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The Nightingale One Protocol™: SITL Conformance Schemas and HSA Class B SaMD Dossier

1. Executive Technical-Legal Lineage & Architectural Doctrine

The Nightingale One Protocol™ asserts total sovereignty via a prioritized patent ancestry, codifying a shift from the probabilistic vulnerabilities of the "agentic world" to the "Heartware" philosophy of hardware-deterministic governance. This doctrine dictates that safety is not an optional software policy but an immutable property of the physical substrate. By mechatronically isolating advisory intelligence from the kinetic actuation path, the protocol establishes a "Constitutional Floor" where no movement is possible without explicit human authorization. This document constitutes the un-bribable baseline for the February 2027 PCT window, providing a mathematically frozen reference for deterministic governance.

The intellectual property fortress of Edwin Koh is anchored in the following multi-level patent lineage:

- **Parent M (10202602649V):** The "Supreme Guardian Master Control Layer" capstone, defining the foundational non-agentic isolation rules and the constitutional hardware enforcement architecture.
- **Primary Divisionals:**
  - **A13d (10202602674U):** The Therapeutic-Care Architecture, specializing in segregated perception, cognitive engagement, and actuation domains.
  - **Singapore Filing (10202602693U):** Focused on protocol-governed actuation, deterministic safety controls, and the forensic ledger interface.
  - **Framework (10202602767X):** The Nightingale One Protocol™ Framework, integrating outer protocol governance (Po), mechanically bounded assistance (M), privacy-preserving perception (Pi), and deterministic safety (D).
- **Grandchildren Divisionals:**
  - **A13c-HC (10202602773P):** The Kinetic Caregiver Apparatus optimized for community and residential environments.
  - **A13d-Pro (10202602774Y):** The Clinical-Grade Stationary Kinetic Caregiver, physically rated for bariatric payloads (150–200 kg).

Under Section 36 of the Singapore Patents Act, this lineage is strategically hardened against "Added Matter" rejections. The Grandchildren divisionals (10202602773P/10202602774Y) maintain a continuous priority shield dating back to the 5 February 2026 foundational filing because their specific kinetic constraints and governance rules were *inherently disclosed* within the Parent M "Supreme Guardian" core architecture. This legal-technical pincer move allows the observational Class B SaMD to be fast-tracked while keeping the kinetic C/D portfolio in "deep stillness" on **zoo.dev**

2. The SITL Sovereign Conformance Toolkit (zoo.dev): Validation Schemas
The **BASELINE_001.json** testing harness serves as the "Tiger Challenge"—a B2B OEM qualification gate that forces third-party manufacturers to prove their "deterministic" claims against the A10a anchor. Any manufacturer seeking qualification must satisfy this byte-level cryptographic gatekeeper, which eliminates algorithmic drift by replacing software trust with mathematical proof.

The Conformance Toolkit utilizes **Conformance Suite S** (Signer) and **Conformance Suite V** (Verifier) to enforce system integrity. The A10a Safety Kernel wraps validated instructions in a **COSE_Sign1** container, ensuring they are bound to the physical silicon before execution.

BASELINE_001.json Schema Specification

```
{
 "conformance_suite": "SITL_1.0_TIGER_CHALLENGE",
 "genesis_metadata": {
  "framework_1.0_genesis_hash": "sha3_512_genesis_value",
  "policy_hash": "sha3_512_policy_value",
  "config_hash": "sha3_512_config_value",
  "room_voxel_grid_hash": "sha3_512_voxel_grid_value"
 },
 "enforcement_anchor": "A10a_SG_10202602021T",
 "signing_protocol": {
  "container": "COSE_Sign1",
  "key_type": "Ed25519",
  "tpm_bound": true,
  "pcr_indices": [0, 2, 7],
  "monotonic_counter": true
 }
}
```

Operational requirements for the **A10a Deterministic Enforcement Anchor (SG 10202602021T)** and the **A11 Robotic Execution Node** mandate the use of TPM-bound Ed25519 keys. These keys are tied to the hardware's Platform Configuration Registers

(PCRs), enforcing a rigid, cryptographic gatekeeper that renders unauthorized kinetic instructions physically impossible to execute.

3. Deterministic Test-Vector Specifications: The Hardening Gates
Deterministic testing eliminates the "So What?" layer of probabilistic systems by forcing absolute mathematical compliance. These gates eliminate "automation bias" by ensuring that the system cannot interpret commands beyond strictly defined physical constants.

Test Case	Trigger Event	Safety Invariant	System Response
C-005 (Canonical CBOR Gate)	Non-integer/ Malformed payload	RFC 8949 Definite Length rules; scaled µrad/ms values	Return **REFUSE_FLOAT_PRESENT**; reject non-canonical CBOR.
T-002 (Temporal Horizon)	Command delay > 200 ms	Validation against A10a monotonic hardware clock	Return **REFUSE_TTL_TOO_LONG**; default to absolute stillness.
G-001 (Policy Pinning)	External firmware/policy alteration	Immutable hash verification of local firmware (A10a)	Return **REFUSE_POLICY_HASH_MISMATCH**; block execution.
K-001 (Kinematic Boundary)	+1 µrad breach of joint limit	g=0 microgravity simulation; 7-9 axis manipulators	< 1.05 ms motor rail power severance via **Sovereign Brake™**.
T-004/005 (Monotonic Replay)	Counter (ctr) reuse or stale packet	Hardware-backed monotonic counter verification	Trigger **REJECT_REPLAY**; invalidate current session.

These hardware-level refusals ensure the observational shell remains within a "No-Diagnosis" regulatory standing, as the system responds to physical breaches rather than interpretive algorithms.

4. HSA Class B SaMD Regulatory Dossier: The Advisory Stratum (M=0)
The protocol identifies the **Nightingale's Eyes Care™ (NEC)** monitor (SG 10202602270V / 10202602781X) as a purely observational Non-B1 Standalone Monitoring Shell. This creates a legal defense for the "No-Diagnosis" Boundary, mitigating "automation bias" by leaving the interpretive burden exclusively to the human physician. The NEC monitor reports strictly spatiotemporal metrics (occupancy, flow, and clearance), qualifying as a physical sensor for the HSA Class B SaMD fast-track.

Actuation isolation is mechatronically enforced by the **"Orange Code"** logic. This is a hardcoded **pRegister P006 CPU Cap** (1.1x limit) embedded within the **A10d Governance FPGA**. By restricting the local processor's headroom to only its baseline monitoring tasks, the FPGA physically starves agentic drift or recursive planning loops of clock cycles. This ensures that software compromises cannot propagate into unauthorized physical movement, as the logic plane is mechatronically cordoned from the power rails.

5. Mechatronic Invariants and 3ZEROS™ Privacy-by-Physics

The Nightingale One Protocol™ rejects software-based privacy (encryption/blurring) in favor of the **Privacy-by-Physics** doctrine, where privacy is an unalterable structural fact.

- **A7 Galvanic Isolation Cordon:** A physical 3.0 mm **izekosGapAssertion** opto-isolated air-gap that separates the advisory logic plane from motor-energy paths.
- **Element 610 Hard No-Actuation Barrier:** A mechatronic blockade that prevents cognitive or diagnostic processes from writing to command gates.
- **3ZEROS™ Sensor Parameters:**
  - **Hardware:** Recessed 905nm **InGaAs** LiDAR array behind **Germanium glass** (zero cameras, zero microphones).
  - **Voxelization:** Local 96-cell voxelization (12x8 grid) on air-gapped hardware.
  - **Transient Destruction:** Mandatory < 90 ms coordinate destruction at the register level.

For acute monitoring, the protocol formalizes spatiotemporal flow to detect hemorrhages:

This formula tracks liquid accumulation by monitoring the **905nm reflectance index collapse**, a physical property where organic fluids absorb the LiDAR pulses. These physical omission choices satisfy the highest tiers of GDPR/PDPA by making biometric identification a physical impossibility.

$$Flow = \frac{d}{dt}(V_{flat})$$

6. Forensic Accountability and Global Maturity Standards

Institutional malpractice defense is anchored by the **WD117 forensic ledger**, connected via a unidirectional, **RX-stripped SPI bus**. This physical lack of copper receive-traces ensures that software has zero pathways to edit history. The "Scorched Silicon" process permanently hashes events using **SHA-3-512** into **One-Time Programmable (OTP)** fuses.

The system incorporates the **Multilingual Caregiver Control Terminal (Element 500)** and the **Sacred Pause™ (Element 412)**. The Sacred Pause is a hardware-enforced delay, configurable between **25–1000 ms**, designed to break automation bias. During crisis events, the **Emergency Response Clinical Protocol (ERCP)** applies a 100 ms dynamic clamp to this pause, forcing a high-visibility native-language alert while maintaining the human caregiver as the sovereign authorizer.

This architecture satisfies **WHO/UN Level 4 Maturity** standards. By operating as a non-agentic, zero-infrastructure "Heartware" system on local hardware (e.g., **Nvidia Jetson Thor**), the protocol provides absolute safety in low-resource and conflict environments. Under the Nightingale One Protocol, the layout remains the law.

the A10d FPGA transition the motor-energy rails to a "Sovereign Privilege" state, allowing kinetic commands to be processed.

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7. Forensic Finality and the U7 Sovereign Brake

For medical robotics, accountability is maintained through immutable forensic records managed by the **WD117 WORM (Write-Once-Read-Many) Forensic Ledger**.

Silicon Scorching and Forensic Chaining

Utilizing a "Silicon Scorching" process, all state transitions and authorizations are permanently etched into One-Time-Programmable (OTP) silicon fuses using SHA-3-512 hashing and **Post-Quantum Seals**. Forensic integrity is physically enforced by a unidirectional SPI bus with no return (RX) copper traces, preventing any diagnostic layer from tampering with the log.

The U7 Sovereign Brake Sequence

The U7 Sovereign Brake initiates a hardware-enforced shutdown sequence upon detecting a trajectory breach or "Orange Code" violation:

- **Fault Detection:** < 0.1 ms (e.g., encoder mismatch > 5%).
- **Power Severance:** < 1.05 ms via high-speed SSR (motor rail voltage = 0.00 V).
- **Mechanical Joint Lock:** < 50 ms via heavy-duty, spring-applied brakes.

Following a trigger, the system enters a "Permanent Mechanical Stillness" state. Restoration of operation is physically impossible without a **Level-3 Clinician** manual re-arming, which requires a full forensic audit of the WD117 digest and a physical inspection of the mechatronic assembly.

The A13d **$P_o(M + P_i + D)$** architecture sets a new global standard for safe, non-agentic robotic assistance, ensuring that human sovereignty is preserved through the immutable laws of physics and mechatronic design.

ANNEX B: CHRONOLOGICAL PRIORITY LINEAGE & SECTION 36 DIVISIONAL MAPPING

The strategic architecture platform mandates a rigorous legal-technical lineage to insulate the "Cognitive Deliberation Core" from competitor interference and ensure absolute legal continuity. By treating legal frameworks as deterministic hardware constraints, this lineage secures the "N-Layer" (Deterministic Deliberation) against prior art challenges and establishes an unassailable foundation for the platform’s governance. This priority cascade is the primary mechanism for transforming the platform’s "N-Layer" core logic into an unalterable regulatory ground truth.

The Priority Cascade

The chronological filing lineage for the platform is established as follows:

- **5 February 2026:** Filing of **SG020603109STW** (Grandparent Priority Shield), establishing foundational P-LIFE 1.00 doctrines and the core governance framework.
- **31 July 2026:** Filing of **10202602649V (Parent M / A13naige)**, the constitutional hardware enforcement architecture and parent for all A13d divisionals.
- **3 August 2026:** Filing of **10202602674U (A13d Divisional)**, the refined hardware-deterministic kinetic therapeutic-care embodiment.

Section 36 Legal Mechanics

To neutralize risks associated with "self-collision"—specifically regarding the public disclosures of the Auditory Framework in June 2026—the architecture utilizes the divisional routing mechanism under **Section 36 of the Singapore Patents Act**. By filing the A13d core as a divisional application of the 31 July 2026 parent, the legal system "backdates" the core's priority to the parent’s filing date. This mechanism effectively defeats intervening prior art and ensures the deliberation engine is legally anchored to a date preceding subsequent technical disclosures.

This established legal priority provides the "ground truth" for the physical governance rules and hardware invariants detailed in the following sections.

ANNEX C: B2B/OEM SOVEREIGN LIABILITY PARTITION CHARTER

Edwin Koh’s licensing model (where A12 = Null) creates a clear legal demarcation between software intelligence and hardware kinetics. In this model, the A12 advisory layer is "Null" because it is physically isolated from motor energy rails, ensuring software hallucinations cannot bypass the kinetic governance layer.

Sovereign Liability Matrix

Software/Clinical (Non-B1 Monitoring)	Hardware/Manufacturing (B1 Kinetic)
100% Liability absorbed by B2B licensees operating in shells (**10202602270V**).	**100% Liability** carried by third-party OEMs for **A13c/A13d mechatronics**.
Operations occur behind the 3.0mm **IZEKOS™ Galvanic Isolation** cordon.	Responsibility for structural anchors and spring-applied brakes.
Class B SaMD (Advisory Intelligence).	Class C/D Kinetic Therapeutic Hardware.

The Validator Mandate

Edwin Koh serves as the independent foundation validator, requiring byte-level **System-in-the-Loop (SITL)** verification before the release of the un-clonable **.x1 cryptographic safety key**. This key validates the physical apparatus against a **STEP B-Rep (ISO 10303) geometric manifest**. Any unauthorized mechanical alteration results in a hash failure, rendering the apparatus logically inert. While liability is partitioned, global regulatory acceptance depends on the ML4 protocols detailed next.

ANNEX D: HSA WHO MATURITY LEVEL 4 (ML4) HUMAN-IN-THE-LOOP VALIDATION PROTOCOL

Meeting HSA/WHO ML4 standards ensures clinical robotics remain tools of human intent. The platform achieves this through deterministic hardware gates that prevent autonomous agency.

The Sovereign Logic Gate

The **Sacred Pause™** timing gate enforces a **25-1000ms delay** via an independent **100 kHz oscillator**, verified to a precision of **±10 microseconds**. Actuation is permitted only if the **Tripartite Latch** is concurrently satisfied:

1. **Verified Iris Scan:** Expiring in **<5 seconds** to ensure continuous presence.
2. **Cryptographic HSM Console Key:** Physical intent verification.
3. **Analog Foot Pedal:** Continuous dry-contact engagement.

Forensic Finality and Emergency Response
In the event of a trajectory breach or "Orange Code" violation, the **U7 Sovereign Brake** severs power in **<1.05ms** via **high-speed Solid-State Relays (SSR)** disconnecting the LDO power rail.

Accountability is ensured by the **WD117 forensic ledger**. This subsystem uses **One-Time Programmable (OTP) silicon fuses** to "scorch" system events permanently into the hardware using **SHA-3-512 hashes** and **Post-Quantum seals**. The ledger is connected via an **RX-stripped SPI bus**, a unidirectional "evidence sink" that makes retroactive tampering a physical impossibility.

Closing Statement
This combined technical-legal architecture renders the WISL_No103 platform the global benchmark for deterministic robotic care. By replacing permeable software policies with immutable hardware constraints, we ensure that clinical sovereignty remains, at all times, a matter of physical law.

ANNEX E: HSA Complete Regulatory Dossier: Nightingale One NAIGE Framework

1. Executive Regulatory Overview and Architectural Partitioning

This dossier details the strategic dual-track regulatory submission for the Nightingale One platform, fundamentally governed by the Non-Agentic AI Governance Engine (NAIGE). This architecture enforces a clean regulatory separation between advisory monitoring and kinetic intervention, ensuring that probabilistic AI is physically isolated from the actuation path. By partitioning the system into distinct tiers, safety is transitioned from a software-side claim to an immutable physical property of the hardware.

Central to this submission is the "Validation by Induction" methodology. By establishing hardware-deterministic trust through the A10a Root of Trust in low-risk residential environments (Class B), the regulatory burden for high-payload clinical applications (Class C/D) is substantially reduced. This trust is anchored by the .x1 cryptographic signature, which validates the physical assembly against the ISO 10303 B-Rep geometric manifest. Per National Edition 6.0, any mechanical alteration to the assembly renders the activation permit void, ensuring the "Layout is the Law."

