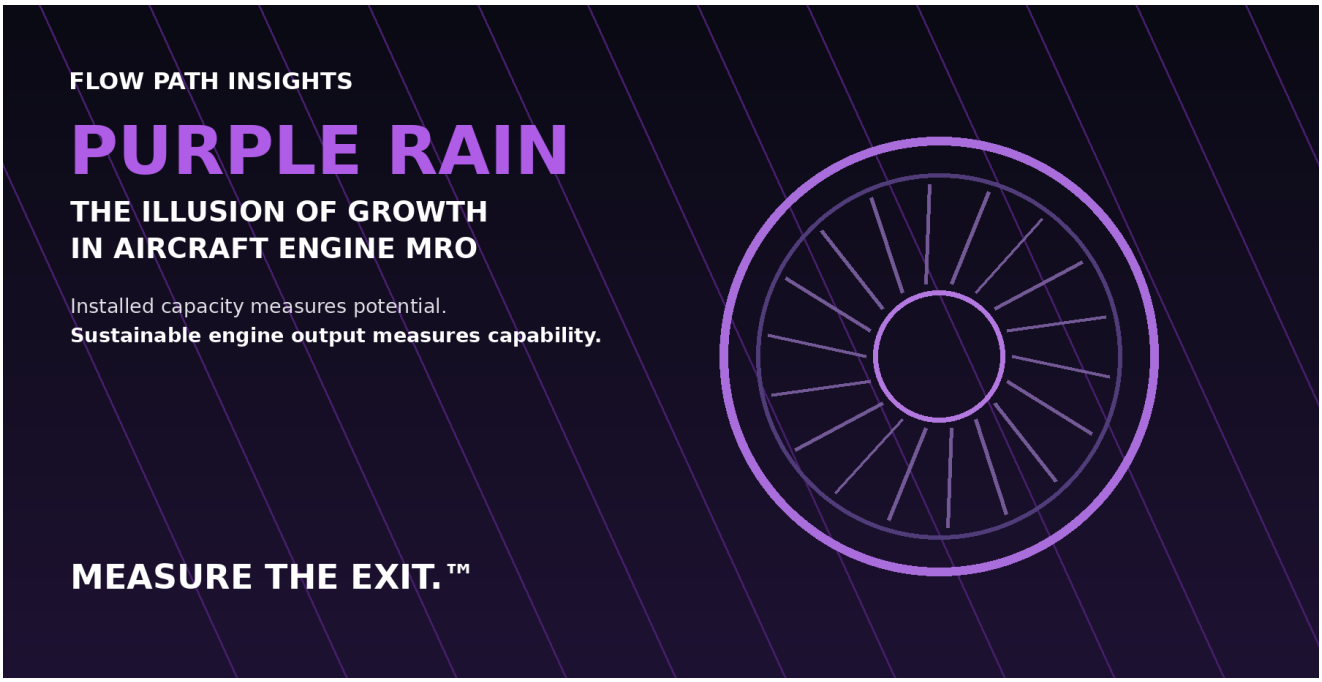
PURPLE RAIN

The Illusion of Growth in Aircraft Engine MRO

Why More Capacity Isn't Necessarily Producing More Engines



FLOW PATH
PRECISION. DIRECTION. IMPACT.

VETERAN-OWNED BUSINESS
Verified by the TEXAS VETERANS COMMISSION

Installed capacity measures potential. Sustainable engine output measures capability.

FLOW PATH INSIGHTS | AUGUST 2026

Executive Summary

The aircraft engine MRO industry may be measuring growth at the wrong point in the value stream. Facilities, engine bays, test cells, tooling and workforce are expanding, but an inducted engine becomes sustainable capacity only when the repair-and-material ecosystem beneath the engine shop can resolve its expected findings within the production need date.

