

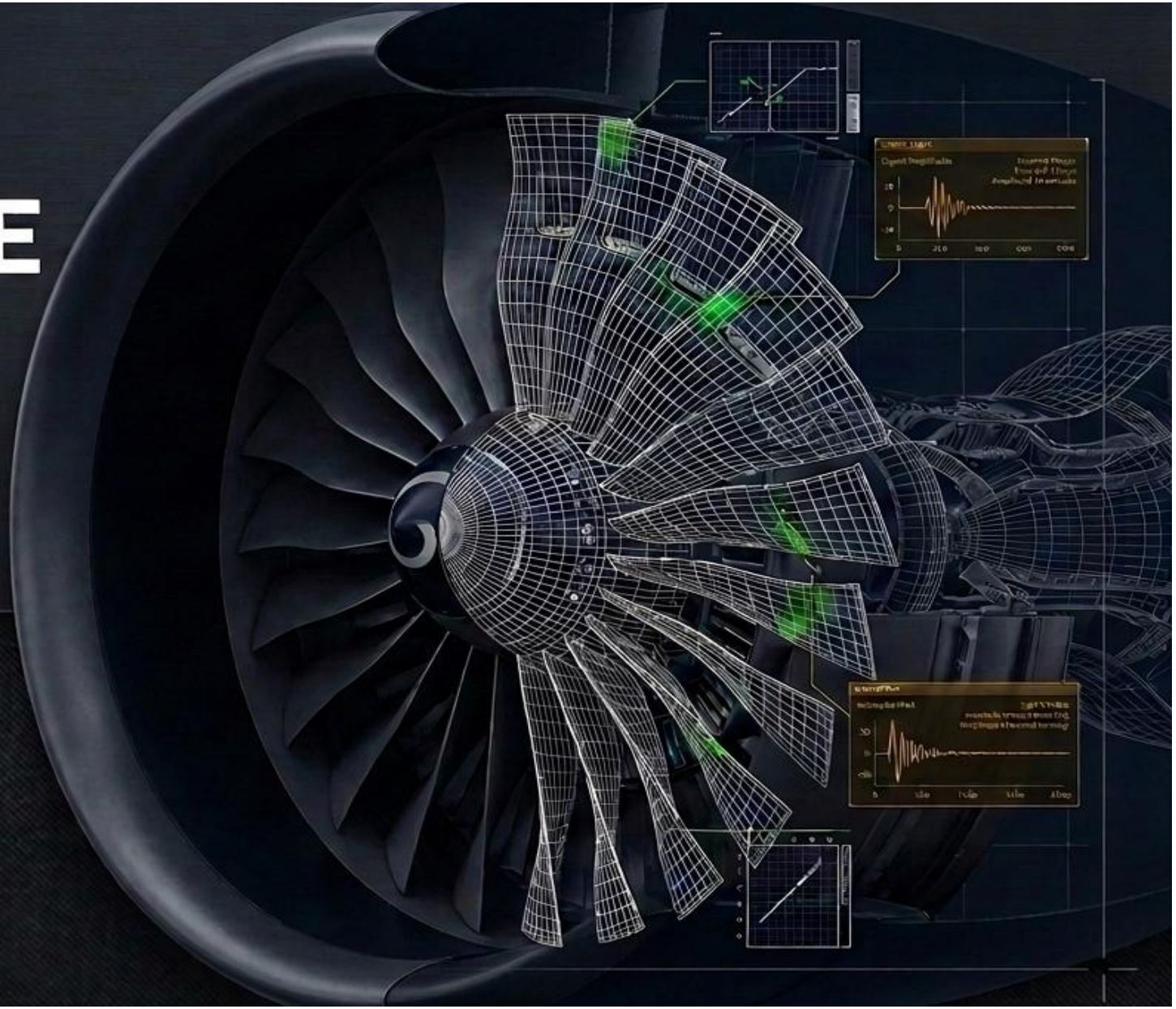
Presented to: A4A NDT Forum

By: FAA – Aircraft Maintenance Division

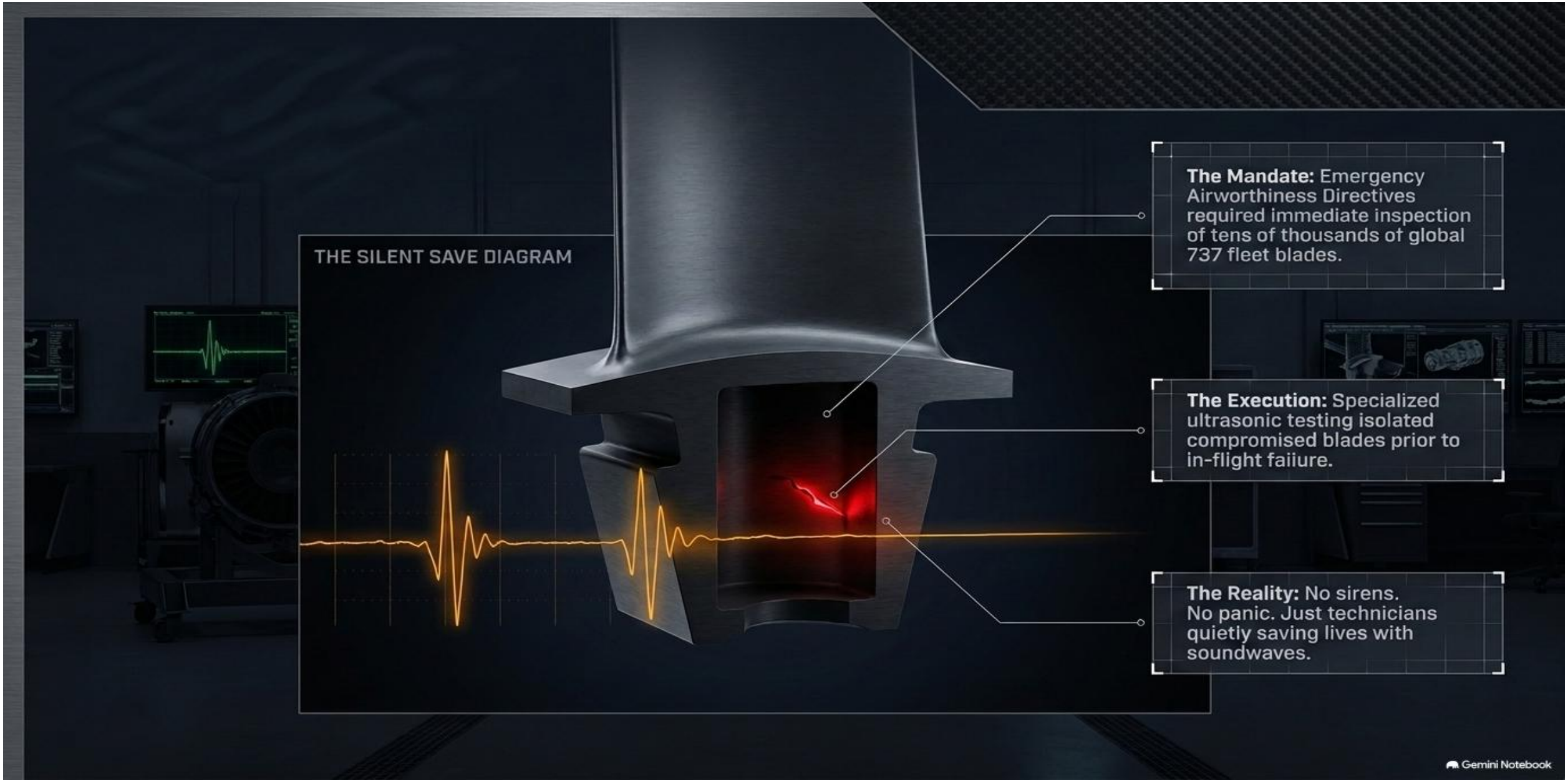
Date: September 21, 2026

Federal Aviation Administration

THE ARCHITECTURE OF TRUST



There’s rarely breaking news about the disaster that didn’t happen.


THE SILENT SAVE DIAGRAM
The Mandate: Emergency Airworthiness Directives required immediate inspection of tens of thousands of global 737 fleet blades.
The Execution: Specialized ultrasonic testing isolated compromised blades prior to in-flight faiiure.
The Reality: No sirens. No panic. Just technicians quietiy saving lives with soundwaves.
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REFRAMING THE BASELINE



THE LEGACY VIEW

Reactive and siloed.