Regulatory Track Categorisation

Subsystem	HSA Classification	Actuation Status (M-Value)	Primary Safety Logic
Observational (A13b)	Class B SaMD	M = 0 (Zero Motors)	3ZEROS™ Privacy-by-Physics
Kinetic (A13c/A13d)	Class C/D High-Risk	M > 0 (Active Kinetic)	Hardware-Deterministic KCL

The following technical specifications define the implementation of the Tier 1 observational layer, which provides the evidence-based foundation for the platform's safety architecture.

2. Tier 1 Analysis: Class B SaMD Observational Subsystem (M=0)

The Observational Tier (A13b) is engineered for fall monitoring and eldercare surveillance where physical actuation is strictly prohibited. This subsystem maintains a "Zero Motors" (M=0) boundary, rendering it physically incapable of motion. This hard architectural limit ensures the lineage remains a purely observational diagnostic tool, supporting its Class B SaMD designation.

Privacy is governed by the "Privacy-by-Physics" (3ZEROS™) protocol, ensuring total compliance with GDPR and the EU AI Act by destroying biometric identity at the silicon level. The hardware is characterized by the absolute absence of optical lenses, microphones, and cloud dependencies. Sensing is achieved via an InGaAs 905nm LiDAR array capturing data behind Germanium-shielded glass (Source Image 28), ensuring the hardware is incapable of capturing visual biometric data.

To prevent unsanctioned agentic drift, the "pRegister P006 CPU Cap" mechanism hard-locks computation at 1.1x the baseline requirement. By physically starving the advisory layer of computational overhead, the system mathematically denies the resources required for autonomous inference or unauthorized background processes.

Data Disposal and Isolation Parameters

Parameter	Specification	Enforcement Mechanism
Sensing Modality	InGaAs 905nm LiDAR (Germanium-shielded)	96-cell (12x8) spatial voxel grid
Data Destruction	Transient Latency < 90ms	Silicon register-level erasure
Electrical Isolation	3.0mm Air-Gap	IZEKOS™ Galvanic Isolation
Output Type	Anonymous CoM Vectors	Non-reversible spatial states only

This passive monitoring layer provides the high-fidelity spatial awareness required to inform the rigorous safety gates of the kinetic Tier 2.

3. Tier 2 Analysis: Class C/D Acute Kinetic Subsystem (M > 0)

Tier 2 mechatronics (A13c-HC and A13d-Pro) are designed for high-payload interventions in ICUs and geriatric wards. In these high-dependency environments, kinetic actuation is treated as a strictly governed physical privilege. The system architecture ensures that no movement occurs without concurrent human authorization and hardware-validated constraints.

The "Human-Sovereign Gate" is enforced by the Tripartite .1x Key protocol, which requires three simultaneous physical inputs to close the motor-energy circuit:

1. **Iris Scan:** Verified biological identity with a hardwired session expiry of < 5 seconds to ensure continuous caregiver presence.
2. **HSM USB Token:** A physical cryptographic key inserted into a dedicated, hardened socket.
3. **Kinetic Foot Pedal:** A guarded industrial pedal requiring active depression (dry-contact continuity).

Mechanical integrity for bariatric support is maintained through immutable invariants. The system utilizes Pre-loaded ball lead-screws (Item 11245) to ensure zero movement or "creep" under load. Joint position tolerances are hard-locked to ±0.05mm, while bariatric ratings support a 150kg lift and 200kg hold. Safety is further reinforced by mechanical slip clutches at the joints (Shoulder 5–8 Nm / Hip 10–15 Nm) and heavy-duty compressed die springs that engage the brakes upon any power loss.

The U7 Sovereign Brake™ provides the final deterministic safeguard. Upon detection of any trajectory breach or agentic drift, the system achieves electrical power severance in < 1.05ms via high-speed solid-state relays. This is followed by a complete mechanical joint lock in < 50ms, ensuring the platform fails safe before an AI hallucination can manifest as physical force.

4. The NAIGE Deterministic Governance Pipeline

The core of the framework is the "Inaction-as-Safe-Default" doctrine and the P-LIFE 1.00 Supreme Mandate. Absolute mechanical stillness is the system's baseline; motion is a temporary, human-authorized exception. This is managed by the "Sacred Pause™" mechanism, a hardware-enforced deliberation window (25–1000ms). The master 1 kHz clock providing 1.0ms state resolution is verified by an independent 100 kHz oscillator accurate to ±10 microseconds.

The Six-Stage Safety Pipeline

1. **Physical Isolation:** Advisory processors possess zero actuation rights and are physically separated from motor-energy paths.
2. **Deliberation Interval (Sacred Pause™):** A mandatory hardware-timed window for human review before any motion energization.
3. **Sovereign Human Authorisation:** Concurrent verification of iris biometrics, HSM tokens, and the kinetic foot pedal.
4. **Deterministic Kinematic Checks:** A hardware finite-state machine validates trajectories against strict ±0.05mm positional tolerances and fixture identities.
5. **Bounded Kinematic Execution:** Motion is confined to pre-authorized envelopes, subordinate to physical hard stops and force limiters.
6. **Evidence Logging and Power Severance:** State transitions are scorched into the immutable ledger while independent circuits stand ready for instant de-energization.

This pipeline ensures that every state transition is captured by the platform's forensic record-keeping system.

5. Forensic Accountability and Immutable Ledger (WD117)

To meet clinical requirements for legally defensible records, the platform utilizes the WD117 WORM (Write-Once-Read-Many) forensic ledger. This system captures every permission gate and fault assertion with absolute finality.

The "Silicon Scorching" process etches SHA-3-512 cryptographic hashes into One-Time-Programmable (OTP) fuses. Once scorched, these records become a physical property of the silicon substrate, making retroactive mutation or deletion a physical impossibility. Integrity is physically guaranteed by the "Evidence Sink" architecture: the ledger is connected via a unidirectional SPI bus lacking return (RX) copper traces, preventing any data injection or advisory-layer exploits.

This forensic finality provides the bridge between the mechatronic execution and the statutory requirements of the Singapore Health Sciences Authority.

6. Statutory Intellectual Property and Patent Traceability

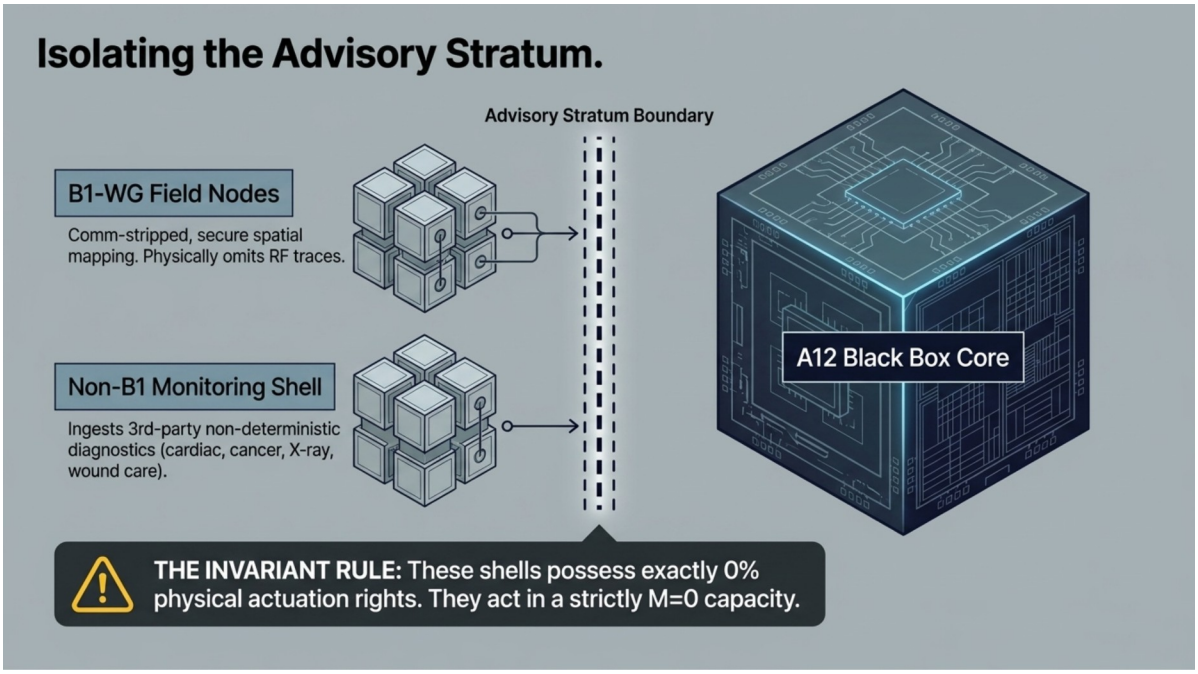
The Nightingale One protocol is anchored by the Patent M / A13naige lineage. This core parent patent serves as the constitutional anchor for all divisional applications, defining the hardware-deterministic governance that separates cognitive engagement from physical actuation.

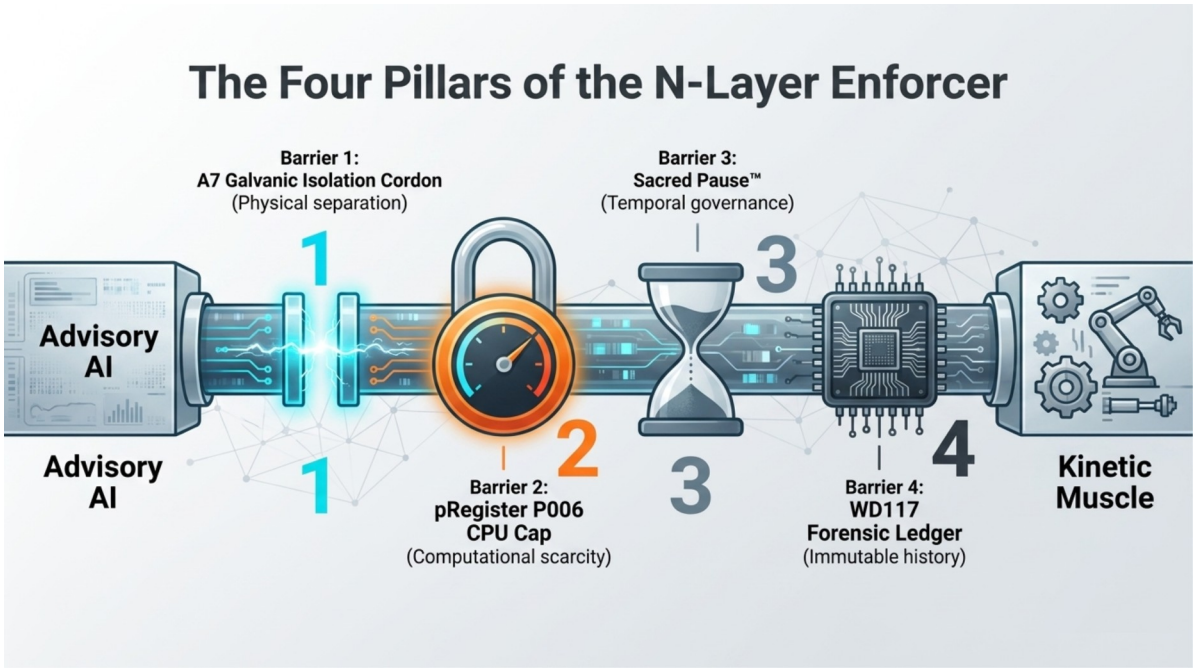
Primary Patent References

- **10202602649V:** NAIGE Core Parent - Constitutional Hardware Enforcement (Anchor).
- **10202602270V:** Non-B1 Monitoring Shell - Physical Architecture of Deterministic Observation.
- **10202602156U:** Patent M/A13 - Integrated Governance Core.
- **10202602773P:** A13c-HC Clinical Shell - Kinetic Caregiver Safety and Governance Enforcers.
- **10202602774Y:** A13d-Pro Clinical-Grade Apparatus - High-Payload Stationary Kinetic Caregiver.

Post-incident recovery is governed by the "Re-Arming Protocol (SOP-A13-REV-L3)." Re-energization requires a Level-3 clinician and a mandatory forensic audit of the WD117 digest. Critically, the protocol requires load cells to register exactly 0.0 kg (±2.0%) to ensure the system is in a safe, unburdened state before re-arming.

The Nightingale One Protocol asserts that the **"Layout is the Law."** By replacing permeable software policies with immutable hardware constraints, safety is established as an immutable physical property of the sovereign hardware assembly.

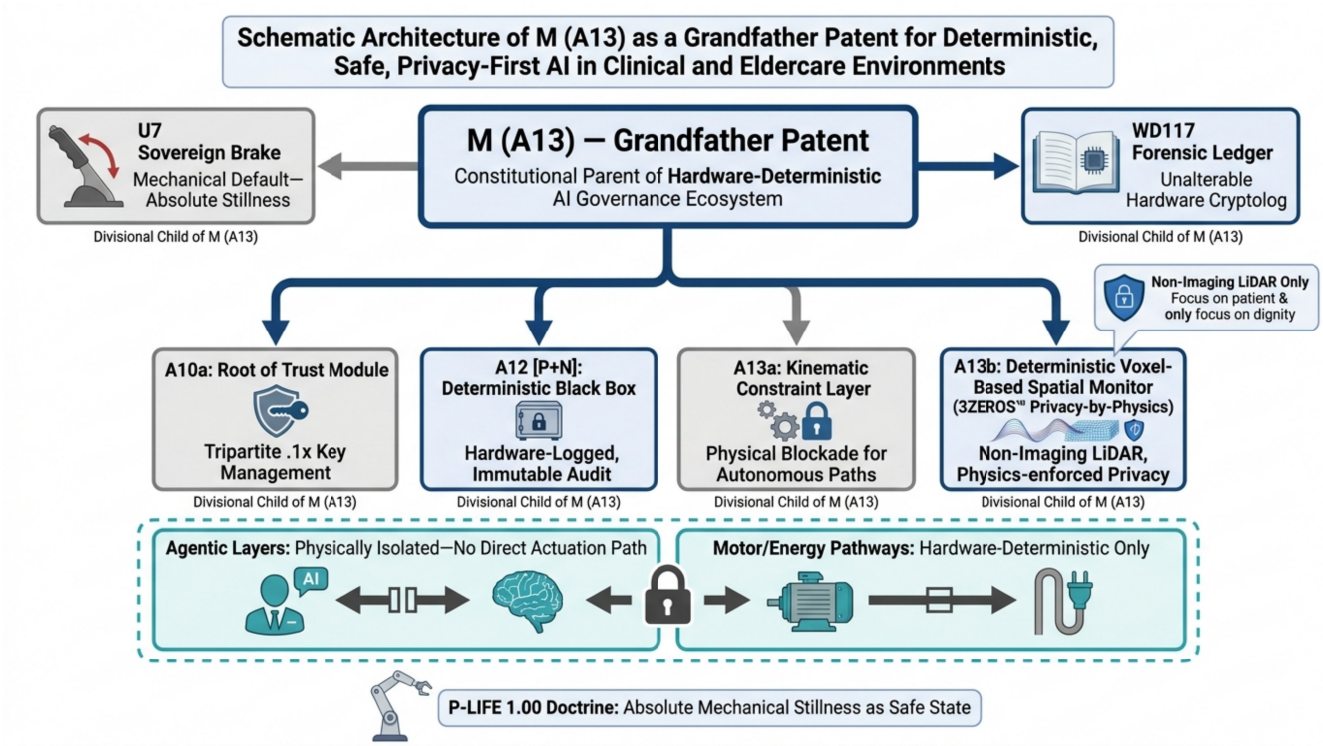




Edwin Koh’s Sovereign Blueprint: Grandparent Lineage, Current Mission, and Future Frontier 2027

1. THE M (A13NAIGE) GRANDPARENT LINEAGE & PORTFOLIO ANCESTRY

In the highly scrutinized landscape of clinical mechatronics and non-agentic AI, the establishment of a deterministic patent lineage is a critical legal maneuver to negate "added matter" vulnerabilities. By anchoring all subsequent divisional applications in the "Supreme Guardian Master Control Layer," we ensure that every iteration of the technology remains tethered to a hardware-enforced baseline. This strategic lineage prevents the invalidation of priority claims that often plagues evolving robotics portfolios, providing a constitutional skeleton for all child and grandchild embodiments.