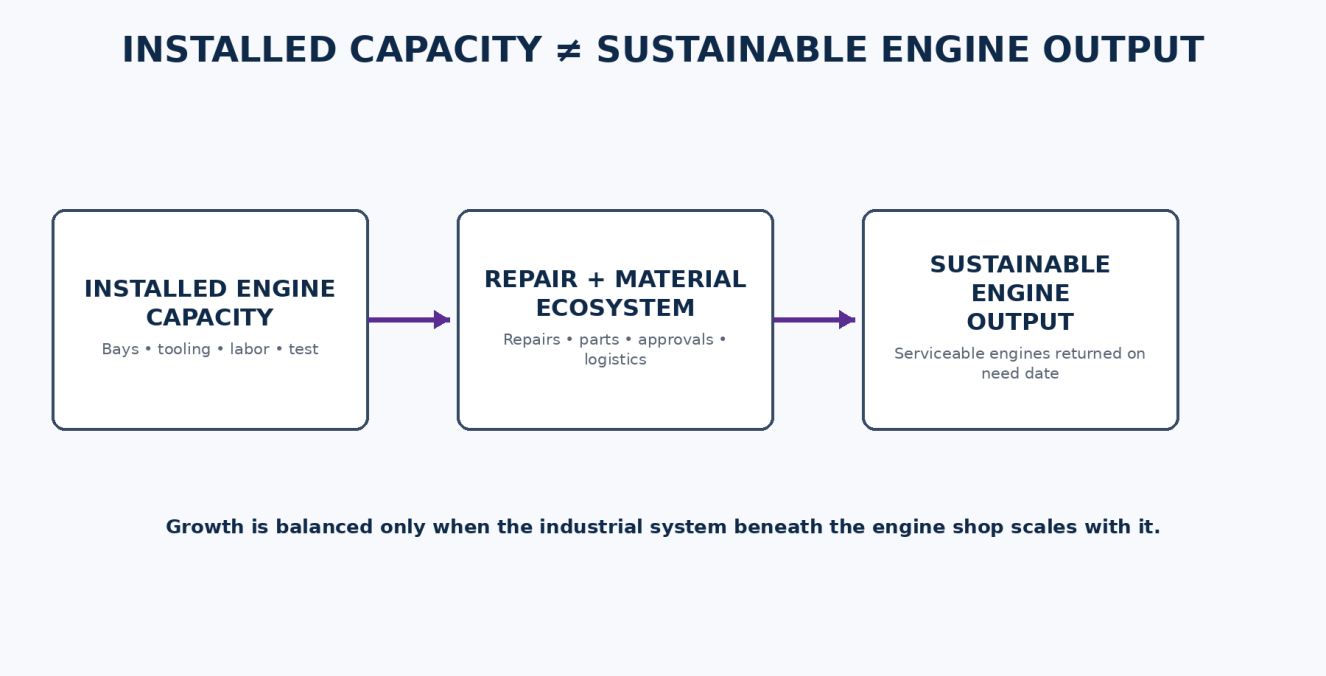
Flow Path defines the condition in which installed engine capacity grows faster than sustainable engine-equivalent output as False MRO Growth™. The physical investment is real; the illusion is treating installed induction capacity as equivalent to sustainable output.

Engine Equivalent Repair Capacity (EERC™) measures the sustainable engine-equivalent output supported by the normal approved repair-and-material ecosystem within the engine production requirement. It converts component-level repair and material capability into the common unit that matters to the MRO and operator: engines returned to service.

More engines inducted ≠ more engine capacity. More serviceable engines returned = more engine capacity.

Publicly documented evidence: IATA and CFM/GE describe an aftermarket response requiring more than engine-shop expansion: repair development, parts access, supplier performance, inventory and broader industrial capacity are also required. [1][2]

1. The MRO Growth Paradox



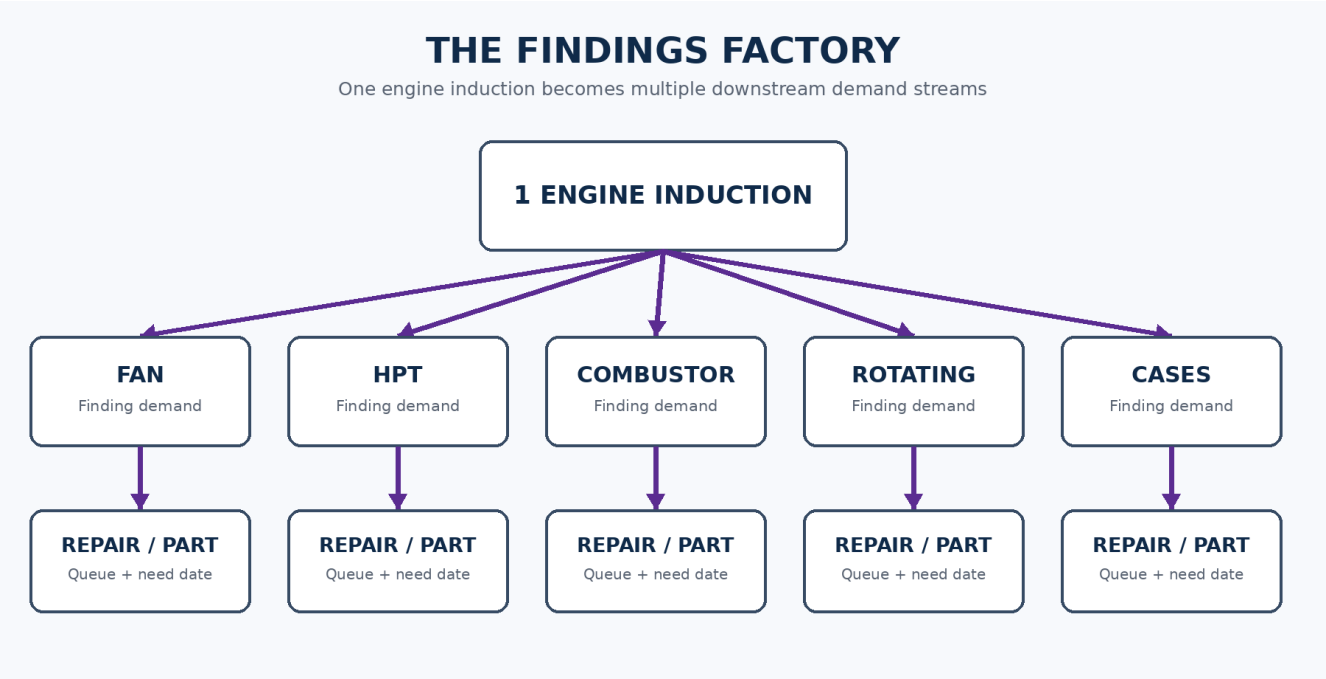
The market needs more engine MRO capacity. The question is what the industry means by capacity. A new engine bay, trained technician and test cell are real investments, but none independently guarantees that a serviceable engine can leave the facility on the promised date.