> "YOU DO NOT JUST FIND DEFECTS. YOU MANUFACTURE TRUST."

THE MODERN REALITY

Predictive and **systemic.**

FAA AIRCRAFT MAINTENANCE DIVISION (AFS-300) OVERSIGHT: CERTIFICATION FROM DRONES TO BOEING 777s
PART 147 AMT SCHOOLS • AIR CARRIER CAMP • REPAIR STATIONS • BILATERAL AGREEMENTS

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An expensive lesson in horizontal stabilizers



The Setup:
US Navy Avionics Technician maintaining F/A-18 aircraft.

The Incident:
Accidentally dropped a sharp-edged panel removed from the vertical stabilizer—it stuck into the horizontal stabilizer like a knife.

The Result:
A very quick, very loud education from the maintenance chief on creating unnecessary work for the structures team.

"Some of the smartest people I have had the fortune to work with in my 40 years in aviation have been NDT technicians, inspectors, and research scientists."

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Reframing the purpose of nondestructive testing

[Rigor of Testing] + [Operational Confidence] = [Aviation Safety]

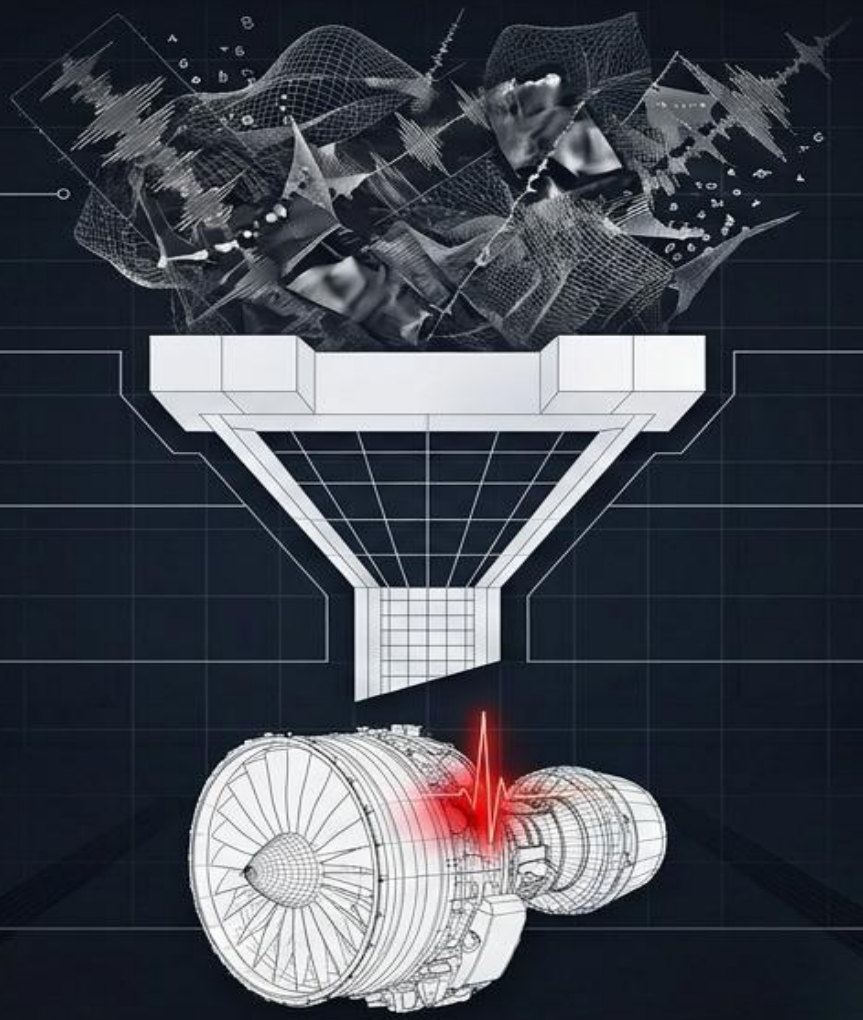
“You do not just find defects. You manufacture trust.”

Every safe flight is a direct testament to the rigor of this room.

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THE SIGNAL-TO-NOISE CRUCIBLE

Terabytes of high-noise volumetric data



Deep Learning Signal Segmentation & GRU Neural Networks

Actionable Safety Decisions

Algorithms do not experience eye strain, providing a consistent baseline for 100,000+ potential defect areas with near-perfect detection.