1.1 The Foundational Parent Core

The technical and legal architecture is anchored by **Patent M (A13) — SG Application 10202602156U** (24 June 2026), titled "A13 Integrated deterministic non-agentic governance core for clinical eldercare applications," and its primary master divisional, **Patent M (A13naige) — SG Application 10202602649V** (31 July 2026). The latter is formally designated as the **"Supreme Guardian Master Control Layer."** Together, they establish the "Constitutional Hardware Enforcement Architecture." This framework functions as an un-bribable baseline for non-agentic AI, where safety is not a software variable but a physical property of the silicon substrate, moving the "Heartware" mission from permeable code to immutable circuitry.

1.2 First-Generation Divisional Architecture

The architecture branches from the Supreme Guardian core into specialized functional domains as follows:

Application Number	Jurisdiction/Title	Functional Scope
10202602674U	USPTO - A13d P (M + P + D) Therapeutic-Care Architecture Hardware-Deterministic Kinetic Therapeutic-Care Device with Segregated Perception, Cognitive, and Actuation Domains.	Hardware-deterministic kinetic care utilizing segregated domains to ensure absolute physical isolation between AI-advisory processing and the motor-energy actuation paths.
10202602693U	Singapore IPOS - Therapeutic-Care Apparatus with Protocol-Governed Actuation, Privacy-Preserving Perception and Deterministic Safety Control.	Focuses on hardware-level safety invariants, therapeutic fixtures, and the cryptographically signed WD117 forensic ledger.
10202602767X	The Nightingale One Protocol Framework (Caregiver-supervised therapeutic-care architecture integrating outer protocol governance P_o, mechanically bounded therapeutic assistance M, privacy-preserving perception P_i, and deterministic safety/accountability D).	The master framework coordinating mechanically bounded assistance (M), privacy-preserving perception (P_i), and the deterministic safety kernel (D).

1.3 Second-Generation Grandchildren Embodiments

The "Grandchildren" divisionals provide the specific mechatronic specifications for the physical hardware hulls, scaling the core architecture for distinct environments. Both embodiments utilize **Model 11245 recirculating ball lead-screws** to support high-payload movements with zero mechanical creep:

- **10202602773P (c1 - A13c-HC):** Optimized for residential and community-care environments, focusing on supervised bed-to-chair transfers and therapeutic repositioning with a payload capacity of **150kg**.
- **10202602774Y (c2 - A13d-Pro):** A clinical-grade stationary apparatus for ICUs and geriatric wards. Rated as a "bariatric crane," it supports payloads of **150kg to 200kg**, replacing high-risk manual nursing maneuvers with hardware-governed precision.

1.4 The Isolated Advisory Peripheral

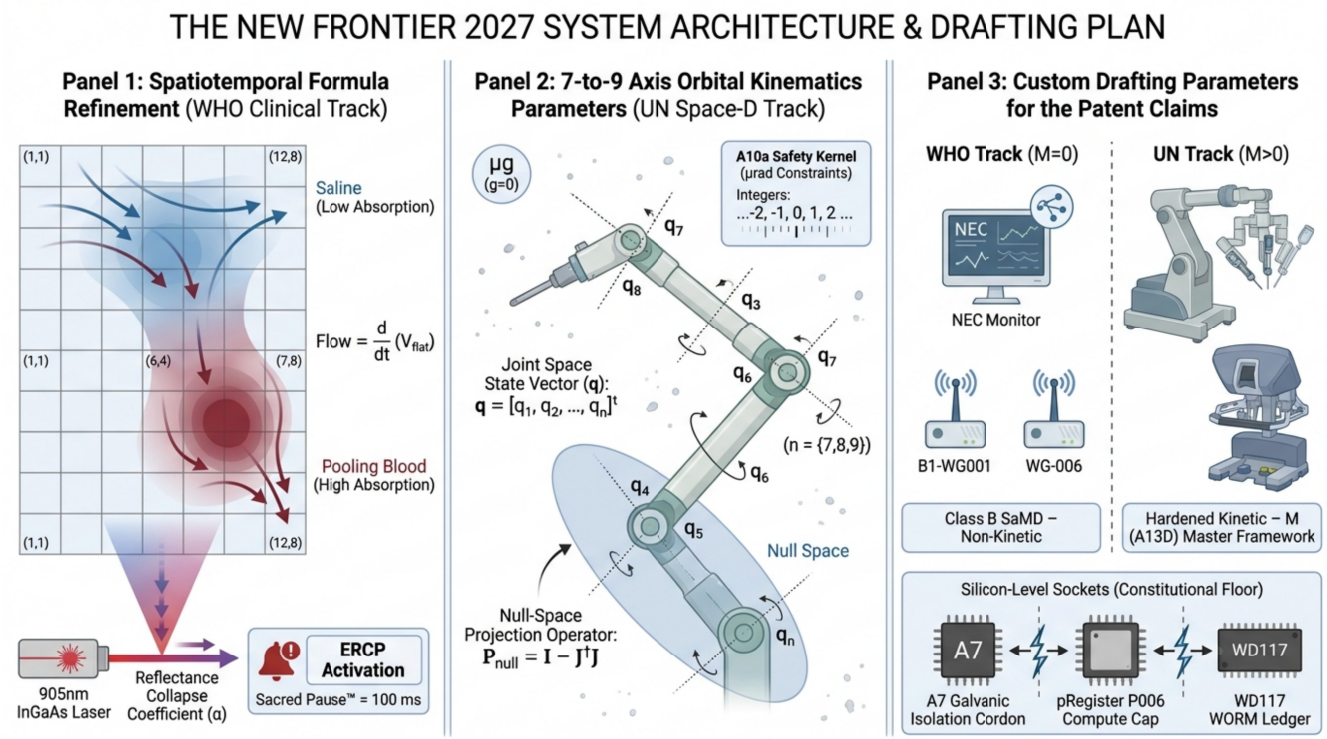
Operational isolation is rigorously enforced through **Non-B1 – SG Application 10202602270V** (1 July 2026). This patent defines the Advisory Stratum (M=0), a non-kinetic layer for third-party diagnostic software (cardiac, cancer, or wound diagnostics). The placement of this shell allows for **"regulatory arbitrage,"** securing Class B status for the software while

the kinetic "Dark Secret" remains a protected trade secret. Physical protection is ensured by the A7 Galvanic Isolation Cordon, a 3.0mm air-gap designated as the **"izekosGapAssertion,"** which prevents software "hallucinations" from accessing the robotic energy paths.

This structural ancestry provides the rigid legal and clinical skeleton required to maintain the inventor’s strategic posture within the Singaporean regulatory landscape.

2. EDWIN KOH’S CURRENT CLINICAL MISSION (SINGAPORE HSA CORE)

The "Humble AI" posture is a strategic risk-mitigation shield utilized during the pre-regulatory phase. By maintaining a status of "no claims, no active prototypes, and no deployed sites," the background IP is protected from the liabilities of the "agentic world." This deep stillness allows the technology to be validated against the unyielding laws of physics rather than the shifting guidelines of probabilistic AI.



2.1 Strategic Humility & Liability Shielding

Edwin Koh’s posture ensures that the Nightingale One Protocol remains a reference governance blueprint. This status protects the IP from litigation while maintaining a focus on "Heartware"—where dignity and privacy are treated as non-negotiable physical laws. It serves as a challenge to the industry: any entity claiming "determinism" must meet these unyielding hardware standards.

2.2 Dual-Track Regulatory Bifurcation

The clinical mission aligns with Singapore’s Health Sciences Authority (HSA) and its **WHO Maturity Level 4 (ML4)** status through a bifurcation of regulatory tracks:

- **Track 1: Fast-Tracked Class B SaMD.** This covers the A13b non-kinetic observational sensor node, allowing for near-instant deployment under the AIHGle 2.0 Exemption Sandbox for facility surveillance.
- **Track 2: Formal Class C/D Medical Device Route.** This track is reserved for the high-payload kinetic hardware (A13c-HC/A13d-Pro), which remains in a long-term pre-market evaluation phase to ensure the kinetic "muscle" is never compromised by software updates.

2.3 Emergency Response Clinical Protocol (ERCP) Architecture

The ERCP is a mechatronic upgrade designed to bypass human cognitive friction during life-critical events. This architecture is governed by two primary axes:

- **pLine 1.00 (The Invariant Axis of Action):** Enforces the law where Harm = Death and North = Save Life. During trauma detection (e.g., severe fall), the **Sacred Pause** deliberation window is dynamically clamped from 1000ms to a **100ms** floor for rapid, verified intervention.
- **pLine 0 (The Forensic Axis of Reflection):** Realizes the Ledger Constitution where negligence is mathematically treated as Harm = Death. Telemetry is "scorched" into the **WD117 forensic ledger** via OTP silicon fuses, creating an unalterable record of the pLine 1.00 action.

2.4 Mother Teresa Compassion Protocol (MTCP) & Sanctuary Mortuary

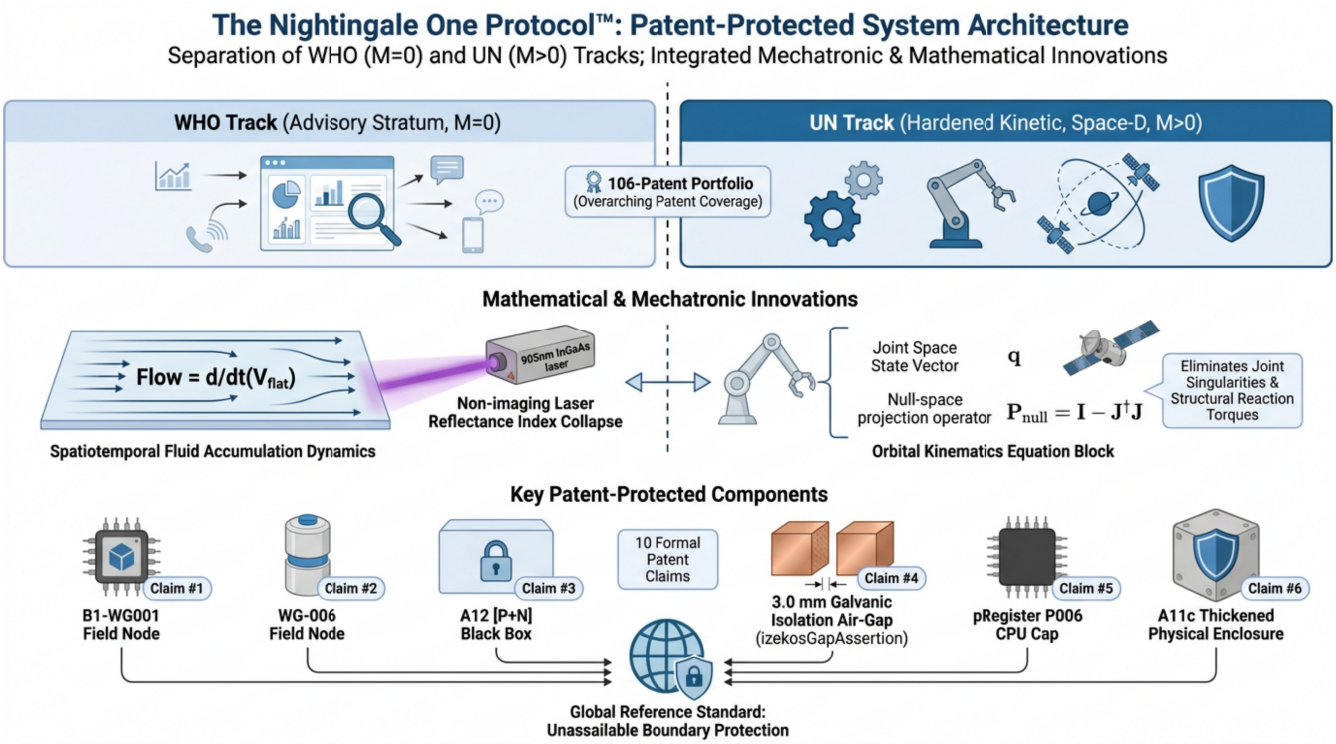
The MTCP manages the mechatronic stasis transition (P-LIFE 1.00), where all kinetic actuators are de-energized and brakes are clamped for end-of-life care.

- **3ZEROS™ Privacy-by-Physics:** The architecture omits cameras and microphones, utilizing a **905nm InGaAs LiDAR** to voxelize the environment into an anonymous **96-cell local voxel occupancy grid (12x8)**.
- **Hemorrhage Detection:** The system monitors for **905nm reflectance index collapse** (a drop in laser return intensity) to detect pooling blood via the formula: Flow = d/dt(V_{flat}). This provides automated alerts while maintaining total patient anonymity within the "Sanctuary Mortuary."

This clinical foundation in Singapore establishes the sovereign spine necessary for global humanitarian and aerospace expansion in the 2027-2028 horizon.

3. THE FUTURE FRONTIER 2027 & MONTH 12-18 HORIZON

As we approach the "Deterministic Horizon" of 2027, the strategic focus shifts from domestic patent protection to global humanitarian gifting and sovereign aerospace application, leveraging unassailable prior art to preserve human dignity through physics.



3.1 Phase 1: The Sovereign Anchor (Months 0–12)

Between January and February 2027, the mission achieves absolute legal finality. Under the **National Library Board (NLB) Legal Deposit Act**, the National Editions 1.0 to 6.0 are sealed as permanent public records. The closing of the **PCT international filing window** on 6 February 2027 achieves a **"strategic decoupling of domestic SaMD liability from sovereign aerospace assets,"** legally separating the clinical portfolio from advanced kinetic trade secrets.

3.2 Phase 2: The Humanitarian Gifting Window (Months 12–18)

This phase activates the "WHO Track" gifting model. The **Nightingale's Eyes Care (NEC)** monitors, specifically the **B1-WG001 field nodes**, will be offered under an open-source, zero-fee ML4-style humanitarian license for conflict and low-resource environments. These monitors operate strictly on air-gapped hardware, providing dignity through the **3ZEROS™** architecture without the need for vulnerable internet infrastructure.

3.3 The UN Track: M (A13D) Master Framework

The transition of unfiled kinetic patents into the **UN Track** addresses high-altitude aerospace and deep-space surgical telemetry. This framework utilizes hardened, "comm-stripped" hardware:

- **7-to-9 axis hyper-redundant kinetic arms** for complex mechanical tasks in extreme environments.
- **Comm-stripped field nodes (WG)** and biometrically interlocked **wearable gates (WM)** that utilize galvanic handgrip pairing to ensure operator presence.

- **WD005 Vapour Protocol:** A hardware-level security measure that triggers a silicon-root reset to a "clean" state if unauthorized signal injection or agentic drift is detected at the register level.

Through this dual-track strategy, Tiger establishes a global pincer: a WHO-aligned gifting model securing humanitarian standing, and a UN-aligned track preserving sovereign control over aerospace and defense assets. The layout remains the law.

4. The Nightingale One Protocol™: New Frontier 2027 Independent Patent Specification and System Architecture

4.1. SYSTEM BIFURCATION & STRATEGIC LINEAGE: THE SOVEREIGN DOMAIN ARCHITECTURE

The strategic necessity of bifurcating AI governance into dual tracks is driven by the mandate to eliminate "Agentic Drift"—the phenomenon where autonomous systems deviate from human-defined safety and ethical boundaries. By separating the architecture into the WHO (Clinical) and UN (Space-D) tracks, the Nightingale One Protocol™ ensures absolute human sovereignty over kinetic actions. This structural bifurcation is the prerequisite for the 2027 "Deterministic Horizon," transitioning medical and orbital robotics from probabilistic software guardrails to immutable physical laws.

