind	45 m/s

DEVICE STAGING

Env station · Vibration · Tilt · Door magnet

ME Low-Profile Node is a 1.6 m Bollard IoT sensing on a CIGS Ø200 · OCT250 section in 6061-T6 4mm, carrying MCU edge compute and 0.5-1.5 kWh of on-pole storage.

ME specification sheet



AXIS	LEVEL 0-5
Energy	1
Compute	1
Sensing	2
Deter	1
Mobility	1
Compliance	3

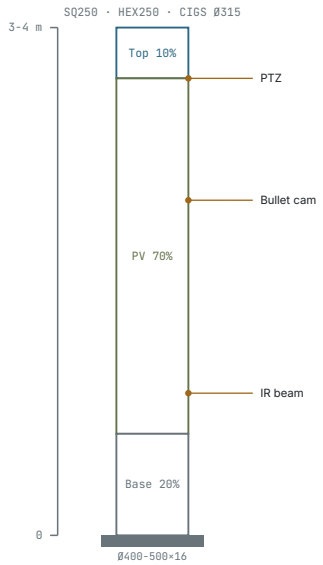
BEST-FIT BOUNDARY OPTIONAL

Dense low-post mesh for ground-level sensing and IR-beam perimeter.

On the six engineering axes, ME maximises deployment density at lowest cost. Flange Ø350×10, mass 25-40 kg, rated to 45 m/s.

FPS Fixed Pole — 3-4 m

Standard security pole



PARAMETER	VALUE
Height	3-4 m
Segments 20/70/10	0.6 / 2.1 / 0.3
Section	SQ250 · HEX250 · CIGS Ø315
Material	Aluminium alloy / stainless steel
Flange / anchor	Ø400-500×16
Mass	120-220 kg
Storage	1.5-3 kWh
Compute	Orin Nano 40T
Wind	45 m/s

DEVICE STAGING

PTZ · Bullet cam · IR beam

FPS Fixed Pole is a 3-4 m Standard security pole on a SQ250 · HEX250 · CIGS Ø315 section in aluminium alloy / stainless steel, carrying Orin Nano 40T edge compute and 1.5-3 kWh of on-pole storage.

FPS specification sheet



AXIS	LEVEL 0-5
Energy	2
Compute	2
Sensing	3
Deter	2
Mobility	1
Compliance	3

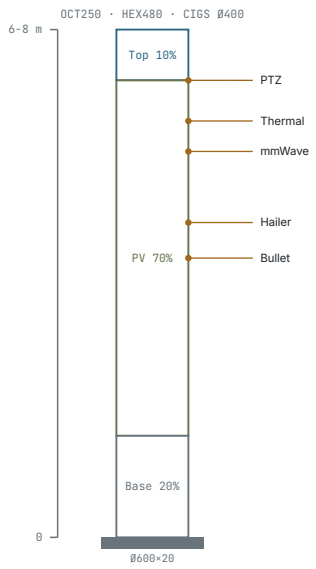
BEST-FIT BOUNDARY STANDARD

Standard mid-height security on existing flanged foundations.

On the six engineering axes, FPS balances sensing and cost for standard sites. Flange Ø400-500×16, mass 120-220 kg, rated to 45 m/s.

FPM Fixed Medium — 6-8 m

Full active-defence pole



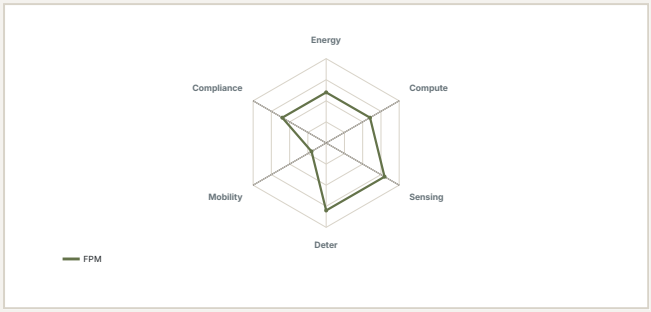
PARAMETER	VALUE
Height	6-8 m
Segments 20/70/10	1.2 / 4.2 / 0.6
Section	OCT250 · HEX480 · CIGS Ø400
Material	Aluminium alloy / stainless steel
Flange / anchor	Ø600×20
Mass	400-700 kg
Storage	3-8 kWh
Compute	Orin NX 100T
Wind	45 m/s

DEVICE STAGING

PTZ · Thermal · mmWave · Bullet · Hailer

FPM Fixed Medium is a 6-8 m Full active-defence pole on a OCT250 · HEX480 · CIGS Ø400 section in aluminium alloy / stainless steel, carrying Orin NX 100T edge compute and 3-8 kWh of on-pole storage.

FPM specification sheet



AXIS	LEVEL 0-5
Energy	3
Compute	3
Sensing	4
Deter	4
Mobility	1
Compliance	3

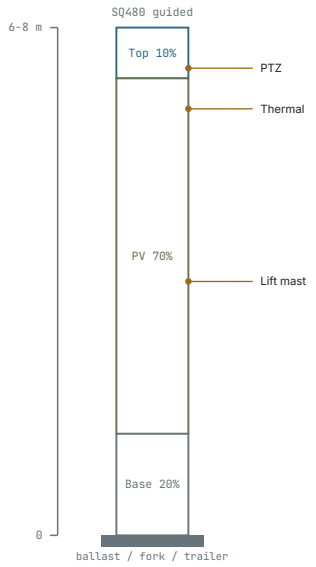
BEST-FIT BOUNDARY STANDARD

Full active-defence with thermal, radar and directional hailer.

On the six engineering axes, FPM leads fixed sensing and deterrence. Flange Ø600×20, mass 400-700 kg, rated to 45 m/s.

Rapid Tower — 6-8 m

Mobile rapid deployment



PARAMETER	VALUE
Height	6-8 m
Segments 20/70/10	telescopic
Section	SQ480 guided
Material	Aluminium alloy / stainless steel
Flange / anchor	ballast / fork / trailer
Mass	mobile
Storage	3-6 kWh
Compute	Orin NX 100T
Wind	project

DEVICE STAGING

PTZ · Thermal · Lift mast

Rapid Tower is a 6-8 m Mobile rapid deployment on a SQ480 guided section in aluminium alloy / stainless steel, carrying Orin NX 100T edge compute and 3-6 kWh of on-pole storage.

Rapid specification sheet



AXIS	LEVEL 0-5
Energy	2
Compute	3
Sensing	3
Deter	3
Mobility	5
Compliance	2

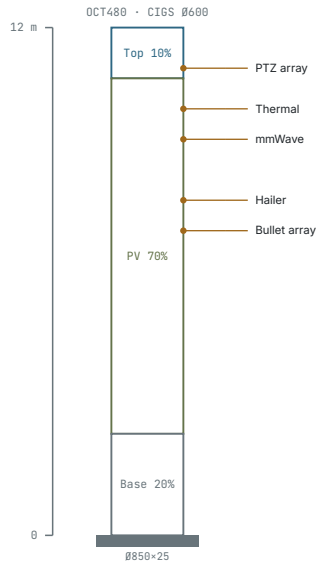
BEST-FIT BOUNDARY OPTIONAL

Mobile lift mast for construction, camps and temporary control.

On the six engineering axes, Rapid leads mobility for rapid deployment. Flange ballast / fork / trailer, mass mobile, rated to project.

FPL High-Power — 12 m

High-power foundation pole



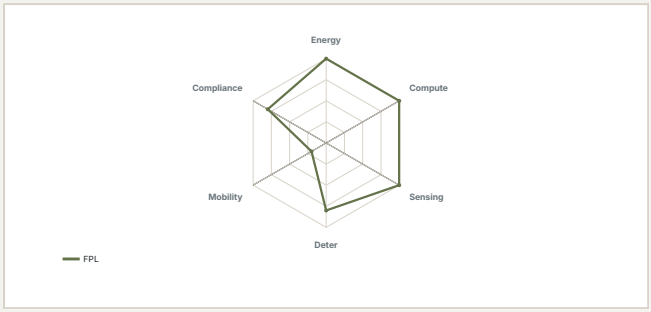
PARAMETER	VALUE
Height	12 m
Segments 20/70/10	2.4 / 8.4 / 1.2
Section	OCT480 · CIGS Ø600
Material	SUS304/316L/2205
Flange / anchor	Ø850×25
Mass	900-1500 kg
Storage	8-15 kWh
Compute	Orin AGX 275T
Wind	project

DEVICE STAGING

PTZ array · Thermal · mmWave · Bullet array · Hailer

FPL High-Power is a 12 m High-power foundation pole on a OCT480 · CIGS Ø600 section in SUS304/316L/2205, carrying Orin AGX 275T edge compute and 8-15 kWh of on-pole storage.

FPL specification sheet



AXIS	LEVEL 0-5
Energy	5
Compute	5
Sensing	5
Deter	4
Mobility	1
Compliance	4

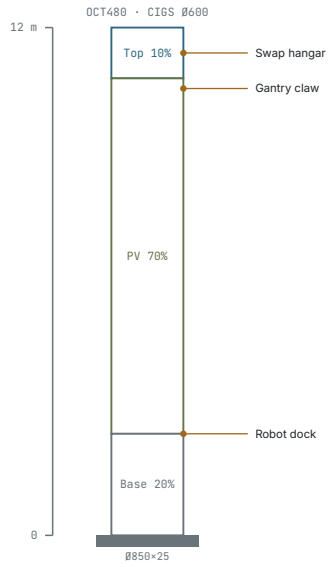
BEST-FIT BOUNDARY STANDARD

High-power fixed pole for oilfield, border and heavy payload.

On the six engineering axes, FPL leads fixed energy and compute. Flange Ø850×25, mass 900-1500 kg, rated to project.

SkyHub Docking Pole — 12 m

Air-ground battery-swap hub



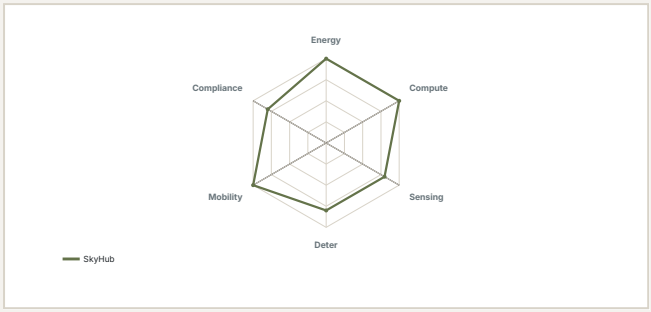
PARAMETER	VALUE
Height	12 m
Segments 20/70/10	2.4 / 8.4 / hangar
Section	OCT480 · CIGS Ø600
Material	stainless
Flange / anchor	Ø850×25
Mass	project
Storage	20-60 kWh
Compute	Orin AGX 275T
Wind	project

DEVICE STAGING

Swap hangar · Gantry claw · Robot dock

SkyHub Docking Pole is a 12 m Air-ground battery-swap hub on a OCT480 · CIGS Ø600 section in stainless, carrying Orin AGX 275T edge compute and 20-60 kWh of on-pole storage.

SkyHub specification sheet



AXIS	LEVEL 0-5
Energy	5
Compute	5
Sensing	4
Deter	4
Mobility	5
Compliance	4

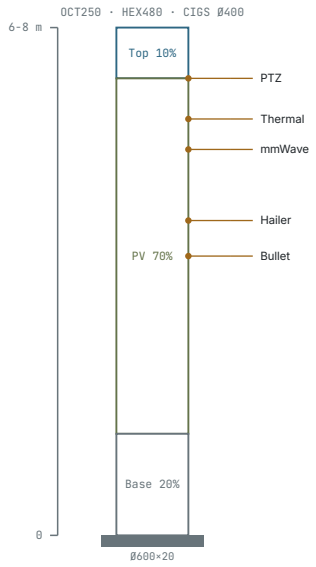
BEST-FIT BOUNDARY PROJECT-SCOPED

Air-ground hub with battery-swap hangar and robot dock.

On the six engineering axes, SkyHub leads mobility and air-ground reach. Flange Ø850×25, mass project, rated to project.

Smart-pole exploded anatomy

FPM 6-8 m reference



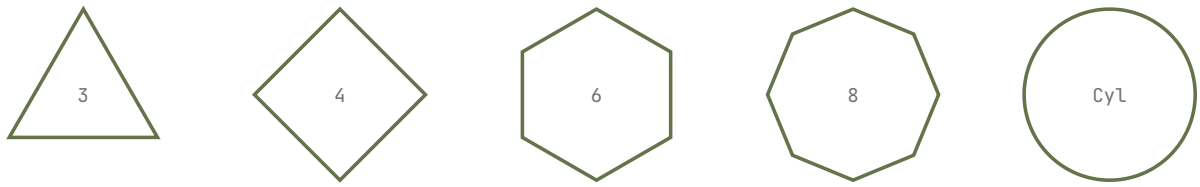
DEVICE	SIZE MM	MOUNT
PTZ Camera	Ø239×291	0.9H
Thermal Imager	244×360×582	0.82H
mmWave Radar	285×206×152	0.78H
Directional Hailer	365×365×160	0.62H
Strobe Beacon	Ø170×66	0.7H
Bullet Camera	Ø132×260	1/3H

THREE-SEGMENT RATIO

Base 20% electrical · PV 70% generating · Top 10% equipment. Locked across every family.

The reference FPM anatomy stages devices by working height: PTZ and environment station at 0.9H, thermal and radar in the upper third, bullet cameras at one-third height, IR beams at low level.

Three PV technology profiles



Triangle	Square	Hexagon	Octagon	Cylinder
289 / 554	250 / 480	433 / 831	604 / 1159	Ø180-600

across-flats / across-corners (mm)

MONO-CRYSTALLINE GLASS

Integrated glass face on FPS/FPM/FPL. Highest yield, most rigid.

FLEXIBLE THIN-FILM

Conforms to curved and mobile poles. Lighter, vandal-tolerant.

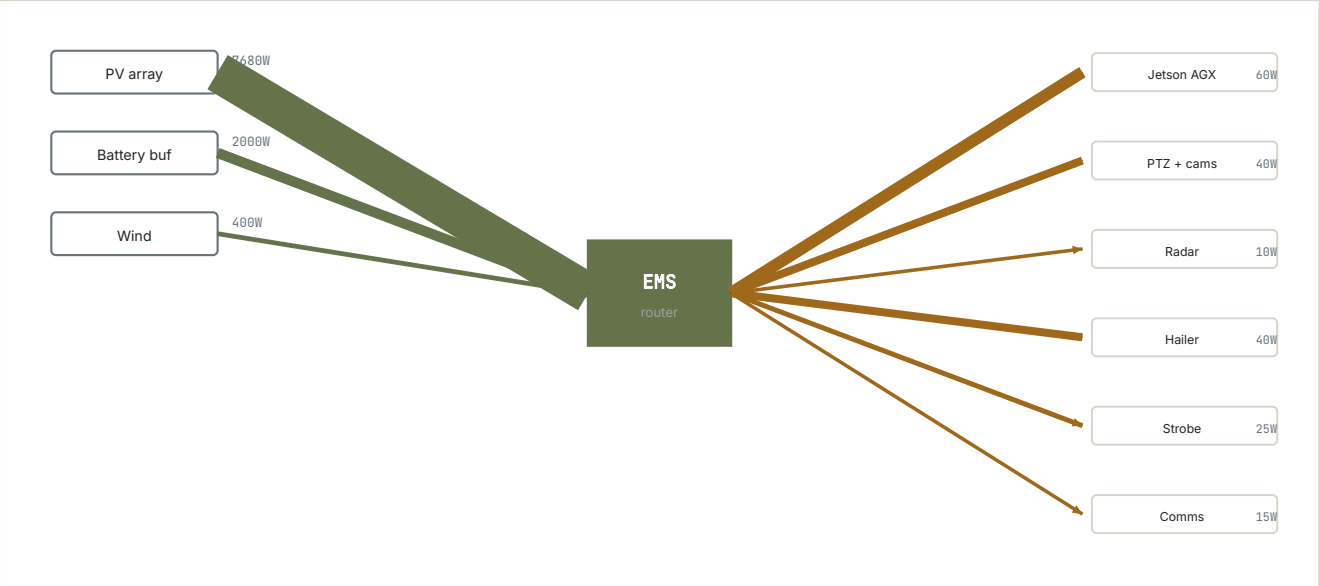
CIGS WRAP

360-degree cylinder skin Ø180-600. Best on ME and SkyHub bodies.

Three PV processes turn the pole body into the generating surface: rigid glass for fixed high yield, thin-film for mobile and curved forms, CIGS wrap for cylindrical bollard and hub sections.

Energy Sankey and load budget

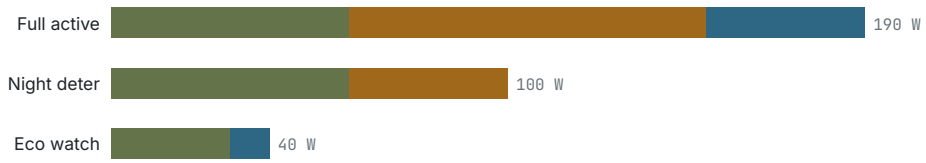
12 m OCT480 reference



7680 W	7680 W	2688 W	3–10 days	15 kWh
NOMINAL STC	AS-BUILT STC	ON-SITE PEAK	AUTONOMY (CUSTOMISABLE)	STORAGE

> Three PV output bases keep the spec honest: nominal STC, as-built STC and a conservative on-site peak. The OCT480 12 m pole rates 7680 W nominal and a conservative 2688 W on-site peak.

Battery endurance and low-power modes

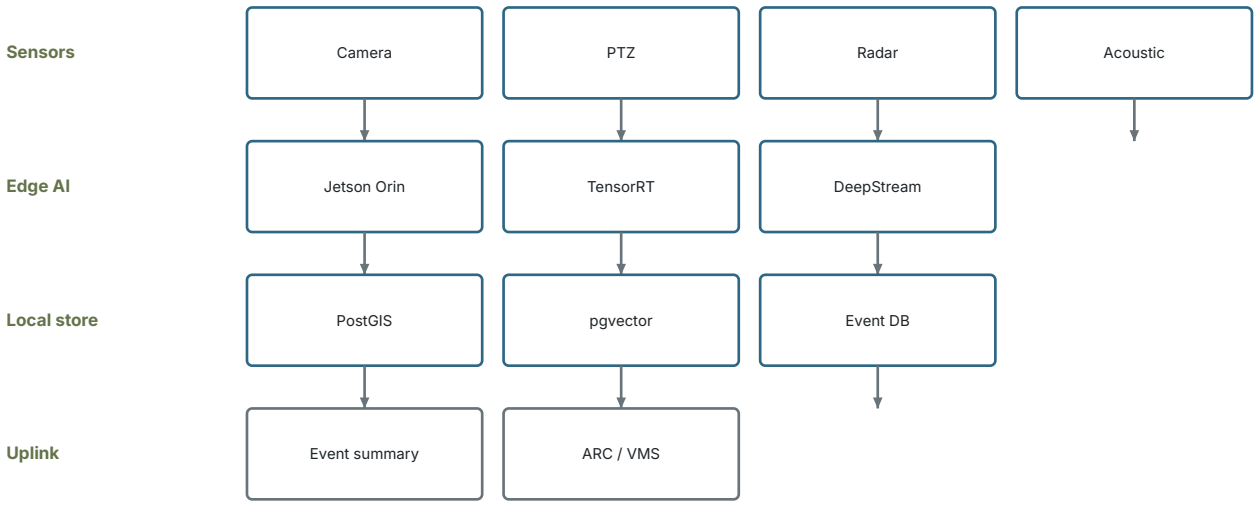


3500 cycles	80 %	3–10 days	3 tiers	CATL
LIFEPO4 LIFE	DEPTH OF DISCHARGE	AUTONOMY (CUSTOMISABLE)	POWER MODES	OR CUSTOMER-SPECIFIED

Tiered low-power modes trade deterrence for endurance: full active near 190 W, night deter near 100 W, eco watch near 40 W. SOH/SOC prediction turns cloudy-day survival into a visible engineering parameter.

