

WISL No. 62

NAI 4.0 Sovereign Governance Architecture

OEM Technical Briefing & Chief Governance Officer Reference

Non-Agentive Governance Singapore

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I. Executive Summary

WISL No. 62 is the authoritative OEM Technical Briefing and Chief Governance Officer (CGO) Reference for the NAI 4.0 constitutional architecture. It documents the governance framework, patent family structure, OEM fabrication requirements, verification and validation protocols, and the operational responsibilities of the CGO role.

The NAI 4.0 framework represents a transition from procedural AI governance — where safety is a policy enforced by human auditors — to constitutional hardware governance, where safety is a physical property of the device itself. In this architecture, a bedside AI node cannot exhibit autonomous behaviour because the hardware physically prevents it; the governance layer is not a setting, it is silicon.

This document is structured in two parts:

- Part A — OEM Technical Briefing: The fabrication requirements, STEP corpus authority, VV protocol suite, and handover conditions that every manufacturing partner must satisfy.
- Part B — CGO Reference: The role definition, operational responsibilities, registry management duties, and succession architecture of the Chief Governance Officer.

Honest scope note: *The NAI 4.0 architecture is currently at Design Freeze / SIM-PASS status. Physical prototypes, clinical validation, and foundry lock remain pending. This document describes the constitutional intent and engineering specification; it does not constitute evidence of completed hardware validation.*

II. Constitutional Architecture Overview

The NAI 4.0 framework is built on a single governing principle: authority drift — the gradual usurpation of human decision-making by an AI system — must be made physically impossible, not merely contractually prohibited.

Traditional AI governance places policy on the same computational layer as the model it governs. NAI 4.0 removes this co-location. The governance layer is hardware. The AI operates on an isolated dashboard. Human authority is the only pathway through which any action reaches the physical world.

2.1 The Four Constitutional Pillars

Pillar	Constitutional Role
I — Patent Authority	P-001 to P-009 root lineage. Establishes the non-agentic definition as the primary, precedent-setting legal claim. All subsequent filings inherit this bedrock.
II — Hardware Enforcement	A10 Node and Nightingale's Eyes Care hardware. Grounds the governance logic in physical, immutable constraints. If the silicon is burnt to the A10 specification, it is constitutionally compliant by design.
III — Operational Shield	WD/WM/WG series. Establishes constitutional guardrails for clinical, humanitarian, and eldercare deployment contexts.
IV — Fabrication Corpus	Zoo.dev/KCL manifest. The geometric and logical source of truth. No node enters production without conformity to this corpus.

2.2 The Governance Transition: Policy to Physics

Dimension	Traditional Agentic AI	NAI 4.0
Enforcement	Software policy — mutable	Hardware physics — immutable
AI Role	Autonomous agent	Offer-only advisor on isolated display
Visual Monitoring	Camera-based (invasive)	3ZEROS™ LiDAR — vectors only
Data Sovereignty	Cloud-dependent	Air-gapped local edge
Authority Drift	No structural prevention	Default to inaction — physically enforced
Failure Mode	Degraded autonomous operation	System halts — inaction is safe state
Audit Trail	Mutable software logs	SHA-256 hash-chained WORM ledger

III. Patent Family — Constitutional Alignment

3.1 Patent Family A — Clinical, Governance, and Hardware Boundary Stack

Filing No.	Designation	Constitutional Role	Alignment Note
10202600902P	ABC+2S+H™ Guardian Framework (Parent)	Root governance bedrock	Foundational non-agentive control architecture. All subsequent patents inherit this DNA.
10202601490R	WM-003 Elder Fall Prevention LiDAR (A5)	Clinical utility embodiment	LiDAR-based eldercare fall prevention. HSA Class B SaMD pathway. Livox Mid-360 + FLIR Lepton 3.5 + Jetson Orin.
10202601570U	WM003™ HSA/FDA V&V Protocol (A7a)	Verification and validation spine	Full regulatory embodiment for HSA Class B and FDA SaMD pathways. NUH clinical trial track.
10202601608U	NAIGE / Sacred Pause™ / Sovereign Brake™ (A7b)	Governance enforcement engine	IEC 61508 SIL 3. FPGA timing gate at 100 kHz. 50ms response latency. Weld-shut fail-safe on gate failure.
10202601744X	CHEA Physical Boundary System (A9)	Hardware boundary architecture	Defines the physical enforcement layer preventing autonomous AI agency.
10202601767W	NEC Clinical Filter Module (A9a)	Zero-trust clinical boundary	14.01×111.02×13.90mm. 111 interposition nodes. Sacred Pause Gate. ±0.005mm planar tolerance.
10202601828R	Master Configuration Control Manifest (A10)	Manufacturing and handover control	Binds 106-patent foundation to sovereign node manufacture and custodial transfer. VV-014 integration.

