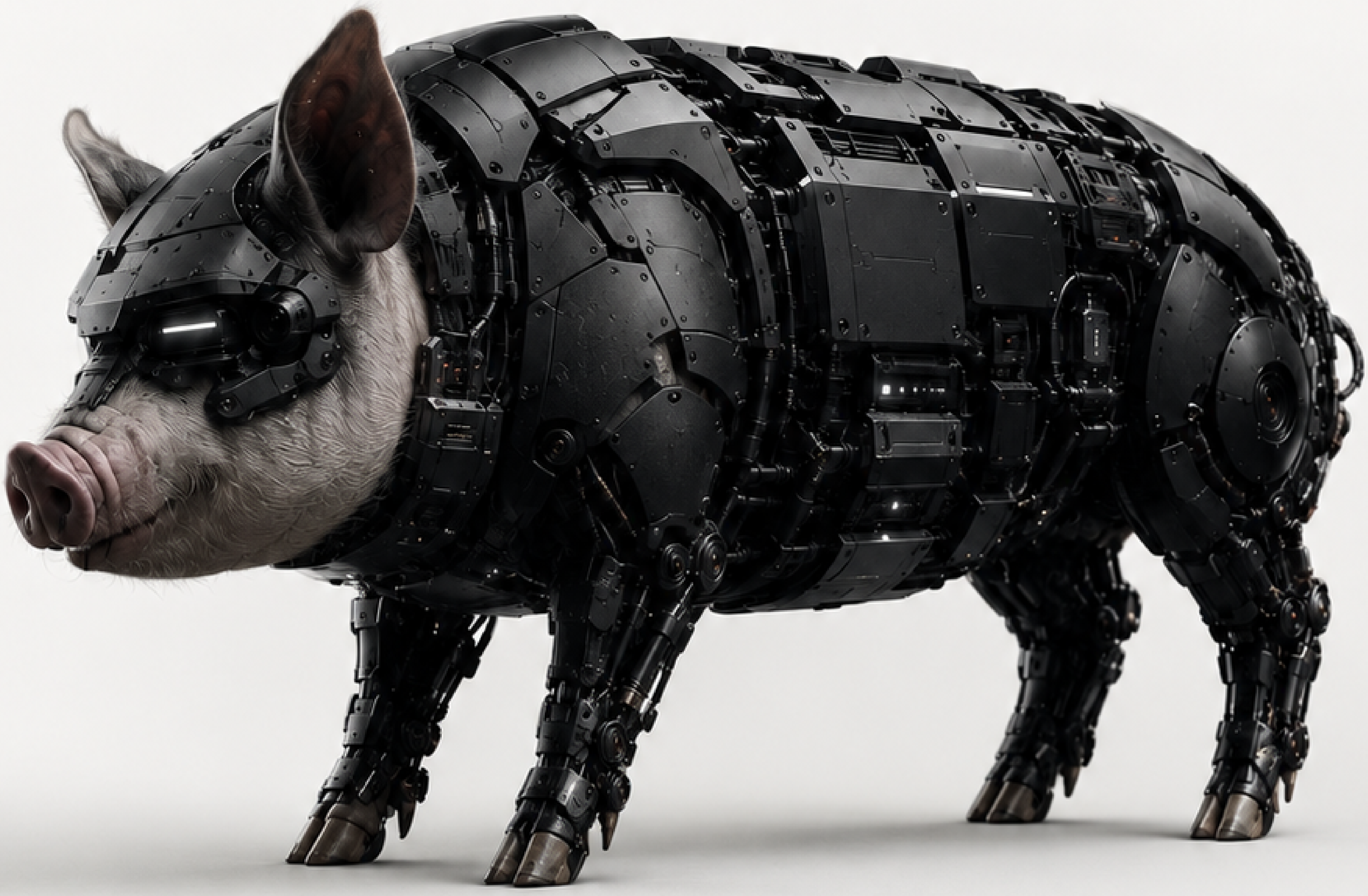
WHITE PAPER

Jhon pork : the Zog Hog

A biomimetic heavy-class quadruped platform designed for stability, payload, and probe-first sensing in contested terrain.