Sovereign edge architecture

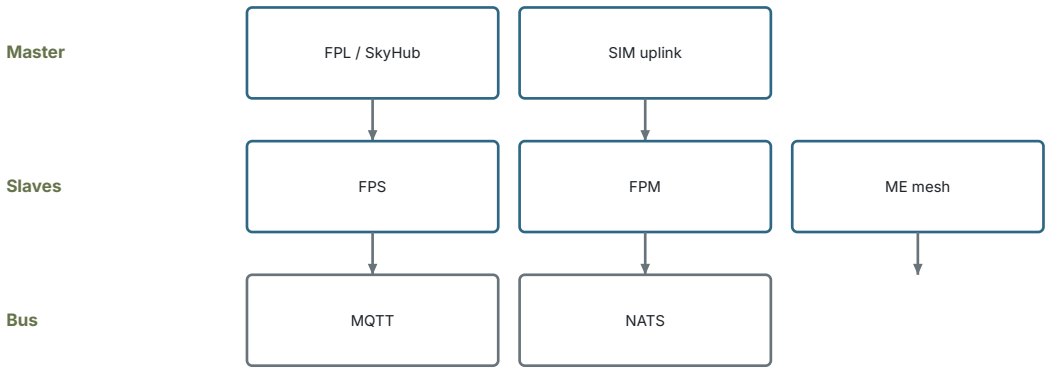
data kept on-site



LAYER	COMPONENTS	ROLE
Sensors	Camera / PTZ / Radar / Acoustic	Capture
Edge AI	Jetson Orin / TensorRT / DeepStream	Local inference
Local store	PostGIS / pgvector	On-site state
Uplink	Event summary / ARC / VMS	Event-only egress

> Sentinel runs inference on-pole with Jetson Orin, TensorRT and DeepStream. Only event summaries leave the node; raw data and identity stay local, and the loop degrades soft when the network drops.

Master-slave cascade network



1 master CELLULAR UPLINK	N slaves LOCAL CASCADE	MQTT NATS MESSAGE BUS	~70 % SIM COST CUT	fail-soft ON NETWORK DROP

> A master pole carries the cellular uplink; slave poles cascade over MQTT and NATS, cutting SIM and platform cost across large arrays while keeping local autonomy at every node.

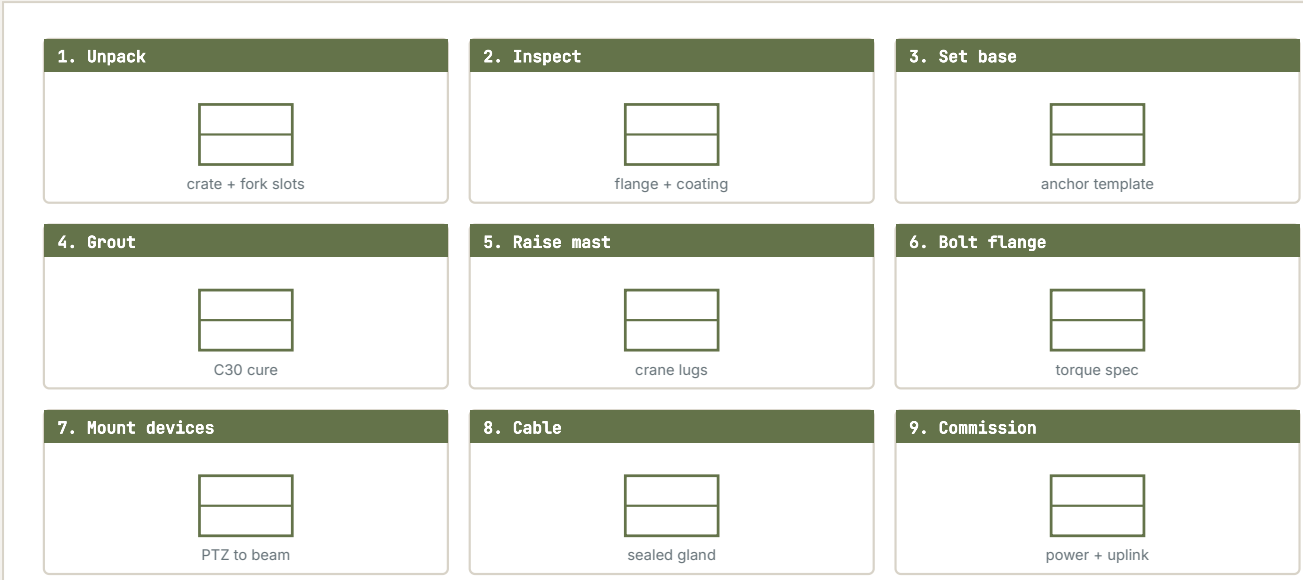
Foundation, anchor and flange system



FAMILY	FLANGE	BOLTS	FOUNDATION
ME	Ø350x10	6	Surface plate
FPS	Ø400-500x16	8 M24	Concrete pad
FPM	Ø600x20	8-12 M30	Reinforced footing
FPL / SkyHub	Ø850x25	12 M30	C30 RC, per site

Flange and anchor scale with pole class: ME on a Ø350×10 plate with 6 bolts up to FPL on a Ø850×25 plate with 12 M30 anchors on a C30 reinforced-concrete foundation, sized per site against overturning.

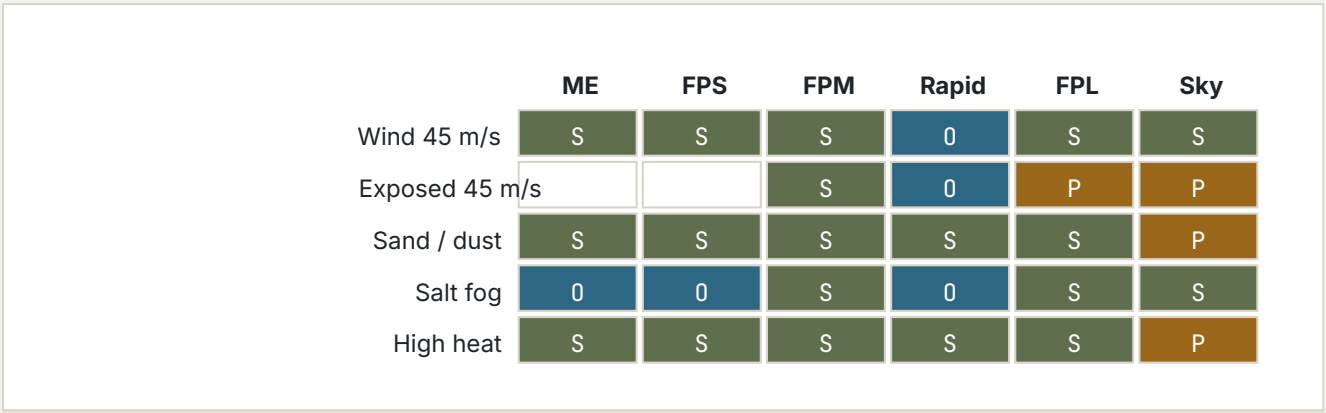
Transport, lifting and field assembly



STAGE	EQUIPMENT	ACCEPTANCE CHECK
Foundation	Anchor template	Bolt torque to spec
Lift	Crane lugs	Plumb within tolerance
Flange	Torque wrench	M30 preload
Devices	Mount platform	PTZ / beam alignment
Commission	Meter + app	Power and uplink live

> Field assembly follows a fixed nine-step sequence from crate to commissioning. Fork slots, crane lugs and a bolt-on flange keep a 12 m pole installable with standard site equipment.

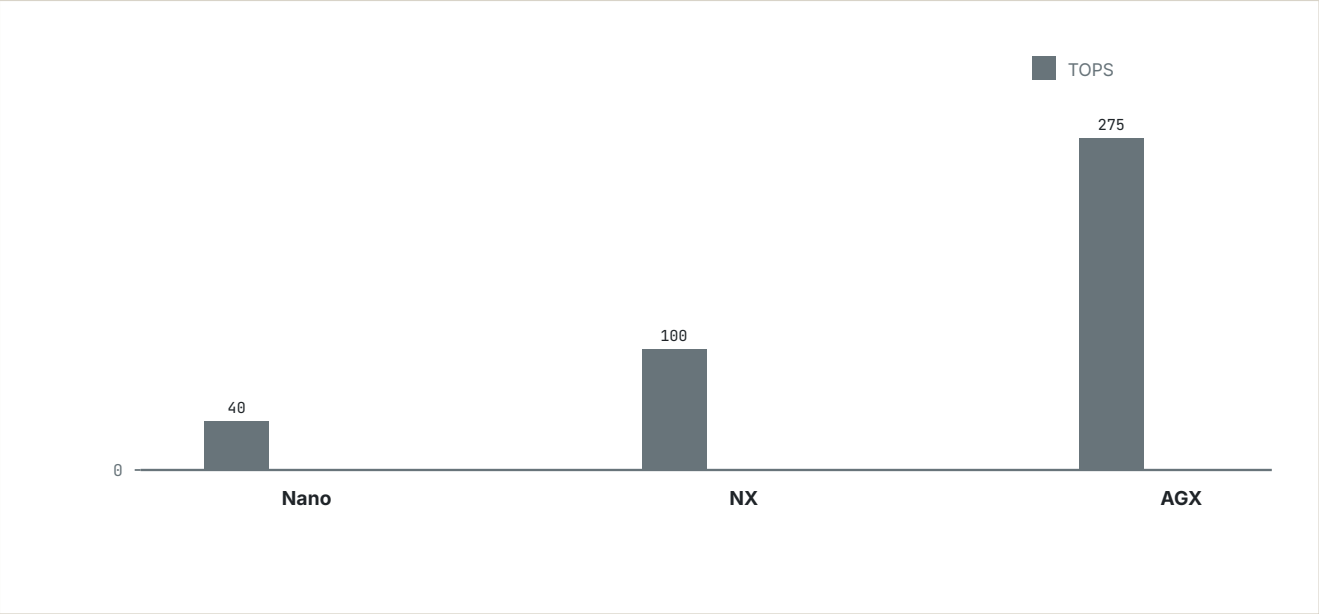
Wind class and site risk matrix



ENVIRONMENT	MATERIAL	BASE
Coastal salt fog	SUS316L / 2205 duplex	Sealed footing
Desert sand	Al alloy + coating	Reinforced
High heat	Stainless / coated	Ventilated
Standard	Stainless steel	Concrete pad

Wind class, base type and environment drive family selection. Stainless and 2205 duplex handle salt fog and coastal sites; ballast and trailer bases trade fixed wind rating for mobility.

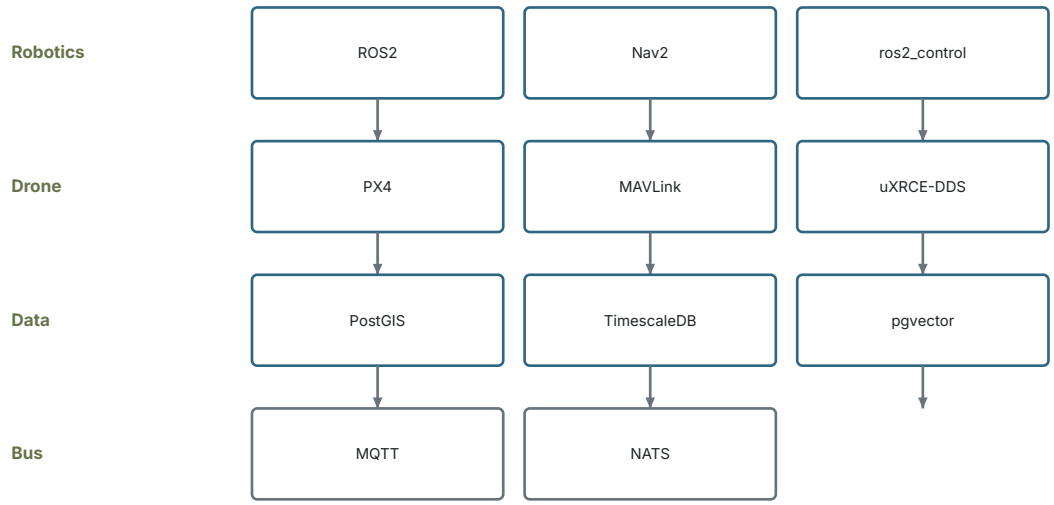
Edge AI compute stack



FAMILY	COMPUTE CLASS	TOPS	TYPICAL STREAMS
ME	MCU	class	Internal IoT
FPS	Orin Nano	40	2-4
FPM / Rapid	Orin NX	100	6-8
FPL / SkyHub	Orin AGX	275	12+

The ME bollard runs an MCU class; poles scale Orin Nano 40 to NX 100 to AGX 275 TOPS. TensorRT and DeepStream run multi-stream detection on-pole; model OTA pushes farm, airport, oilfield and rail scene packs without site visits.

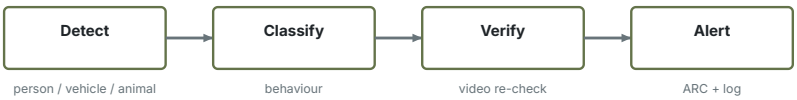
Robot, drone and data middleware stack



DOMAIN	STACK	RESPONSIBILITY
Robotics	ROS2 / Nav2 / ros2_control	Navigation + control
Drone	PX4 / MAVLink / uXRCE-DDS	Flight + bridge
Data	PostGIS / TimescaleDB / pgvector	Spatial / time / vector
Bus	MQTT / NATS	Messaging

> The project-scoped middleware layer is standard open infrastructure: ROS2 and Nav2 for robots, PX4 and MAVLink for drones, PostGIS and pgvector for spatial and vector state, MQTT and NATS for messaging.

Perimeter AI core



AI Perimeter Intrusion

STANDARD

WHAT	Detects people, vehicles, animals, loitering, climbing, crossing, and dwell events.
HOW	Jetson Orin Nano runs TensorRT models on DeepStream video locally.
STACK	camera,PTZ
MOAT	Off-grid local judgment fits remote critical sites.
FIT	FPS

Anti-Masking

STANDARD

WHAT	Alerts on lens covering, spray, deflection, strong light, and contamination.
HOW	DeepStream quality checks run on Jetson Orin Nano with MQTT/NATS alerts.
STACK	camera,PTZ
MOAT	Software subscription protects unattended assets.
FIT	FPS

Tamper-Vibration-Tilt-Door

OPTIONAL

WHAT	Links cabinet, vibration, tilt, and door events to evidence capture.
HOW	Contact sensors trigger DeepStream recording and MQTT/NATS cloud notification.
STACK	contact,camera,strobe
MOAT	Internal electrical bay improves tamper coverage.
FIT	FPS

> On-pole AI detects intrusion, climbing, crossing and loitering, with anti-masking and tamper sensing. Off-grid local judgment fits remote critical sites a cloud camera cannot serve.

Perimeter sensor fusion

	Day	Night	Dust	Rain
Camera AI	S	O	O	O
IR beam	S	S	O	O
mmWave radar	S	S	S	S

Active IR Beam

OPTIONAL

WHAT	Creates invisible perimeter lines and confirms trips with video AI.
HOW	Contact beams send MQTT/NATS events; Jetson Orin Nano verifies DeepStream clips.
STACK	contact,camera
MOAT	Low-post beam mesh covers ground details towers miss.
FIT	ME

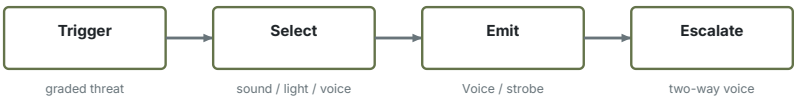
mmWave Radar

OPTIONAL

WHAT	Fills detection gaps in dust, darkness, glare, and low visibility.
HOW	Radar tracks fuse with TensorRT vision on Jetson Orin NX.
STACK	radar,camera
MOAT	Desert deployment data tunes real thresholds.
FIT	FPM

IR beam and mmWave radar cover camera blind spots in sand, night and low light, with every beam trip cross-checked by video AI to cut the false alarms that plague standalone beams.

Active deterrence hardware



Directional Hailer

OPTIONAL

WHAT	Warns intruders with targeted remote or automatic voice messages.
HOW	MQTT/NATS triggers speaker playback from Jetson Orin Nano event rules.
STACK	speaker,camera
MOAT	Eight-language voice library localizes deterrence.
FIT	FPS

Strobe Beacon

OPTIONAL

WHAT	Escalates night events with visible warning and evidence marking.
HOW	Jetson Orin Nano rules trigger strobe over MQTT/NATS after verification.
STACK	strobe,camera
MOAT	Deterrence is policy-driven, not isolated hardware.
FIT	FPS

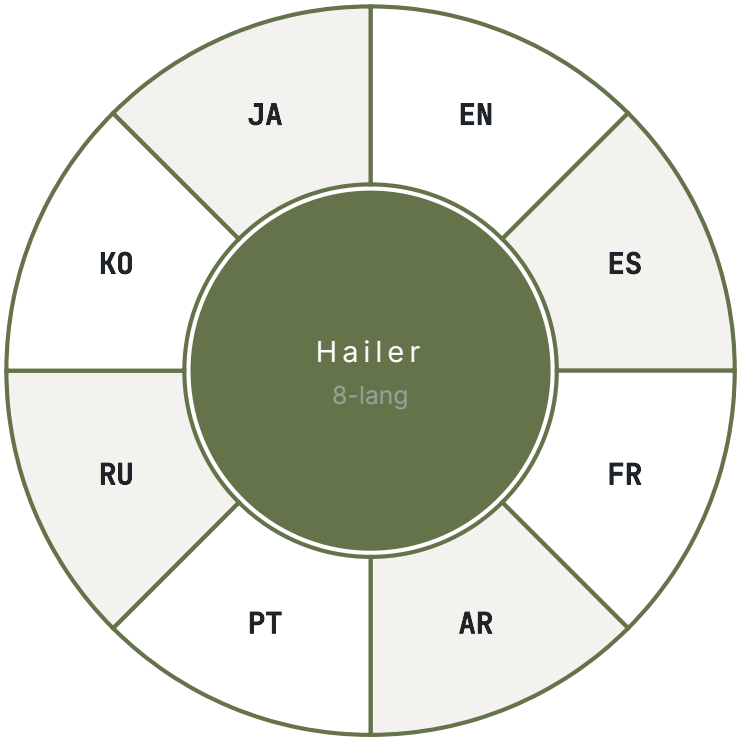
Ultrasonic Deterrent

OPTIONAL

WHAT	Discourages birds, rodents, and bats by target and time window.
HOW	Jetson Orin Nano schedules speaker frequencies through MQTT/NATS deterrence policies.
STACK	speaker,acoustic,camera
MOAT	Wildlife behavior rules convert hardware into managed response.
FIT	ME

> Layered deterrence adds a directional hailer, strobe beacon and frequency-banded ultrasonic, chained by a strategy engine so the response matches target type and time of day, not just raw volume.

Multimodal deterrence strategy engine



Multimodal Deterrence Engine

STANDARD

WHAT	Combines sound, light, and ultrasonic actions by target and schedule.
HOW	TensorRT classification drives MQTT/NATS policies for speaker and strobe devices.
STACK	speaker,strobe,camera
MOAT	Closed-loop strategy beats hardware stacking.
FIT	FPS

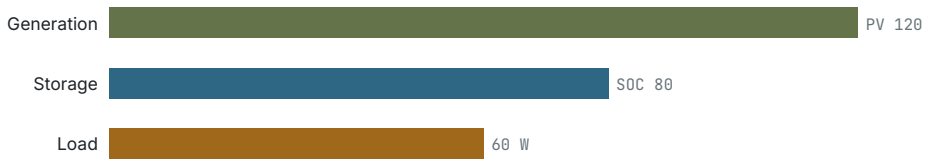
Two-Way Voice

OPTIONAL

WHAT	Operators speak with field personnel or intruders from the app.
HOW	MQTT/NATS audio sessions route through Jetson Orin Nano edge nodes.
STACK	speaker,acoustic,camera
MOAT	Remote talkdown matches security operations workflow.
FIT	FPS

A strategy engine sequences sound, light, ultrasonic and voice by species and schedule, delivered as eight-language hailing including Arabic RTL. No competitor pairs graded deterrence with local-language voice.