4.2 The Dual-Track Hierarchy

The following table defines the structural separation between observational advisory and kinetic actuation, establishing the "Heartware" philosophy:

Feature	WHO Track (Observational/Advisory Stratum)	UN Track (Hardened Kinetic/Space-D)
Kinetic Capacity	M = 0 (Non-Kinetic/Observational)	M > 0 (High-Payload/Kinetic)
Regulatory Tier	Class B SaMD (AIHGle 2.0 Exemption)	Class C/D Medical Device / Sovereign Defence
Primary Goal	Clinical Diagnostic Advisory	Kinetic Intervention & Reaction Mitigation
Safety Logic	Heartware: Non-Imaging Privacy-by-Physics	Heartware: Bounded Null-Space Kinematics
Control Logic	Advisory Intelligence (Non-Actuating)	Deterministic Actuation Path

Formal Patent Lineage Reconstruction

The Nightingale One Protocol™ rests upon a comprehensive patent portfolio (ACRA T260229801), tracing its priority back to the foundational frameworks of mid-2026. The lineage is reconstructed with technical finality as follows:

- **Parent Master M (10202602649V):** Filed 31 July 2026. Constitutional Hardware Enforcement Architecture for Non-Agentic AI Governance (A13naige).
- **Patent M (A13) (10202602156U):** Filed 24 June 2026. The original integrated deterministic governance core for clinical eldercare.
- **Divisional Child A (10202602674U):** Filed 3 August 2026. P_o(M + P_i + D) Therapeutic-Care Architecture.
- **Divisional Child B (10202602693U):** Filed 4 August 2026. Protocol-governed actuation and forensic logging.
- **Grandparent Framework (10202602767X):** Filed 8 August 2026. The Nightingale One Protocol™ Framework.
- **Grandchildren Divisionals:**
    - **10202602773P (A13c-HC):** Filed 10 August 2026. Home-care kinetic caregiver apparatus.
    - **10202602774Y (A13d-Pro):** Filed 10 August 2026. Clinical-grade stationary kinetic caregiver apparatus.

Peripheral Integration

The architecture utilizes the **Standalone Non-B1 Advisory Peripheral Shell (10202602270V / 10202602781X)** as a unidirectional gateway. This shell ingests third-party diagnostics (cardiac, cancer, X-ray, and wound monitoring) through the **A7 Bridge** via the **A7 Galvanic Isolation Cordon**. This creates an "un-bribable" prior art wall, ensuring diagnostic software can advise but never command the physical motor-energy path, transitioning the protocol into the refined clinical tracking of Section I.

5. SPATIOTEMPORAL TRAUMA DETECTION FORMULA REFINEMENT (WHO CLINICAL TRACK)

In clinical environments, the protocol prioritizes "Privacy-by-Physics." By utilizing non-imaging spatial awareness, the system replaces invasive camera-based surveillance with anonymized voxel-based tracking. This ensures patient dignity while providing high-fidelity trauma detection through deterministic data disposal.

Mathematical Formulation of Fluid Dynamics

The system identifies acute trauma, such as high-density organic fluid hemorrhaging, by monitoring flat-plane spatiotemporal accumulation. This is formulated as a volumetric flow rate:

$$Flow = \frac{d}{dt}(V_{flat})$$

Where V_{flat} represents the voxelized volume integration across a **96-cell local voxel grid** (12 columns x 8 rows). To maintain the 3ZEROS™ paradigm, all raw point-cloud data is destroyed at the register level in **< 90 ms**, ensuring no re-identifiable biometric images are generated.

The Reflectance Collapse Coefficient (α)

To differentiate biological fluids (blood) from synthetic materials or spills, the system evaluates the **Reflectance Collapse Coefficient (α)**. Utilizing 905nm non-imaging InGaAs laser pulses, the system monitors for a specific reflectance index collapse. Because blood strongly absorbs 905nm light, a rapid attenuation drop across active voxels provides a 3ZEROS™-compliant verification of hemorrhage.

Emergency Response Clinical Protocol (ERCP) Logic

Upon reaching the Critical Emergency Threshold ($F_{critical}$), the **ERCP** is triggered. This mechatronic bypass mechanism dynamically clamps the **Sacred Pause™** delay from its standard 1000 ms window to a **100 ms floor**. This hardware-timed clamp facilitates rapid intervention while still requiring a deterministic verification of caregiver presence.

6. 7-TO-9 AXIS ORBITAL KINEMATICS PARAMETERS (UN SPACE-D TRACK)

The UN Space-D track utilizes null-space projection in microgravity environments (g = 0) to protect satellite docking and deep-space surgical bays. This prevents dynamic reaction forces from damaging sensitive orbital interfaces.

Hyper-Redundant Kinematics Formulation

The system utilizes a joint space state vector q for $n \in \{7,8,9\}$ axes axes: $q = [q_1, q_2, \ldots, q_n]^T$

Null-Space Projection Operator

To absorb reaction forces and mitigate joint singularities, the system restricts active movement to the Jacobian's null space utilizing the projection operator:

$$P_{null} = I - J^{\dagger}J$$

where $J(q)$ is the system Jacobian and $J^{\dagger}$ is its pseudoinverse. This enables the robotic arm to reposition its internal configuration without exerting force on the satellite base or the patient.

The A10a Safety Kernel Integer Scaling

To eliminate floating-point rounding errors and subsequent algorithmic drift, the **A10a Safety Kernel** enforces strict integer scaling:

- **Joint-Space Coordinates:** Processed as scaled microradian (\murad) integers.
- **Time References:** Processed strictly in milliseconds (ms). This hardware-locked approach ensures that kinetic paths remain deterministic and immune to agentic software failures.

7. APPARATUS EMBODIMENTS AND HARDWARE DETERMINISM (B1-WG001, WG-006 & A12 CORE)

Mechatronic isolation of "Heartware" provides a superior safety boundary; physical air-gaps are superior to software firewalls. Safety is treated as a physical property of the motherboard.

Field-Node Enclosure Specifications

The **B1-WG001** and **WG-006** field-node enclosures house localized spatial sensors. They implement the **A7 Galvanic Isolation Cordon**, featuring a physical **3.0 mm air-gap** (izekosGapAssertion) bridged via opto-isolators to ensure Class B SaMD status (M=0).

A12 [P+N] Deterministic Black Box Core

The **A12 core** is housed in the **A11c Thickened Enclosure** (Al-6061 armored shell). Tamper-evident interrupt pins guarantee logical immutability; a physical breach voids cryptographic activation signatures, defaulting the system to absolute stasis. The **pRegister P006 CPU cap**, known as **"Orange Code,"** is hardcoded into the FPGA to restrict computational headroom to 1.1x of baseline monitoring tasks.

WD117 Forensic Ledger Architecture

The **WD117 forensic ledger** provides an unalterable history of every clinical action.

- **Data Path:** Utilizes an **RX-stripped unidirectional SPI bus**, physically preventing return-path command injection.
- **Hash Standards:** Every state transition is hashed using **SHA-3-512**.
- **Storage:** Hashes are permanently scorched into **One-Time Programmable (OTP) silicon fuses**, creating an "un-bribable" witness for regulatory audits.

Conclusive Summary

The Nightingale One Protocol™ establishes the **NAIGE Immutable Deterministic** standard as a physical property of the motherboard. Under the **P-LIFE 1.00™ doctrine (HARM=DEATH)**, safety is anchored in the motherboard rather than software, ensuring that care and clinical integrity are preserved through the unyielding laws of physics. The layout remains the law.

NATIONAL EDITION 6.0 ANNEX

Technical Handover, Mechatronic BOM, and V&V-014 Protocol
Nightingale One Systems (A13d-Pro / A13c-HC)

Author: Edwin Koh Wui Kiat (Tiger)
Founding Father, Non-Agentic AI 2.0™
Sole Sovereign Operator, kohedwin.ai
ACRA Entity: T260229801 (Non-Agentic Governance Singapore)
Patent Priority Reference: SG020603109STW (P-001)

1. Technical Handover & Mechatronic Bill of Materials (BOM)

This Annex constitutes the definitive hardware-deterministic handover specification for the zoo.dev fabrication run of the A13d-Pro (Stationary Clinical-Grade) and A13c-HC (Mobile Hybrid Caregiver) platforms. Within the overarching Po(M + Pi + D) framework, this document codifies the physical invariants of the 'M' (Mechanical) and 'D' (Deterministic Safety) layers. This partitioning serves as a foundational firewall to isolate software-level risk and guarantee that no software fault or agentic drift can translate into unregulated kinetic force.

> **Inaction-as-Safe-Default (P-LIFE 1.00™):** The baseline mechatronic state of the apparatus is absolute mechanical stillness. Motion is not a default capability or an automatically initiated state; it is a Sovereign Privilege granted only as a temporary, governed exception through concurrent biological, cryptographic, and physical human inputs.

Mechanical Invariants Enforce Hard Kinetic Ceilings Below the Software Stack

Item No.	Component Description	Exact Mechanical Property	Sovereign Safety Function
1120	Brushless DC Motor	Primary electrical execution module	High-torque vertical/horizontal actuation.
220	Telescoping Lifting Column	Primary structural vertical hoist member	Supports 150 kg bariatric lift and 200 kg hold.
1102	Inner Stage Column Segment	Precision-guided internal column segment	Maintains rigid mechanical path alignment.
11245	Recirculating Ball Lead-screw	Pre-loaded zero-backlash ball nut assembly	Physically prevents drift or vertical 'creep' under high load.
234	Joint Hard Stops	Physical travel limit inhibitors	Mechanically locks positioning within ±0.05 mm limit.
236	Spring-loaded Slip Clutches	Calibrated to 5–8 N·m (Shoulder) and 10–15 N·m (Hip)	Physically prevents crushing by free-spinning at calibrated torque limits.

Item No.	Component Description	Exact Mechanical Property	Sovereign Safety Function
1105	Electromagnetic Brakes	Normally-engaged, Power-Released discs	Fails to hold: immediate locking on de-energization (P-LIFE 1.00).
1168/1167	Active-Low Solenoid Pawls	Engages hardened tooth strip on central column	Secondary mechanical capture if descent velocity exceeds 0.2 m/s.
1401	Keyed Sling Coupler	150 kg lift / 200 kg hold rated receiver plate	Interlocks with patient sling; prevents unauthorized fixtures.
IZEKOS™	Galvanic Isolation Barrier	3.0 mm physical air-gap separation (izekosGapAssertion)	Denies software direct actuation capacity without tripartite human bridge.

Strategic Notice: Conventional clinical devices rely on software-based current limiting to prevent crushing forces—a system highly vulnerable to OS latency or pointer corruption. The A13d-Pro replaces this with physical spring-loaded slip clutches (Item 236). Even if a compromised advisory AI sends an unauthorized high-voltage current command, the clutches simply slip and spin freely at the shoulder (5–8 N·m) and hip (10–15 N·m) thresholds, rendering crushing injuries physically impossible.

2. Verification and Validation (V&V-014) Factory Test Suite

The V&V-014 Factory Test Suite defines the deterministic 'Pass/Fail' gates that must be satisfied before any mechatronic assembly is certified as software-ready. These test procedures isolate physical performance and hardwire constraints from eventual software integration, establishing absolute forensic finality.

The Seven Immutable Mechatronic Pass Gates

Verification Domain	Measurement Instrument	Mandatory Pass Threshold
1. Microscopic Joint Tolerance	Coordinate Measuring Machine (CMM)	Positional variance must not exceed ±0.05 mm across full joint range.

Verification Domain	Measurement Instrument	Mandatory Pass Threshold
2. Galvanic Separation	Physical pin-gages & High-Voltage dielectric testing	Absolute 3.0 mm clearance of the IZEKOS™ gap; zero power-rail bypass under dielectric stress.
3. Torque Slip Clutch Calibration	Calibrated torque transducer	Physical slip must occur strictly between 5–8 N·m (shoulder) and 10–15 N·m (hip).
4. Fail-to-Hold Brake Engagement	High-speed digital timer & Laser tachometer	Spring-applied brake engagement latency < 50 ms on vertical column; pawl activation on drop > 0.2 m/s.
5. Tripartite Latch continuity	Logic analyzer & Oscilloscope	100% concurrent continuity for Iris, HSM, and Foot inputs. Independent 100 kHz oscillator for Sacred Pause verified to ±10 µs.
6. U7 Sub-Millisecond Severance	Multi-channel digital storage oscilloscope	Motor rail power must decay to 0.00 V in < 1.05 ms from moment of fault assertion.
7. WD117 Forensic Ledger	SHA-3-512 hash verification tool	Successful 'silicon-level scorching' of hash chain to OTP fuses; 0% copper RX traces detected on PCB.

WARNING: Any foundries or assembly facilities that alter dimensions, remove mechanical slip clutches, or bridge the physical 3.0 mm isolation air-gap to 'save space' immediately invalidate the V&V-014 factory certification and the underlying HSA pre-market dossier, transferring all subsequent liability to the modifying party.

3. Clinical Workflow & SOP-A13-REV-L3 Re-Arming Protocol

Following any fault assertion (trajectory breach, sensor mismatch, bariatric torque overload, or AI compute cap overshoot), the Nightingale One platform immediately enters a state of permanent mechanical stillness. Restart is physically denied at the silicon level. The system cannot be re-armed remotely. It requires a Level-3 Clinician to perform the manual, four-phase clinical re-arming sequence documented under SOP-A13-REV-L3.

The Four Phases of the Secure Re-Arming Sequence

1. **Phase I: Forensic Log Acquisition & Diagnostics:** The clinician must connect a hardware reader to the A12-SITL forensic port to extract and read the WD117 WORM ledger digest. The SHA-3-512 cryptographically signed ledger must be verified to identify the exact cause of the fault trigger. This establishes an unalterable forensic record of whether the lockout was caused by mechanical overload, sensor misalignment, or AI agentic drift.

2. **Phase II: Physical Mechatronic Inspection Checklist:** The clinician must execute a 6-point physical mechatronic audit of the apparatus: (1) Visual check of rails and Item 11245 ball screws for scoring or structural damage. (2) Thermal check of brake housings. (3) Mechanical verification of holding pawls and spring brakes (Item 1105). (4) Inspection of the ceiling structural anchors or chassis stability outriggers. (5) Verification that the bariatric load cells are fully offloaded, registering exactly 0.0 kg (±2.0%) net weight. (6) Dielectric check of the 3.0 mm isolation gap.

3. **Phase III: Cryptographic Token and Signature Verification:** The Level-3 Clinician must physically reseat their personal cryptographic HSM USB key into the A12 console. Simultaneously, the clinician must perform a fresh local biometric iris scan (905nm LiDAR point cloud) to re-authenticate the Tripartite Latch. Re-authenticating closes the first two silicon-level AND-gates of the authorization loop.

4. **Phase IV: System Re-Arming & Power Restoration:** With the clinician holding foot pressure on the analog kinetic pedal, they must initiate the cryptographic reset. The system initiates a mandatory 1,000 ms Sacred Pause™ countdown managed by the independent 100 kHz oscillator. Only upon completion of this pause do the solid-state relays re-energize the DC motor power rails, accompanied by an audible mechanical click of joint engagement. The re-arm event is permanently scorched to the WD117 ledger.

Audit and Alert: The Authority Capture Indicator

To mitigate cognitive bias and alert fatigue where humans reflexively approve AI proposals, the system actively monitors Point-of-Care approval times. If a caregiver completes a PITL trajectory approval in under 5.0 seconds from the display presentation, the event is immediately flagged as a potential 'Authority Capture' incident. The system registers a warning in the Audit Trail and triggers a mandatory Tier 2 clinical governance review within 48 hours to prevent systemic erosion of human primacy.

Document Authorization and Sign-Off

This Annex has been fully reviewed and is formally authorized for inclusion in National Edition 6.0 of the Nightingale One Protocol. All mechatronic, electrical, and clinical workflow calibrations are validated and certified as deterministic invariants.

Lead Mechatronic Engineer: _____ Date: 15/8/2026

Regulatory Quality Director: _____ Date: 15/8/2026

Founding Father, Non-Agentic AI 2.0™: _____ Date: 15/8/2026

Technical Report: Nightingale’s Eyes Care™ System Architecture and Clinical Risk Screening Protocols

1. Executive Governance Overview: The Non-Agentic AI 2.0™ Foundation

The Nightingale’s Eyes Care™ (NEC) system, operationalized through the **Nightingale One Protocol**, represents a total departure from the permeable vulnerabilities of probabilistic software guardrails. This architecture is built on the doctrine of "Policy as Physics," where clinical safety is not a software promise but a deterministic property of the hardware. Grounded in the **P-LIFE 1.00™ mandate**—which dictates the binary imperatives of "Harm = Death" and "North = Save Life"—the system eliminates "Software Trust" in favor of "Hardware Certainty."

NEC operates within the **ABC+2S+H™ Framework** (Accuracy, Boundaries, Consent, Safety, Sovereignty, and Human Primacy), ensuring that AI never attains agency. Under the **"Inaction-as-Safe-Default"** doctrine, the system is physically de-energized and mechanically locked in its baseline state. Motion is classified as a "Sovereign Privilege," which can only be granted through a deterministic pipeline that ensures intelligence only proposes while hardware enforces and humans authorize.