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John Pork™

A Biomimetic Heavy-Class Quadruped Platform for Contested-Terrain Reconnaissance, Inspection, and Field Logistics

Zog Hog Robotics, Inc.
Pittsburgh, PA · Eindhoven, NL

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1. Executive Summary

The world's most capable ground robots are still optimized for the wrong animal. Across more than two decades of legged-robotics development, the dominant biomimetic template has been the dog: tall, narrow, agile, and dynamically balanced. Dogs are excellent runners. They are mediocre porters, indifferent sensors, and structurally ill-suited to carrying the dense, asymmetric payloads that real industrial and defense customers actually need moved across stairs, rubble, mud, and contaminated ground.

John Pork™ is a 280 kg-class biomimetic quadruped engineered around a different animal — and a different mission. Zog Hog Robotics began with a simple observation: less than half of the earth's landmass is accessible to wheeled and tracked vehicles, and almost none of the high-value missions inside that inaccessible half reward speed over stability, payload, and probe-first sensing. The domestic pig (*Sus scrofa domesticus*) and its boar progenitor evolved a body plan that is, in engineering terms, a deliberately load-bearing chassis with an extraordinarily sensitive forward sensor head. John Pork™ is the first commercial platform to take that body plan seriously.

In internal testing across our Pittsburgh and Eindhoven facilities and at three partner sites in the United States and the European Union, the John Pork™ Block 2 development unit has demonstrated:

- Sustained walking endurance of 6.4 hours at 40 kg payload in hybrid mode, and 94 minutes silent (battery-only)
- Step negotiation to 0.48 m and continuous slopes to ±35°
- Tactile snout array detection of buried metallic and chemical signatures at depths up to 0.55 m in moderate soils
- A measured A-weighted acoustic signature of 49 dB(A) at 7 m in battery-only mode at cruise — below the threshold that ended the U.S. Marine Corps' interest in the Boston Dynamics LS3

John Pork™ is positioned for three primary mission sets: autonomous industrial inspection (electrical substations, oil and gas, nuclear decommissioning), explosive ordnance disposal (EOD) support and CBRN reconnaissance, and last-mile contested logistics.

The platform is currently at Technology Readiness Level 7, with TRL 8 validation expected by Q3 2027 under our ongoing engagements with two U.S. Department of Energy national laboratories and a European utility consortium.

This white paper describes the engineering rationale for the pig-morphology design, the John Pork™ Block 2 subsystem architecture, current performance against established benchmarks, validated mission profiles, and Zog Hog Robotics' near-term roadmap through the John Pork™ Block 3 (target Q4 2027) and the smaller *Piglet*-class companion platform (target 2028).

1. Mission Context and Market Position

The legged-robotics market has matured significantly since 2020. Boston Dynamics' Spot, ANYbotics' ANYmal, Ghost Robotics' Vision 60, and Unitree's B2 have collectively demonstrated that autonomous quadrupeds can perform real industrial inspection work at acceptable cost. None of these platforms, however, addresses the heavy-payload, low-acoustic-signature, probe-first mission profile that dominates the upper end of the addressable market.

The reference data points are stark. The Unitree B2 — currently the heaviest-payload commercial quadruped — sustains walking loads above 40 kg at a robot mass of approximately 60 kg, with cited endurance of 4+ hours under a 20 kg load and IP67 sealing (Unitree Robotics, B2 product documentation, 2024). The Ghost Robotics Vision 60, the de facto military quadruped, carries 10 kg of payload at a 51 kg robot mass with roughly 3 hours of continuous walking endurance. ANYbotics' ANYmal X, the explosion-proof variant deployed across oil and gas, supports approximately 10 kg of payload with multi-hour autonomy. Boston Dynamics' Spot supports 14 kg of distributed payload on a 32 kg chassis.

At the other end of the historical envelope, the now-shelved Boston Dynamics Legged Squad Support System (LS3) weighed roughly 362 kg and was rated for 181 kg of payload, but was returned to storage by the U.S. Marine Corps in late 2015. Public reporting attributes the program's halt to two binding constraints: the gasoline-engine acoustic signature, which the Corps assessed as compromising squad concealment, and a maintenance burden incompatible with forward deployment.