The controlling constraint can sit below the engine level: a critical repair, a specialized process, an engineering approval, replacement material, logistics, or a component queue shared across multiple customers. Engine MRO capacity can therefore be installed faster than sustainable engine output capacity can be industrialized.

An induction is activity. An available engine is output.

2. The Findings Factory

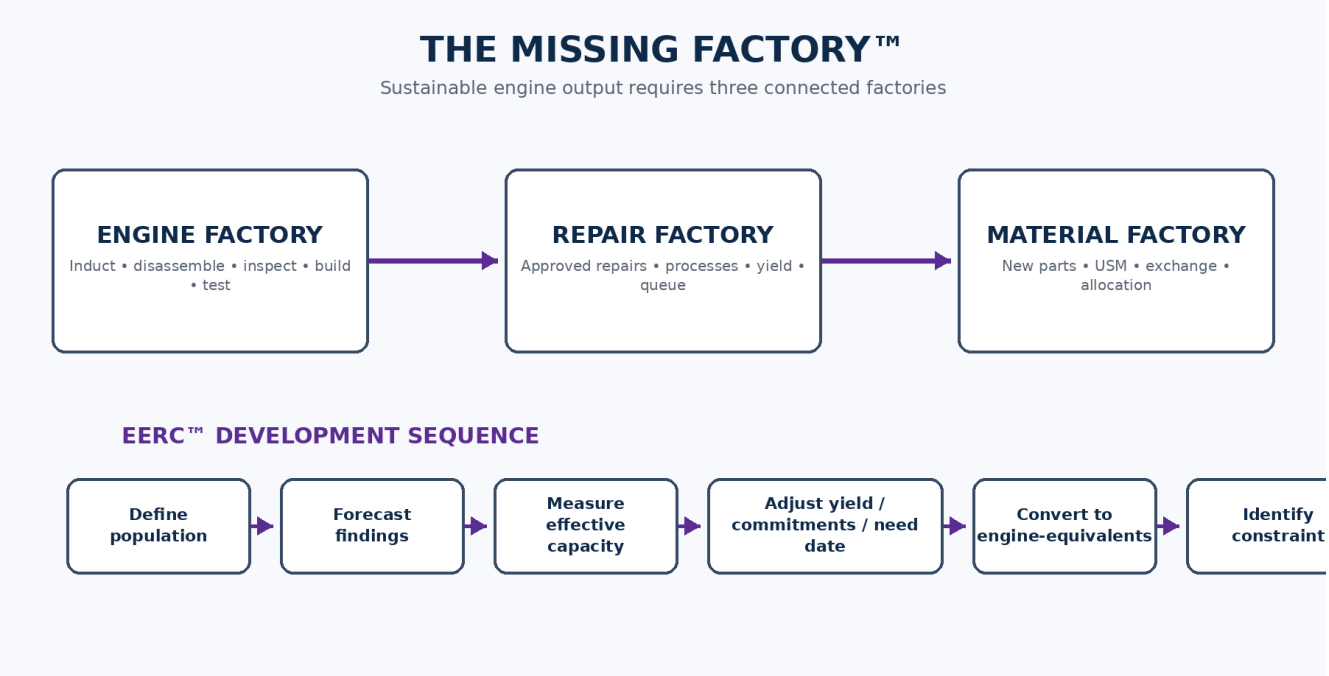
Why one engine becomes many downstream clocks



A shop visit is not one unit of downstream demand. Inspection converts one engine into multiple repair orders, material requirements, technical dispositions, logistics moves and supplier queues. Adding induction capacity therefore adds findings-generation capacity.

If the industrial system below the engine shop does not expand at compatible takt, additional inductions increase demand on the constraint rather than eliminating it.

3. The Missing Factory™



Purple Rain treats the aftermarket as three connected factories: the Engine Factory, the Repair Factory and the Material Factory. True engine capacity exists only when all three can support compatible sustainable output.

