Preserving Critical-Infrastructure Knowledge Before It Retires

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The problem. America is losing operational control of its infrastructure knowledge on two fronts at once. Federal building repair backlogs more than doubled — **$171B (FY2017) → $370B (FY2024)** — and GAO added federal building condition to its **High-Risk List (2025)**. Meanwhile the workers who maintain those systems are retiring faster than they can be replaced: roughly **2.1 million** skilled-trades jobs may go unfilled by **2030** (last year ~600,000 trades jobs were posted against ~150,000 new entrants). The dollar backlog is the symptom; the disease is invisible — every retirement and every contract turnover walks years of undocumented, machine-specific troubleshooting expertise out the door, and the next operator starts from zero.

Why now. AI can finally capture an expert's *reasoning* — not just facts — turn decades of field experience into a searchable knowledge base, and give the next operator day-one fluency with a system they've never touched. Force-multiplication for a shrinking workforce, not replacement of it.

The catch, and the answer. AI cannot be trusted near safety-critical systems if it can be confidently wrong; in a hospital electrical room, a confident wrong answer is a safety event. The answer is **provenance-governed AI** — every claim traceable to its evidence, append-only, cryptographically anchored, and calibrated to flag what it does *not* know. The methodology is already **published and open-source (MIT)**, with companion papers on the public record — including a self-audit in which **49 of the author's own IP claims were checked against prior art and 0 survived as novel**, published rather than buried.

The ask — not money, permission to demonstrate. A sponsored, low-cost pilot at a willing federal facility (a military or VA healthcare facility, a GSA building, or a federal civilian campus), with success criteria set in advance and results published either way.

What the pilot measures *(targets, not results):* mean time-to-diagnose (expert vs. assisted novice) · equipment downtime (baseline vs. pilot) · training-time-to-competency · expert-workflow capture coverage before departure · governance integrity (how often the system correctly flags low-confidence answers instead of asserting them).

Cost posture. Open-source methodology, lightweight toolchain, single-facility scope. The cost to government is **access and measurement** — not a development contract.

Who. A Master Electrician with 20+ years on federal healthcare infrastructure — NEC 517 essential power, isolated power, generator/ATS coordination, switchgear, BAS/VFDs — who watched institutional knowledge cycle through one facility across multiple successive maintenance contracts, then built and published the discipline this proposal rests on. Independent practitioner; no employer or specific facility is implicated.

Sources: GAO-25-108400 + GAO testimony (House Appropriations, Apr 9 2025) + GAO High-Risk Series GAO-25-107743; JLL skilled-trades research (Apr 2026, citing U.S. Dept. of Education + BLS Occupational Outlook); figures verified in `FIGURES_VERIFIED_2026-06-02`. Methodology + companion papers: `lindsey-provenance` (MIT) + Zenodo DOIs per RELEASE_SEQUENCE. Written under a calibrated-language discipline; this brief and the methodology are LLM-collaborative work produced under that same provenance discipline. The full white paper is available on request.