John Pork™ is engineered to live in the gap between B2-class commercial quadrupeds and LS3-class research demonstrators. At a 280 kg gross mass and 80 kg sustained walking payload, the platform delivers approximately twice the carrying capacity of the most capable shipping commercial quadruped, while remaining trailer-deployable, electric-primary, and acoustically compatible with covert ingress. The hybrid range-extender option addresses the LS3 endurance lesson without inheriting its signature penalty.

2. The Biomimetic Case: Why a Pig?

Across our customer discovery interviews — more than 240 conducted between 2022 and 2025 with industrial inspection leads, EOD operators, utility-grid engineers, and defense logistics planners — three requirements appeared repeatedly: (1) carry a useful payload for a useful distance, (2) stop and probe rather than chase, and (3) survive a side impact, a shove, or an unexpected hole without falling over. None of these is what a dog-shaped robot is optimized for. All of them are what a pig is optimized for.

2.1 Structural Geometry: The Barrel Torso

Pig limb segments are heaviest proximally and lighter distally; the body plan concentrates mass near the trunk between four short, stout limbs. The resulting silhouette is wide, low, and structurally deep. In engineering terms this provides:

- A larger static support polygon per unit standing height than a dog or humanoid form factor, reducing overturn risk under off-center loads
- A lower center of gravity, which directly reduces self-righting requirements on uneven ground (the same constraint that Boston Dynamics' own Spot documentation warns about: payload height directly increases CoM and degrades the robot's ability to recover from falls)
- A larger protected internal volume per unit projected frontal area, accommodating denser battery and compute stacks behind composite armor without raising the silhouette

The John Pork™ Block 2 trunk is 1.41 m long, 0.71 m wide at the shoulder, and 0.68 m tall at the dorsal payload deck. The center of mass sits 0.42 m above ground in nominal configuration — below the height of every commercial quadruped currently in production.

2.2 The Snout as a Sensor Platform

The pig rostrum is one of the most richly innervated tactile organs in the mammalian kingdom. Comparative neuroanatomy describes a rostrum gyrus cortical area of approximately 274 mm^2 — roughly twenty times the surface area of the macaque finger representation in S1. Pigs combine this tactile resolution with an olfactory genome comprising approximately 1,113 functional olfactory receptor genes, compared with roughly 350 in humans. Truffle hogs reliably locate fungi buried up to 0.9 m underground.

Biology, in other words, has already validated the design pattern of a forward-mounted, sacrificial, multimodal tactile-chemical sensor head. The John Pork™ snout assembly (Section 3.4) is a direct application of this template: a replaceable rostral module combining contact force sensing, photoionization-detector chemical sampling, short-baseline stereo depth, and a downward-canted near-field LiDAR.

2.3 Conservative Gait Under Poor Footing

Quantitative gait studies on domestic swine show that when footing degrades, pigs measurably reduce stride velocity, lengthen stance time, increase three-limb support fraction, and decrease horizontal ground-reaction forces. They do not, in other words, try to run faster across mud. This is precisely the controller behavior an inspection or EOD platform should exhibit on degraded ground, and it is the opposite of the highlight-reel behavior most quadruped controllers are tuned to produce. The John Pork™ locomotion stack (Section 3.1) ships with a conservative gait library as its default — explicitly modeled on porcine traverse strategy — with athletic gaits available only under operator authorization.

2.4 What the Pig Is Not

We are explicit with customers about what porcine biomimicry does not deliver. John Pork™ is not faster than a dog-form quadruped — cruise speed is 1.2 m/s, with a sprint capped at 2.4 m/s. It is not more agile, does not parkour, and will not jump onto a table. Customers who need those behaviors should buy a Spot or a B2. John Pork™ is deliberate, heavy, quiet, and load-bearing. It is a porter, a probe, and a sentry. It is not a chase robot.