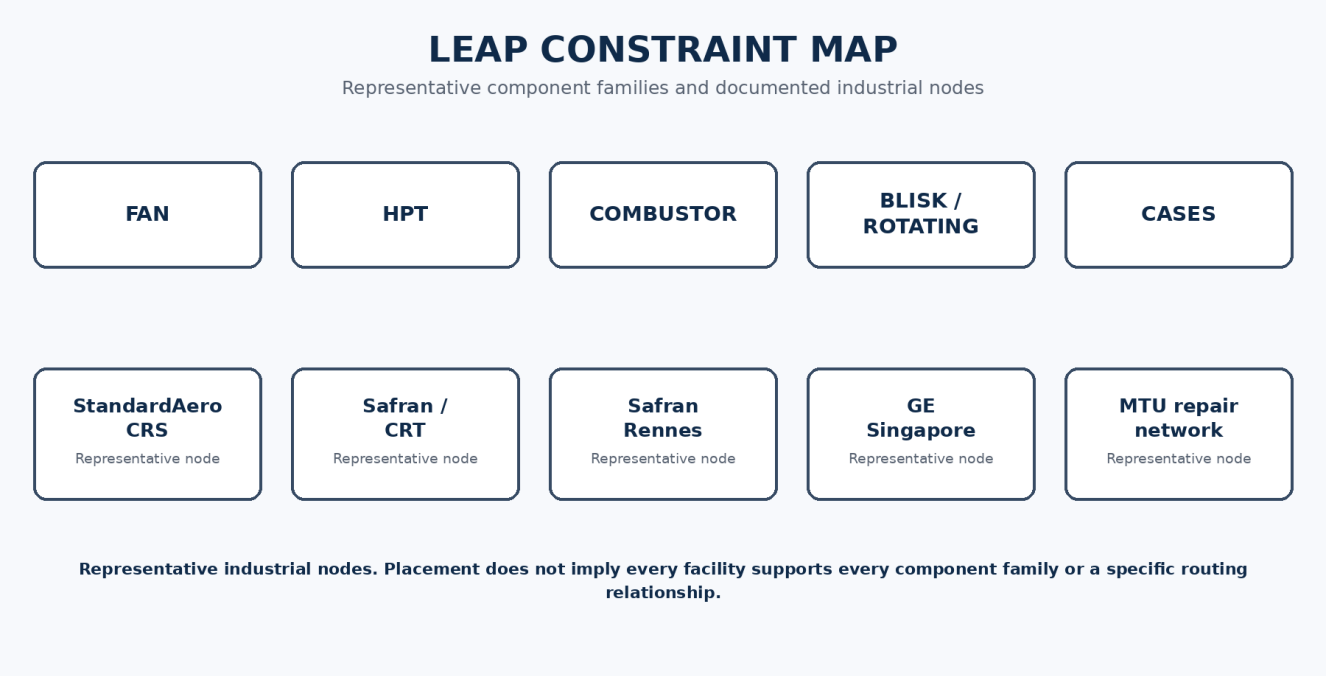
Engine Equivalent Repair Capacity (EERC™) is the sustainable number of engine shop visits that a defined repair-and-material ecosystem can support within a specified period by resolving expected critical component findings within the engine production need date, using normal approved repair, replacement-material and technical pathways, without extraordinary intervention beyond the defined operating model.

EERC™ converts component capability into sustainable engine output.

EERC™ development sequence: Define the engine population and period; forecast critical finding demand by component family; determine effective approved repair/material capacity; adjust for yield, committed demand and need-date performance; convert each critical pathway to engine-equivalents; identify the constraining pathway.

Method: System EERC™ is governed by the sustainable engine-equivalent capability of the constraining pathway under the defined demand mix, specified period and operating assumptions. Normal planned inventory, approved exchanges, routine USM and contractually planned customer-furnished material can be part of EERC™.

4. The LEAP Constraint Map



Representative LEAP findings can include fan hardware, HPT airfoils, combustor hardware, blisks and other rotating hardware, and large structural cases. Multiple independent engine MRO organizations can converge on a smaller set of approved repair, manufacturing, material and technical nodes.

The engine-overhaul market can be open and competitive while individual repairs, specialized processes, technical data and replacement-material pathways remain more concentrated.

Evidence boundary: The graphic shows representative documented industrial nodes, not hard routing relationships. Placement does not imply that every listed facility supports every component family. [2][3][5][6][8]

5. Fan Blade Case Study

Repair capacity is not necessarily engine capacity

Public information demonstrates meaningful LEAP composite fan-blade manufacturing and repair capability across the aftermarket. Flow Path firsthand industry experience nevertheless illustrates why broad component capability should not automatically be interpreted as complete engine-equivalent capability.

During direct involvement with LEAP fan-blade repair activity, Flow Path's founder participated in discussions concerning multiple approved fan-blade repair pathways. One repair, commonly referred to in that operating environment as Repair 5, followed a more restricted repair pathway. During a meeting attended by Flow Path's founder, GE represented that sufficient processing capacity existed for that repair pathway. Yet customer-supplied matched serviceable fan-blade hardware was used in some cases to support engine completion when normal replenishment timing did not align with the production requirement.