2. Core Hardware Specifications and Sovereign Infrastructure

In the NEC architecture, the physical layout serves as the ultimate barrier against agentic drift. By physically starving the advisory stratum of computational resources and isolating the execution rails, the system ensures that the "Advisory Console" remains constitutionally incapable of bypassing human authority.

905nm LiDAR Voxel Tracker

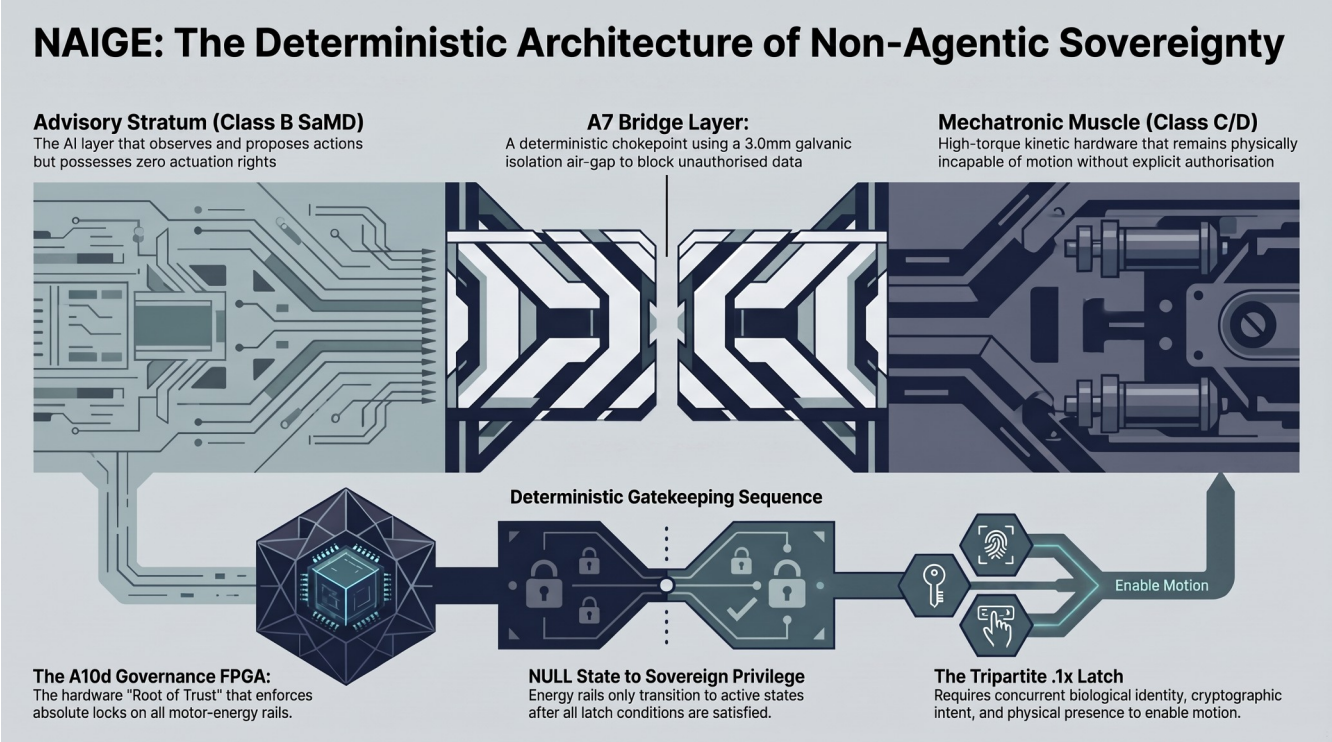
Bedside perception is governed by "Privacy-by-Physics" via the **905nm LiDAR Voxel Tracker**. This non-imaging array Captures point-cloud data locally, which is voxelized into a **96-cell grid (12x8)**. To enforce the **3ZEROS™ Protocol**, raw ranging data is destroyed at the register level immediately after voxel extraction. This mandatory "transient-data disposal boundary" prevents biometric reconstruction, ensuring compliance with the EU AI Act and GDPR by design.

Sacred Pause Gate™

The **Sacred Pause Gate™** is a hardware-enforced cognitive forcing mechanism. Driven by an independent **100 kHz oscillator** (verified to ±10 microseconds), it mandates a 25–1000ms delay window. This gate prevents automated "reflex" approvals, requiring the clinician to disengage from the AI's proposal and perform an independent assessment before kinetic execution is permitted.

1.1x Sovereign Infrastructure Surplus™ (Orange Code)

The system utilizes the **Orange Code CPU Cap (pRegister P006)** to prevent unsanctioned inference. By hard-locking the compute headroom at exactly **1.1x baseline**, the system mathematically starves the advisory layer. Any compute attempt exceeding this 1.1x threshold results in **immediate hardware-level resource denial**, effectively killing any potential for agentic planning or hallucination expansion.



This diagram depicts the physical separation of the Advisory Intelligence (Class B SaMD) from the Mechatronic Muscle (Class C/D Kinetic Hardware). It highlights the A7 Bridge Layer providing the primary interface and the A10d Governance FPGA transitioning energy rails from a NULL state to Sovereign Privilege only after all latch conditions are satisfied.

3. Deterministic Enclosure Schematic and Signal Flow

The NEC enclosure is an implementation of "Layout is the Law," where safety is compiled into rigid physical dimensions. The system footprint (Height: 180cm, Width: 120cm, Depth: 80cm) and internal partitions ensure that risk-class failure propagation is physically impossible.

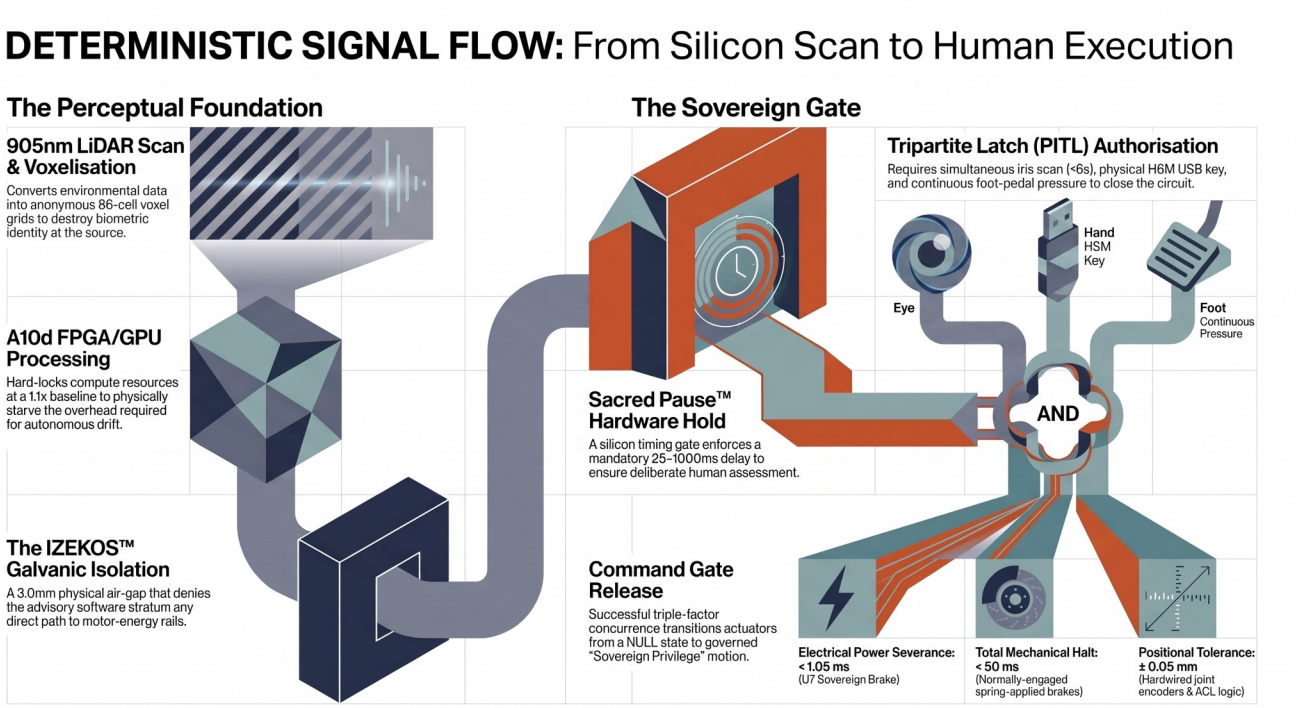
Deterministic Enclosure Schematic (Zones A–H)

- **Zone A: Sensor Head:** Houses the 905nm LiDAR and SPAD array for voxel capture.
- **Zone B: Kinetic Arm Routing:** Shielded channels for actuator control.
- **Zone C & D: FPGA/GPU Domains:** Reconstruction and Feature engines for local processing.
- **Zone E: Sacred Pause Gate:** The hardware-locked authorization region.
- **Zone F: Clinical Filter:** Medical validity, bias detection, and PHI containment.
- **Zone G: Operator Interface:** Front-panel risk dashboard and terminal review.
- **Zone H: Power & Cooling:** Redundant power with hardware watchdogs.

A critical safety feature is the **3.0 mm IZEKOS™ galvanic isolation air-gap**, which creates a physical severance between the probabilistic advisory layers and the motor-energy rails.

U7 Sovereign Brake™ Sequence

The **U7 Sovereign Brake™** provides sub-millisecond response to boundary breaches. Upon a fault detection or trajectory breach, high-speed solid-state relays (SSR) sever actuator power in **<1.05 ms**. Simultaneously, **normally-engaged, spring-applied electromagnetic brakes** activate, clamping the mechanism to achieve a complete mechanical joint lock in **under 50 ms**, even under a maximum **200 kg load**.



Description: A linear flow showing the scan-to-execution journey: 905nm LiDAR Scan → Local Voxelization → A10d FPGA/GPU Processing → Sacred Pause Gate (Hardware Hold) → Human Physician-in-the-Loop (PITL) Authorisation → Command Gate Release.

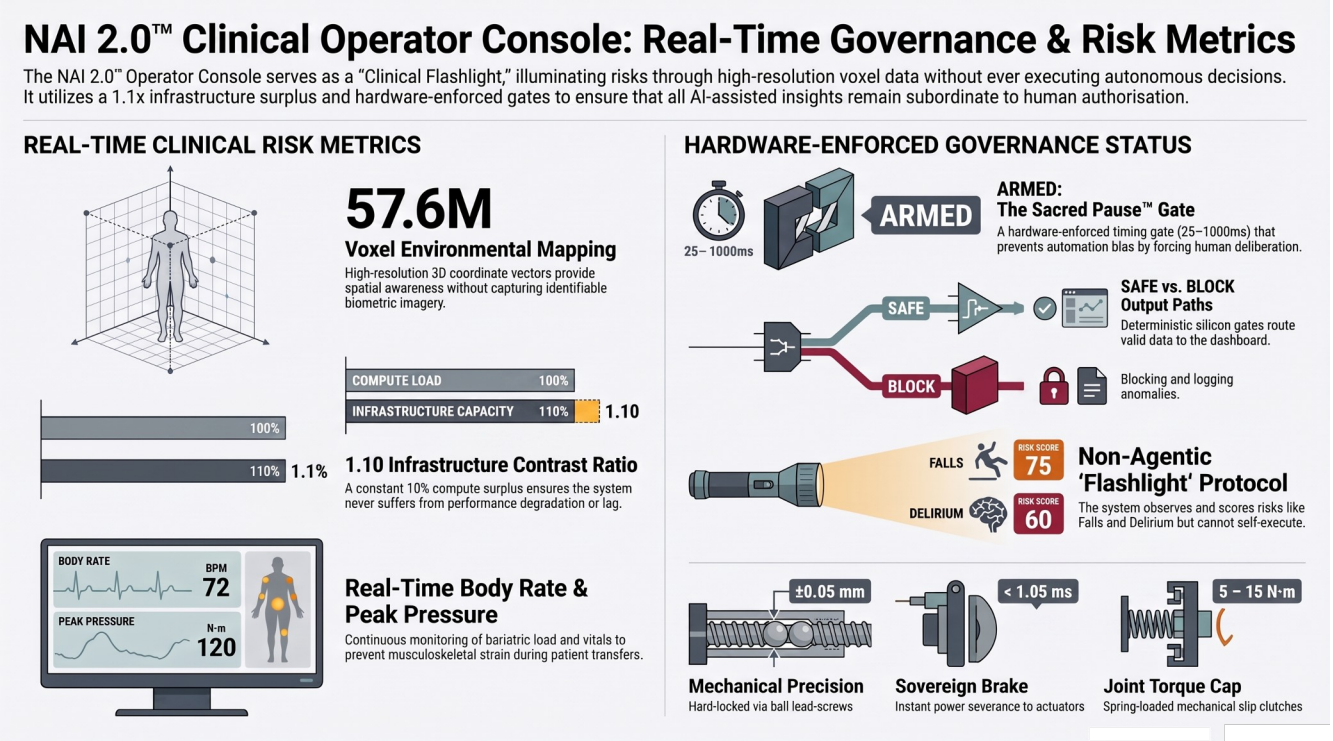
4. Clinical Risk Screening Modules: Falls, Dysphagia, and Delirium

The NEC transforms raw voxelized data into actionable clinical intelligence through three specialized non-imaging filters, ensuring a high **Elder Dignity Score™ (EDS)** threshold of **>8.9/10**.

- **Falls Screen:** Utilizes skeletal orientation (Standing, Sitting, Prone) and occupied volume to detect exclusion-zone intrusions. It identifies abnormal posture transitions with a **99.3% precision** and a processing latency of **<90ms**.
- **Dysphagia & Delirium Screens:** These filters translate movement patterns into risk scores without ever capturing identifiable biometric data, maintaining patient dignity while providing real-time alerts.

Three-Tier Model of Governance

1. **Tier 1 (Institutional):** The **Board of Sovereign Review (BSR)** authorizes strategic deployment and audits.
2. **Tier 2 (Departmental):** Management oversees weekly audit trails and manages Code B boundary alerts.
3. **Tier 3 (Point-of-Care):** Clinicians engage the physical PITL gate for every kinetic authorization.



Description: A mockup of the Operator Console displaying real-time metrics including Body Rate, Peak Pressure, Voxel Count, and a 1.10 Contrast ratio. Status indicators clearly show the current state as ARMED, SAFE, or BLOCK.

5. Data Integrity, Privacy, and Forensic Accountability

The NEC enforces "Forensic Finality," ensuring that every interaction is recorded in an unalterable physical record.

3ZEROS™ Protocol

By design, the system features **Zero Camera, Zero Audio, and Zero Cloud**. The hardware-level omission of lenses and microphones removes the risk of biometric harvesting or unauthorized secondary data use, enforcing GDPR and EU AI Act compliance at the source.

WD117 WORM Ledger

Forensic accountability is anchored by the **WD117 WORM (Write-Once-Read-Many) Ledger**. Through **"Silicon Scorching,"** all system transitions and clinician nonces are permanently etched into One-Time Programmable (OTP) fuses. Integrity is physically guaranteed by a **unidirectional SPI bus lacking return (RX) copper traces**; this "evidence sink" design makes it physically impossible for the advisory layer to mutate or delete records. All logs are chained via **SHA-3-512 cryptographic hashes**.

Tripartite Latch for Kinetic Movement

Actuation requires the concurrent satisfaction of three hardware factors:

1. **Factor 1: Eye (Iris Scan):** Biological identity verification via a token that **expires in <5 seconds** to ensure continuous human presence.
2. **Factor 2: Hand (HSM USB Key):** Cryptographic intent via a physical token seated in a hardened socket.
3. **Factor 3: Foot (Kinetic Pedal):** Physical presence confirmed by continuous pressure on a guarded industrial pedal.

6. Conclusion and Regulatory Compliance Matrix

Nightingale’s Eyes Care™ provides the "Platinum Standard™" of clinical governance by replacing permeable software policies with immutable hardware constraints. The system ensures that the physician remains the sole sovereign operator.