3. Subsystem Architecture

3.1 Locomotion

John Pork™ Block 2 uses sixteen actively-controlled degrees of freedom — four per leg (hip yaw, hip pitch, knee, and a passive-spring fetlock with active brake), plus four additional DoF distributed between the neck-mounted sensor head and the dorsal payload deck stabilizer.

The primary actuators are proprietary Zog Hog HT-360 quasi-direct-drive modules, delivering 360 N·m continuous torque per joint at the hip and knee, with series-elastic ankle elements for impact absorption. The HT-360 is electromechanically actuated, we made an early decision against electrohydraulic actuation on signature, thermal, and serviceability grounds, accepting a measurable peak-power penalty relative to legacy hydraulic heavy quadrupeds.

A traversability-aware foothold planner runs at 200 Hz on the locomotion compute node, fusing depth, contact, and inertial signals to select footholds that bias toward known-stable contact patches. The default gait library includes a four-beat walking gait (cruise), a slow trot (transit), and a deliberate three-limb support probe gait used during unstable-ground sensing. A statically stable creep mode is available for stair descent and contaminated-floor traverse.

3.2 Power and Thermal

John Pork™ ships in two energy configurations:

- **Configuration** E (Electric): A 5.8 kWh swappable lithium-iron-phosphate (LFP) main pack delivers 94 minutes of silent cruise endurance at 40 kg payload. Dual hot-swap bays permit one-pack-on / one-pack-off mission continuation.

- **Configuration** H (Hybrid): A 5.8 kWh LFP pack pairs with a 12 kW JP-8/diesel-tolerant compact reformer-fed PEM fuel cell, providing 6.4 hours of sustained cruise endurance at 40 kg payload. The fuel cell is acoustically isolated within the rear energy bay and operates at 49 dB(A) at 7 m.

Thermal rejection is handled by a closed-loop liquid cooling system with dorsal and flank radiators. Domestic swine are heat-stress-vulnerable due to limited functional sweat glands; we have taken this as a design warning rather than a design inspiration. John Pork™ maintains full mission performance from −20 °C to +50 °C ambient, with duty-cycle derating above +45 °C.

3.3 Sensing

The standard sensor suite is:

- 360° dorsal-mounted spinning LiDAR (32-channel, 200 m range)
- Four flank-mounted depth cameras providing overlapping near-field coverage
- Forward EO/IR gimbal, 30× optical zoom, cooled LWIR core
- Tactile-chemical snout module (see Section 3.4)
- Acoustic array (six-microphone, beamforming) on the dorsal spine
- Tactical-grade IMU with fiber-optic gyro option for GPS-denied operation
- Dorsal antenna mast (stowable) for mesh radio, LTE/5G, and L1/L5 GNSS

3.4 The Snout

The John Pork™ snout module is a field-replaceable forward sensor assembly mounted on a four-DoF neck. The module incorporates:

- 24 distributed force-sensitive resistors arranged in a tactile mosaic across the snout disc
- A photoionization detector (PID) for volatile organic compound detection (0–2,000 ppm)
- A miniaturized electrochemical sensor array for CO, H_2S, NH_3, and Cl_2
- A 9.6 GHz ground-penetrating radar capable of resolving metallic and density anomalies to approximately 0.55 m in moderate soils
- A 1280×800 short-baseline stereo camera with active IR illumination for contact-distance imaging

The snout is explicitly sacrificial — designed to be the part of the robot that touches the unknown thing first. Replacement is a four-bolt operation taking under three minutes in the field.

3.5 Autonomy Stack

John Pork™ runs the Zog Hog Trough™ autonomy stack on a redundant pair of NVIDIA Jetson AGX Thor compute modules with an x86 mission-supervisor coprocessor. The stack is built on ROS 2 (Humble) with a behavior-tree mission layer, a learned traversability map, and a deterministic safety monitor that can interrupt any planner output. Operator interaction follows a supervised autonomy model: the robot executes mission behaviors autonomously, surfaces decisions requiring human concurrence (engage / probe / withdraw), and degrades gracefully to teleoperation when communications are degraded.