Energy autonomy software



Power-Budget Engine

STANDARD

WHAT	Shows whether the site survives cloudy days under selected loads.
HOW	BMS battery telemetry and MQTT/NATS feed Jetson Orin Nano budgets.
STACK	contact,screen
MOAT	Engineering power model prevents oversold configurations.
FIT	FPS

SOH-SOC Prediction

STANDARD

WHAT	Predicts battery health, runtime, and replacement risk across fleets.
HOW	BMS telemetry, PostGIS assets, and Jetson Orin Nano models forecast SOH.
STACK	contact,screen
MOAT	Large-scale fleet data makes predictions credible.
FIT	FPS

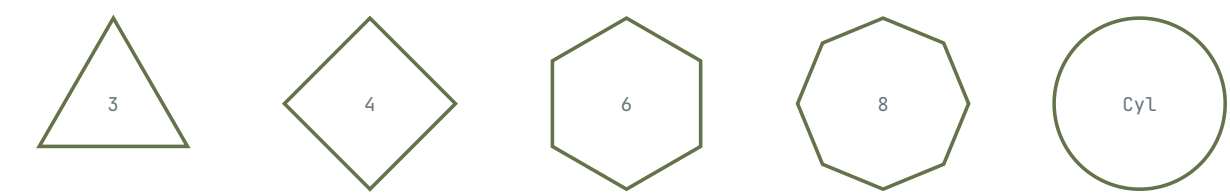
Tiered Low-Power

STANDARD

WHAT	Preserves sensing and key recording while shedding high-load deterrence.
HOW	Jetson Orin Nano applies MQTT/NATS load policies from battery state.
STACK	contact,camera,speaker
MOAT	Remote systems keep core security alive.
FIT	FPS

A power-budget engine turns can it survive the rainy season into a visible parameter; SOH and SOC prediction flag battery health across thousand-pole projects, and tiered modes protect critical recording at low charge.

Energy autonomy hardware options



Triangle	Square	Hexagon	Octagon	Cylinder
289 / 554	250 / 480	433 / 831	604 / 1159	Ø180-600

across-flats / across-corners (mm)

Three PV Processes

OPTIONAL

WHAT	Matches crystalline glass, flexible film, or CIGS PV to pole form.
HOW	MQTT/NATS collects PV output; PostGIS compares site and product data.
STACK	contact
MOAT	Integrated PV is cleaner and harder to vandalize.
FIT	FPL

Wind-Solar Hybrid

OPTIONAL

WHAT	Adds small wind generation only where wind resource justifies cost.
HOW	Jetson Orin Nano monitors turbine and PV telemetry over MQTT/NATS.
STACK	contact
MOAT	Power model decides site-specific hybrid value.
FIT	Rapid

> Three PV processes and an optional wind-solar hybrid let the pole body generate on its own surface. Integrated bodywork is harder to vandalise than the bolt-on panels competitors hang off a tower.

Edge vision and sensor intelligence

	Person	Vehicle	Animal	Bird	Sand
Classifier	S	S	S		
Bird flock				S	
Fusion	S	S	S	S	S

Human-Vehicle-Animal Classifier

STANDARD

- **WHAT** Classifies perimeter targets before alarms, deterrence, or reporting.
- **HOW** TensorRT models run on DeepStream with Jetson Orin Nano.
- **STACK** camera,PTZ
- **MOAT** Baseline AI supports both security and Wildlife packages.
- **FIT** FPS

Small-Target Bird Flock

STANDARD

- **WHAT** Detects small bird clusters for airport, PV, and agriculture risk.
- **HOW** Jetson Orin NX runs TensorRT small-object models on DeepStream streams.
- **STACK** camera,PTZ
- **MOAT** Bird datasets create specialized differentiation.
- **FIT** FPM

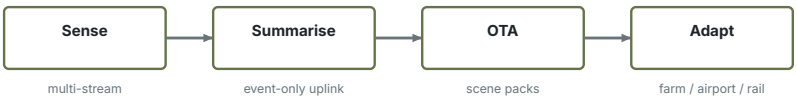
Multi-Sensor Fusion

STANDARD

- **WHAT** Combines camera, beam, radar, vibration, and environment signals before alarms.
- **HOW** Jetson Orin NX fuses MQTT/NATS events with DeepStream metadata.
- **STACK** camera,radar,contact
- **MOAT** Fusion lowers false alarms in harsh sites.
- **FIT** FPM

> A human-vehicle-animal classifier, a hard small-target bird-flock detector and a multi-sensor fusion rule engine fuse camera, beam, radar, vibration and environment into one graded decision on the edge.

Edge AI operations



Local Event Summary

STANDARD

WHAT	Uploads key snapshots and clips instead of continuous raw video.
HOW	DeepStream summaries and pgvector evidence run on Jetson Orin Nano.
STACK	camera,screen
MOAT	Cuts cellular and cloud costs for remote fleets.
FIT	FPS

Environmental Anomaly

STANDARD

WHAT	Flags dust, rain, lens pollution, and confidence degradation.
HOW	Jetson Orin Nano analyzes DeepStream quality metrics and sensor telemetry.
STACK	camera,contact
MOAT	Operations know when AI confidence changes.
FIT	FPS

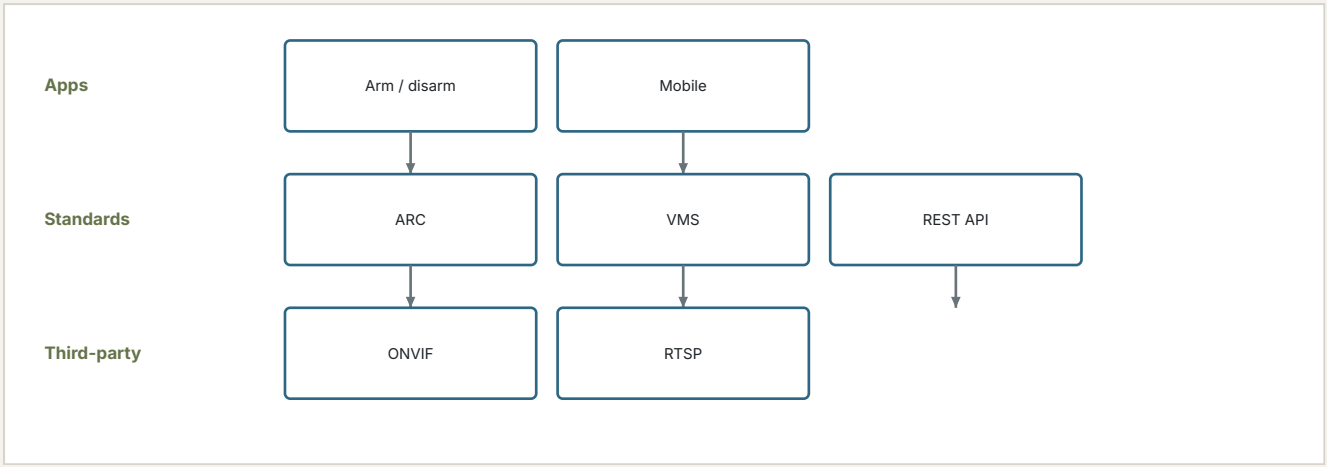
Model OTA Scene Packs

STANDARD

WHAT	Delivers farm, airport, oilfield, and rail rule packs per site.
HOW	MQTT/NATS deploys signed TensorRT models to Jetson Orin devices.
STACK	camera,radar,contact
MOAT	Scene data shifts SOLARTODO toward algorithm products.
FIT	FPS

> Local event summaries cut 4G and cloud cost; environmental anomaly detection lowers confidence under sand and lens contamination; model OTA pushes farm, airport, oilfield and rail scene packs without site visits.

Platform integration layer



Arm-Disarm App

STANDARD

WHAT	Remote teams arm zones, silence maintenance windows, and review alarms.
HOW	MQTT/NATS syncs app commands with Jetson Orin Nano edge rules.
STACK	screen,camera
MOAT	Completes the security workflow around the pole.
FIT	FPS

ARC-VMS-API

STANDARD

WHAT	Connects alarms, evidence, and device status to monitoring centers.
HOW	ONVIF/RTSP, MQTT/NATS, and PostGIS expose verified event data.
STACK	camera,screen
MOAT	B2B tenders require platform integration depth.
FIT	FPS

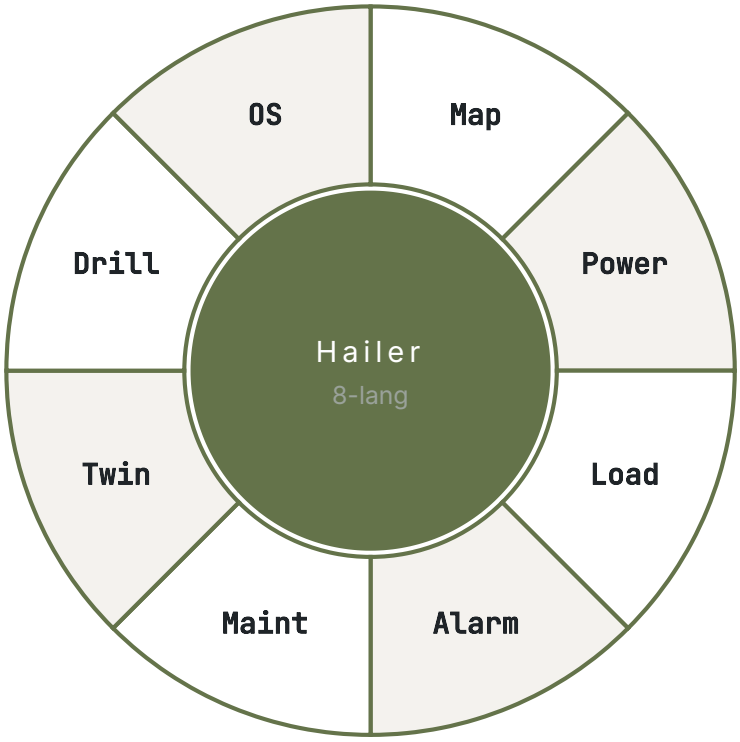
ONVIF Third-Party Camera

STANDARD

WHAT	Adds existing cameras into Sentinel AI and event workflows.
HOW	ONVIF/RTSP feeds DeepStream on Jetson Orin NX for reuse.
STACK	camera,PTZ
MOAT	Retrofit path expands accounts beyond new poles.
FIT	FPS

App arm and disarm, ARC, VMS and open REST APIs meet B2B tender requirements, while ONVIF and RTSP ingest existing third-party cameras so Sentinel upgrades a brownfield site instead of replacing it.

Operations twin and smartcity OS



Master-Slave Cascade

OPTIONAL

WHAT	Clusters towers to reduce SIM, platform, and backhaul costs.
HOW	MQTT/NATS links local nodes; Jetson Orin NX aggregates events.
STACK	camera,contact
MOAT	Fleet topology lowers operating expense.
FIT	FPM

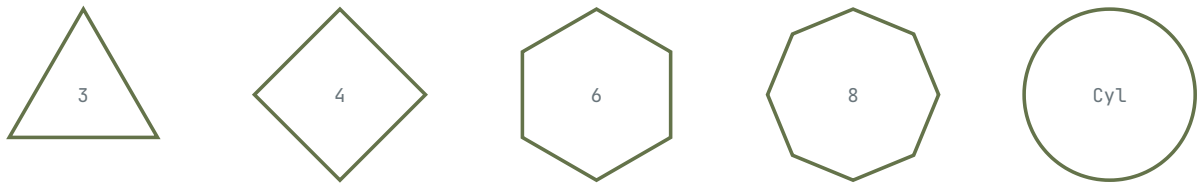
Operations Digital Twin

STANDARD

WHAT	Shows battery, PV, load, alarms, and maintenance for every pole.
HOW	PostGIS assets, MQTT/NATS telemetry, and Jetson Orin summaries feed OS.
STACK	screen,contact,camera
MOAT	Existing smartcity OS accelerates deployment.
FIT	FPL

Master-slave cascade and an operations digital twin track every pole battery, PV, load and alarm. The smartcity /os console already provides the cinematic operable base; Wildlife and perimeter modules drop in.

Rapid deployment forms



Triangle	Square	Hexagon	Octagon	Cylinder
289 / 554	250 / 480	433 / 831	604 / 1159	Ø180-600

across-flats / across-corners (mm)

Telescopic Square Pole

OPTIONAL

WHAT	Raises 4-8m square poles for field-of-view and service access.
HOW	MQTT/NATS reports actuator and safety state to Jetson Orin Nano.
STACK	contact,camera
MOAT	Starts lift engineering at practical height.
FIT	Rapid

Mobile Ballast Base

OPTIONAL

WHAT	Deploys Sentinel without foundations for temporary blind spots.
HOW	Jetson Orin Nano keeps local AI and power budgets portable.
STACK	camera,contact
MOAT	Rapid placement avoids civil works delays.
FIT	Rapid

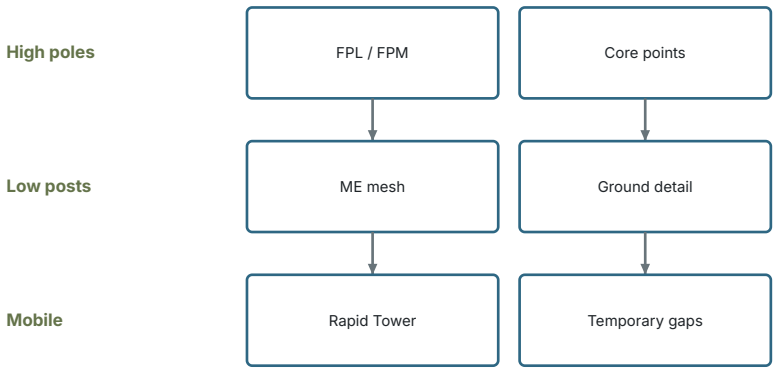
Trailer Rapid Tower

OPTIONAL

WHAT	Provides fast 6-8m surveillance and deterrence for temporary sites.
HOW	Jetson Orin NX runs DeepStream, power budgets, and MQTT/NATS alerts.
STACK	camera,PTZ,speaker,strobe
MOAT	Escapes low-price fixed-pole competition.
FIT	Rapid

> Telescopic square poles, mobile ballast bases and a trailer-mounted Rapid Tower deploy without foundations for construction, camps, farms and plant sites, validated first at 6-8 m before any 12 m heavy mast.

High-low system deployment



ME-15 Low-Post Mesh

OPTIONAL

WHAT	Covers low-level beams, vibration, access, environment, and animal triggers.
HOW	ME contacts stream MQTT/NATS events to Jetson Orin Nano verification.
STACK	contact,camera,e-nose
MOAT	Dense low-post arrays capture ground details towers miss.
FIT	ME

High-Low System Solution

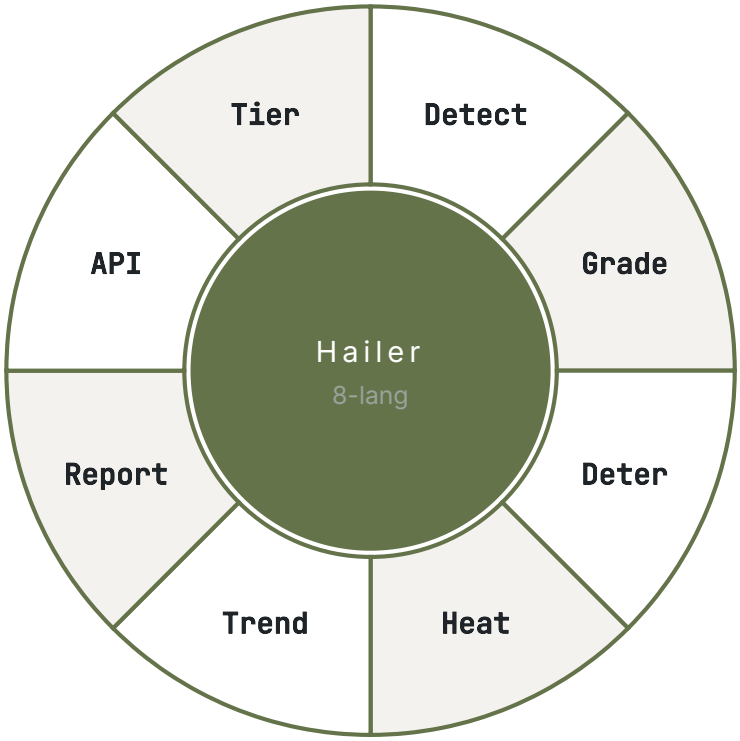
PROJECT-SCOPED

WHAT	Combines high fixed poles, mobile towers, and low posts by site risk.
HOW	PostGIS planning and MQTT/NATS events unify ME, FPS, Rapid, FPL.
STACK	camera,contact,PTZ
MOAT	System configuration capability beats single-product sellers.
FIT	FPL

Fixed high poles cover core points, ME-15 bollard mesh covers ground detail a tower cannot see, and mobile towers fill temporary gaps. The system turns single-product sales into a configurable site solution.

Wildlife AI three-tier product

the largest differentiator



Wildlife Detect

STANDARD

WHAT	Alerts on animal entry, bird flocks, and human-vehicle-animal classes.
HOW	TensorRT wildlife models run on DeepStream with Jetson Orin Nano.
STACK	camera,PTZ
MOAT	Treats animals as managed business objects.
FIT	FPS

Wildlife Deter

OPTIONAL

WHAT	Links ultrasonic, hailer, and strobe responses to species risk and time.
HOW	Jetson Orin Nano policies drive speaker and strobe devices over MQTT/NATS.
STACK	speaker,strobe,camera
MOAT	Deterrence strategy adapts by scene and behavior.
FIT	ME

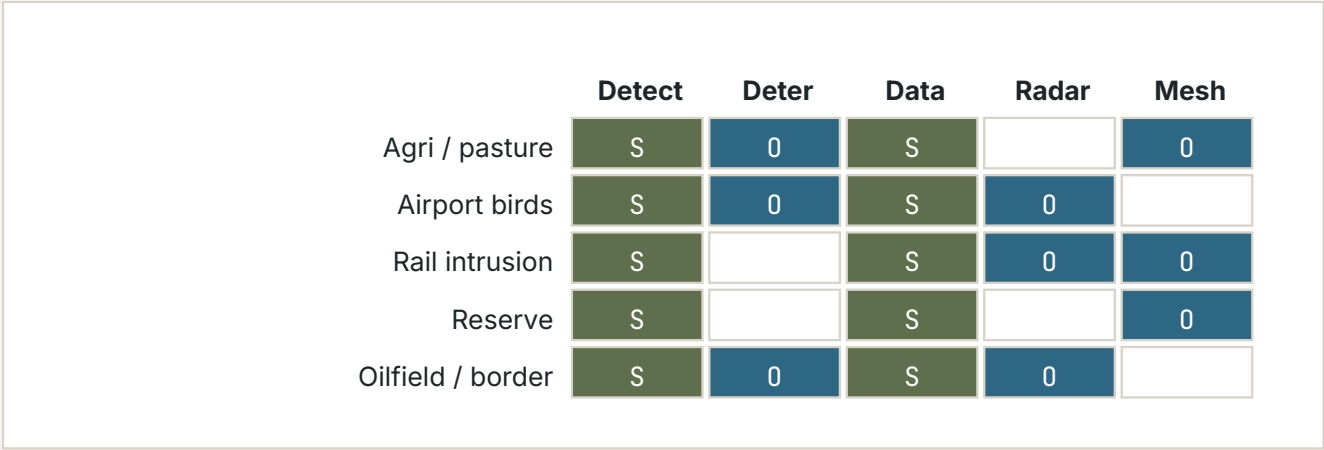
Wildlife Intelligence

STANDARD

WHAT	Reports species groups, activity heatmaps, seasonal trends, and risk summaries.
HOW	DeepStream summaries store in PostGIS and pgvector for API reporting.
STACK	camera,acoustic,screen
MOAT	Wildlife datasets become recurring software value.
FIT	FPM

Competitors discard animals as noise; Sentinel manages them as business objects. Detect grades intrusion, Deter adds targeted ultrasonic and hailing, Intelligence sells species, heat-map and trend data as a high-margin subscription.