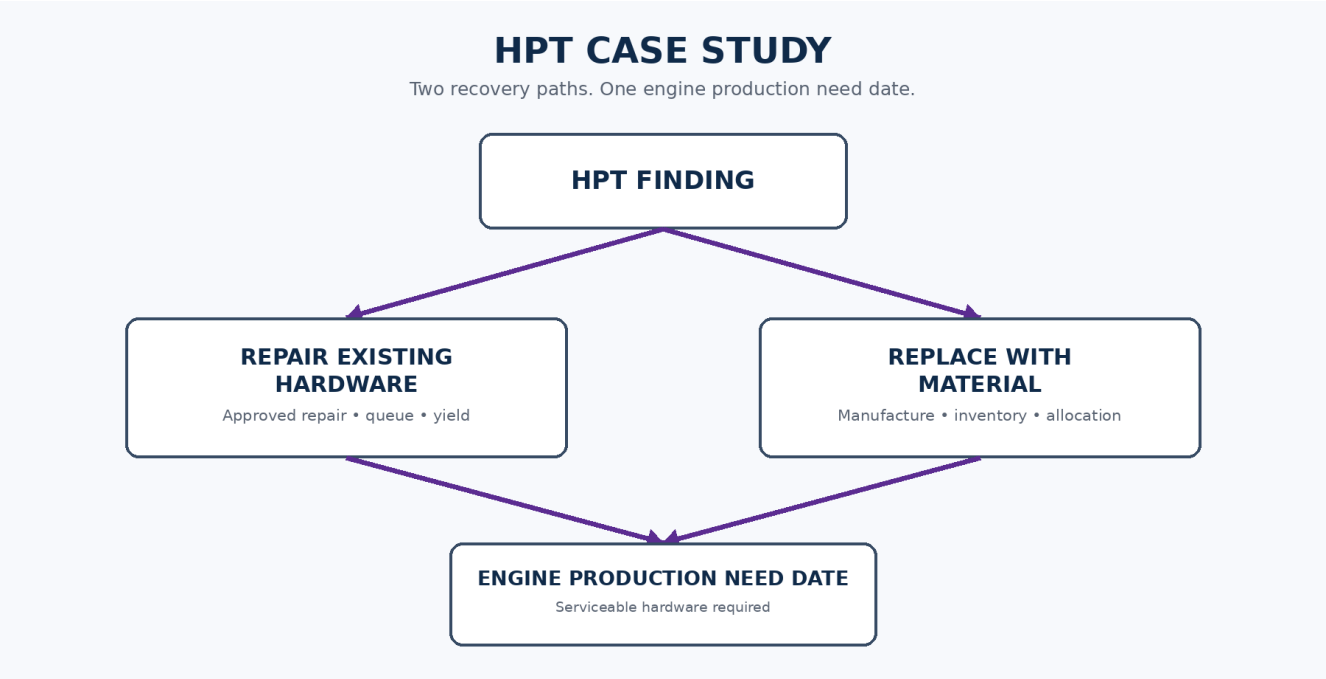
These observations are not necessarily contradictory. A repair source can possess adequate technical processing capacity while the complete replenishment cycle - routing, queue, repair, inspection, logistics and return - remains incompatible with the engine need date.

Repair capacity asks whether the component can be repaired. EERC™ asks whether serviceable hardware arrives when the engine requires it.

Flow Path firsthand industry experience: Repair 5 terminology, the GE capacity representation and matched-blade observations are not presented as published GE/CFM data, as evidence of current conditions, or as representative of fleet-wide frequency.

