LIVE: https://astrosoma.space/ | 0-SRAM Autonomous Triage | CEIT Adaptive Crew UX

AstroSoma

Zero-SRAM Bioneural & Homeostatic Health Monitoring Software for Astronauts on Space Missions

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Open Source & Contact: `github.com/Lexovian/astrosoma` (Apache-2.0) · `info@astrosoma.space`



Mission Patch (SI-GENERATED) · WERR-24 & CEIT

Why Astronaut Health Monitoring Must Be Radiation-Resilient & Autonomous

NASA HRP 5 Hazards of Human Spaceflight

- **Space Radiation:** Galactic Cosmic Rays (GCR) & Solar Proton Events (SPE) increase biological dose AND trigger Single-Event Upsets (SEUs) in avionics SRAM.
- **Distance from Earth:** Mars transit reaches **22-minute one-way latency** — flight surgeons cannot intervene live.
- **Altered Gravity Fields:** Causes cephalad fluid shift (**SANS**), ~1–1.5%/mo bone mineral loss, and orthostatic intolerance.
- **Isolation & Closed Cabin:** 16 orbital sunrises/day impair sleep; rising **CO2** causes headache before SpO2 drops.

Why Heavy Learned Weights Fail Deep Space

SRAM Bit-Flip Vulnerability

Conventional neural networks store megabytes to gigabytes of learned parameters in mutable SRAM. A single unmitigated cosmic-ray bit-flip can silently distort triage thresholds when Earth links are unavailable.

AstroSoma Defense: 0 Bytes Weight RAM

Deterministic `WERR-24` procedural escape boundary + transparent `NASA-STD-3001` guardrails + `CRC-16/CCITT-FALSE` packet authentication.

Dual-Layer Triage: Clinical Guardrails + 24-Byte 0-SRAM WERR-24 Protocol

Immutable 192-Bit (24-Byte) Telemetry Frame

Bytes	Fields	Quantization Resolution
`0..1`	Magic + Environment ID	`0xA5` + 5 Space Environments
`2..9`	HR, BP (SBP/DBP), SpO2, Core Temp	0.1 BPM, 1 mmHg, 0.01%, 0.01°C
`10..17`	Glucose, Dose Rate, Sleep, Mood, HRV	0.1 mg/dL, 1 µSv/d, 1 min, SDNN
`18..23`	Cabin pCO2, Cum. Dose, CRC-16	`CRC-16/CCITT-FALSE` over 0..22

Zero-SRAM Procedural Homeostatic Index ($z \to z^2 + c$)

12 physiological & habitat variables normalize into a 4D strain vector mapped onto the quadratic stability boundary (32 iterations):

- **Mutable Neural Weight RAM:** `0 Bytes` — zero weight corruption vector.
- **Cross-Runtime Parity:** Bit-identical 24-byte frames & reserve scores verified across Python & browser JS.
- **Clinical Safety First:** Explicit NASA-STD-3001 / ALARA limits always govern alerts transparently.

Interactive Human Anatomy, Multi-Modal Inputs & 5 Space Environments

7 Clickable Body Systems

- **Neuro / Brain:** Sleep & Mood readiness
- **Ocular (SANS):** Cephalad fluid & pCO2 watch
- **Cardiovascular:** Lead-II ECG, HR, BP & HRV
- **Respiratory:** SpO2 + Cabin pCO2 co-alerts
- **Metabolic:** Capillary glucose & hydration
- **Musculoskeletal:** Core temp & ARED bone loading
- **Immune & Radiation:** ALARA + GOES flux

Multi-Modal Data Capture

- **Keyboard / Sliders:** Instant sensitivity exploration across all 12 metrics.
- **Webcam Optical rPPG:** Browser `getUserMedia` green-channel pulse estimation (+ deterministic optical waveform fallback).
- **JSON / CSV Import:** Replays wearable & portable ultrasound telemetry logs.
- **Dynamic Charts:** Real-time Canvas P-QRS-T ECG & 14-Sol nominal band trends.