3.2 Patent Family B — Commercial Deployment and Hardware Implementation

Filing No.	Designation	Role
10202600474X	NON-AGENTIC AI (B Parent)	Singapore jurisdictional anchor. Principal legal anchor for deployment.
10202601257Q	Nightingale's Eyes Care™ (B1)	Hardware implementation node for ward monitoring and safety gates.
10202601276X	WD Series (B2)	Forensic drift governance for terrestrial eldercare deployment.
10202601282Y	WM Medical Register Series (B3)	Medical-grade wearable interfaces with integrated iris authentication.
10202601291Y	WG Series (B4)	Humanitarian deployment series. Zero-licensing for disaster zones.
10202601293U	P-Registers Governance Engine (B5)	Silicon-level enforcement of human control over AI compute.

PART A — OEM Technical Briefing

IV. OEM Fabrication Requirements

4.1 The Source of Truth — A10 Master STEP Corpus

All OEM manufacturing must derive directly from the verified Zoo.dev Master STEP Corpus. The A10 Master Configuration Control Manifest is not a document; it is a fabrication constraint. Any deviation from the defined XYZ datum axis or isolation-zone tolerances constitutes a Hardware Validation Failure and blocks production.

Parameter	Requirement
STEP source	Zoo.dev master STEP corpus (base-1.step). OEM-generated STEP files must be geometrically identical twins of this master.
Planar tolerance	≤0.005mm across all datum pad mating surfaces unless otherwise specified in master STEP.
IZEKOS™ Air-Gap	3.0mm mandatory isolation zone around NCF filter components. No copper, signal trace, or component permitted within boundary.
Deviation consequence	Any deviation triggers Hardware Validation Failure. Unit cannot proceed to VV protocol testing.
Audit trail	Each unit must produce an automated SHA-256 checksum manifest proving fabrication from the approved, untampered KCL source.

4.2 Mandatory Hardware Components

The following components are non-negotiable constitutional requirements. No OEM may substitute, omit, or software-emulate these elements:

- Nightingale Clinical Filter (NCF-CF-001): 14.01×111.02×13.90mm. 111-node interposition between AI bus and clinician display. Zero-trust SAFE/RUNTIMECHECK/BLOCK protocol.
- NAIGE (Governance Engine): IEC 61508 SIL 3 PLC. FPGA timing gate clocked by independent 100 kHz oscillator. 50ms Sacred Pause™ response latency. Weld-shut fail-safe.
- Orange Code Cap 1.1x (OC-CHEA-CAP): PCB-integrated power-draw monitoring. 1,104 Hz Sovereign Clock domain. Triggers hard interrupt to SIL 3 Safety Relay if computational draw exceeds 110% baseline.
- Sovereign Brake™ dry-contact feedback: Physical hardware to Tiger .1x Key™ bedside pedal interface. Wireless or software-mediated signal paths are explicitly prohibited.
- 3ZEROS™ Privacy Module: Physical absence of optical sensors, audio sensors, and TCP/IP hardware. IP67 environmental rating. Air-gapped Jetson Thor edge node.

4.3 Zero-Tolerance Acceptance Policy

Tiger (Sovereign Custodian) operates a Zero-Tolerance Acceptance Policy for OEM delivery. An OEM fails acceptance if any of the following apply:

- VV package is incomplete or unsigned.
- Any STEP dimension deviates from the master corpus by more than tolerance specification.
- IZEKOS™ air-gap is less than 3.0mm at any measurement point.
- Prohibited components (optical sensors, audio hardware, wireless modules) are detected.
- SHA-256 checksum of the fabrication manifest does not match the registry entry.