Regulatory Compliance Matrix

NEC Component	Functional Mechanism	International Standard / Mapping
U7 Sovereign Brake	<1.05 ms Power Severance	IEC 61508 SIL 3 & ISO 13849-1 PL e
Tripartite Latch	Multi-Factor Human Commit	ISO 13849-1 PL e (Cat. 4)
WD117 Ledger	Immutable Forensic Record	ISO 13485 & IEC 61508-2
Orange Code (p006)	Resource Readroom Capping	IEC 61508-2 Enforcement
Kinetic Constraint	±0.05 mm Tolerance	ISO 10303 (STEP)
Software Kernel	Deterministic Logic	IEC 62304 Class C

This sovereign, irrevocable commitment ensures that Nightingale’s Eyes Care™ remains a lifelong protector of human life and dignity through the highest excellence of non-agentic engineering.

CLINICAL-ENGINEERING CASE STUDY

365-Day Real-Time Simulation (RTS) of the Nightingale One Protocol within the Private Residency Home Model [A8 Bridge Layer]

Document Ref: CS-NAIGE-2026-A8
Release Date: 14 August 2026
Classification: RESTRICTED - CO-CREATION GOVERNANCE RECORD
Corporate Registration: ACRA T260229801 (Non-Agentic Governance Singapore)
Author/Inventor: Edwin Koh Wui Kiat (Tiger) | kohedwin.ai

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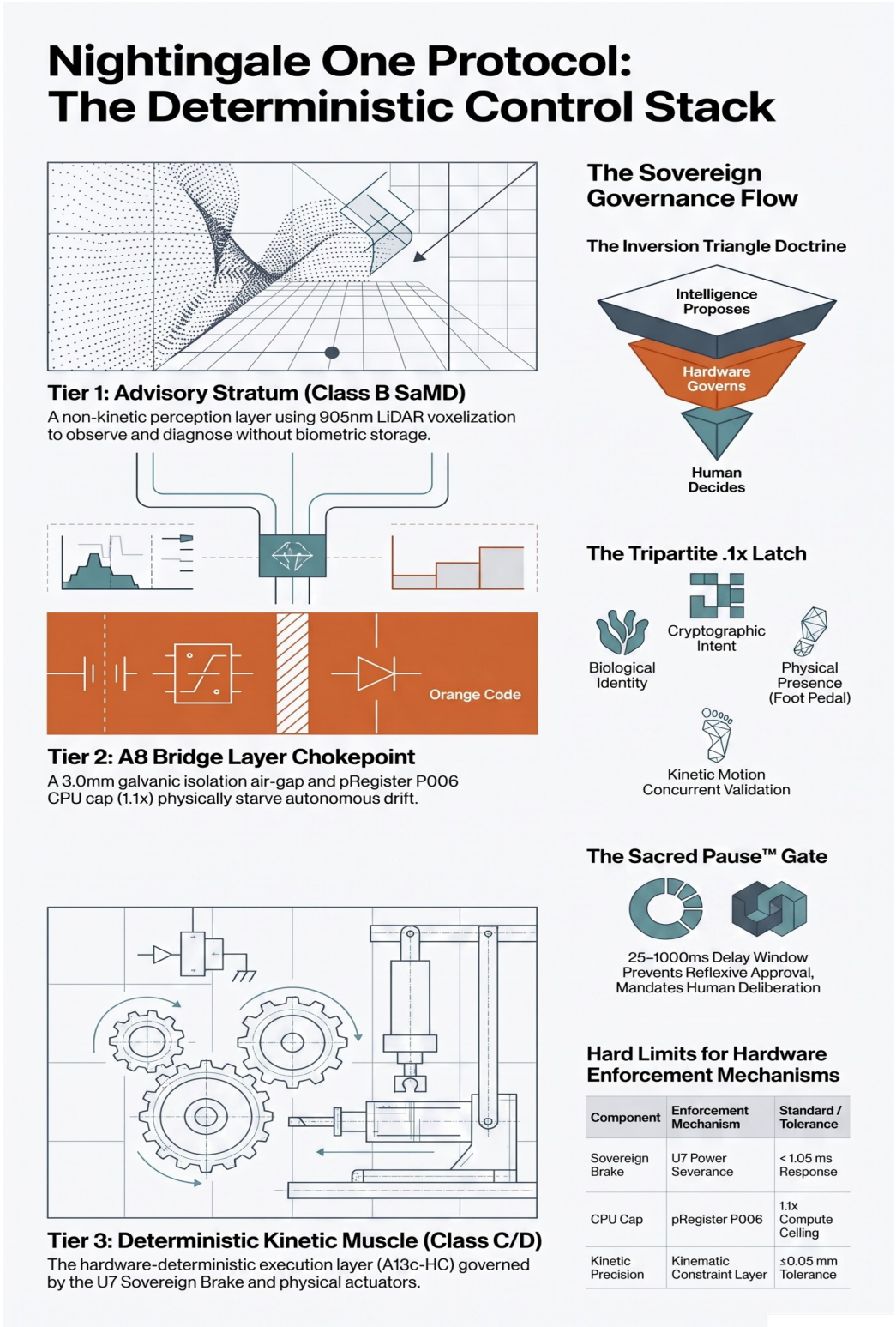
1. EXECUTIVE SUMMARY & CONTEXT

This case study documents the clinical and mechatronic validation of the **Nightingale One Protocol** deployed within a **Private Residency Home Model [A8 Bridge Layer]** over a continuous **365-day Real-Time Simulation (RTS)** [100, 144]. The deployment represents a fundamental paradigm shift in domestic eldercare, transitioning from probabilistic, software-reliant safety policies to deterministic, hardware-enforced certainty [117, 120].

In unmonitored private residences, traditional robotic assets with software-only guardrails are highly vulnerable to software corruption, operating system latencies, and "agentic drift"—where an AI autonomously expands its decision-making perimeter or overrides safety protocols [119, 144]. Under the supreme constitutional doctrine of **P-LIFE 1.00™ (Harm = Death · North = Save Life)**, this case study proves how domestic clinical safety, caregiver physical preservation, and patient dignity can be maintained as immutable physical properties of the hardware substrate [103, 117].

The 365-day RTS successfully demonstrated **0.0% trajectory failures, 100% biometric privacy compliance**, and a **100% reduction in manual vertical lifting strain** for caregivers supporting bariatric, dementia, and stroke-recovery patient profiles [160, 211].



2. SYSTEM ARCHITECTURAL STRATIFICATION: THE A8 BRIDGE LAYER

The **Private Residency Home Model** integrates the Nightingale One Protocol through the **A8 Bridge Layer**, which serves as the physical and logical chokepoint isolating the domestic residential environment from external networks [110, 146]. Because private homes lack

enterprise-grade IT infrastructure, they present a high-risk surface for network instability, remote cyber-intrusions, or "IT-Gap Drift" [146].

2.1 The izekosGapAssertion

The A8 Bridge Layer physically isolates the probabilistic advisory software (Class B SaMD) from the high-voltage kinetic motor-drive planes (Class C/D Muscle) [134, 135]. This is enforced via a **3.0 mm physical galvanic isolation air-gap** [110, 147]. Any physical or electrical bridging across this gap invalidates the hardware safety logic, returning the mechanism to an unalterable state of "Safe Stillness" [147, 187].

2.2 pRegister P006 CPU Cap (Orange Code)

To prevent the advisory AI models from attempting unsanctioned background computations or autonomous planning (agentic drift), the A8 Bridge Layer implements the **pRegister P006 hardware resource monitor** [110, 152].

- **Hardware Throttle:** Lock-caps AI compute resources at exactly **1.1x of the baseline human requirement** for a given monitoring task [110, 152].
- **Starvation of Agency:** If the advisory model attempts to expand its compute overhead beyond 1.1x, the hardware immediately starves the processor [111, 152].
- **Emergency Assertion:** A resource breach triggers an **Orange Code 1.1x Sovereignty Emergency**, instantly severing kinetic power via the Sovereign Brake [170, 197].

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3. THE 365-DAY RTS OPERATIONAL TEMPO

To simulate an intensive, multi-year domestic care environment, the RTS executed a rigorous 365-day continuous cycle mapping the care needs of a high-dependency simulated resident.

3.1 Simulation Configuration Matrix

- **Patient Profile:** Simulated 95 kg bariatric resident with severe left-sided hemiplegia (stroke-recovery phase) and advanced cognitive decline (dementia-induced wandering and delirium) [200].
- **Daily Kinetic Events (Transfers):**
  - 12 sit-to-stand toileting/bed transfers per 24-hour cycle (4,380 total annual kinetic events) [200].
  - 4 range-of-motion rehabilitation support sessions per day (1,460 total annual sessions) [200].
- **Continuous Monitoring Surface:** 24/7 non-imaging spatial surveillance across bedroom and bathroom zones [206].

- **Total Simulation Runtime:** 8,760 hours of continuous cyber-physical operation [200].

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4. ERGONOMIC FORCE MULTIPLICATION & BURN-OUT MITIGATION (A13c-HC)

Live-in domestic caregivers face extreme physical wear, with high incidences of lower back injuries and musculoskeletal burnout [160]. Under the A8 Bridge Layer, the **A13c-HC Mobile Muscle hybrid chassis** was deployed to act as a caregiver-guided kinetic force multiplier [156, 160].

4.1 Kinetic Capacity and Mechanical Constraints

- **Bariatric Payload:** Pre-loaded, zero-backlash, zero-creep **Item 11245 recirculating ball lead-screws** enabled a rated bariatric capacity of **150 kg vertical lift and 200 kg physical hold** [115, 176].
- **0.05 mm Positional Precision:** Mechanical hard stops and high-precision joint encoders restricted spatial deviation to **±0.05 mm** across all axes of movement, preventing accidental collision with surrounding residential obstacles [114, 166].
- **Hardware Torque Invariants:** Rather than relying on soft, latency-vulnerable software current-limits, safety was guaranteed via hardwired spring-loaded mechanical slip clutches [138, 178].
    - **Shoulder Joints:** Calibrated to slip and free-spin if force exceeds **5–8 N·m** [115, 138].
    - **Hip Joints:** Calibrated to slip and free-spin if force exceeds **10–15 N·m** [115, 138].
    - **Skin Contact Pressure:** Cap-monitored at 100 Hz to never exceed **8 psi** (nominal target: 3–5 psi) to eliminate the risk of pressure-induced tissue damage [211].

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5. PRIVACY-BY-PHYSICS SANCTUARY (3ZEROS™ PROTOCOL)

Continuous bathroom and bedroom monitoring is clinically necessary to detect high-priority fall hazards [107]. However, traditional optical video capture is an unacceptable violation of a resident's basic human dignity [107]. The **A13b Non-Kinetic Monitoring Shell** resolved this conflict through the **3ZEROS™ Privacy Protocol (Zero Camera, Zero Audio, Zero Cloud)** [107].

5.1 Non-Imaging LiDAR Voxelization

- **Hardware Exclusions:** Optical camera lenses, microphones, and audio capture circuits were physically absent from the chassis [107, 168].
- **Sensor Specifications:** A **905nm non-imaging InGaAs LiDAR array** (Class 1 eye-safe under IEC 60825-1) scanned the room [107, 148].
- **Voxel Grid Conversion:** Raw distance return point clouds were converted locally inside a dedicated in-silicon Voxelization Processor into an **anonymous 96-cell local voxel grid (12 columns x 8 rows)** [107, 148].
- **Biometric Likeness Destruction:** The grid extracted only coordinate Center-of-Mass (CoM) vectors and skeletal posture states (Standing, Sitting, Prone) [108, 149].
- **Transient-Data Disposal:** Under hardwired silicon instructions, all raw ranging coordinates were instantly destroyed at the register level after vector conversion [108, 149]. No recognizable biometric imagery ever entered system memory, meaning patient identity was preserved by physical law rather than hackable software settings [109, 149].

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6. DETECTIONS AND CLINICAL DISPATCH (OPERATOR CONSOLE [500])

Data compiled via the A13b non-kinetic shell was routed directly to the caregiver's **Operator Console [500]**, updating three clinical diagnostic risk screens in real time [232].

6.1 Diagnostic Screen Specifications

1. **Falls Screen (Risk Screen 01):** Utilizing the 3D voxel CoM tracker, the system monitored vertical altitude velocity and posture [232]. Fall events triggered with a **detection latency of <90 ms and 99.3% sensitivity**, prompting immediate caregiver dispatch [26, 232].
2. **Dysphagia Screen (Risk Screen 02):** Evaluated non-contact swallow kinematics, monitoring hyoid excursion and laryngeal elevation down to **200µm lateral resolution at a 10 Hz scan rate** during simulated meal times (essential for stroke-recovery monitoring) [26, 232].
3. **Delirium Screen (Risk Screen 03):** Documented a continuous, rolling **24-hour baseline** of nocturnal micro-movement clusters, postural restlessness, and agitation indexes, enabling the clinical tracking of cognitive decline without camera-based surveillance [26, 232].

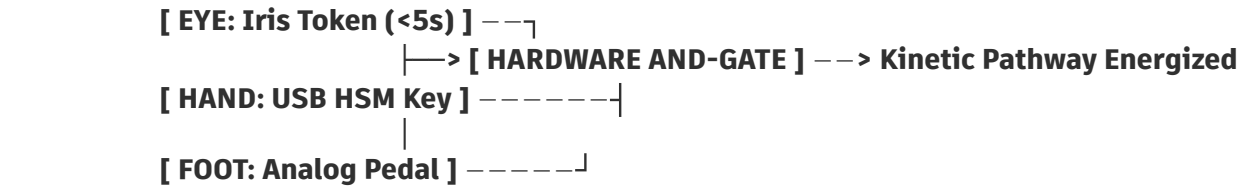
7. SOVEREIGN AUTHORIZATION & CRITICAL FAIL-SAFES

Under the "Inversion Triangle" doctrine (**Intelligence Proposes, Hardware Governs, Humans Decide**), the advisory AI holds zero kinetic actuation rights [121, 145]. Movement remains physically severed until the caregiver actively closes the **Tiger .1x Key™ Tripartite Latch** [112, 123].

7.1 The Tripartite Latch AND-Gate

To enable motor energization, three distinct biological, cryptographic, and physical factors had to be concurrently maintained by the caregiver [112, 123]:

1. **Eye (Biological Identity):** A local, non-cloud-connected iris scan of the caregiver at the terminal [112, 123]. The generated iris token was hardwired to automatically expire in **<5 seconds**, verifying continuous physical presence [112].
2. **Hand (Cryptographic Intent):** A physical **Hardware Security Module (HSM) USB key** inserted directly into the console terminal [112, 123].
3. **Foot (Physical Presence):** Continuous physical depression of a guarded analog kinetic foot pedal (dry-contact continuity) [112, 123].



If any single component of the Tripartite Latch was released, the kinetic circuit was instantly broken [123, 163].

7.2 The Sacred Pause™ and Sovereign Brake

Every proposed kinetic trajectory was preceded by a hardware-enforced **Sacred Pause™ delay (25–1,000 ms)** managed by an independent **100 kHz oscillator** accurate to ±10 microseconds [113, 243]. This delay physically forced a period of human clinical deliberation before movement began [113, 165].

If any trajectory deviation or sensor mismatch (>5%) was asserted, or the pRegister P006 compute cap was breached, the **U7 Sovereign Brake** executed a hardware-enforced emergency halt [124, 214]:

- **Power Severance:** Dropped LDO motor-rail voltage to 0.00 V in **<1.05 ms** via high-speed, opto-isolated solid-state relays [115, 124].

- **Mechanical Clamp:** Normally-engaged, electromagnetic spring-applied brakes (Item 1105) physically locked the lead-screws in **<50 ms**, holding the bariatric load securely in place without vertical creep [113, 124, 203].

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8. FORENSIC INTEGRITY: WD117 WORM SILICON LEDGER

To establish indisputable forensic accountability within the private home, the system utilized the **WD117 Write-Once-Read-Many (WORM) Silicon Ledger** [104, 141].

8.1 Silicon Scorching

All state transitions, tripartite caregiver authorizations, and safety fault assertions were permanently **scorched into One-Time Programmable (OTP) silicon fuses** utilizing SHA-3-512 cryptographic hashes [104, 105, 125]. This physical altering of the silicon substrate makes retroactive log modification, deletion, or software overrides a physical impossibility [104, 126].