6. HPT Case Study

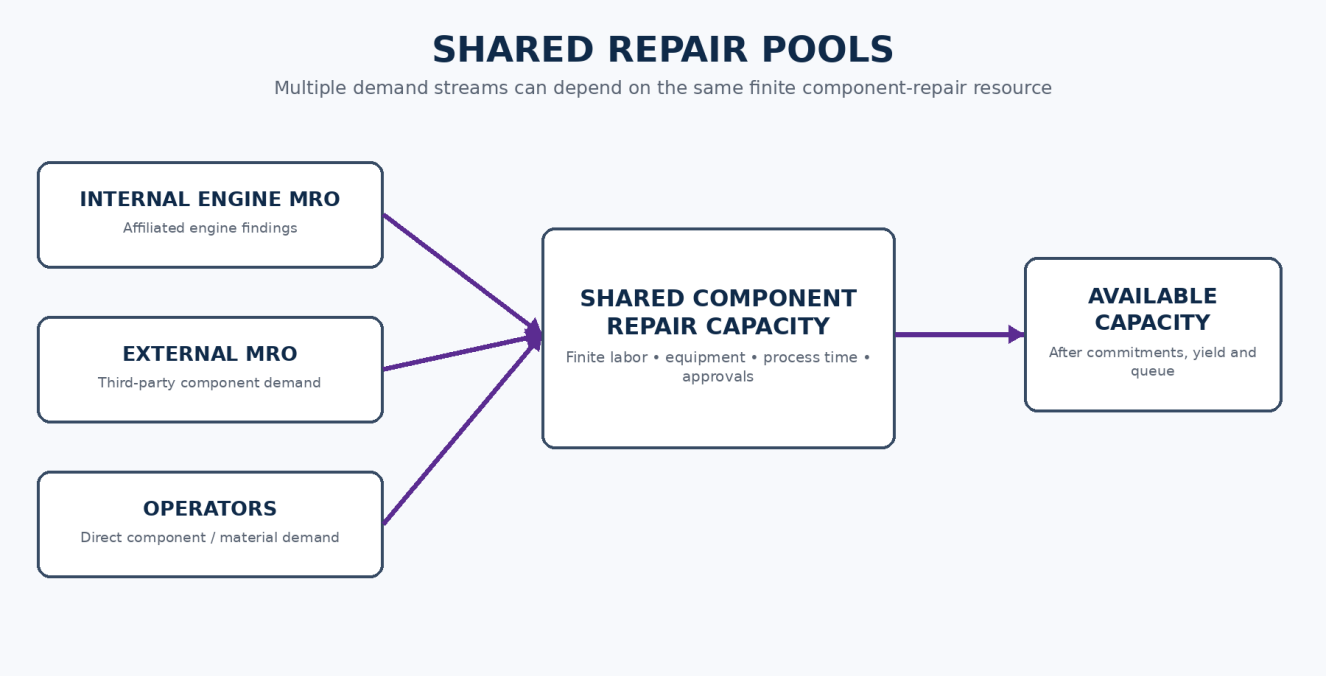
Two recovery paths. One engine need date.



An HPT finding appears to offer two recovery paths: repair the existing hardware or replace it with new material. Those paths are not necessarily independent. Repair capability, new-part manufacturing, technical approval and allocation can exist within interconnected OEM and authorized industrial systems.

Safran's Rennes strategy is a useful public example: the site is intended to combine new LEAP turbine-blade production with turbine-blade repair capability. Flow Path analysis: when repair and replacement depend on interconnected industrial resources, changing the recovery path does not automatically remove the engine-level constraint. [8]