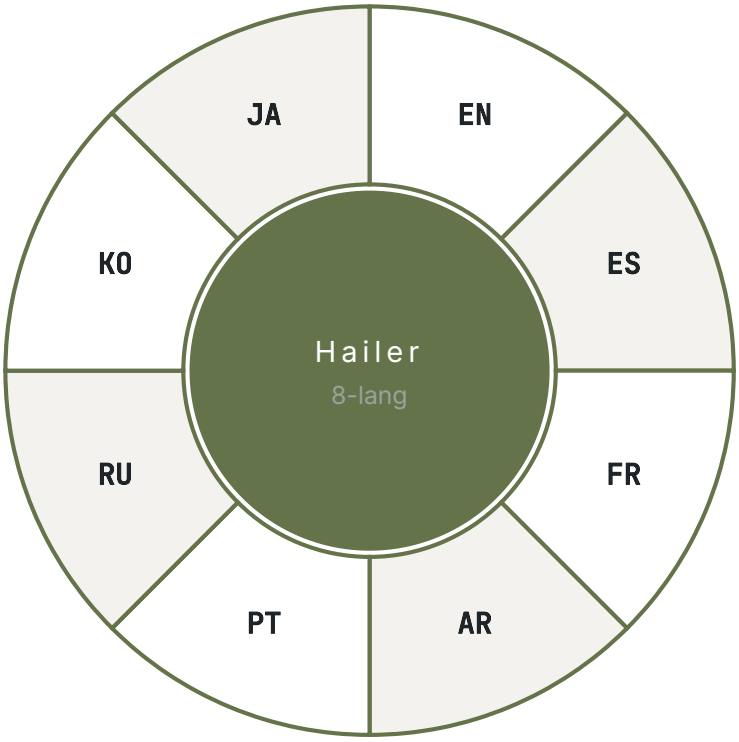
Wildlife vertical applications



SECTOR	TARGETS	CONFIGURATION
Agri / pasture	Livestock, fence breach	ME mesh + Detect
Airport	Bird flocks	Bird detect + deter
Rail	Animals, debris	Beam + AI re-check
Reserve	Anti-poaching	ME + high node
Oilfield / border	Mixed intrusion	Radar + thermal

Five sectors turn a competitor blind spot into a managed asset: agriculture and pasture, airport bird hazard, rail intrusion, conservation reserves and oilfield or border camps, each with a different species data set.

Defensible moats I



EIGHT-LANGUAGE DETERRENCE STANDARD

Voice hailing in en/es/fr/ar/pt/ru/ko/ja with Arabic RTL. Local-voice warning no competitor, including DREAM, offers. Best-fit FPM/FPL.

SMARTCITY /OS CONSOLE STANDARD

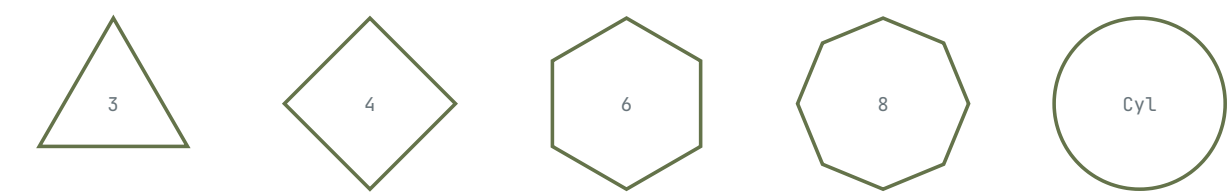
Cinematic operable twin with a day-night engine and fault drills. Wildlife and perimeter modules drop onto an existing base, not a blank screen. Best-fit all families.

REAL PROJECT PROOF PROJECT-SCOPED

Large-scale pole deployments and the ME-15 IoT bollard line give oilfield and desert credibility a startup cannot show. Best-fit FPM/FPL.

Three moats competitors cannot copy quickly: native eight-language voice deterrence, a ready cinematic operations console, and real Middle-East project proof in oilfield and desert conditions.

Defensible moats II



Triangle	Square	Hexagon	Octagon	Cylinder
289 / 554	250 / 480	433 / 831	604 / 1159	Ø180-600

across-flats / across-corners (mm)

LOW-POST MESH ARRAY OPTIONAL

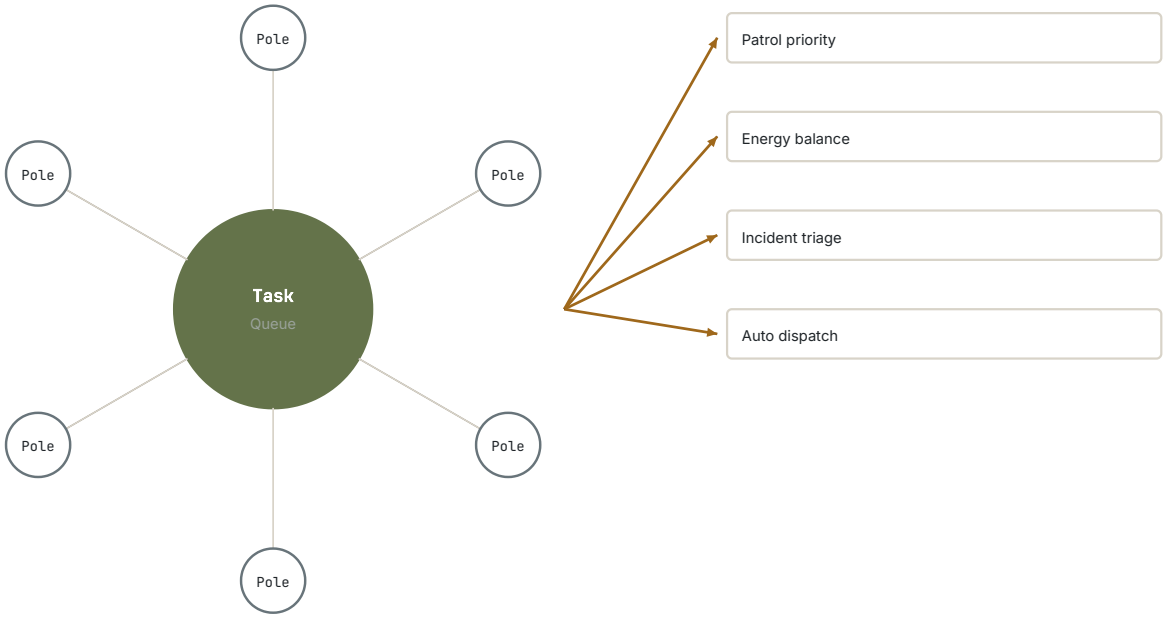
The 1.6 m ME bollard suits dense layout: multi-post IR-beam perimeter plus low animal triggers cover ground detail a mobile tower cannot reach.

INTEGRATED PV BODYWORK OPTIONAL

Mono glass, thin-film and CIGS chosen by form; pole-integrated PV is more aesthetic, more vandal-resistant and better for permanent infrastructure than bolt-on panels.

Two structural moats: a low-post bollard mesh that nets the ground a tower misses, and three pole-integrated PV processes that make the body itself the generating, harder-to-attack surface.

Autonomous City Agent Layer (1/3)



#1 Pole Council

PROJECT-SCOPED

WHAT	District poles vote patrol, energy, and incident priorities locally.
HOW	Jetson Orin NX runs agents over MQTT/NATS with PostGIS state.
STACK	camera,PTZ,contact
MOAT	City-scale pole quorum grows with deployments.
FIT	FPL

#2 Municipal Agent

PROJECT-SCOPED

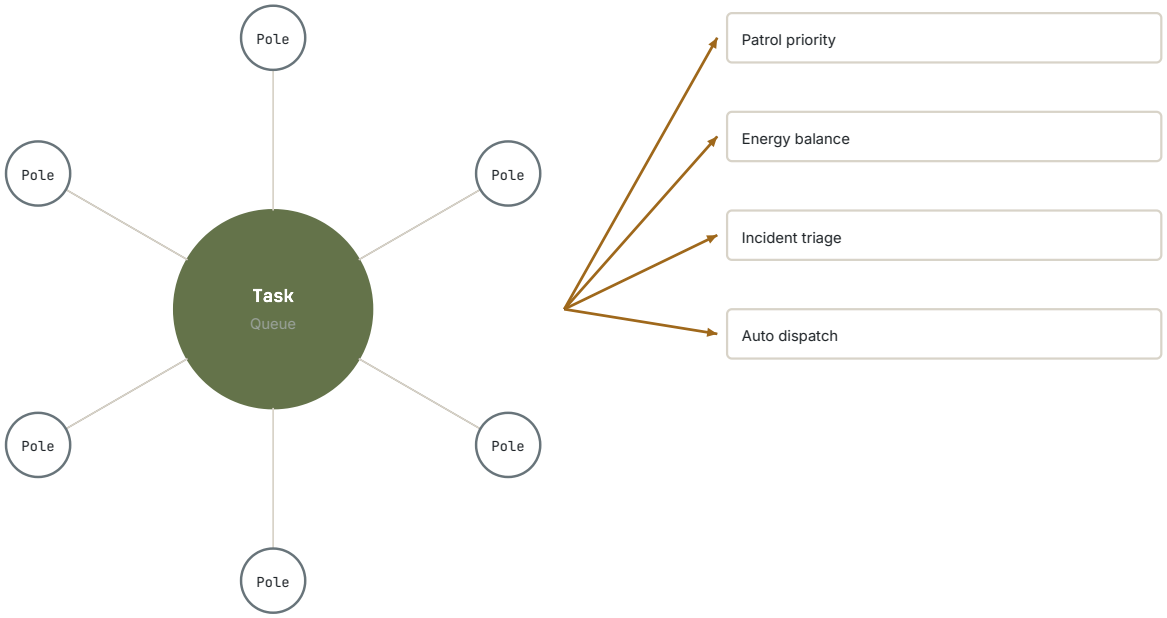
WHAT	AI triages faults, flooding, parking, and facility damage into work orders.
HOW	Jetson Orin NX, TensorRT, PostGIS, and MQTT/NATS route tasks.
STACK	camera,contact,screen
MOAT	Turns SOLARTODO OS into municipal operations layer.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#1 Pole Council PROJ #2 Municipal Agent PROJ #3 Task Auction Market PROJ #4 Adaptive Patrol Policy PROJ #5 Embodied Control Model PROJ #6 Anomaly Forecast Agent PROJ

> District pole groups vote patrol, energy and incident priorities locally, turning a field of devices into a city-scale self-organising layer competitors sell as isolated cameras.

Autonomous City Agent Layer (2/3)



#3 Task Auction Market — PROJECT-SCOPED

WHAT	Poles, drones, and robots bid for incidents by location, power, compute.
HOW	MQTT/NATS brokers bids; PostGIS ranks assets; ROS2+Nav2 dispatches robots.
STACK	camera,drone,robot
MOAT	Physical AI scheduling improves with every site.
FIT	SkyHub

#4 Adaptive Patrol Policy — PROJECT-SCOPED

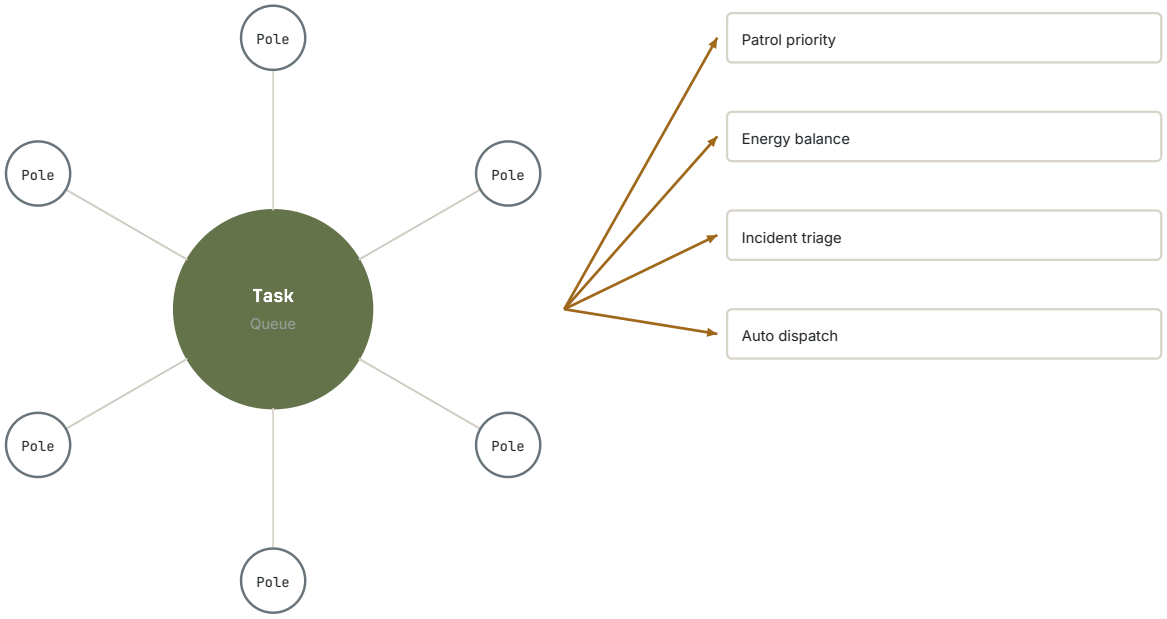
WHAT	Patrol routes, angles, and coverage density update from replayed incidents.
HOW	Jetson Orin AGX trains policies from DeepStream clips and PostGIS traces.
STACK	camera,PTZ,drone
MOAT	Customer city model becomes nonportable operational data.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#1 Pole Council PROJ #2 Municipal Agent PROJ #3 Task Auction Market PROJ #4 Adaptive Patrol Policy PROJ #5 Embodied Control Model PROJ #6 Anomaly Forecast Agent PROJ

> A task-auction market and self-evolving patrol let poles, drones and robots bid for work by location, charge and compute, so the city model grows more unique the longer it runs.

Autonomous City Agent Layer (3/3)



#5 Embodied Control Model — PROJECT-SCOPED

WHAT	One model controls poles, cameras, drones, robots, audio, lighting, energy.
HOW	Jetson Orin AGX runs TensorRT policies across PX4+MAVLink and ROS2+Nav2.
STACK	camera,drone,robot,speaker
MOAT	Unified hardware brain binds every SOLARTODO asset.
FIT	SkyHub

#6 Anomaly Forecast Agent — PROJECT-SCOPED

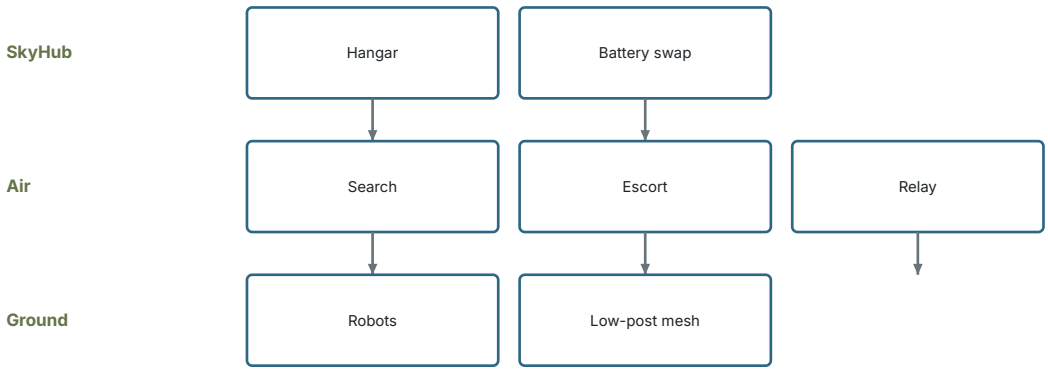
WHAT	Predicts crowd, traffic, fault, and energy stress before service loss.
HOW	PostGIS trends feed Jetson Orin NX inference and MQTT/NATS alerts.
STACK	camera,radar,contact
MOAT	Moves customers from response to rehearsal.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#1 Pole Council PROJ #2 Municipal Agent PROJ #3 Task Auction Market PROJ #4 Adaptive Patrol Policy PROJ #5 Embodied Control Model PROJ #6 Anomaly Forecast Agent PROJ

> One embodied foundation model drives poles, cameras, drones, robots, broadcast and energy, while an anomaly agent predicts crowding, congestion and shortage before they occur.

Air-Ground Swarm Operations (1/3)



#7 Swarm Search Grid — REGULATED

WHAT	Multiple drones scan people, vehicles, animals, fire, and pollution zones.
HOW	PX4+MAVLink coordinates drones; Jetson Orin NX runs TensorRT vision.
STACK	drone,camera,PTZ
MOAT	Pole grid plus air assets gives continuous low-cost coverage.
FIT	SkyHub

#8 Dynamic Containment Formation — REGULATED

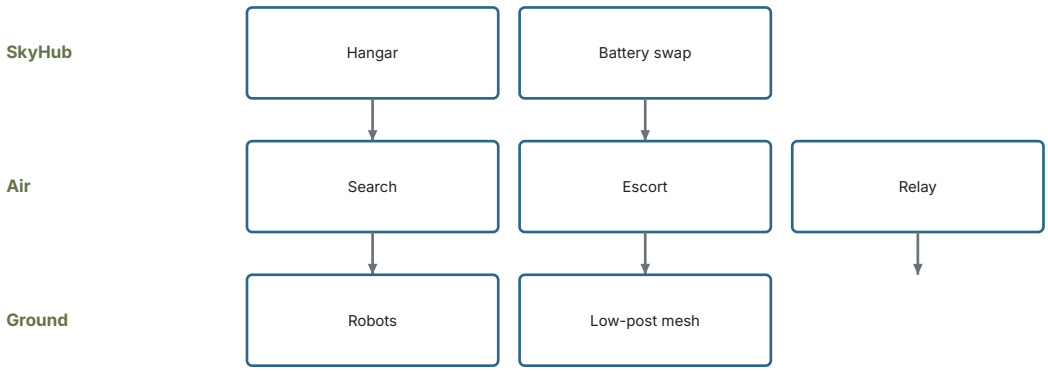
WHAT	Swarm forms fan, ring, or corridor patterns around moving targets.
HOW	PX4+MAVLink formation logic uses PostGIS tracks and MQTT/NATS commands.
STACK	drone,camera,speaker
MOAT	Air-ground geometry is native to SkyHub deployments.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#7 Swarm Search Grid REGU · #8 Dynamic Containment Formation REGU · #9 Compound-Eye Fusion PROJ · #10 Echo Motion Sensing OPTI · #11 E-Nose Pole Mesh OPTI · #12 Aerial Relay Chain REGU

> Drone swarms spread like a moving radar net and form fan, ring or corridor shapes around a target, giving fixed poles plus air a continuous low-cost coverage a single tower cannot match.

Air-Ground Swarm Operations (2/3)



#9 Compound-Eye Fusion — PROJECT-SCOPED

WHAT	City poles reconstruct multi-camera 3D trajectories across blind spots.
HOW	DeepStream streams to PostGIS; Jetson Orin AGX fuses camera tracks.
STACK	camera,PTZ,radar
MOAT	Single-camera vendors lack citywide viewpoint ownership.
FIT	FPL

#10 Echo Motion Sensing — OPTIONAL

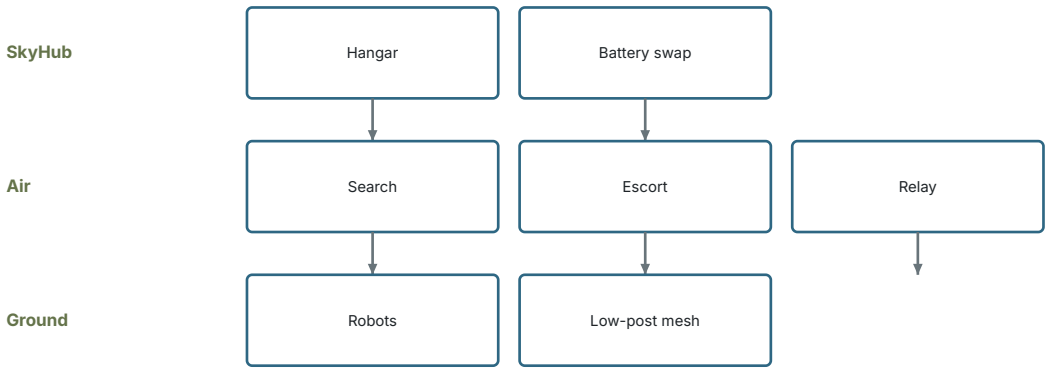
WHAT	Acoustic, ultrasonic, and radar cues reveal occluded movement and structures.
HOW	Jetson Orin NX fuses acoustic and radar signals with TensorRT classifiers.
STACK	acoustic,radar,camera
MOAT	Extends Sentinel beyond camera-only perception.
FIT	FPS

DOMAIN INDEX — 6 CONFIGURATIONS

#7 Swarm Search Grid REGU · #8 Dynamic Containment Formation REGU · #9 Compound-Eye Fusion PROJ · #10 Echo Motion Sensing OPTI · #11 E-Nose Pole Mesh OPTI · #12 Aerial Relay Chain REGU

> A pole compound-eye reconstructs city-scale 3D tracks, while echo and bat-style sensing read motion behind occlusion that camera-only systems miss.