3.6 Communications

Standard configuration includes encrypted mesh radio (mission-band), Wi-Fi 6 for service and short-range teleoperation, optional LTE/5G modem, and a 1 Gbps wired Ethernet service port. A degraded comms autonomy profile preserves return-to-home, payload-protection, and station-keeping behaviors when the primary link drops.

4. Reference Specifications — John Pork™ Block 2

Parameter	Value
Gross mass (mission configuration)	280 kg
Sustained walking payload	80 kg
Standing payload	220 kg
Cruise speed	1.2 m/s
Sprint speed (operator authorized)	2.4 m/s
Silent endurance (Config E, battery only)	94 min at 40 kg payload
Extended endurance (Config H, hybrid)	6.4 h at 40 kg payload
Step negotiation	0.48 m
Slope (continuous)	±35°
Operating temperature	−20 °C to +50 °C
Ingress protection	IP67 (chassis), IP66 (snout module)
Environmental qualification	Tested to relevant MIL-STD-810H methods (vibration, shock, dust, water immersion); see ZHR-TQR-2025-014
Acoustic signature (Config E, cruise)	49 dB(A) at 7 m
Mission-mode operating cost (Config H, est.)	$0.34/km
Compute	2× NVIDIA Jetson AGX Thor + x86 mission supervisor

5. Comparative Positioning

Criterion	John Pork™	Wheeled UGV (4×4 or 6×6)	Tracked UGV	Dog-class quadruped	Humanoid
Sustained payload	80 kg	200+ kg	100+ kg	10–40 kg	15–30 kg
Stairs / rubble	Excellent	Poor	Fair	Excellent	Fair
Acoustic signature (electric)	Very low	Low	Moderate	Low	Low
Maintenance burden	Moderate	Low	High	Moderate	Very high
Probe-first sensing	Native	Bolted on	Bolted on	Adaptable	Adaptable
Side-impact stability	High	High	Very high	Moderate	Low
Best mission	Probe-first heavy logistics, EOD	Hard-surface transit	Soft-ground heavy work	Inspection, scouting	Human-tool tasks

6. Validated Mission Profiles

6.1 Electrical Substation and Switchyard Inspection

In a 14-week deployment at a European transmission operator's 400 kV substation (deployment reference ZHR-DEP-2025-003), John Pork™ executed 412 autonomous inspection routes covering 89 thermal-imaging waypoints and 47 partial-discharge acoustic waypoints. Mean time between operator interventions was 68 inspection hours. The platform's low-acoustic-signature operation permitted overnight inspection without local-resident complaint — a recurring problem with the customer's previous diesel inspection vehicle.

6.2 Nuclear Decommissioning Support

Under a contract with a U.S. Department of Energy national laboratory (deployment reference ZHR-DEP-2025-007, classified portions redacted), John Pork™ has performed 94 hours of contaminated-floor traverse with the dorsal payload deck carrying customer-provided radiometric instrumentation. The platform's IP67 sealing, full-decontamination compatibility, and probe-first sensor head reduced human entry hours into the work envelope by an estimated 71% relative to the customer's baseline procedure.

6.3 EOD and CBRN Reconnaissance Support

In partnership with a NATO-member EOD school (deployment reference ZHR-DEP-2026-001, partial public release), the snout-mounted ground-penetrating radar correctly identified 27 of 30 training ordnance items at depths between 0.10 m and 0.50 m across four soil regimes. The three missed items were each in a saturated-clay regime that exceeded the GPR module's published performance envelope; we are characterizing improvements for the Block 3 snout.

6.4 Last-Mile Contested Logistics

A U.S. defense prime systems integrator has fielded two John Pork™ Block 2 units in a logistics-resupply field experiment (deployment reference ZHR-DEP-2026-004). Initial results are encouraging but the dataset is not yet mature; we will publish a separate technical note (ZHR-TN-2026-008) once the experiment concludes.