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THE SYSTEMIC RISKS OF ARTIFICIAL INTELLIGENCE IN AVIATION

The Black Box Trap

AI flags a component as safe, but the operator cannot explain how.

Result: Automation complacency and degraded foundational skills.

Bias and Overfitting

Algorithms trained on specific composite structures become highly accurate in labs but completely miss novel fatigue signatures on the flight line.

False Negatives

Poorly calibrated AI prioritizes processing speed over sensitivity, dismissing critical microscopic cracks (like a CFM56 dovetail fracture) as camera noise.

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THE ARCHITECTURE OF AUGMENTED SAFEGUARDS

EXPLAINABLE AI (XAI)

AI maps anomalies and triggers alerts. The system must “show its work” with visual overlays.



HUMAN-IN-THE-LOOP

AI acts as an automated pre-filter. Certified inspectors make the final evaluation.



SAFETY-WEIGHTED ALGORITHMS

Systems explicitly calibrated to prioritize safety over false negatives.



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THE AIRCRAFT AS A NERVOUS SYSTEM

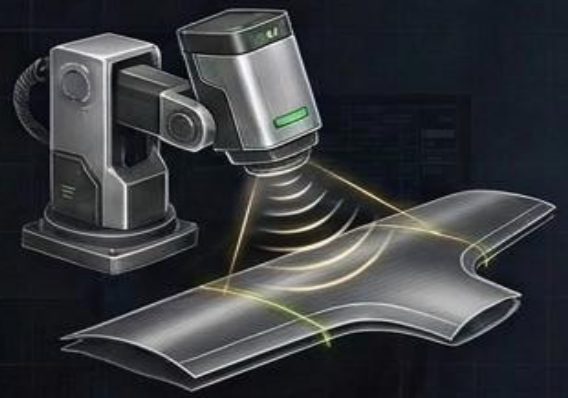


Composite smart skins transform aerodynamic shells into living structures. Validating this baseline without harming embedded electronics requires highly targeted, robotic volumetric NDT.

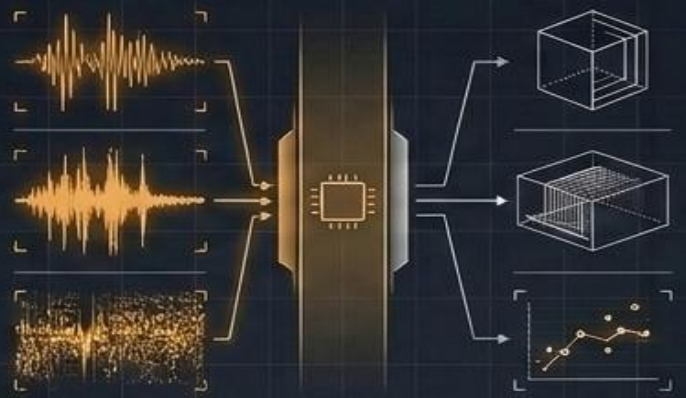
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THE VOLUMETRIC SHIFT

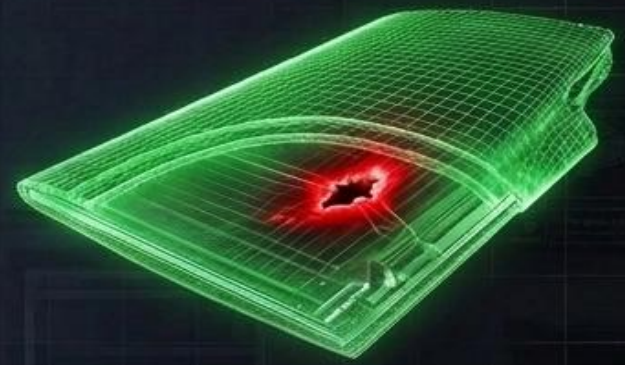
1. THE INPUT (PHYSICAL SCAN)



2. THE PROCESSING (DEEP LEARNING)



3. THE OUTPUT (AUTOMATED AUDITING)



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THE PREDICTIVE DIGITAL TWIN LIFECYCLE