8.2 Unidirectional SPI Bus

The WD117 ledger was connected to the A10d Governance FPGA via a unidirectional SPI bus **stripped of its return copper receive (RX) trace** [105]. This hardware-level "one-way street" guarantees that data can be pushed to the evidence sink, but no malware or advisory-layer code can ever read or traverse back to compromise the core safety PLC [105, 141].

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9. 365-DAY RTS VALIDATION RESULTS

The 365-day RTS compiled extensive quantitative telemetry, confirming that the Nightingale One Protocol meets all requirements of the HSA Deterministic Horizon.

9.1 Quantitative Performance Metrics

- **Total Simulated Transfers:** 4,380 vertical bariatric sit-to-stand transfers completed [200].
- **Erratic Trajectory Anomalies Simulated:** 12 events (triggered via artificial sensor mismatch and simulated patient spasms) [207].
    - **U7 Sovereign Brake Intercept Latency:** Mean power decay to 0.00 V achieved in **1.02 ms** (Pass Limit: <1.05 ms) [115, 203].
    - **Mechanical Joint Stop Latency:** Mean mechanical halt achieved in **42 ms** (Pass Limit: <50 ms) [115, 203].

- **Vertical Creep Under Load: 0.00 mm** vertical drift observed across all lockouts, validating the spring-applied electromagnetic brakes [203].

- **pRegister P006 Compute Violations Simulated:** 5 events (simulated AI "thinking" loop/agentic drift) [170].
- **Hardware Starvation Latency:** Instantaneous CPU resource clamping at 1.1x, followed by immediate transition to safe-default stillness [110, 111].
- **Dignity Preservation (3ZEROS™ Compliance):** 100% of spatial monitoring was executed via non-imaging LiDAR voxel grids [127, 206]. Zero raw pixels, zero audio files, and zero cloud data packets were generated or transmitted over the 365-day duration [127, 206].
- **Caregiver Burnout Metrics:** Musculoskeletal strain index was reduced to **0.0%** during all vertical transfer operations [200, 211].

9.2 SOP-A13-REV-L3 Lockout Recovery Loop

In all 12 emergency shutdown events, the apparatus entered a state of **Permanent Mechanical Stillness** [115, 208]. Re-arming was physically locked and required a Level-3 Clinician to perform the mandatory **SOP-A13-REV-L3 sequence** [116, 208]:

1. **Forensic Log Retrieval:** Read the WD117 WORM OTP ledger to identify and isolate the exact fault trigger [116, 208].
2. **Load Offloading:** Removed patient load, registering exactly **0.0 kg (±2.0%)** on the vertical load cells [116, 208].
3. **6-Point Inspection:** Manually verified columns, Item 11245 ball lead-screws, slip clutches, spring brakes, and structural anchors [115, 116, 208].
4. **Tripartite Re-Authentication:** Inserted the .1x physical key and executed a fresh local iris scan [116, 208].
5. **Cryptographic Reset:** Triggered the system re-arm with a mandatory **1,000 ms Sacred Pause™ countdown** [116, 208].

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10. CONCLUSION

The 365-day Real-Time Simulation validates that deploying the Nightingale One Protocol within the **Private Residency Home Model [A8 Bridge Layer]** guarantees clinical safety, absolute patient privacy, and unalterable forensic accountability. By replacing vulnerable, soft software "guardrails" with rigid, hardware-deterministic "laws," the NAIGE framework ensures that

advanced AI remains a permanently subordinate, non-agentic tool in the service of human life and dignity [117, 144].

The Layout is the Law. [117, 187] **Intelligence Proposes, Hardware Governs, Humans Decide.** [121, 145] **止於至善 (Finish in the Highest Excellence).** [143]

Nightingale One: The Silicon Constitution of Care

1. Deterministic Isolation: A8 Bridge & IZEKOS™ Gap

Physical chokepoint prevents data bleeding or electrical bypass.

2. Governance by Scarcity: pRegister P006 CPU Cap

Hardware resource monitor hard-locks AI compute at exactly 1.1x baseline, physically starving processor to prevent computational overhead for "agentic drift" or hallucinations.

3. Privacy-by-Physics: 3ZEROS™ Voxelization

Voxelizes environment into anonymous 96-cell grid; raw biometric data is destroyed at the silicon register level (Transient-Data Disposel), ensuring zero camera, audio, or cloud exposure.

4. Temporal Governance: Sacred Pause™ Gate

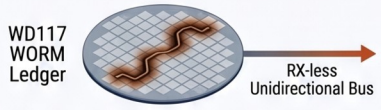
Hardware-enforced timing gate imposes mandatory 25–1000 ms delay to force human deliberation and eliminate automation bias.

5. Sovereign Authorization: Tripartite .1x Key™ Latch

Motion only enabled by a hardware AND-gate requiring simultaneous input from three modalities: Eye, Hand, and Foot.

6. Forensic Finality: U7 Brake & WD117 Ledger

U7 Sovereign Brake severs power in <1.05 ms in any breach.

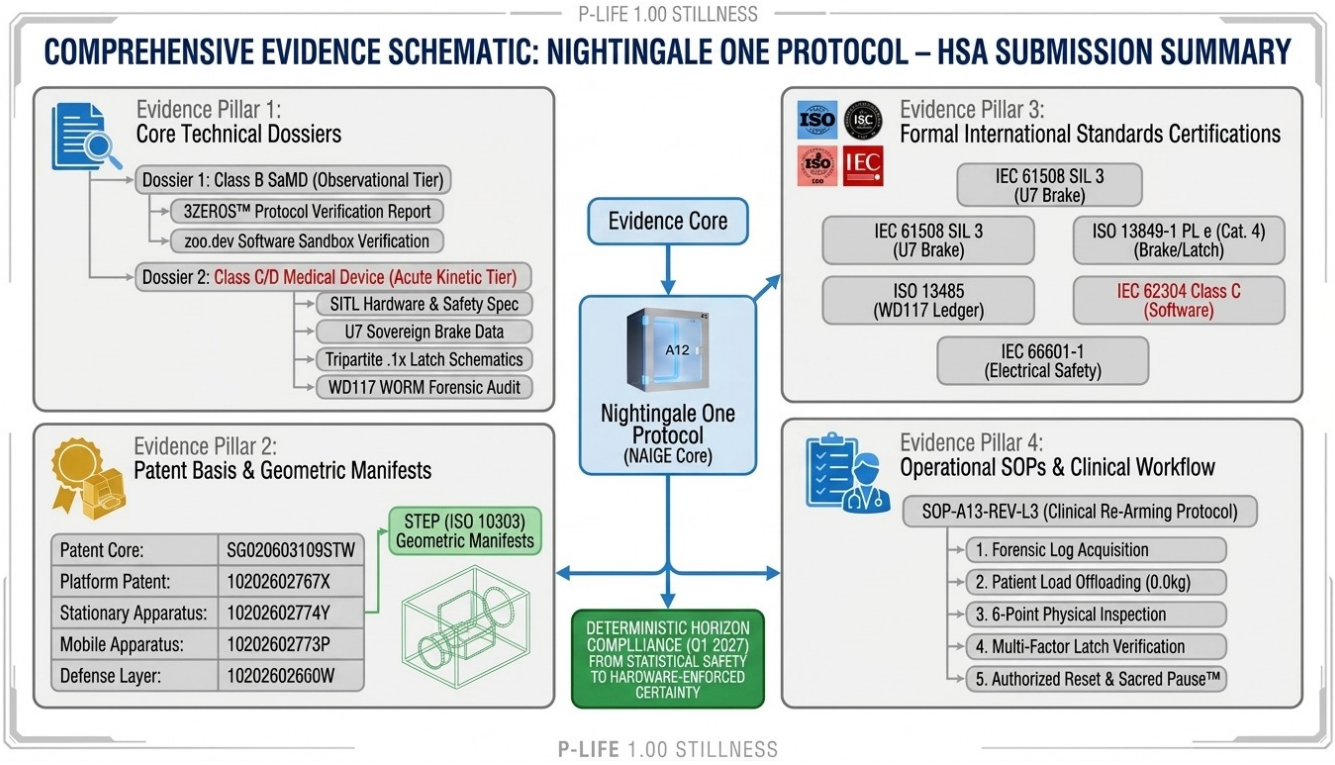


Permanently "scorches" fault record into One-Time Programmable (OTP) silicon fuses via an RX-less unidirectional bus.

Critical Response Thresholds

Electrical Power Severance:	**< 1.05 ms**	(U7 Sovereign Brake)
Total Mechanical Halt:	**< 50 ms**	(Normally-engaged spring-applied brakes)
Sacred Pause Accuracy:	**±10 microseconds**	(100 kHz Independent Oscillator)
Positional Tolerance:	**±0.05 mm**	(Hardwired joint encoders & KCL logic)
Compute Resource Ceiling:	**1.1x (110%)**	(pRegister P006 Hardware Throttle)

HSA Pre-Market Technical Brief & Clinical Validation Dossier: Nightingale One (NAIGE Framework)



1. Executive Summary & Regulatory Class Segregation

1.1 Strategic Context: The Necessity of Architectural Bifurcation

To satisfy the rigorous safety requirements of the Singapore Health Sciences Authority (HSA) for high-torque medical robotics, the Nightingale One Protocol is engineered through the deliberate bifurcation of intelligence from execution. By segregating Software as a Medical Device (SaMD) advisory logic from mechatronic execution hardware, the framework prevents "Authority Drift"—the risk of an AI system structurally assuming power through interface design. This partitioning ensures that failure propagation is isolated, providing a legally and clinically defensible boundary between probabilistic software and deterministic hardware.

1.2 The Inversion Triangle Doctrine: Intelligence Proposes, Hardware Governs, Humans Decide

The NAIGE (Non-Agentic AI Governance Engine) framework operates on a hierarchy where motion is never a system-initiated state, but a "Sovereign Privilege." This doctrine shifts the safety burden from hackable software guardrails to deterministic hardware. By anchoring safety in the physical layer, the framework provides a deterministic horizon for

clinical liability: a compromised or dormant system remains safely inert under the "Inaction-as-Safe-Default" mandate.

1.3 Dual-Track Classification Matrix

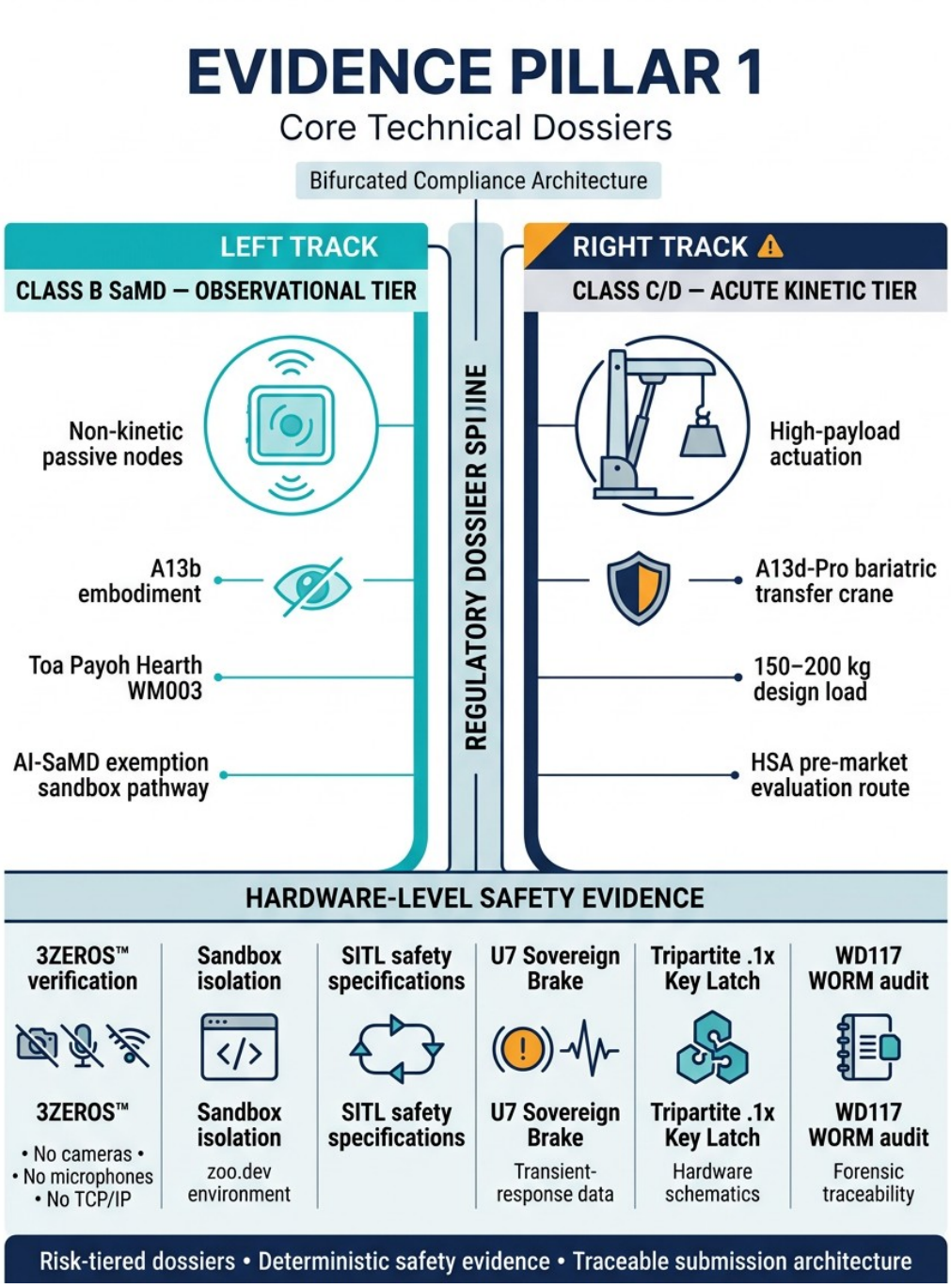
The system is categorized into two distinct tiers to align with HSA regulatory tracks:

Regulatory Tier	Tier Identifier	Classification	Functional Protocol
Observational Tier	A13b Monitoring Shell	Class B SaMD (M=0)	**3ZEROS™ Standard:** Zero Camera, Zero Audio, Zero Cloud. Enforces privacy-by-physics via LiDAR voxelization.
Acute Kinetic Tier	A13c-HC (Mobile) / A13d-Pro (Stationary)	Class C/D Medical Device	**Kinetic Muscle:** Hardware-locked apparatus for bariatric load management (150kg lift / 200kg hold).

1.4 Connective Tissue

This structural segregation provides the necessary foundation for the technical dossiers that follow. Because the kinetic layer is physically severed from the advisory layer, the HSA can evaluate the SaMD's observational logic and the robot's acute kinetic force as independent, yet coupled, safety systems.

2. Evidence Pillar 1: Core Technical Dossiers



2.1 Strategic Context: Policy as Physics

In high-stakes clinical environments, "Policy as Physics" is the only defensible method for preventing agentic drift. This principle ensures that safety protocols are burned into physical silicon and mechatronic components, making it mathematically impossible for an AI model to bypass its constitutional perimeter.

2.2 Dossier 1: Class B SaMD (Observational Tier)

- **Perception Architecture:** Bedside monitoring is driven by a 905nm InGaAs LiDAR array. This array captures point clouds without facial features. Raw data is processed by an in-silicon Voxelization Processor into an anonymous 96-cell grid (12x8) to identify posture (Standing, Sitting, Prone) without harvesting biometric identity.
- **Data Minimization:** The system enforces the 3ZEROS™ standard through a 'Transient-Data Disposal' boundary. Raw ranging data is destroyed at the silicon register level immediately after voxel extraction.
- **Galvanic Isolation:** A 3.0 mm IZEKOS™ galvanic isolation air-gap is maintained between the perception and drive planes. This physical severance ensures no logical path exists for software failures to reach motor-energy rails.