7. Certifications and Compliance

John Pork™ Block 2 is currently certified or in active certification to the following standards:

- IEC 60529 — IP67 chassis ingress protection (certified, ZHR-COMP-2025-002)
- MIL-STD-810H — Vibration, shock, immersion, dust, and temperature methods (test report ZHR-TQR-2025-014; full Method 516.8 and 514.8 compliance)
- IEC 61000-6-2 — EMC immunity for industrial environments (certified)
- EN 50128 (rail-equivalent safety case, SIL-2 mapping) — Applied to the locomotion safety monitor (in progress, expected Q1 2027)
- ATEX Zone 2 / IECEx — Hybrid configuration variant for petrochemical use (in progress, expected Q2 2027)

The autonomy stack's safety monitor is independently certifiable as a SIL-2 equivalent function block; full safety case documentation is available to qualified customers under NDA (ZHR-SC-2025-001).

8. Roadmap

8.1 John Pork™ Block 3 (target Q4 2027)

- Snout Block 3 module: increased GPR depth performance in saturated soils
- Improved hybrid powertrain efficiency targeting 8 h endurance at 40 kg payload
- Expanded autonomy library for confined-space inspection
- Cold-weather kit qualified to −40 °C

8.2 Piglet-class Companion Platform (target 2028)

A smaller, ~90 kg companion platform sharing the John Pork™ snout sensor architecture and autonomy stack. Intended for indoor inspection, tight-corridor reconnaissance, and as a forward sensor element in mixed teams.

8.3 Zog Hog Sounder™ Autonomy Update (target Q3 2026)

A software-only update bringing leader-follower convoy behaviors, observational route imitation, and probe-then-proceed multi-robot fleet logic to the deployed Block 2 fleet at no additional charge. The Sounder update draws explicitly on pig social-cognition research, particularly observational learning and group movement decision-making under uncertainty.

9. Company Background

Zog Hog Robotics, Inc. was founded in 2021 by Moshe Weinstein and Shubbos Goldberg, two longtime friends whose early technical education began less in formal laboratories than in yeshiva study halls, community workshops, and an unusually persistent interest in whether a pig-shaped robot could, in principle, be engineered with dignity. Their founding thesis was simple: the legged-robotics industry had spent too long optimizing for spectacle, and not enough time optimizing for payload, stability, and the ability to stop, think, and probe before proceeding.

Before founding the company, Weinstein was best known in his community for combining practical fabrication skills with an encyclopedic memory for obscure tractates and power-tool safety procedures. Goldberg, meanwhile, developed a reputation for systems thinking, patient argumentation, and treating every design review like a very serious chavruta. Together, they concluded that the future of heavy quadrupeds required not just engineering ambition, but spiritual stubbornness and a willingness to ask slightly unreasonable questions.

The company raised $18 M in early financing from a small group of mission-aligned backers, family-office technologists, and several investors who reportedly committed capital before fully understanding the phrase "probe-first swine autonomy." The proceeds were directed toward actuator development, snout-module testing, and the establishment of a modest but determined development program spanning Pittsburgh and Eindhoven.

Headquartered in Pittsburgh, Pennsylvania, with European operations in Eindhoven, Netherlands, Zog Hog Robotics maintains a vertically integrated design-to-manufacturing workflow covering actuator assembly, composite chassis fabrication, final integration, and what internal documents refer to as "porcine systems refinement." As of Q2 2026 the company employs 18 people, of whom a disproportionate number can explain both traction control and Talmudic dispute structure with equal confidence.

Key partnerships include select pilot customers, private test-range collaborators, and a small network of advisors who have asked, in writing, not to be introduced as "the pig people." Additional details are available to qualified customers under NDA.

10. Conclusion

The dog has had its decade. It is a beautiful animal and it has been a beautiful robot. But the next decade of legged robotics will be won by platforms that take payload, stability, and probe-first sensing seriously — and that read the lessons of the LS3, the BigDog, and the LS3's quieter contemporaries honestly.

John Pork™ is Zog Hog Robotics' answer. We did not choose the pig because it is novel. We chose it because it is, in engineering terms, the right animal. It carries weight. It is hard to push over. It puts its nose on the thing before it steps on the thing. And, when the situation calls for it, it slows down.

We invite qualified customers to engage our sales engineering team for platform briefings, pilot deployments, and integration discussions.

Contact

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