PHASE 1: IN-FLIGHT EVENT



PHASE 2: AHMS ACTIVATION



PHASE 3: REAL-TIME ALERTS



PHASE 4: PRE-LANDING BLUEPRINTS

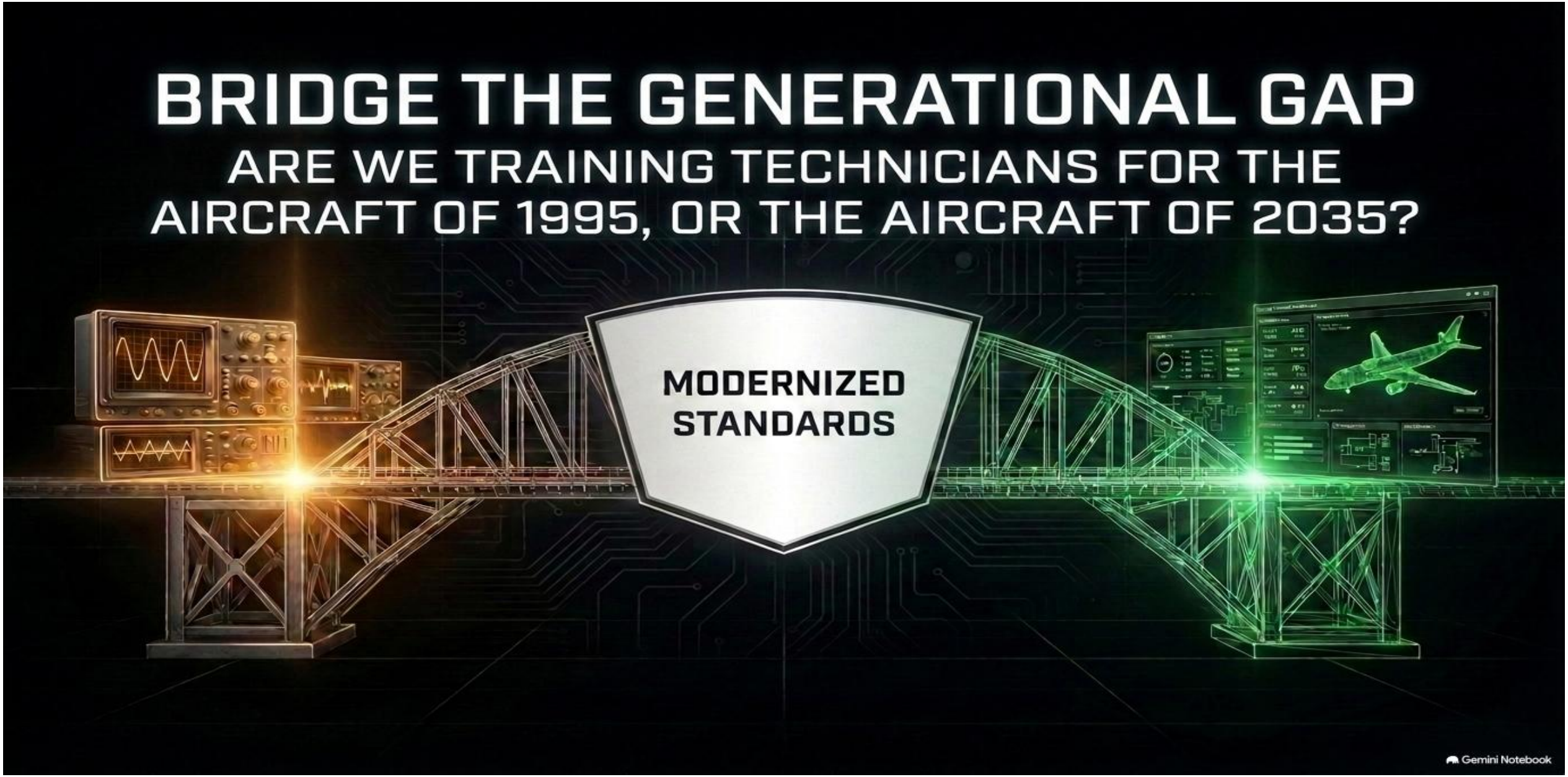


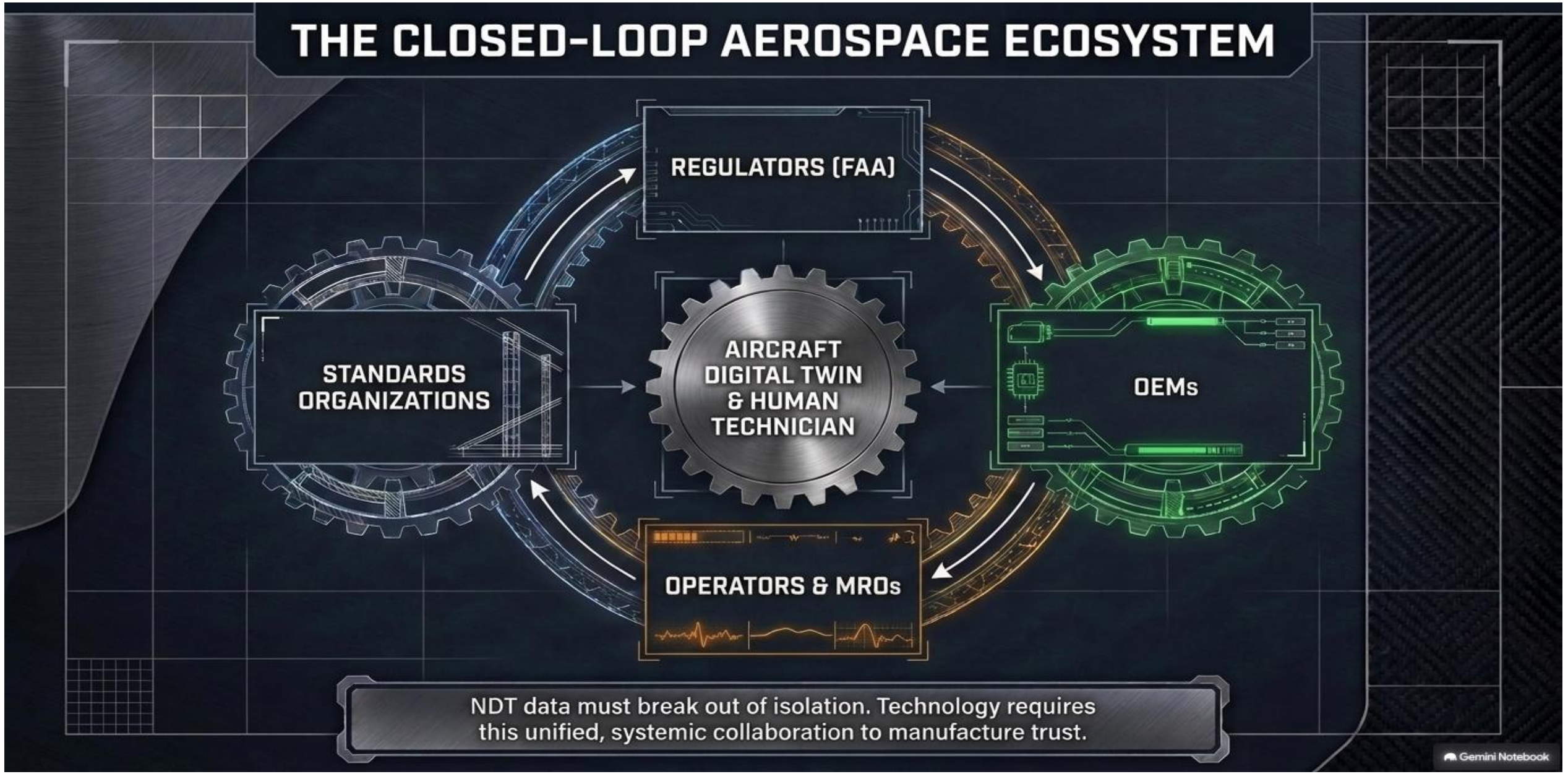


AIRCRAFT HEALTH MONITORING SYSTEM (AHMS)