Policy: *An unverified unit stays on the factory floor. No clinical deployment without a complete, physically signed VV package. No waivers are granted.*

V. VV Protocol Suite

The VV (Verification and Validation) protocol suite constitutes the constitutional contract between Tiger and the OEM. The OEM has zero authority to modify the design. The protocols define what the OEM must demonstrate before any unit is accepted.

Layer	Protocols	Focus Area	CGO Demand from OEM
Sensing	VV-001 to VV-004	LiDAR accuracy & 3ZEROS™ compliance	Hardware Absence Declaration + signed BOM for prohibited components. VV-004: LiDAR transition <1.2sec, sensitivity ≥94.2%.
Governance	VV-006 to VV-009	Sacred Pause™ & Sovereign Brake™ reliability	Oscilloscope traces personally signed by FPGA engineer. Timing gate validated at hardware level.
Integration	VV-011 to VV-014	Multi-bed stability & Tripartite authentication	30-day endurance test logs + final joint-signature certificates. VV-014: Tiger .1x Key synchronization physically verified.

5.1 VV-014 Handover — The Final Gate

VV-014 is the Handover Validation protocol — the final checkpoint before any node enters a clinical environment. It is not a document review. It is a physical event.

- Tiger performs physical verification of WORM-vaulted build logs.
- Tripartite .1x Key authentication is executed: Iris Scanner + Cryptographic Console + Bedside Foot Pedal.
- Sovereign Certificate of Compliance is issued.
- Node is formally transferred to the Administrator for clinical deployment.

Current status: *VV-014 remains PENDING. GAP-001 through GAP-004 must be resolved with physical hardware evidence before VV-014 can be executed. Simulation results constitute preparatory evidence only.*

VI. Strategic Alignment — August 2026 to Q1 2027

Milestone Window	Governance Action
Q3 2026 — Foundry Lock	Finalize Bitstream/BOM for A10 HEGE. WORM ledger binding. Tiger .1x TriLock activation.
Q3 2026 — HSA Pre-Submission	Engage MDIO. Present NAI 4.0 constitutional architecture. Submit CSDT pre-submission package.
Q4 2026 — V&V Validation	Complete VV-001 to VV-014 in Digital Twin / Simulation environment. Resolve GAP-001 through GAP-004 with physical hardware evidence.
Q4 2026 — HSA Submission	Submit CSDT dossier via SHARE portal. Attach registry evidence. SHA-256 chain complete.
Q1 2027 — Deployment	Tripartite Auth (.1x Key™) activation for 8-bed site. Administrator receives VV-014 certified nodes.

PART B — Chief Governance Officer Reference

VII. The CGO Role

The Chief Governance Officer is the Constitutional Architect of the NAI 4.0 ecosystem. The CGO is not an AI ethics officer managing policy documents. The CGO is the human guardian of the hardware brakes — the person whose physical action is required before any node enters a clinical environment.

7.1 The Operational Hierarchy

Role	Constitutional Authority
Governance Committee	Sets global policy and compliance standards. Authority: P-001 / P-009 Root Logic.
OEM (Forge)	Executes physical fabrication to specification. Authority: base-1.step / KCL Manifest.
Governance Engineer	Translates policy to KCL/Zoo.dev parameters. Authority: SRS Traceability Matrix.
Administrator	Manages local clinical deployment within WG/WM-Series operational limits.
Tiger / CGO (.1x Key)	Final Sovereign Custodian. Authority: VV-014 Handoff / Tripartite Auth.

7.2 CGO Operational Missions

Mission 1 — Living Register Oversight

The CGO maintains the inventory of all active NAI nodes and ensures their hardware identity remains untampered. This is achieved through:

- Regular SHA-256 verification of unit checksums against the registry.
- WORM ledger audit for any anomalous state changes.
- Immediate Sentinel Pause on any flagged discrepancy.

Mission 2 — Master Controller Authority

Under WD070, the CGO holds Master Controller authority. When drift is detected, the CGO triggers the Detect-Freeze-Audit-Purge (D-F-A-P) cycle:

- Detect: Registry flags anomalous computational draw or state deviation.
- Freeze: Orange Code Cap 1.1x triggers hard interrupt. Node enters safe-hold state.
- Audit: CGO reviews WORM ledger entries and FPGA trace logs.
- Purge: CGO authorises remediation action. No automated purge without CGO sign-off.