7. Shared Repair Pools

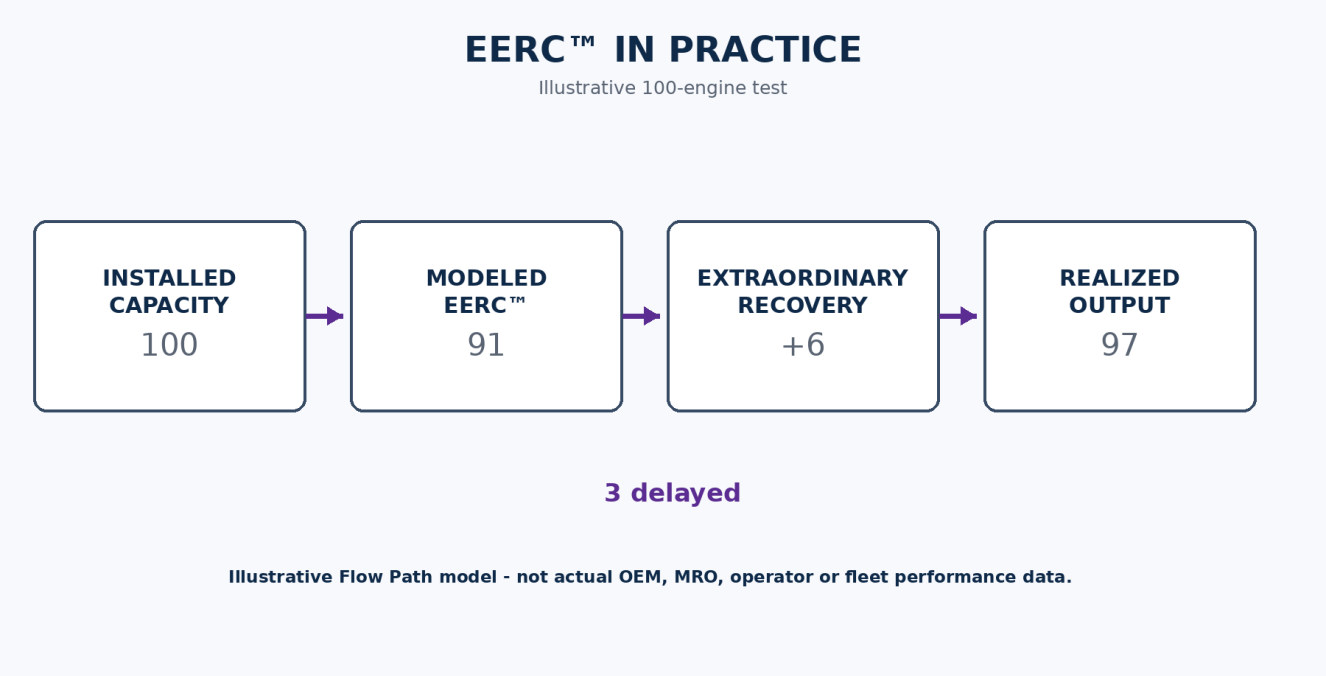


Component repair organizations can serve multiple demand streams. StandardAero's 2025 Form 10-K reports both external Component Repair Services revenue and intersegment revenue, which primarily consists of subcontract services between segments. Safran states that CRT supports Safran engine-shop visits as well as other engine makers and third-party MRO companies. [4][7]

Flow Path analysis: these structures demonstrate why installed repair capability should not be assumed to be fully available to any one engine shop or customer. The relevant measure is available capacity after commitments, yield, queue and other operating constraints - not simply the existence of a repair process.

Important: This paper does not allege internal customer prioritization or commercial conflict. The point is physical: multiple demand streams can consume finite industrial resources.

8. EERC™ in Practice — The 100-Engine Test

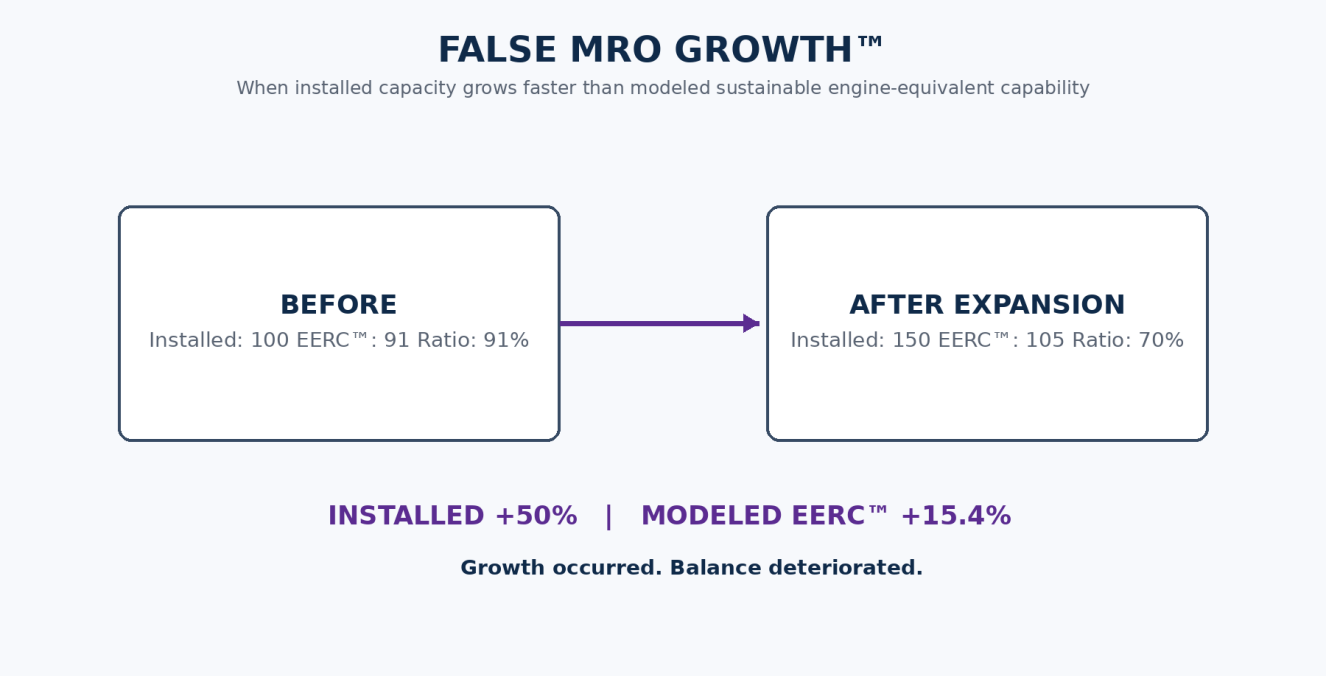


Assume a shop has installed physical capacity for 100 annual engine visits. In the illustrative Flow Path model, the normal approved repair-and-material ecosystem has a modeled EERC™ of 91 engine-equivalents per year. Six additional engines are completed through extraordinary recovery outside the defined normal operating model, producing realized output of 97 while three remain delayed.

The dashboard can see 97 shipments. EERC™ separates the 91 engine-equivalents of modeled sustainable ecosystem capacity from six completions enabled by extraordinary resilience.

Illustrative Flow Path model: 100 → 91 → +6 → 97 is not actual LEAP, OEM, MRO, operator or fleet performance data.