5 Mission Environments

- **ISS Station:** 0 g, live flight surgeon link
- **Orion Spacecraft:** Transit relay & water-wall storm shelter
- **Surface Rover:** EVA CO2 scrubber & thermal watch
- **Artemis Lunar Base:** 0.165 g + regolith overburden
- **Mars Transit / Hab:** Up to 22-min delay — Autonomous Mode

Plain-Language Crew Explanations & Gamified Health Routines

Adaptive `LearningGate` (Dept. of CEIT, Mersin Univ.)

Built on Dr. Zerrin Dağlı's *Procedural Fractal Pedagogy* (SSRN `7641538`), cognitive reserve (sleep + mood) and mastery dynamically select the ZPD tier:

- **Tier 1 (High Fatigue / Stress):** Ultra-clear analogy, step-by-step measurement tip, and one immediate action.
- **Tier 2 (Crew Coach):** Spaceflight rationale (why rising CO2 impairs judgment before SpO2 drops).
- **Tier 3 (Medical Liaison):** Full NASA HRP hazard cross-references and clinical operational bands.

Scheduled Routine Prompts & Gamification

`+290 XP Daily Mission Adherence Loop`

- **Routine Check-ins:** Morning Rest BP/SpO2, 11:00 ARED Bone Loading (45 min), Hydration/Glucose Sync, Dosimeter Sync, Evening Circadian Dimming.
- **Milestones & Badges:** *ARED Iron Spine*, *ALARA Shield Steward*, *Circadian Guardian*.
- **Interactive Micro-Quiz:** Builds non-medical crew autonomy across orbital and surface emergencies.

Live NASA OSDR + NOAA SWPC Feeds & Reproducible Verification

Real Flight & Space Weather Endpoints

NOAA SWPC GOES Live: ≥10 MeV Proton Flux = `0.207 pfu` (S0 (Quiet)), **Kp = 1.0**.

OSDR ID	Organism	Verified NASA OSDR Study
`OSD-340`	Mus musculus	Mlh1 deficiency increases the risk of hematopoietic malignancy after simulated...
`OSD-334`	Mus musculus	miRNA signature detection and countermeasures against HZE radiation exposure f...
`OSD-812`	Homo sapiens	Simulated microgravity impairs human NK cell cytotoxic activity against space ...
`OSD-52`	Homo sapiens	Expression data from SPHINX (SPaceflight of Huvec: an INtegrated eXperiment)...

Empirical Engineering Checks

6 / 6 Automated Tests Passing

- **Cross-Runtime Bit-Exact Parity:** Python (`codec_werr24.py`) and JS (`werr24_core.js`) match byte-for-byte via Node.js CI verification.
- **Exhaustive 192-Bit SEU Fault Sweep:** Every single bit-flip across the 24-byte frame is flagged by `CRC-16` while neural weight RAM stays at `0 Bytes` .
- **Cloudflare Pages Edge Proxy:** `/api/nasa-osdr` resolves browser CORS cleanly with versioned JSON fallback.

Ready for Analog Crews & Deep-Space Validation

Verified Project Links

- **Live Console:** `https://astrosoma.space/` (Cloudflare Pages, Full Strict SSL)
- **GitHub Repository:** `https://github.com/Lexovian/astrosoma` (Apache-2.0)
- **NASA Space Apps Team:** `spaceappschallenge.org/2026/find-a-team/astrosoma1/`
- **Team Email:** `info@astrosoma.space`

Post-Hackathon Roadmap

- **Sensor Bridge:** Direct WebSerial / microcontroller WERR-24 framing from Arduino & wearable PPG/dosimeter hardware.
- **OSDR/ALSDA Replay:** Streaming historical spaceflight physiology cohorts directly through the clinical guardrail evaluator.
- **Analog Habitat Trials:** Bilingual EN/TR CEIT usability evaluation with non-medical analog crew volunteers.