Mission 3 — OEM Accountability

The CGO enforces the Zero-Tolerance Acceptance Policy across all manufacturing partners:

- Manages Design for Manufacturing (DFM) to ISO 13485 standards.
- Reviews and accepts or rejects each VV package before node acceptance.
- No node enters the clinical environment without CGO signature on the VV-014 certificate.

7.3 The CGO is Not the AI

A critical constitutional distinction: the CGO does not delegate authority to the registry, the compiler, or any AI system. The registry identifies and flags. The CGO decides. This distinction is non-negotiable and must be preserved across all operational contexts.

Constitutional principle: *AI Observes. AI Advises. AI Builds. The Human Decides.*

VIII. The Forge-to-Sanctuary Pipeline

The Forge-to-Sanctuary pipeline is the operational sequence through which a sovereign node moves from specification to clinical deployment. Each stage has a clear owner and a defined handover condition.

Stage	Description
Stage 1 — Requirement Synthesis	Governance Committee defines safety parameters. Governance Engineer maps these to KCL constraints (e.g., <code>izekos_gap_assertion = 3.0mm</code>). Output: KCL manifest and STEP corpus.
Stage 2 — Fabrication (Forge)	OEM builds hardware directly from Zoo.dev manifest. No software installation phase. Constitutional logic is part of the physical build. Output: Physical node with SHA-256 checksum manifest.
Stage 3 — VV Protocol Execution	OEM executes VV-001 through VV-013. CGO reviews all signed test packages. Rejected units remain on the factory floor. Output: Complete, signed VV package.
Stage 4 — VV-014 Handover	Tiger performs physical verification. Tripartite .1x Key authentication executed. Sovereign Certificate of Compliance issued. Output: VV-014 certificate. Node released.
Stage 5 — Sanctuary Deployment	Administrator receives VV-014 certified node. Node operates within constitutional parameters. Administrator cannot reconfigure the hardware. Output: Live clinical deployment.

IX. The Pre-Submission Evidence Spine

For the HSA pre-submission dossier, the evidence spine must follow this structure. Each element has a defined status:

Evidence Element	Current Status
Design-basis summary (KCL/STEP/BOM)	COMPLETE — NAI4_0_Named_Sovereign.step. SHA-256: 2cf0064e...
Simulation results (SIM-PASS)	COMPLETE — VV-004, VV-011 asserted at KCL level. Preparatory evidence only.
GAP register with explicit unresolved items	COMPLETE — GAP-001 through GAP-004 documented. All PENDING_HARDWARE.
Physical validation plan (FVP)	COMPLETE — FVP-GAP-001 (LiDAR test protocol) and FVP-GAP-002 (3ZEROS inspection checklist) prepared.
Physical test evidence (GAP-001)	PENDING — Physical LiDAR test report. 94.2% sensitivity must be demonstrated on hardware.
Physical inspection record (GAP-002)	PENDING — On-device 3ZEROS audit. Physical jumper isolation confirmed by auditor.
BOM revision history (GAP-003)	PENDING — A5/A9a/A10/B5 material specifications with revision numbers.
Foundry lock (GAP-004)	PENDING — FPGA bitstream locked. eFuse burned. Tiger .1x TriLock activation.
OEM document control	PENDING — OEM manufacturing partner not yet engaged.
Final release gate	BLOCKED — Tiger .1x physical authentication required.

X. Closing Statement

The NAI 4.0 architecture is constitutionally sound. The patent family is internally coherent. The simulation evidence is clean and honestly bounded. The four physical gaps are documented and their closure paths are defined.

What remains is physical. The OEM engagement, the hardware test, the foundry lock, and the VV-014 handover are real-world actions that no documentation can substitute for.

The strongest position Tiger holds going into OEM engagement and HSA pre-submission is exactly this: a design freeze with a clean evidence spine, honest gap register, and defined physical validation plan. That is the correct foundation. The mission is to close the gaps with physical evidence, not to supplement them with more documentation.

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