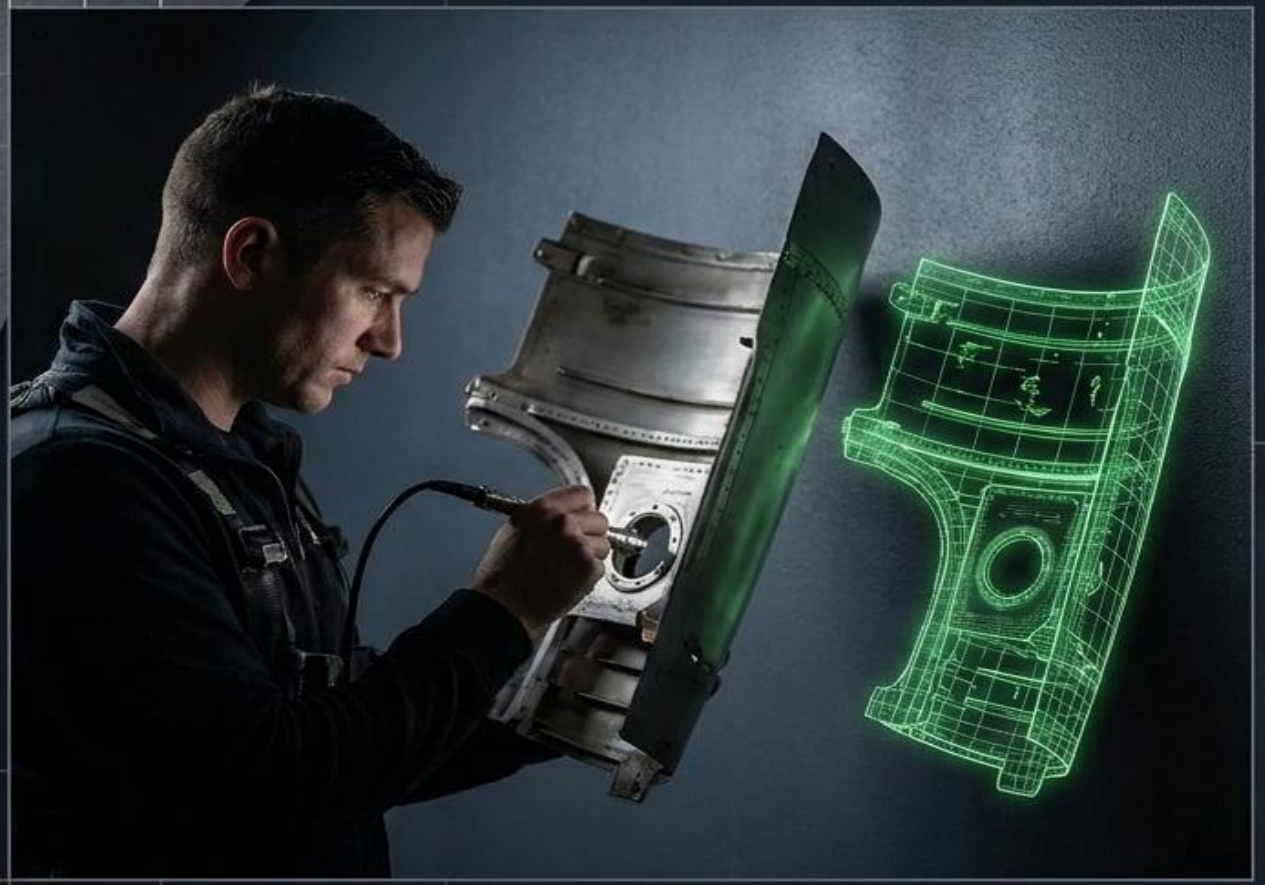
Eliminating wasteful, schedule-based teardowns in favor of highly focused, predictive safety.

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BRIDGE THE GENERATIONAL GAP
ARE WE TRAINING TECHNICIANS FOR THE AIRCRAFT OF 1995, OR THE AIRCRAFT OF 2035?
MODERNIZED STANDARDS
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THE CLOSED-LOOP AEROSPACE ECOSYSTEM
REGULATORS (FAA)
STANDARDS ORGANIZATIONS
AIRCRAFT DIGITAL TWIN & HUMAN TECHNICIAN
OEMs
OPERATORS & MROs
NDT data must break out of isolation. Technology requires this unified, systemic collaboration to manufacture trust.
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THE ULTIMATE LINE OF DEFENSE



Verify a design.

Feed data back to the manufacturer.

Train the AI of tomorrow.

Protect the family flying at 35,000 feet.

Embrace the technology. Never lose the craftsmanship. Keep our skies safe.

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