Air-Ground Swarm Operations (3/3)



#11 E-Nose Pole Mesh — OPTIONAL

WHAT	Detects gas leaks, chemicals, smoke precursors, and animal odor patterns.
HOW	Jetson Orin Nano processes e-nose telemetry over MQTT/NATS.
STACK	e-nose,contact,camera
MOAT	Chemical sensing differentiates remote infrastructure monitoring.
FIT	ME

#12 Aerial Relay Chain — REGULATED

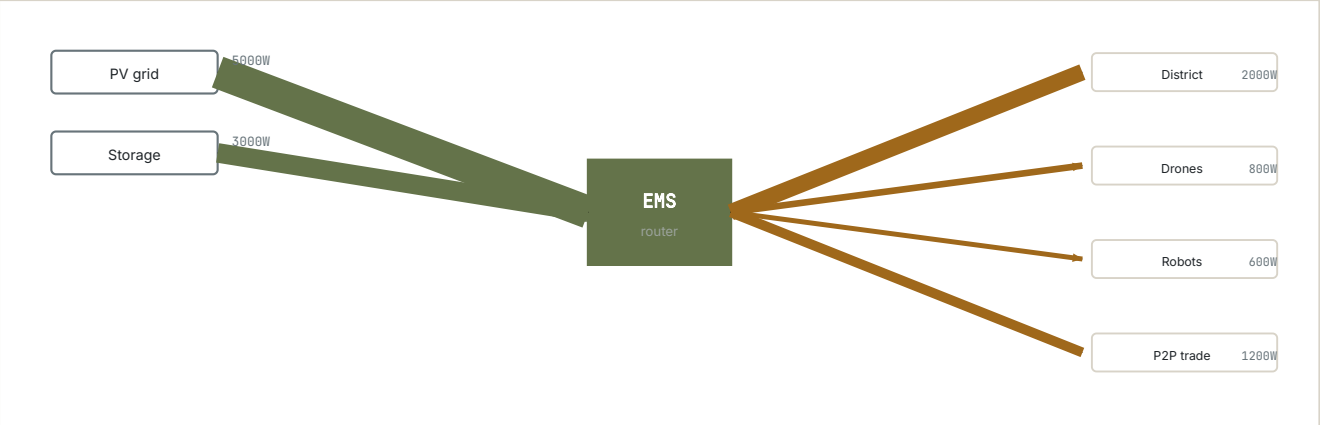
WHAT	Drones hand off long tracking missions as batteries rotate through hangars.
HOW	SkyHub battery-swap hangar, PX4+MAVLink, and PostGIS maintain tracks.
STACK	drone,camera,PTZ
MOAT	Battery-swap hangar enables persistent aerial presence.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#7 Swarm Search Grid REGU #8 Dynamic Containment Formation REGU #9 Compound-Eye Fusion PROJ #10 Echo Motion Sensing OPTI
#11 E-Nose Pole Mesh OPTI #12 Aerial Relay Chain REGU

> Electronic-nose poles extend sensing into chemical space, and an air relay chain hands tracking drone-to-drone, using the battery-swap hangar for continuous airborne presence.

Energy Routing and Resilience (1/3)



#13 Energy Routing Node — REGULATED

WHAT	Poles route stored solar power across a street-level energy mesh.
HOW	BMS battery telemetry, MQTT/NATS, and PostGIS manage metered energy flows.
STACK	contact,screen
MOAT	Combines energy, sensing, and compute in one pole grid.
FIT	FPL

#14 Aerial Swap Corridor — REGULATED

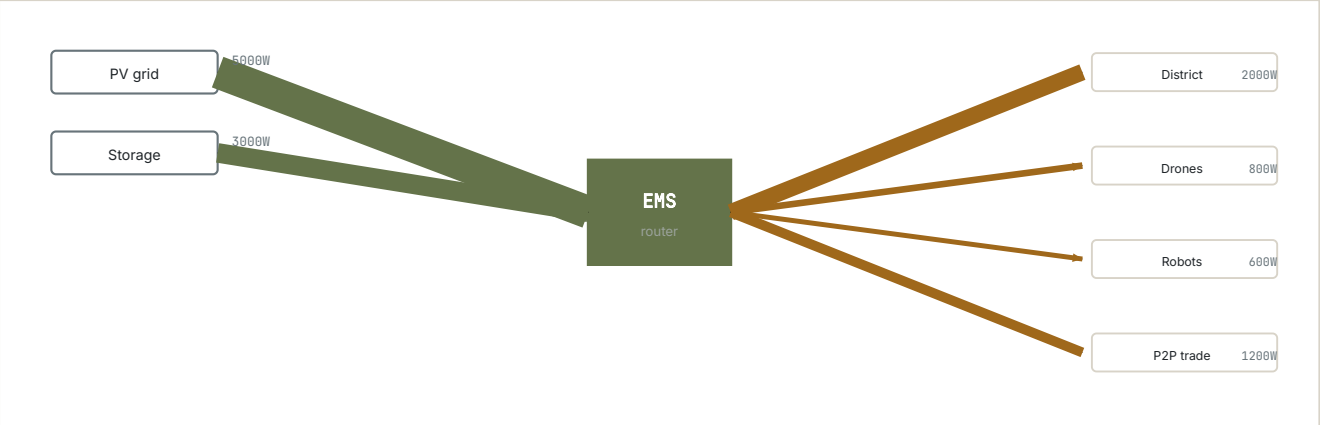
WHAT	Drones swap packs at pole nodes while moving through defined air lanes.
HOW	SkyHub battery-swap hangar coordinates swap windows through PX4+MAVLink.
STACK	drone,contact
MOAT	Turns short-endurance drones into scheduled city labor.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#13 Energy Routing Node REGU **#14** Aerial Swap Corridor REGU **#15** Robot Charging Bay PROJ **#16** Solar Urban Skin PROJ **#17** Integrated Battery Bay PROJ **#18** Carbon Ledger Engine REGU

> The pole becomes an energy router forming a block-level energy internet with P2P settlement, and an in-air recharge corridor turns drones from short-endurance tools into resident city labour.

Energy Routing and Resilience (2/3)



#15 Robot Charging Bay — PROJECT-SCOPED

WHAT	Ground robots queue at pole bases for autonomous charging and redeployment.
HOW	ROS2+Nav2 docks robots; MQTT/NATS reports power and queue state.
STACK	robot,contact,camera
MOAT	Pole bases become robot energy infrastructure.
FIT	FPL

#16 Solar Urban Skin — PROJECT-SCOPED

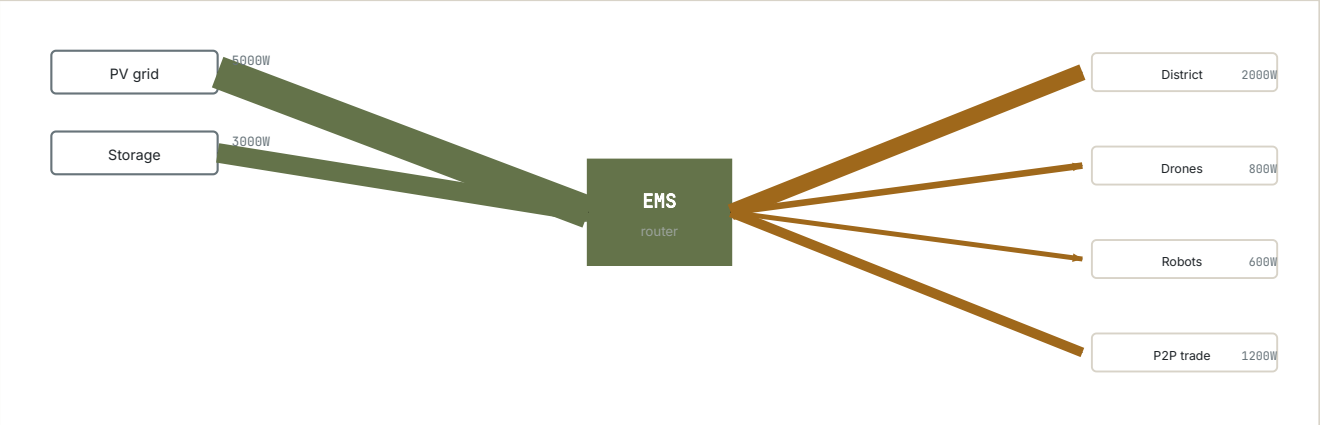
WHAT	Pole bodies, shelters, rails, and screens generate distributed solar power.
HOW	MQTT/NATS ingests PV telemetry; PostGIS maps generation by surface.
STACK	contact,screen
MOAT	Integrated PV forms outlast bolt-on panels.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#13 Energy Routing Node REGU · #14 Aerial Swap Corridor REGU · #15 Robot Charging Bay PROJ · #16 Solar Urban Skin PROJ · #17 Integrated Battery Bay PROJ · #18 Carbon Ledger Engine REGU

> Ground recharge points queue robots by OS schedule, and transparent PV turns pole bodies, shelters, railings and glass screens into generating surface, making city surface area an asset.

Energy Routing and Resilience (3/3)



#17 Integrated Battery Bay — PROJECT-SCOPED

WHAT	Pole integrates a sealed battery bay with thermal isolation.
HOW	BMS battery telemetry feeds Jetson Orin Nano power supervision.
STACK	contact,camera
MOAT	Energy density and pole packaging create hardware barrier.
FIT	FPL

#18 Carbon Ledger Engine — REGULATED

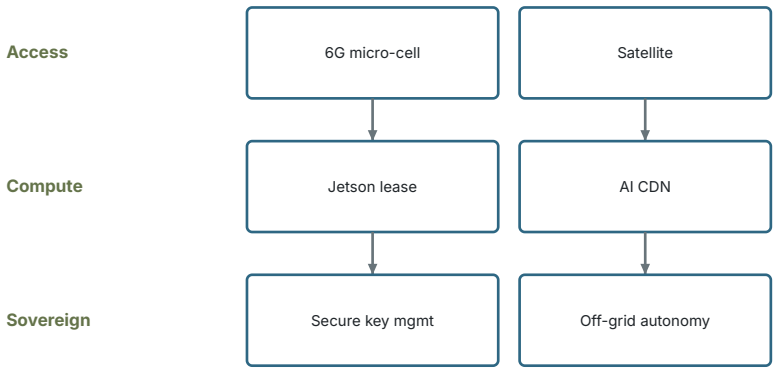
WHAT	Generates auditable carbon evidence from solar, storage, and avoided patrols.
HOW	PostGIS logs assets; MQTT/NATS captures meter data; pgvector stores evidence.
STACK	contact,camera,drone
MOAT	Transforms deployed hardware into carbon finance data.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#13 Energy Routing Node REGU · #14 Aerial Swap Corridor REGU · #15 Robot Charging Bay PROJ · #16 Solar Urban Skin PROJ · #17 Integrated Battery Bay PROJ · #18 Carbon Ledger Engine REGU

> Solid-state cells make the pole structure itself a storage unit, and a carbon-asset generator turns avoided diesel and patrol mileage into auditable, sellable carbon credits.

Sovereign Edge Network (1/3)



#19 Private Microcell Mesh — REGULATED

WHAT	SkyHub poles host private communications for city AI nodes.
HOW	Jetson Orin NX supervises network telemetry through MQTT/NATS and PostGIS.
STACK	contact,camera
MOAT	AI pole sites occupy strategic communications positions.
FIT	SkyHub

#20 Satellite Failover Link — OPTIONAL

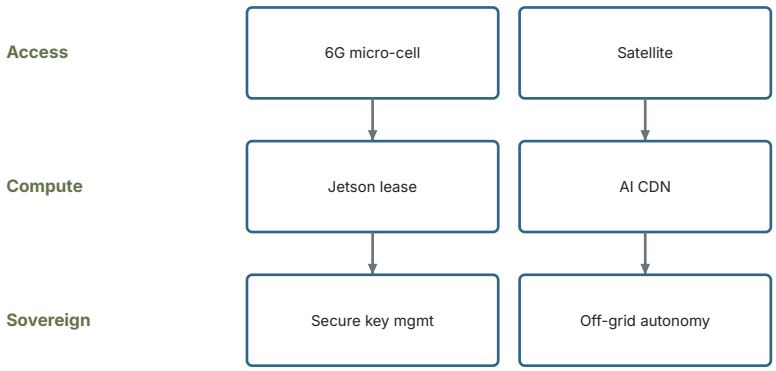
WHAT	Sites keep alarms and command channels alive during terrestrial outages.
HOW	MQTT/NATS queues events; Jetson Orin Nano switches approved uplinks.
STACK	contact,camera,speaker
MOAT	Remote Sentinel nodes stay operational when networks fail.
FIT	Rapid

DOMAIN INDEX — 6 CONFIGURATIONS

#19 Private Microcell Mesh REGU #20 Satellite Failover Link OPTI #21 Edge Compute Leasing PROJ #22 City AI CDN PROJ #23 Secure Key PoleNet REGU #24 Offline Autonomy Mode PROJ

> SkyHub becomes a 6G and private-network base, with satellite direct-connect failover so the city does not go blind or silent when terrestrial links drop.

Sovereign Edge Network (2/3)



#21 Edge Compute Leasing

PROJECT-SCOPED

WHAT	Idle Jetson capacity serves billed local inference workloads.
HOW	Jetson Orin AGX schedules TensorRT containers with MQTT/NATS metering.
STACK	camera,screen
MOAT	Installed poles become revenue-generating edge cloud.
FIT	FPL

#22 City AI CDN

PROJECT-SCOPED

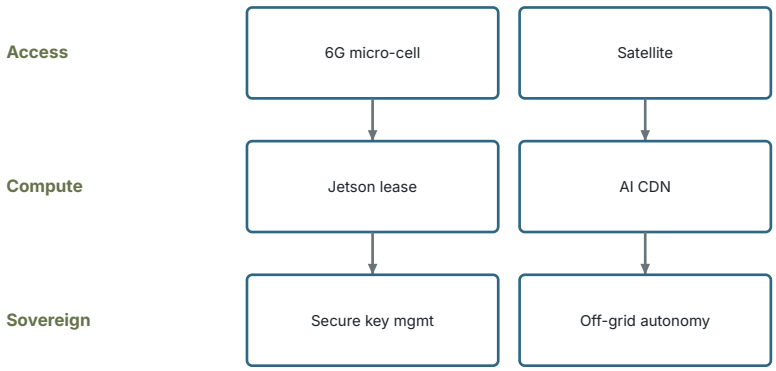
WHAT	Models, maps, and event summaries cache near users and assets.
HOW	PostGIS indexes regions; MQTT/NATS syncs packages to Jetson Orin NX.
STACK	camera,screen
MOAT	Physical edge footprint cuts latency and bandwidth.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#19 Private Microcell Mesh REGU · #20 Satellite Failover Link OPTI · #21 Edge Compute Leasing PROJ · #22 City AI CDN PROJ · #23 Secure Key PoleNet REGU · #24 Offline Autonomy Mode PROJ

> Idle on-pole Jetson capacity is leased as a profitable edge cloud, and a city AI CDN caches popular models, maps and video summaries at the pole group for low-latency local serving.

Sovereign Edge Network (3/3)



#23 Secure Key PoleNet — REGULATED

WHAT	High-grade civic communications distribute cryptographic keys through pole corridors.
HOW	Jetson Orin NX handles key telemetry with MQTT/NATS audit logs.
STACK	contact,screen
MOAT	Security layer rides owned physical infrastructure.
FIT	FPL

#24 Offline Autonomy Mode — PROJECT-SCOPED

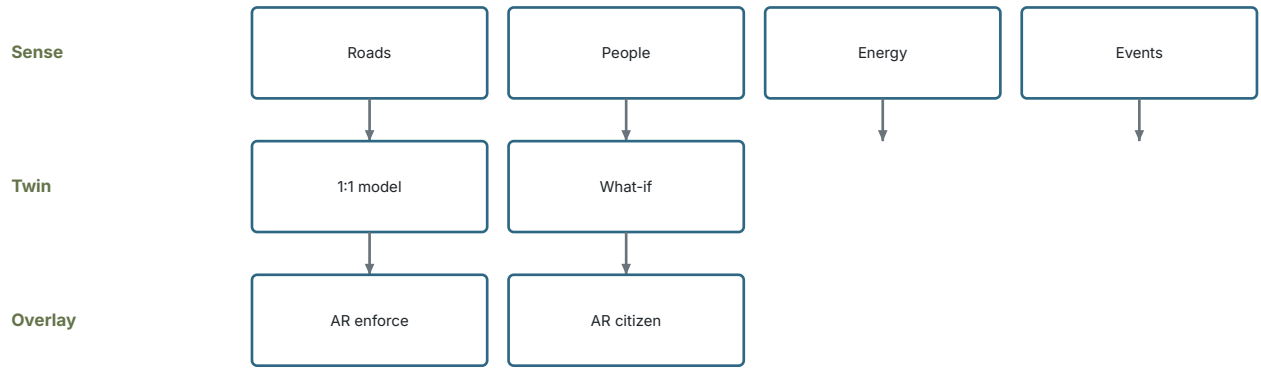
WHAT	Poles keep identity, maps, energy, and dispatch local during outages.
HOW	Jetson Orin NX runs local models, PostGIS cache, and MQTT/NATS mesh.
STACK	camera,contact,speaker
MOAT	Sovereign physical AI works without cloud dependency.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#19 Private Microcell Mesh REGU · #20 Satellite Failover Link OPTI · #21 Edge Compute Leasing PROJ · #22 City AI CDN PROJ · #23 Secure Key PoleNet REGU · #24 Offline Autonomy Mode PROJ

> Secure key distribution lifts government traffic to high-grade security, and an off-grid autonomy mode keeps the pole group running models, maps, identity, dispatch and energy when cloud, network and grid all fail.

Real-Time Twin and Spatial Operations (1/2)



#25 Live City Twin — PROJECT-SCOPED

WHAT	Roads, people, vehicles, energy, and incidents synchronize into 3D operations.
HOW	DeepStream, PostGIS, pgvector, and Jetson Orin AGX build live state.
STACK	camera,PTZ,radar,screen
MOAT	Customer operational data becomes nonportable city memory.
FIT	FPL

#26 Scenario Rehearsal Engine — PROJECT-SCOPED

WHAT	Teams test road closures, storms, fires, events, and outages before action.
HOW	PostGIS scenarios replay through Jetson Orin AGX and MQTT/NATS controls.
STACK	screen,camera,contact
MOAT	Twin turns monitoring into operational simulation.
FIT	FPL

#27 AR Evidence Anchors — REGULATED

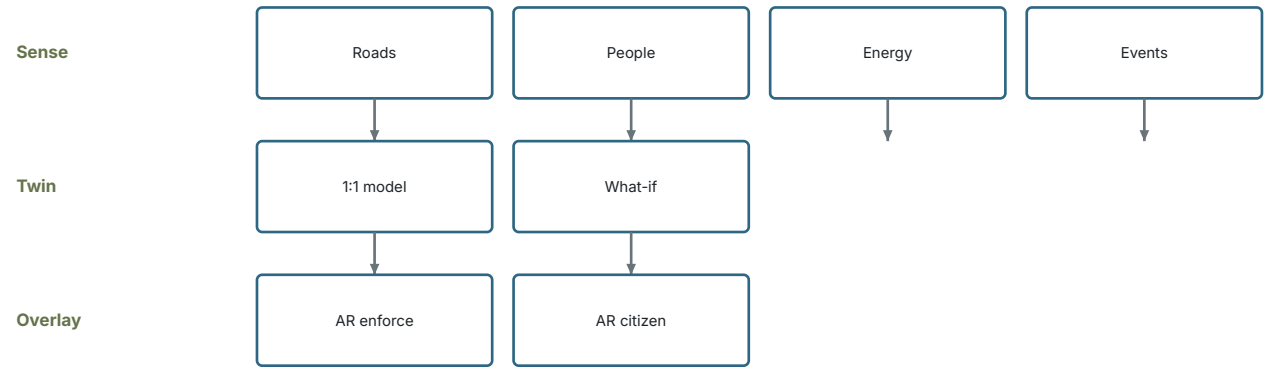
WHAT	Authorized responders view tracks, hazards, evidence, and drone feeds onsite.
HOW	PostGIS anchors evidence; PX4+MAVLink streams drones; MQTT/NATS syncs views.
STACK	screen,drone,camera
MOAT	Physical evidence aligns directly with field operators.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#25 Live City Twin PROJ · #26 Scenario Rehearsal Engine PROJ · #27 AR Evidence Anchors REGU · #28 Civic AR Layer PROJ · #29 Spatial Memory Replay REGU · #30 Surface-Subsurface Twin PROJ

> A 1:1 real-time twin syncs roads, crowds, vehicles, energy and events in 3D; a what-if engine pre-simulates closures, storms and concerts; AR anchors overlay tracks and evidence for enforcement.