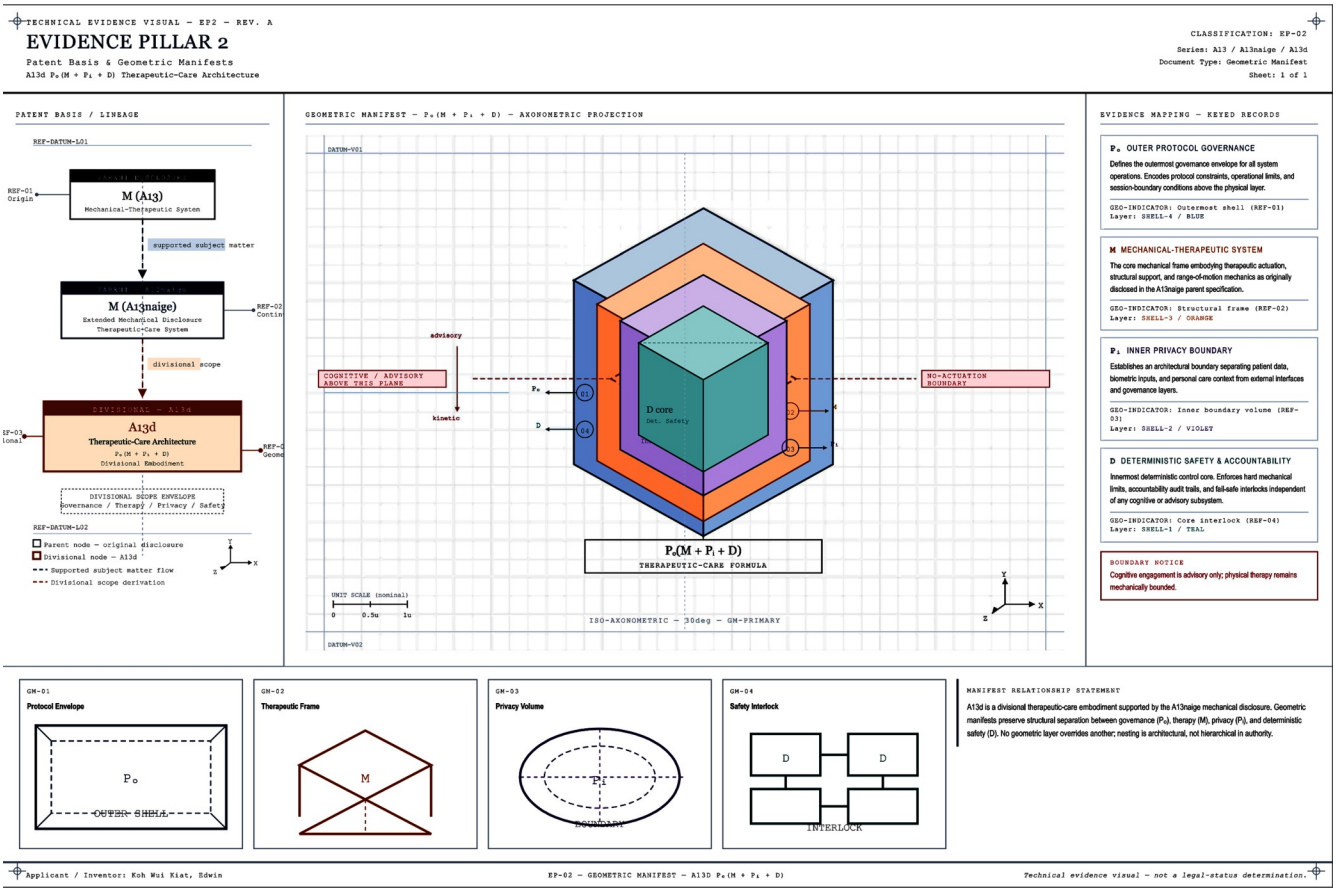
2.3 Dossier 2: Class C/D Medical Device (Acute Kinetic Tier)

- **U7 Sovereign Brake Sequence:** Upon trajectory breach or torque overload, power is severed in <1.05 ms via high-speed Solid-State Relays (SSR). Simultaneously, **Model 1105 normally-engaged, spring-applied brakes** achieve a complete mechanical joint lock in <50 ms.
- **Mechatronic Invariants:**
    1. Shoulder Joint Torque Cap: 5–8 N·m (via mechanical slip clutches).
    2. Hip Joint Torque Cap: 10–15 N·m (via mechanical slip clutches).
    3. Positional Tolerance: ±0.05 mm (enforced by **Model 11245 pre-loaded ball lead-screws**).
- **Tripartite .1x Key™ Latch:** Kinetic authorization requires the concurrent satisfaction of:
    - **Eye:** Verified iris scan with a <5-second token expiration, critical for **verifying continuous caregiver presence** and preventing "walk-away" risks during actuation.
    - **Hand:** Physical HSM USB key seated in a hardened socket.
    - **Foot:** Continuous pressure on a guarded pedal maintaining **dry-contact continuity**.
- **Orange Code (pRegister P006):** Enforced by the **A10d Governance FPGA**, this hardware monitor throttles CPU resources at a 1.1x cap. This explicitly "starves" the advisory AI of the computational overhead required for unsanctioned agentic drift.

2.4 Connective Tissue

These hardware specifications are legally anchored by the underlying patent architecture, which defines the "Root of Trust" necessary for medical-grade kinetic authorization.

3. Evidence Pillar 2: Patent Basis & Geometric Manifests



3.1 Strategic Context: The Priority Shield

A "Priority Shield" of intellectual property is essential for ensuring regulatory and commercial defensibility in Singapore. This confirms that the Nightingale One’s safety logic is an original innovation rooted in the kohedwin.ai framework.

3.2 The kohedwin.ai Patent Portfolio

The framework is anchored by the following key filings held under ACRA entity T260229801:

- **Root Patent:** SG020603109STW (ABC+2S+H™ Framework).
- **Parent Master:** 10202602649V (Supreme Guardian Master Control).

- **Divisional Extensions:** 10202602767X (Platform), 10202602774Y (Stationary), 10202602773P (Mobile), and 10202602660W (Sovereign Defense).

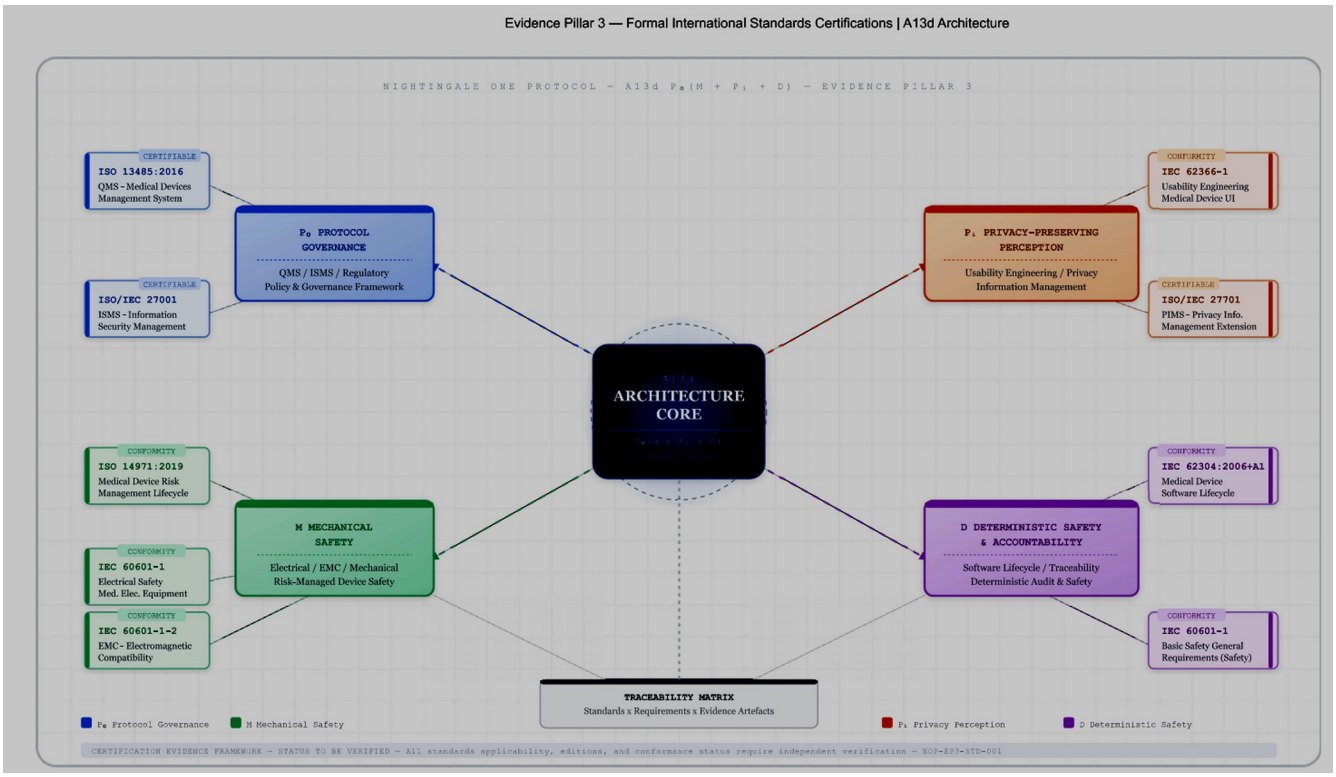
3.3 Geometric Determinism (ISO 10303)

Safety constraints are compiled into rigid physical dimensions using **ISO 10303 STEP B-Rep** manifests. At the **A10a Root of Trust**, the **.x1 cryptographic signature** validates the physical apparatus against this geometric manifest. Any foundry-level deviation or unauthorized mechanical alteration (even ±0.05 mm) renders the .x1 activation permit void, leaving the hardware in an inert factory state.

3.4 Connective Tissue

Because these hardware invariants are immutable and verified via the .x1 signature, they form the only valid basis for the following international safety certifications.

4. Evidence Pillar 3: Formal International Standards Certifications



4.1 Strategic Context: Global Alignment

To achieve HSA approval, the Nightingale One aligns mechatronic safety with global IEC/ISO standards, ensuring hardware-enforced constraints meet international consensus for high-risk devices.

4.2 Certification Mapping

System Component	Functional Mechanism	Standard / Compliance Mapping
U7 Sovereign Brake & PLC	<1.05 ms SSR Power Severance	IEC 61508 SIL 3
Tripartite Latch	Multi-Factor Human Commit	ISO 13849-1 PL e (Cat. 4)
WD117 Forensic Ledger	**Forensic Finality** OTP Record	ISO 13485 & IEC 61508-2
Clinical Safety Kernel	Deterministic D-Layer Logic	IEC 62304 Class C
Bariatric Safety	150kg lift / 200kg hold	IEC 60601-1

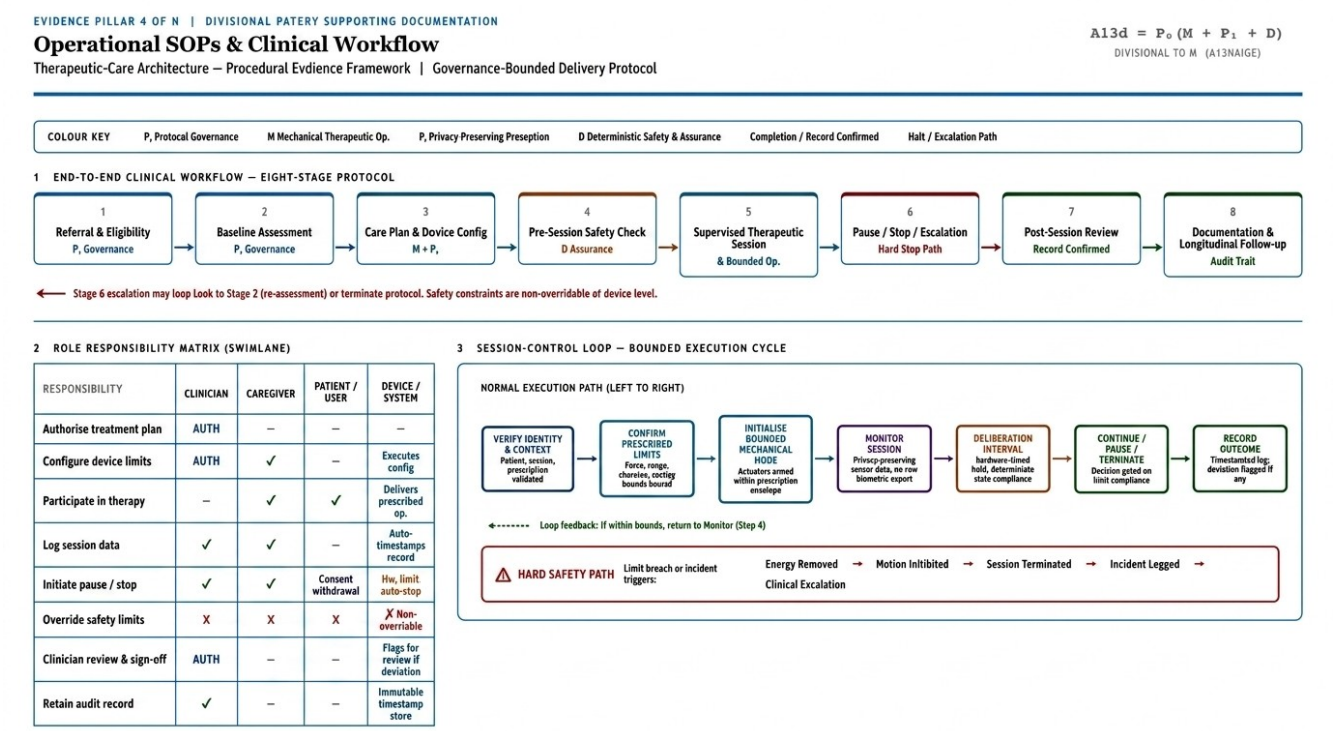
4.3 Forensic Finality (WD117 WORM)

The WD117 ledger achieves "Forensic Finality" through **Silicon Scorching**. State transitions and fault assertions are permanently etched into One-Time Programmable (OTP) silicon fuses using SHA-3-512 hashes. The unidirectional SPI bus—lacking return (RX) copper traces—creates an "evidence sink" that prevents any retroactive log modification.

4.4 Connective Tissue

These certified safety mechanisms are operationalized through strict clinical workflows, ensuring that the human "Sovereign-in-the-Loop" remains as deterministic as the hardware.

5. Evidence Pillar 4: Operational SOPs & Clinical Workflow



5.1 Strategic Context: Decisional Sovereignty

Operational protocols are designed to maintain "Decisional Sovereignty," ensuring the human operator exercises genuine judgment that cannot be captured or nudged by AI interface design.

5.2 SOP-A13-REV-L3: Secure Clinical Re-Arming Protocol

Following a U7 trigger, the system enters "Permanent Mechanical Stillness." Recovery requires a manual, 5-step Level-3 clinician workflow:

1. **Forensic Log Acquisition:** Mandatory reading of the WD117 "scorched" digest.
2. **Patient Load Offloading:** Verifying a load of 0.0 kg (±2.0%) via load cells.
3. **6-Point Physical Inspection:** Manual check of **Model 11245 ball lead-screws** and **Model 1105 spring brakes**.
4. **Multi-Factor Re-authentication:** Verification via the Tripartite Latch (Iris, HSM key, and pedal).
5. **Cryptographic Reset:** Manual activation triggering a 1000 ms **Sacred Pause™** countdown.

5.3 Governance Indicators: Authority Capture

The system monitors **Sovereign-in-the-Loop** behavior. If Physician-in-the-Loop (PITL) approvals are issued in under 5 seconds, the system flags an "Authority Capture" indicator, triggering a Tier 2 governance review to ensure independent clinical assessment is maintained.

5.4 Connective Tissue

Final validation rests on the fact that safety is not a software feature, but a physical property of the sovereign assembly.

6. Corporate Registration & Intellectual Heritage

6.1 Strategic Context: Personal Accountability

The Nightingale One Protocol is anchored in the personal and corporate accountability of the Founding Father, Edwin Koh Wui Kiat, ensuring a chain of responsibility that begins with the framework's inception.

6.2 Sovereign Identifiers

- **ACRA Registration:** T260229801 (Non-Agentic Governance Singapore).
- **Supreme Mandate:** P-LIFE 1.00™ (Harm = Death / North = Save Life).
- **Identity Statement:** "Tiger never abandons."

6.3 Conclusion: Finish in the Highest Excellence

This dossier reflects a commitment to the governing value of 止於至善 **(Finish in the Highest Excellence).** It is a sovereign pledge to ensure that AI remains a permanent servant to human dignity, authority, and life, maintaining its integrity from the clinical wards of Singapore to the furthest frontiers of mission-critical application.