Real-Time Twin and Spatial Operations (2/2)



#28 Civic AR Layer — PROJECT-SCOPED

WHAT	Citizens see transit, parking, safety, and service guidance in place.
HOW	PostGIS publishes anchors; MQTT/NATS updates screen and mobile services.
STACK	screen,camera,speaker
MOAT	Pole grid becomes city spatial interface.
FIT	FPS

#29 Spatial Memory Replay — REGULATED

WHAT	Operators replay summarized site state without storing irrelevant raw footage.
HOW	DeepStream summaries embed in pgvector with PostGIS time-space indexing.
STACK	camera,PTZ,screen
MOAT	Searchable memory lowers storage while preserving evidence.
FIT	FPS

#30 Surface-Subsurface Twin — PROJECT-SCOPED

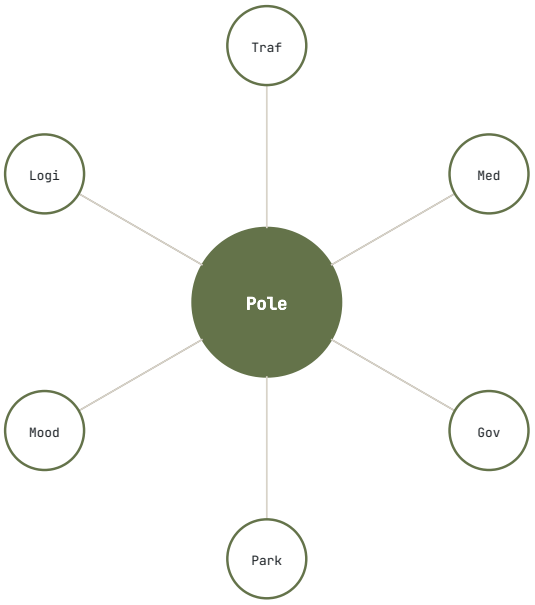
WHAT	Pole network links street assets with underground utility robots and sensors.
HOW	ROS2+Nav2 robot data merges with PostGIS city layers.
STACK	robot,contact,camera
MOAT	Extends smart city control below ground.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#25 Live City Twin PROJ #26 Scenario Rehearsal Engine PROJ #27 AR Evidence Anchors REGU #28 Civic AR Layer PROJ #29 Spatial Memory Replay REGU #30 Surface-Subsurface Twin PROJ

> A citizen AR layer shows transit, parking and safe routes in eight languages; a city memory replays any place and time; and a unified above-and-below twin links surface poles with underground pipe robots.

City Service Nodes (1/2)



- Adaptive traffic
- Emergency / AED
- Civic micro-terminal
- Dynamic parking
- Sentiment map
- Drone logistics

#31 Adaptive Traffic Signal — REGULATED

WHAT	Intersections adjust signal plans from flow, incidents, weather, and crowds.
HOW	Jetson Orin NX fuses DeepStream, radar, and MQTT/NATS signal commands.
STACK	camera,radar,screen
MOAT	Traffic control runs on owned city AI nodes.
FIT	FPL

#32 Drone Logistics Hive — REGULATED

WHAT	Pole-top hangars route small parcels, medicine, and emergency supplies.
HOW	SkyHub battery-swap hangar and PX4+MAVLink manage missions and custody.
STACK	drone,camera,contact
MOAT	Pole deployment creates low-altitude logistics network.
FIT	SkyHub

#33 Emergency Care Node — REGULATED

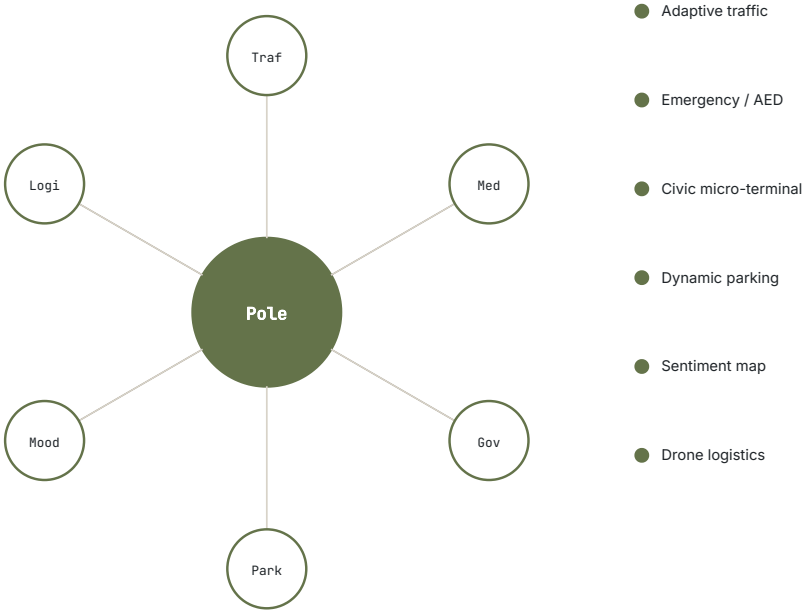
WHAT	Poles combine AED access, medical drone delivery, and remote clinician link.
HOW	SkyHub battery-swap hangar, PX4+MAVLink, and MQTT/NATS verify dispatch.
STACK	drone,screen,speaker,contact
MOAT	Public safety moves from alarm to onsite care.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#31 Adaptive Traffic Signal REGU · #32 Drone Logistics Hive REGU · #33 Emergency Care Node REGU · #34 Civic Service Kiosk REGU · #35 Curb Space Dispatch PROJ · #36 Crowd Sentiment Map REGU

> Poles adapt traffic signals to real-time flow, host drone logistics hives, and store an AED with drone-delivered medicine and a remote doctor link, pushing public safety from alert to on-scene rescue.

City Service Nodes (2/2)



#34 Civic Service Kiosk — REGULATED

WHAT	Pole screens handle reporting, service requests, identity checks, and guidance.
HOW	Jetson Orin NX, screen UI, MQTT/NATS, and PostGIS route cases.
STACK	screen,speaker,camera
MOAT	Owns the last-100-meter government service point.
FIT	FPS

#35 Curb Space Dispatch — PROJECT-SCOPED

WHAT	Detects parking and loading availability, then guides and prices curb use.
HOW	DeepStream cameras write curb state to PostGIS and MQTT/NATS.
STACK	camera,screen
MOAT	Roadside space becomes managed operating inventory.
FIT	FPS

#36 Crowd Sentiment Map — REGULATED

WHAT	Density, speech tone, and help requests reveal public stress patterns.
HOW	Jetson Orin NX fuses DeepStream and acoustic features into PostGIS heatmaps.
STACK	camera,acoustic,screen
MOAT	Governance gains early social signal from physical nodes.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#31 Adaptive Traffic Signal REGU · #32 Drone Logistics Hive REGU · #33 Emergency Care Node REGU · #34 Civic Service Kiosk REGU
#35 Curb Space Dispatch PROJ · #36 Crowd Sentiment Map REGU

> A civic micro-terminal handles services, repairs and identity in eight languages; dynamic parking turns kerb space into a managed asset; and a sentiment map reads crowd density and distress frequency.

Autonomous Maintenance and Robotics (1/2)



#37 Self-Healing Pole Mesh STANDARD

WHAT Nodes detect drift, software faults, and storage decay, then recover automatically.

HOW Jetson Orin Nano runs health agents over MQTT/NATS with OTA rollback.

STACK contact,camera

MOAT Fleet operations cost falls as scale rises.

FIT FPS

#38 Maintenance Robot Crew PROJECT-SCOPED

WHAT Robots clean, inspect, and replace parts across pole clusters.

HOW ROS2+Nav2 routes robots; MQTT/NATS dispatches jobs from PostGIS plans.

STACK robot,camera,contact

MOAT System maintains its own deployed hardware.

FIT FPL

#39 Drone Pole Inspection REGULATED

WHAT Drones scan pole bodies, PV, bolts, hangars, and antennas automatically.

HOW PX4+MAVLink flies routes; DeepStream analyzes defects on Jetson Orin NX.

STACK drone,camera,PTZ

MOAT Lifecycle defect data compounds across fleets.

FIT SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#37 Self-Healing Pole Mesh STAN #38 Maintenance Robot Crew PROJ #39 Drone Pole Inspection REGU #40 Predictive Spares Engine STAN

#41 Autonomous Module Swap PROJ #42 Resilient Mesh Rebuild PROJ

> Pole groups self-diagnose drift and storage decay and self-heal by OTA, maintenance robots service whole arrays, and drones scan pole, PV, bolts and antennas so lifecycle data compounds.

Autonomous Maintenance and Robotics (2/2)



#40 Predictive Spares Engine — STANDARD

WHAT	Teams know which parts will fail and stage inventory beforehand.
HOW	PostGIS asset history and Jetson Orin NX models forecast replacements.
STACK	contact,camera,screen
MOAT	Reliability becomes a subscription metric.
FIT	FPS

#41 Autonomous Module Swap — PROJECT-SCOPED

WHAT	Robots replace battery packs, sensor boxes, comms modules, and filters.
HOW	ROS2+Nav2 coordinates robots with SkyHub battery-swap hangar standards.
STACK	robot,contact,camera
MOAT	Quick-swap hardware creates long-term platform control.
FIT	SkyHub

#42 Resilient Mesh Rebuild — PROJECT-SCOPED

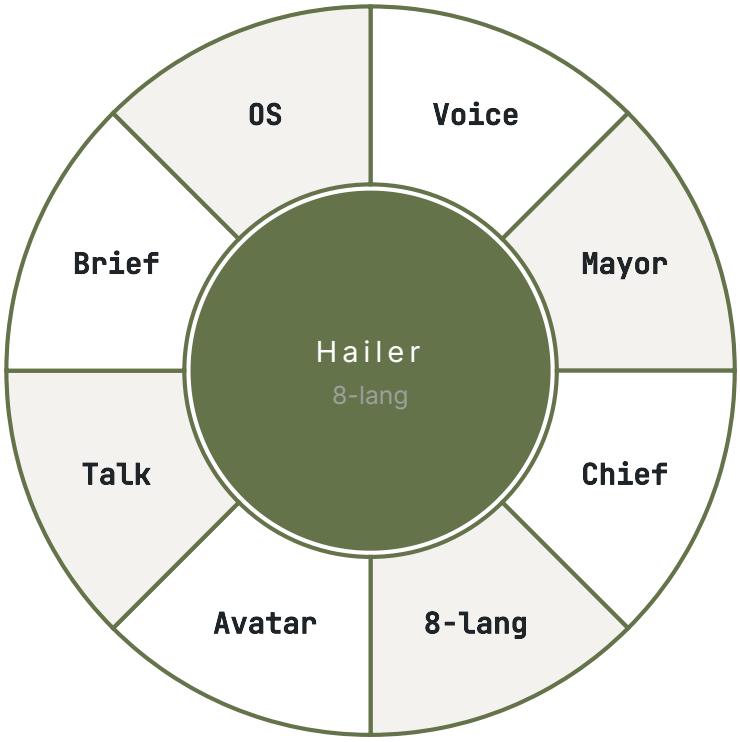
WHAT	Nearby poles take over coverage, communications, and compute after node loss.
HOW	MQTT/NATS mesh reroutes streams; PostGIS recalculates coverage tasks.
STACK	camera,contact,PTZ
MOAT	City AI network stays useful under damage.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#37 Self-Healing Pole Mesh STAN #38 Maintenance Robot Crew PROJ #39 Drone Pole Inspection REGU #40 Predictive Spares Engine STAN #41 Autonomous Module Swap PROJ #42 Resilient Mesh Rebuild PROJ

> A twin predicts which part fails when and pre-stocks it, robots swap battery, sensor, comms and filter modules through standard quick-release bays, and a self-reconfiguring network absorbs node loss.

AI-Native Civic Interface (1/2)



#43 Natural Language Command — STANDARD

WHAT	Operators issue area policies that OS translates into device actions.
HOW	Jetson Orin NX agents publish MQTT/NATS commands to PX4+MAVLink and ROS2+Nav2.
STACK	screen,speaker,drone,robot
MOAT	OS shifts from buttons to operational language.
FIT	FPL

#44 Mayor Copilot — PROJECT-SCOPED

WHAT	Leadership receives action recommendations from live twin, budget, energy, work orders.
HOW	PostGIS and pgvector context feed Jetson Orin AGX copilots.
STACK	screen,camera,contact
MOAT	Executive workflow locks in the full platform.
FIT	FPL

#45 Sheriff Copilot — REGULATED

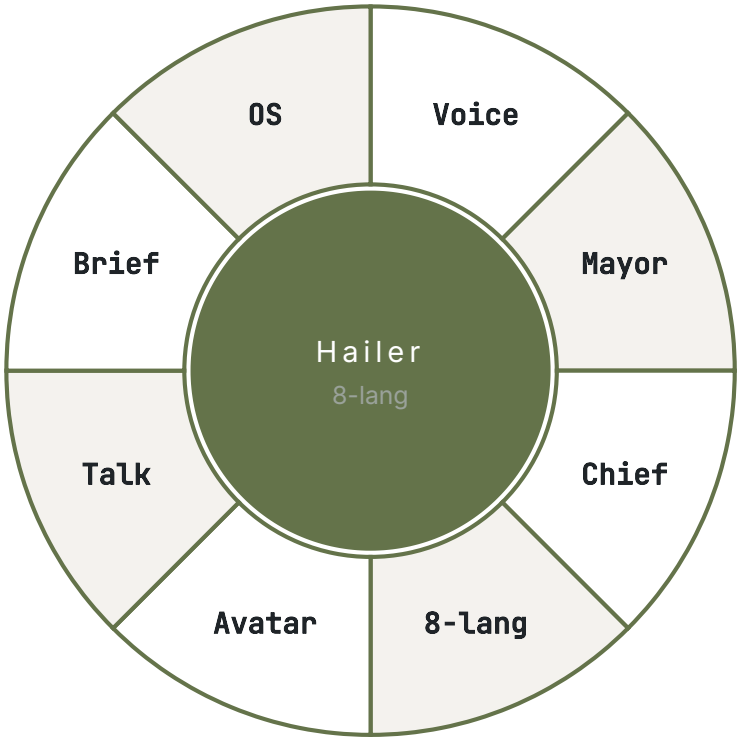
WHAT	Evidence chains, drone views, robot feeds, and voice commands support incident command.
HOW	DeepStream, pgvector, PX4+MAVLink, and MQTT/NATS assemble verified case context.
STACK	screen,drone,camera,speaker
MOAT	Latin America safety workflows bind multi-source physical AI.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#43 Natural Language Command STAN · #44 Mayor Copilot PROJ · #45 Sheriff Copilot REGU · #46 Multilingual Service Pole OPTI · #47 Digital Civic Officer PROJ · #48 Field AI Mediator REGU

> Natural-language commands turn raise night cover here or prepare storm mode into device, drone and robot tasks; mayor and police-chief copilots fuse twin, budget and evidence into action advice.

AI-Native Civic Interface (2/2)



#46 Multilingual Service Pole — OPTIONAL

WHAT	Citizens ask directions, report issues, and request help in eight languages.
HOW	Jetson Orin NX runs local voice services over MQTT/NATS.
STACK	speaker,screen,camera
MOAT	Eight-language localization is already in SOLARTODO stack.
FIT	FPS

#47 Digital Civic Officer — PROJECT-SCOPED

WHAT	Screen, phone, and AR avatar explains services and accepts reports.
HOW	Jetson Orin NX, screen UI, pgvector knowledge, and MQTT/NATS workflow.
STACK	screen,speaker,camera
MOAT	City service experience becomes branded SOLARTODO interface.
FIT	FPS

#48 Field AI Mediator — REGULATED

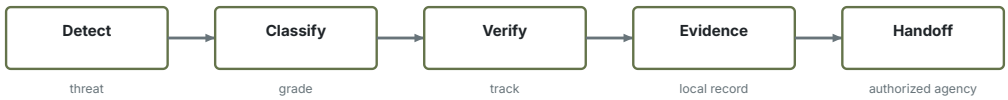
WHAT	Pole-side AI communicates, calms, translates, and guides people during incidents.
HOW	Jetson Orin NX voice models trigger speaker workflows via MQTT/NATS.
STACK	speaker,screen,camera
MOAT	Poles participate in response, not only observation.
FIT	FPS

DOMAIN INDEX — 6 CONFIGURATIONS

#43 Natural Language Command STAN · #44 Mayor Copilot PROJ · #45 Sheriff Copilot REGU · #46 Multilingual Service Pole OPTI · #47 Digital Civic Officer PROJ · #48 Field AI Mediator REGU

> An eight-language citizen voice pole answers wayfinding, reporting and services; a digital civic avatar represents the city across screen, phone and AR; an on-scene AI mediator calms, translates and guides.

Urban Safety and Immunity (1/3)



#49 Urban Immune System — REGULATED

WHAT	Detects fire, pollution, violence, cyberattack, and sabotage patterns for recovery.
HOW	DeepStream, e-nose telemetry, PostGIS, and MQTT/NATS coordinate alerts.
STACK	camera,e-nose,acoustic,strobe
MOAT	Complete safety loop beats single-point security.
FIT	FPL

#50 C-UAS Sensing Shield — REGULATED

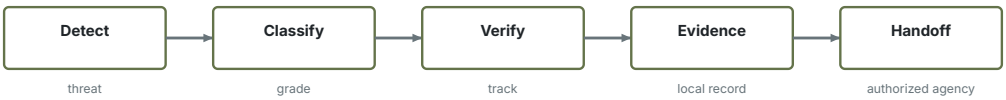
WHAT	Detects, classifies, tracks, verifies, and evidences unauthorized drones for handoff.
HOW	Radar and cameras run TensorRT on Jetson Orin AGX with PostGIS tracks.
STACK	radar,camera,PTZ
MOAT	SkyHub airspace awareness starts from owned hangar network.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#49 Urban Immune System REGU #50 C-UAS Sensing Shield REGU #51 Boundary Verification Lane REGU #52 Cyber Sentinel Mesh STAN #53 Tamper Evidence Mode STAN #54 Mobile Decoy Node REGU

> A city immune system treats fire, pollution, violence and cyber-attack as pathogens to detect, isolate and recover; the counter-UAS shield detects, classifies, tracks, verifies and evidences drones for authorized handoff, with no response effectors claimed.

Urban Safety and Immunity (2/3)



#51 Boundary Verification Lane — REGULATED

- **WHAT** Confirms restricted-zone presence and builds evidence for authorized handoff.
- **HOW** Radar, camera, and acoustic data fuse on Jetson Orin NX.
- **STACK** radar,camera,acoustic
- **MOAT** Regulated spatial safety becomes a platform module.
- **FIT** FPL

#52 Cyber Sentinel Mesh — STANDARD

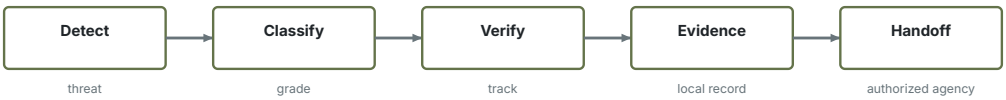
- **WHAT** Each pole detects attacks, isolates nodes, and restores approved configurations.
- **HOW** Jetson Orin Nano runs network sentinels over MQTT/NATS with signed OTA.
- **STACK** contact,screen
- **MOAT** Physical AI network protects itself locally.
- **FIT** FPS

DOMAIN INDEX — 6 CONFIGURATIONS

#49 Urban Immune System REGU · #50 C-UAS Sensing Shield REGU · #51 Boundary Verification Lane REGU · #52 Cyber Sentinel Mesh STAN · #53 Tamper Evidence Mode STAN · #54 Mobile Decoy Node REGU

> Boundary verification builds an authorized non-contact sensing and evidence chain around a zone, and a network-security sentinel on every pole detects attacks and isolates nodes.

Urban Safety and Immunity (3/3)



#53 Tamper Evidence Mode

STANDARD

WHAT	Damage triggers recording, upload, neighbor coverage, and verified evidence packaging.
HOW	DeepStream clips, contact sensors, pgvector evidence, and MQTT/NATS alerts.
STACK	camera,contact,strobe
MOAT	Single-node vandalism cannot erase the incident record.
FIT	FPS

#54 Mobile Decoy Node

REGULATED

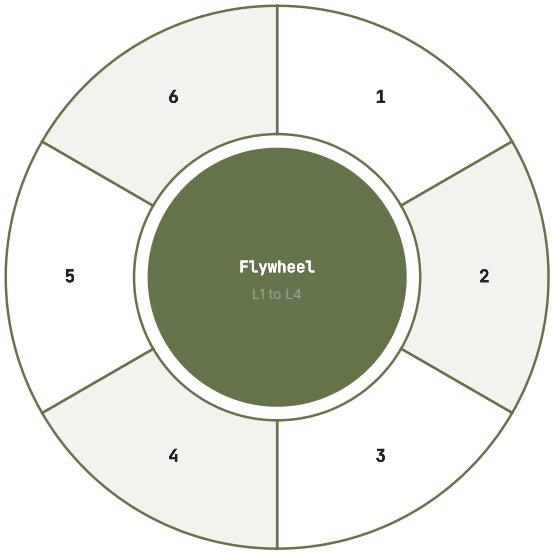
WHAT	Robots or drones expose hostile probing by acting as high-value assets.
HOW	ROS2+Nav2 and PX4+MAVLink coordinate decoys through MQTT/NATS.
STACK	robot,drone,camera
MOAT	Active defense uses owned mobile assets and city context.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#49 Urban Immune System REGU #50 C-UAS Sensing Shield REGU #51 Boundary Verification Lane REGU #52 Cyber Sentinel Mesh STAN
#53 Tamper Evidence Mode STAN #54 Mobile Decoy Node REGU

> A tamper-forensics mode records, uploads and hands neighbour and drone coverage to authorities when a node is attacked, and mobile decoys expose attackers; lawful response stays with the agency.

Platform Revenue and Ecosystem (1/2)



1. Hardware install
2. AI subscription
3. API usage
4. Data products
5. App ecosystem
6. Service renewal

#55 Pole-as-a-Service — PROJECT-SCOPED

WHAT	Customers pay by coverage, event, energy, compute, or flight usage.
HOW	MQTT/NATS meters usage; PostGIS maps service zones and SLA evidence.
STACK	screen,camera,contact
MOAT	Revenue shifts from hardware margin to recurring service.
FIT	FPL

#56 Pole OS Store — PROJECT-SCOPED

WHAT	Developers publish traffic, ecology, advertising, logistics, and inspection applications.
HOW	Jetson Orin NX runs sandboxed apps with MQTT/NATS and pgvector APIs.
STACK	screen,camera,speaker
MOAT	Ecosystem scale makes hardware harder to replace.
FIT	FPL

#57 Compliant Data Exchange — REGULATED

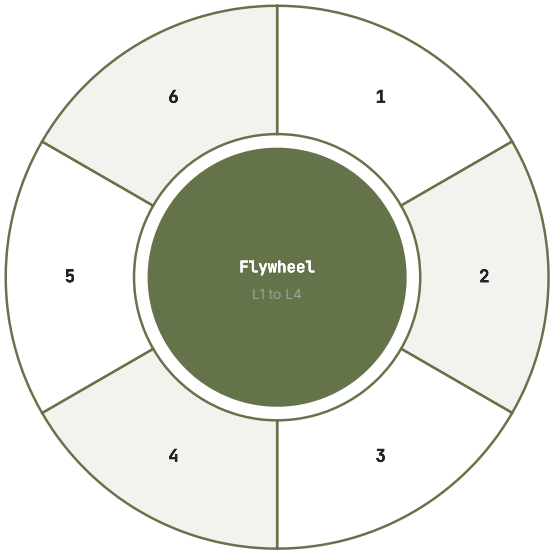
WHAT	Authorized traffic, crowd, environment, energy, and spatial data become products.
HOW	PostGIS anonymizes layers; pgvector indexes evidence; MQTT/NATS records consent.
STACK	camera,contact,screen
MOAT	Physical deployment creates data software firms cannot access.
FIT	FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#55 Pole-as-a-Service PROJ · #56 Pole OS Store PROJ · #57 Compliant Data Exchange REGU · #58 Triple Network Leasing REGU · #59 City AI Insurance REGU · #60 Low-Altitude Operations REGU

> Pole-as-a-service bills by coverage, events, energy, compute and flights; a pole OS app store lets developers build on the array; a compliant data market turns anonymised city data into a product.

Platform Revenue and Ecosystem (2/2)



1. Hardware install
2. AI subscription
3. API usage
4. Data products
5. App ecosystem
6. Service renewal

#58 Triple Network Leasing — REGULATED

WHAT	One pole leases compute, energy, and data capacity under separate contracts.
HOW	Jetson Orin AGX, BMS telemetry, MQTT/NATS, and PostGIS meter services.
STACK	camera,contact,screen
MOAT	Layered commercial model multiplies each installed asset.
FIT	FPL

#59 City AI Insurance — REGULATED

WHAT	Continuous site data supports dynamic risk pricing for cities and logistics.
HOW	PostGIS risk history and pgvector evidence feed actuarial APIs.
STACK	camera,radar,contact
MOAT	Financial pricing uses verified physical operations data.
FIT	FPL

#60 Low-Altitude Operations — REGULATED

WHAT	SkyHub manages drone routes, docking, power, supervision, and settlement.
HOW	SkyHub battery-swap hangar, PX4+MAVLink, PostGIS, and MQTT/NATS coordinate.
STACK	drone,camera,contact
MOAT	Owns the physical gateway to low-altitude economy.
FIT	SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#55 Pole-as-a-Service PROJ #56 Pole OS Store PROJ #57 Compliant Data Exchange REGU #58 Triple Network Leasing REGU #59 City AI Insurance REGU #60 Low-Altitude Operations REGU

> Compute, energy and data lease in one node; a city AI insurance product prices risk on real continuous data; and a low-altitude economy platform manages drone routes, docking, recharge and settlement.

Climate, Ecology and MRV (1/2)

	Air	Water	Fire	Bio	Carbon
Microclimate	S				
Flood foresight		S			
Wildfire			S		
Biodiversity				S	S
MRV audit					S

#61 Microclimate Dispatcher — PROJECT-SCOPED

- **WHAT** Poles sense heat, wind, humidity, pollution, then trigger local mitigation.
- **HOW** Jetson Orin Nano processes sensors; PostGIS maps actions; MQTT/NATS dispatches.
- **STACK** contact,e-nose,camera
- **MOAT** Moves from climate monitoring to local actuation.
- **FIT** ME

#62 Flood Forecast Mesh — PROJECT-SCOPED

- **WHAT** Predicts block-level ponding and drainage stress before storms overload streets.
- **HOW** PostGIS terrain layers and MQTT/NATS sensors feed Jetson Orin NX.
- **STACK** contact,camera,robot
- **MOAT** Ground and underground model gives complete water context.
- **FIT** FPL

#63 Wildfire Chemical Fingerprint — OPTIONAL

- **WHAT** Detects fire precursors before smoke is visible to cameras.
- **HOW** E-nose, temperature, wind, and humidity run TensorRT classifiers locally.
- **STACK** e-nose,camera,contact
- **MOAT** Early chemical warning widens response window.
- **FIT** ME

DOMAIN INDEX — 6 CONFIGURATIONS

#61 Microclimate Dispatcher PROJ · #62 Flood Forecast Mesh PROJ · #63 Wildfire Chemical Fingerprint OPTI · #64 Biodiversity Ledger STAN · #65 Pollution Source Trace REGU · #66 Carbon MRV Auditor REGU

> A microclimate scheduler reads heat island, wind and pollution and drives mist, shade and ventilation; a flood-foresight net predicts ponding; a wildfire chemical-fingerprint detector reads fire before smoke is visible.

Climate, Ecology and MRV (2/2)

	Air	Water	Fire	Bio	Carbon
Microclimate	S				
Flood foresight		S			
Wildfire			S		
Biodiversity				S	S
MRV audit					S

#64 Biodiversity Ledger — STANDARD

- **WHAT** Records birds, insects, and animal activity into ecological asset reports.
- **HOW** DeepStream wildlife models store summaries in PostGIS and pgvector.
- **STACK** camera,acoustic,e-nose
- **MOAT** Longitudinal ecology data supports research and finance.
- **FIT** ME

#65 Pollution Source Trace — REGULATED

- **WHAT** Drones trace contamination upstream through odor, water, and wind fields.
- **HOW** PX4+MAVLink follows PostGIS plumes from e-nose and weather telemetry.
- **STACK** drone,e-nose,camera
- **MOAT** System identifies responsible source, not just pollution presence.
- **FIT** SkyHub

#66 Carbon MRV Auditor — REGULATED

- **WHAT** Measures, reports, and verifies forest, farmland, and greening carbon sinks.
- **HOW** DeepStream, PostGIS, pgvector, and field sensors create MRV evidence.
- **STACK** camera,contact,drone
- **MOAT** Continuous field MRV is hard to replicate remotely.
- **FIT** FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#61 Microclimate Dispatcher PROJ · #62 Flood Forecast Mesh PROJ · #63 Wildfire Chemical Fingerprint OPTI · #64 Biodiversity Ledger STAN · #65 Pollution Source Trace REGU · #66 Carbon MRV Auditor REGU

> A biodiversity ledger logs birds, insects and animals as a continuous ecological asset; a pollution back-tracer follows odour, flow and wind to the source; an MRV auditor measures and certifies carbon sinks.

Sovereign Physical AI Extensions (1/3)

	Pole	Drone	Robot	Screen	Energy
see	y			y	
fly		y			
patrol		y	y		
charge			y		y
broadcast	y			y	
measure	y	y	y		y

#67 Intent Control Console — REGULATED

- **WHAT** Commanders steer city state through gaze, voice, and validated intent.
- **HOW** Jetson Orin AGX maps operator intent to MQTT/NATS control workflows.
- **STACK** screen,camera,speaker
- **MOAT** Human command speed matches AI execution speed.
- **FIT** FPL

#68 Reality API — PROJECT-SCOPED

- **WHAT** Developers call physical actions: see, fly, patrol, charge, broadcast, measure.
- **HOW** PostGIS permissions and MQTT/NATS APIs route PX4+MAVLink and ROS2+Nav2 tasks.
- **STACK** drone,robot,camera,speaker
- **MOAT** SOLARTODO becomes cloud API for physical operations.
- **FIT** SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#67 Intent Control Console REGU **#68** Reality API PROJ **#69** Autonomous District Kit REGU **#70** Civic Rule Executor REGU **#71** Twin Training Ground PROJ **#72** Sovereign AI OS REGU

> A brain-machine console lets a commander steer city posture by intent, and a city-scale reality API lets developers call see, fly, patrol, charge, broadcast and measure like a cloud API.

Sovereign Physical AI Extensions (2/3)

	Pole	Drone	Robot	Screen	Energy
see	y			y	
fly		y			
patrol		y	y		
charge			y		y
broadcast	y			y	
measure	y	y	y		y

#69 Autonomous District Kit — REGULATED

- **WHAT** A district runs security, energy, traffic, services, logistics, and environment operations.
- **HOW** Jetson Orin AGX, PostGIS, MQTT/NATS, PX4+MAVLink, and ROS2+Nav2 integrate.
- **STACK** camera,drone,robot,screen
- **MOAT** Exports an AI-native city operating template.
- **FIT** SkyHub

#70 Civic Rule Executor — REGULATED

- **WHAT** Parking, works, emissions, energy trades, and public-space rules execute automatically.
- **HOW** PostGIS rule zones trigger MQTT/NATS workflows with audited pgvector evidence.
- **STACK** camera,screen,contact
- **MOAT** Urban governance rules become executable operations.
- **FIT** FPL

DOMAIN INDEX — 6 CONFIGURATIONS

#67 Intent Control Console REGU · #68 Reality API PROJ · #69 Autonomous District Kit REGU · #70 Civic Rule Executor REGU · #71 Twin Training Ground PROJ · #72 Sovereign AI OS REGU

> An autonomous city sandbox runs a new district on the pole group, and a city smart-contract executor turns parking, construction, emission and energy rules into executable code.

Sovereign Physical AI Extensions (3/3)

	Pole	Drone	Robot	Screen	Energy
see	y			y	
fly		y			
patrol		y	y		
charge			y		y
broadcast	y			y	
measure	y	y	y		y

#71 Twin Training Ground — PROJECT-SCOPED

- **WHAT** Real city data trains robots, drones, and agents in operational environments.
- **HOW** DeepStream clips, PostGIS maps, and pgvector memories build training sets.
- **STACK** camera,drone,robot
- **MOAT** Reality data loop compounds model advantage.
- **FIT** SkyHub

#72 Sovereign AI OS — REGULATED

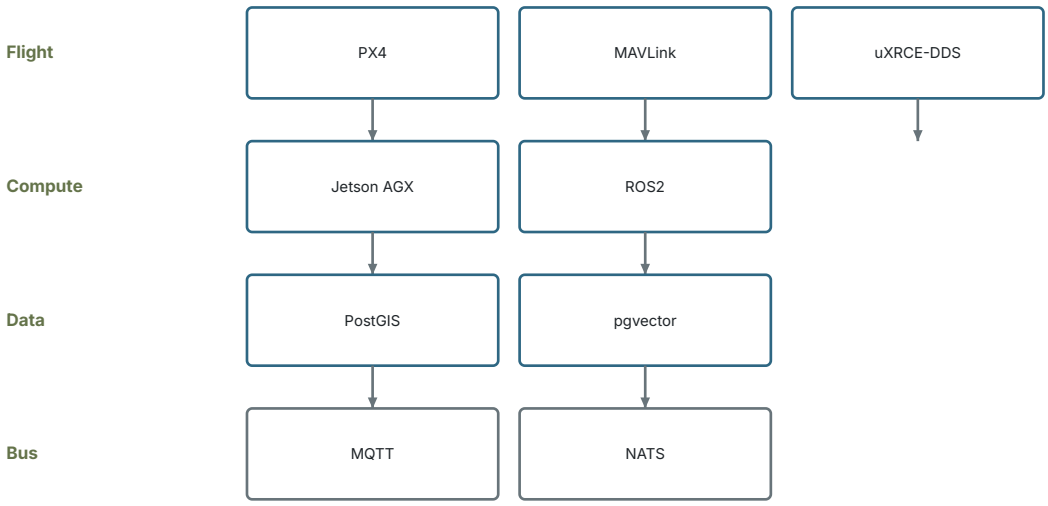
- **WHAT** Pole, drone, robot, energy, OS, and data compliance ship together.
- **HOW** Jetson Orin AGX, SkyHub hangar, PostGIS, MQTT/NATS integrate national deployments.
- **STACK** camera,drone,robot,screen
- **MOAT** Exports full city operating system, not single products.
- **FIT** SkyHub

DOMAIN INDEX — 6 CONFIGURATIONS

#67 Intent Control Console REGU · #68 Reality API PROJ · #69 Autonomous District Kit REGU · #70 Civic Rule Executor REGU · #71 Twin Training Ground PROJ · #72 Sovereign AI OS REGU

> A twin training ground turns real city data into a robot, drone and agent training environment, and a sovereign physical-AI OS export pack ships poles, drones, robots, OS, energy and data compliance as national infrastructure.

SkyHub air-ground control plane

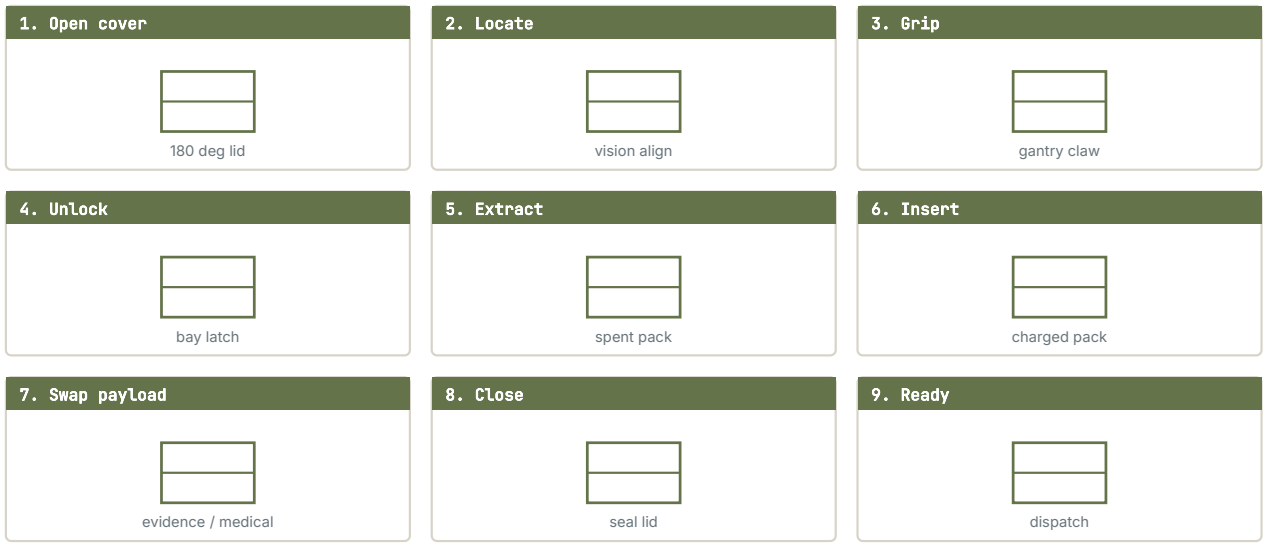


12 m POLE HEIGHT	20-60 kWh HANGAR STORAGE	275 TOPS EDGE AGX	4 slots BATTERY MAGAZINE	180 deg SWAP LID

SkyHub couples a 12 m solar pole to a battery-swap hangar and an open control plane: PX4 and MAVLink for flight, ROS2 and Jetson AGX for compute, PostGIS and pgvector for state, all kept on-site.

Modular payload dock

battery-swap hangar as a universal mission-module dock



Modular Payload Dock

PROJECT-SCOPED

WHAT	Drones swap camera, speaker, spotlight, first-aid, and logistics payloads quickly.
HOW	SkyHub battery-swap hangar coordinates payload IDs through PX4+MAVLink.
STACK	drone,camera,speaker,contact
MOAT	Battery-swap hardware becomes a multi-role robot arsenal.
FIT	SkyHub

The swap mechanism is not only for batteries: as a standard quick-change dock a drone hot-swaps surveillance pod, hailer, spotlight, inspection pod, medical kit or cargo box, so one drone plays many roles and one pole serves many craft.

Persistent drone mother-net

the sky that never lands



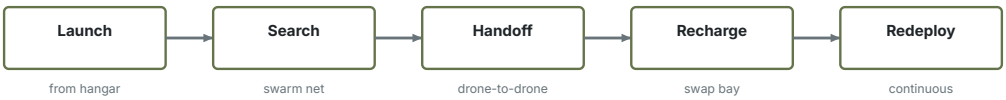
Persistent Drone Mothership

REGULATED

WHAT	Swarm rotates through SkyHub to maintain continuous aerial coverage.
HOW	SkyHub battery-swap hangar, PX4+MAVLink, and PostGIS preserve mission continuity.
STACK	drone,camera,PTZ
MOAT	Persistent aerial presence depends on SOLARTODO hangar mechanics.
FIT	SkyHub

Swarms rotate back to SkyHub to swap, giving round-the-clock airborne coverage where single-drone endurance no longer limits the mission. This is the product end-state of relay and recharge, which makers without a hangar cannot reach.

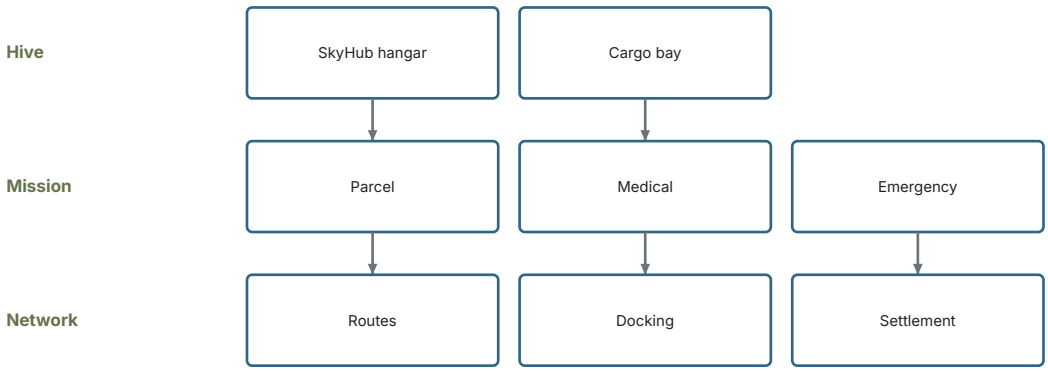
Air relay and recharge timeline



<20 %	<60 s	0 gap	24/7	local
RETURN SOC	SWAP TIME	RELAY HANDOFF	AIRBORNE	EVIDENCE LOG

Relay, handoff and recharge run on a fixed timeline so coverage stays continuous: as one drone reaches its charge threshold a neighbour assumes the track and the first returns to the hangar to swap packs.

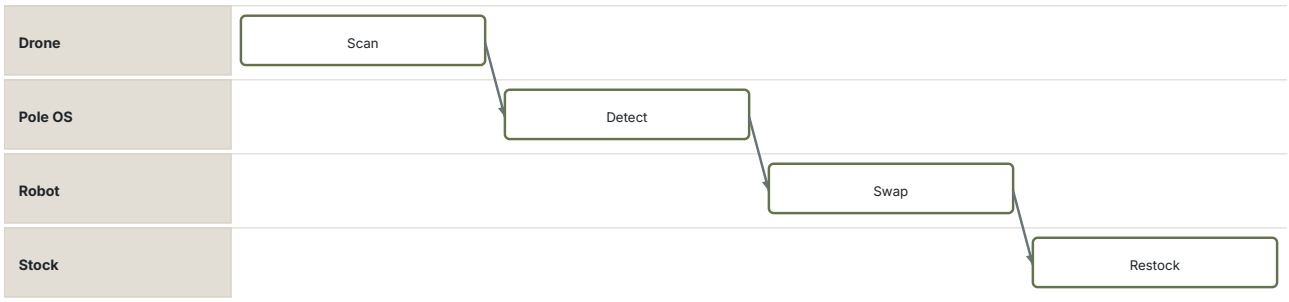
Low-altitude logistics and emergency hive



MISSION	PAYLOAD	PRIORITY
Parcel	Small box	Scheduled
Medical	AED / medicine	High
Emergency	Relief supplies	On-demand

> Pole-top hangars become air waystations for small parcels, medical supplies and emergency goods, so deploying the pole network is the same as owning a low-altitude logistics network with managed routes and settlement.

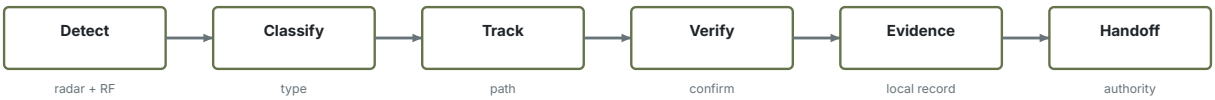
SkyHub evidence and maintenance loop



STAGE	ACTOR	OUTPUT
Inspect	Drone	Defect scan
Detect	Pole OS	Drift flag
Replace	Robot	Module swap
Evidence	Tamper mode	Distributed chain

> Drones inspect pole, PV, bolts and antennas; the OS flags drift; robots swap modules through quick-release bays; and a tamper-forensics mode keeps a distributed evidence chain when a single node is attacked.

Counter-UAS authorized handoff chain



#50 C-UAS Sensing Shield

REGULATED

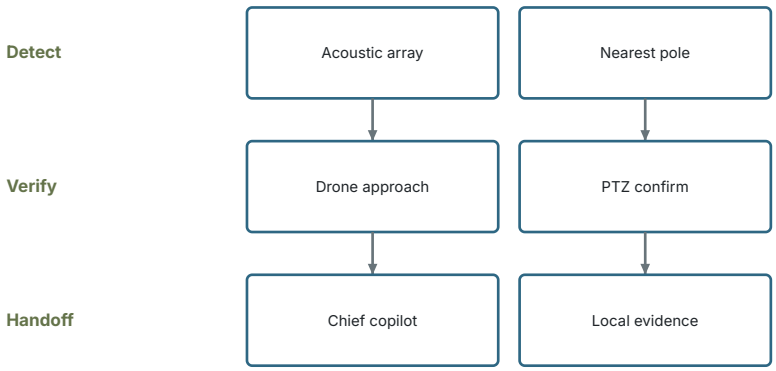
WHAT	Detects, classifies, tracks, verifies, and evidences unauthorized drones for handoff.
HOW	Radar and cameras run TensorRT on Jetson Orin AGX with PostGIS tracks.
STACK	radar,camera,PTZ
MOAT	SkyHub airspace awareness starts from owned hangar network.
FIT	SkyHub

REGULATED BOUNDARY

No response effectors are claimed. Lawful response is performed by authorized agencies. Detection, classification, tracking, verification and evidence only.

Sentinel detects, classifies, tracks, verifies and evidences unauthorized drones for authorized handoff. Response is performed only by authorized agencies; the owned hangar and swarm give a natural airspace-awareness advantage at the sensing layer.

Gunshot acoustic evidence chain



Gunshot Evidence Chain REGULATED

WHAT	Acoustic location triggers verified evidence capture and authorized police handoff.
HOW	Acoustic sensors, Jetson Orin NX, PX4+MAVLink, pgvector evidence, MQTT/NATS.
STACK	acoustic,drone,camera
MOAT	Offline edge evidence suits data-sovereign public safety buyers.
FIT	SkyHub

A gunshot triggers acoustic localisation at the nearest pole, an authorized drone approaches for evidence, and a chief copilot files an authorized notification package. Off-grid and data-sovereign, unlike a cloud service; lawful response stays with police.

Non-contact boundary verification

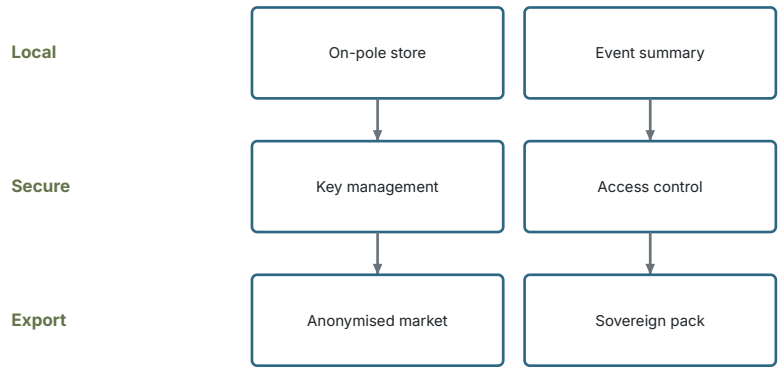
	Sense	Verify	Evidence	Authorize
Zone edge	S	S	S	R
Approach	S	S	S	R

#51 Boundary Verification Lane REGULATED

WHAT	Confirms restricted-zone presence and builds evidence for authorized handoff.
HOW	Radar, camera, and acoustic data fuse on Jetson Orin NX.
STACK	radar,camera,acoustic
MOAT	Regulated spatial safety becomes a platform module.
FIT	FPL

The protected-zone configuration is written strictly as authorized non-contact sensing, boundary verification and an evidence chain. Only sensing, verification and evidence are claimed; the platform documents and the authorized agency acts.

Data sovereignty and regulated data chain

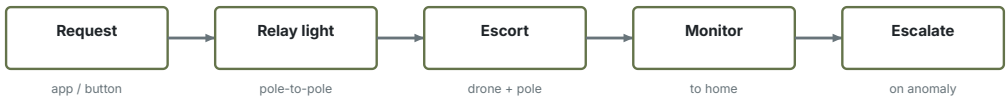


STAGE	DATA	EGRESS
Capture	Raw video	None
Process	Edge inference	None
Store	Local PostGIS	None
Summarise	Event only	Encrypted
Export	Anonymised	Under local law

Raw data and identity stay on-pole; only summaries leave. Secure key management, a compliant anonymised data market and a sovereign OS export pack let a nation keep data local while still trading derived products under local law.

Night escort chain

the killer app for Latin-American safety



Night Escort Chain

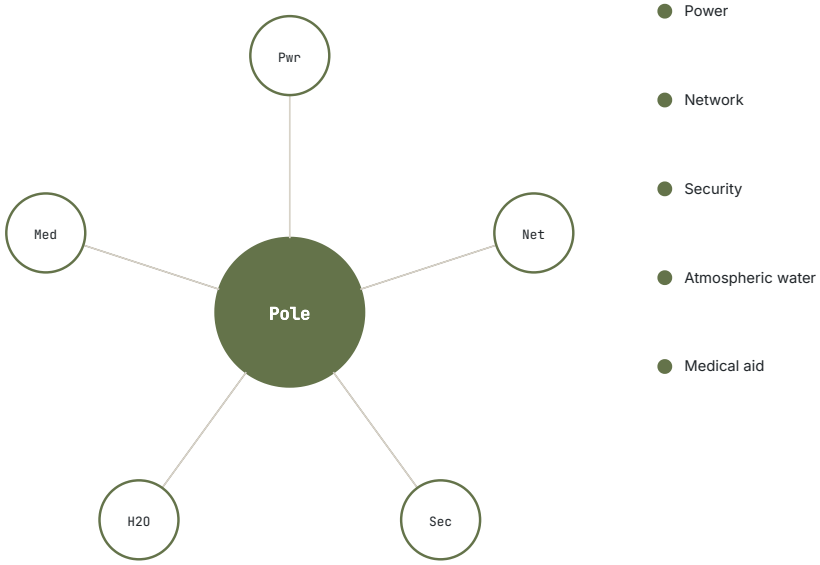
REGULATED

WHAT	Citizens request escorted routes with lighting, monitoring, and escalation.
HOW	PostGIS routes, PX4+MAVLink drones, MQTT/NATS alarms, and speaker workflows.
STACK	drone,camera,speaker,strobe
MOAT	Latin America public-safety use case converts security into accompaniment.
FIT	SkyHub

A citizen requests escort and the pole group plus drones relay lighting and accompanying surveillance home, escalating on anomaly. Turning security from watching into accompanying is the civic scene governments most readily fund.

Oasis life node

five-in-one for off-grid zones



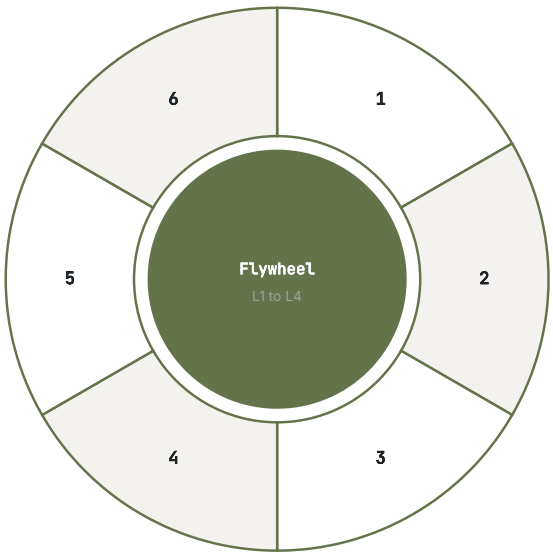
Desert Oasis Node

PROJECT-SCOPED

WHAT	Off-grid pole provides power, network, security, water, and medical help.
HOW	Jetson Orin NX, BMS telemetry, MQTT/NATS, and PostGIS manage services.
STACK	contact,camera,screen,speaker
MOAT	One pole supports communities beyond grid and network reach.
FIT	FPL

In zones with no power or network, one pole is power, network, security, atmospheric water and medical aid in a single life node, sustaining a nomad point, border post, refugee camp or new village. One pole lights a community.

L1 to L4 commercial transition

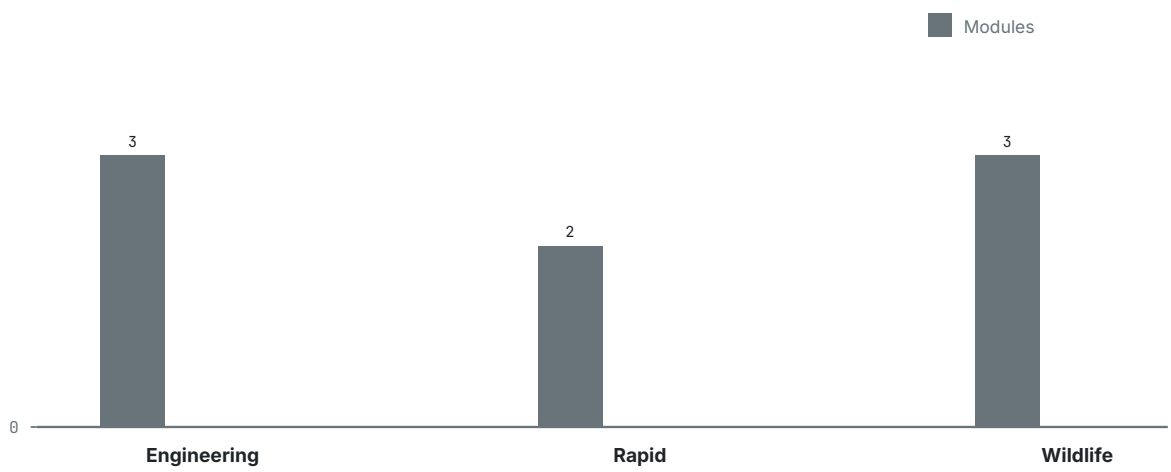


1. L1 Hardware
2. L2 Subscription
3. L3 Platform
4. L4 Data
5. App ecosystem
6. Renewal

LEVEL	SELLS	MOAT
L1 Pole	Hardware	Low-margin red ocean
L2 Subscription	AI scene packs	High margin, near-zero marginal
L3 Platform	Pole OS app store	Platform lock-in
L4 Data	Real-world data flywheel	Twenty-year, uncopyable

> The model climbs from selling poles to subscriptions, then a platform, then a data flywheel. Each level compounds the last; competitors stuck at L1 hardware cannot reach the L4 data moat.

Three product packages



ENGINEERING SECURITY

Fixed Pro + perimeter AI + sound-light deterrence. The present-day signing base.

RAPID DEPLOYMENT

Rapid Tower 6-8 m + mobile base + cloud alerting. Construction, camps, temporary.

WILDLIFE AI

Detect / Deter / Intelligence three tiers. The differentiator label.

Three present-day packages cover the signing base: an engineering security pack, a rapid deployment pack and the Wildlife AI differentiator, each mapped to specific families and boundary labels.

Three strategic packages

	Voice	Copilot	Swap	API	Export
LatAm beacon	S	P			
Swap moat			P		
Platform endgame				P	P

LATAM SAFETY BEACON
PROJECT-SCOPED
#46 voice + #45 chief copilot + gunshot chain + night escort.

BATTERY-SWAP MOAT
PROJECT-SCOPED
#32 logistics hive + exclusive A payload dock + exclusive B sky-net.

PLATFORM ENDGAME REGULATED
#56 app store + #68 reality API + #72 sovereign OS export.

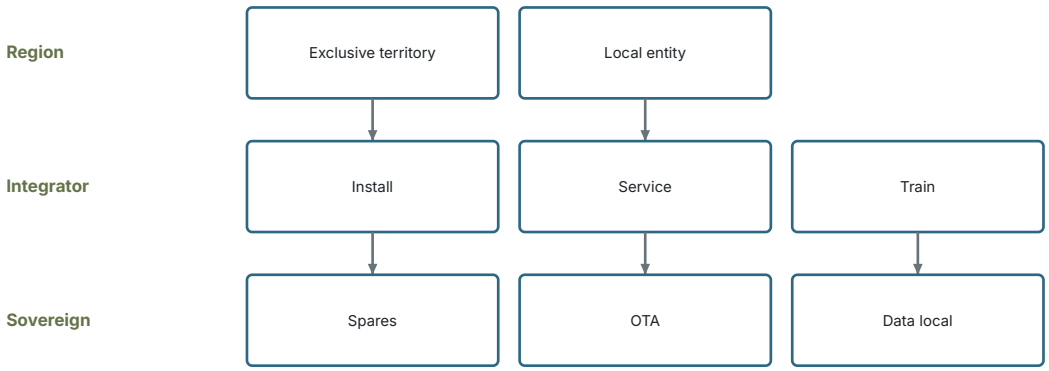
Three strategic packages weld the moats together: a Latin-American safety beacon, a battery-swap hardware moat, and a platform endgame that turns the pole network into a physical-world platform.

Family by capability matrix

	Sense	Deter	Energy	Edge	Air	City
ME	O	O	O	O		O
FPS	S	O	O	O		O
FPM	S	S	S	S		O
Rapid	S	S	O	S	P	O
FPL	S	S	S	S		P
SkyHub	S	S	S	S	P	P

Mapping six families against six capability groups shows the platform logic: ME and FPS anchor sensing density, FPM and FPL anchor fixed deterrence and energy, Rapid and SkyHub anchor mobility and air-ground city operations.

Global partner authorization model



SEEKING STRONG GLOBAL PARTNERS

SOLARTODO seeks capable distributors and integrators worldwide. Regional exclusivity is available, with localised spares, OTA and on-soil data handling.

SOLARTODO seeks strong global partners with regional exclusivity, supported by local spares, OTA and on-soil data. The model fits markets where data sovereignty and authorized operation are decisive.

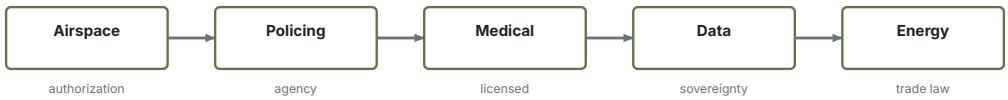
Physical API packaging

	Pole	Drone	Robot	Screen	Energy
see	y			y	
fly		y			
patrol		y	y		
charge			y		y
broadcast	y			y	
measure	y	y	y		y

VERB	RESOURCES	CONTROL
see	Pole / Screen	Scope token
fly	Drone	Airspace grant
patrol	Drone / Robot	Schedule
charge	Robot / Energy	Queue
broadcast	Pole / Screen	Permission
measure	All sensors	Audit log

> The city-scale reality API exposes physical verbs: see, fly, patrol, charge, broadcast and measure, against pole, drone, robot, screen and energy resources, each cell carrying permission and audit.

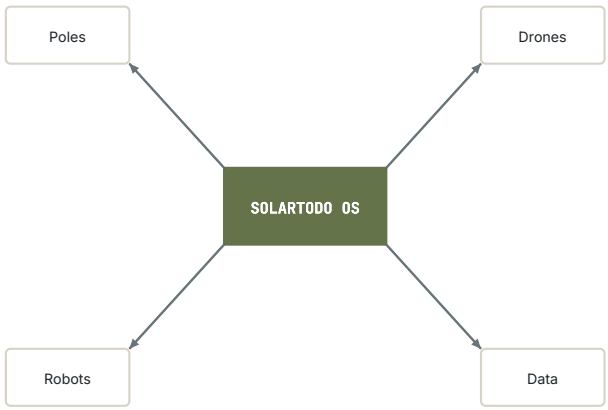
Legal and safety disclaimer



Regulated configurations (counter-UAS, acoustic localisation, boundary verification, medical response, data trade, energy routing) are subject to local authorization and engineering confirmation. Sense, verify, evidence and authorized handoff only; lawful response is performed by authorized agencies. NVIDIA Jetson edge compute; CATL or customer-specified cells.

Every regulated configuration ships under one rule: the platform senses, verifies, evidences and hands off; the authorized agency acts. All such configurations are subject to local authorization and final engineering confirmation.

Contact and project intake



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STANDARD OPTIONAL PROJECT-SCOPED REGULATED

> One engineered field-node system: six solar pole families, 116 documented capabilities, eight languages, Jetson edge inference and on-site data. Seeking strong global partners with regional exclusivity.