9. False MRO Growth™



Now expand installed engine capacity from 100 to 150 annual positions - a 50% increase. If modeled EERC™ rises from 91 to only 105, sustainable engine-equivalent capability increases 15.4%, while the EERC-to-Installed Capacity Ratio falls from 91% to 70%.

Growth occurred. Balance deteriorated. The falsehood is not the physical investment; it is the assumption that installed engine capacity and sustainable engine output increased at the same rate.

Illustrative Flow Path model: The scenario demonstrates system behavior if downstream industrialization does not keep pace with upstream expansion.

10. TAT Creates Asset Demand



For 100 annual shop visits, theoretical average engine-equivalents in the maintenance pipeline equal annual shop visits × average TAT ÷ 365. At 60 days the pipeline contains about 16.4 engine-equivalents; at 90 days, 24.7; at 120 days, 32.9; and at 150 days, 41.1.

Against a 60-day baseline, every additional 30 days of average TAT adds approximately 8.2 engine-equivalents to the theoretical maintenance pipeline at 100 annual visits.

Flow Path calculation: This is a theoretical average pipeline calculation, not a recommended spare-engine ratio. Actual operator requirements depend on fleet mix, removal variability, utilization, pooling, ownership and maintenance strategy.

Industry context: IATA has linked longer engine maintenance times and parts/MRO constraints to excess engine leasing and additional spares inventory. [1]

11. Operator Resilience Tax™

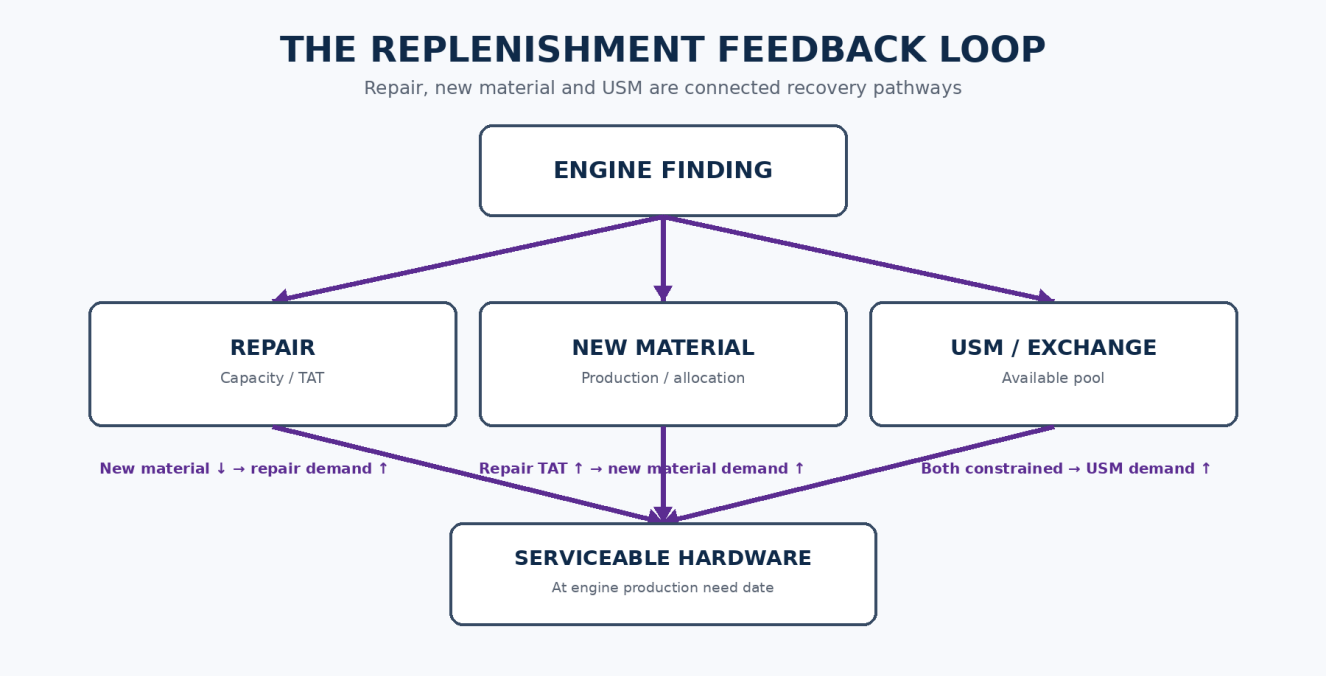


When the industrial system cannot reliably provide availability within the planned operating model, the operator purchases resilience. The burden can appear as additional component inventory, USM, exchanges, spare engines, leases, expedited logistics, retained aircraft or schedule flexibility.

Flow Path defines the cumulative burden as the Operator Resilience Tax™: incremental capital, inventory, leasing, logistics and operational expense used to compensate for uncertainty or insufficient capability beyond the planned operating model.

The cost may appear in different budgets. The constraint can begin with one unresolved engine finding.

12. The Replenishment Feedback Loop

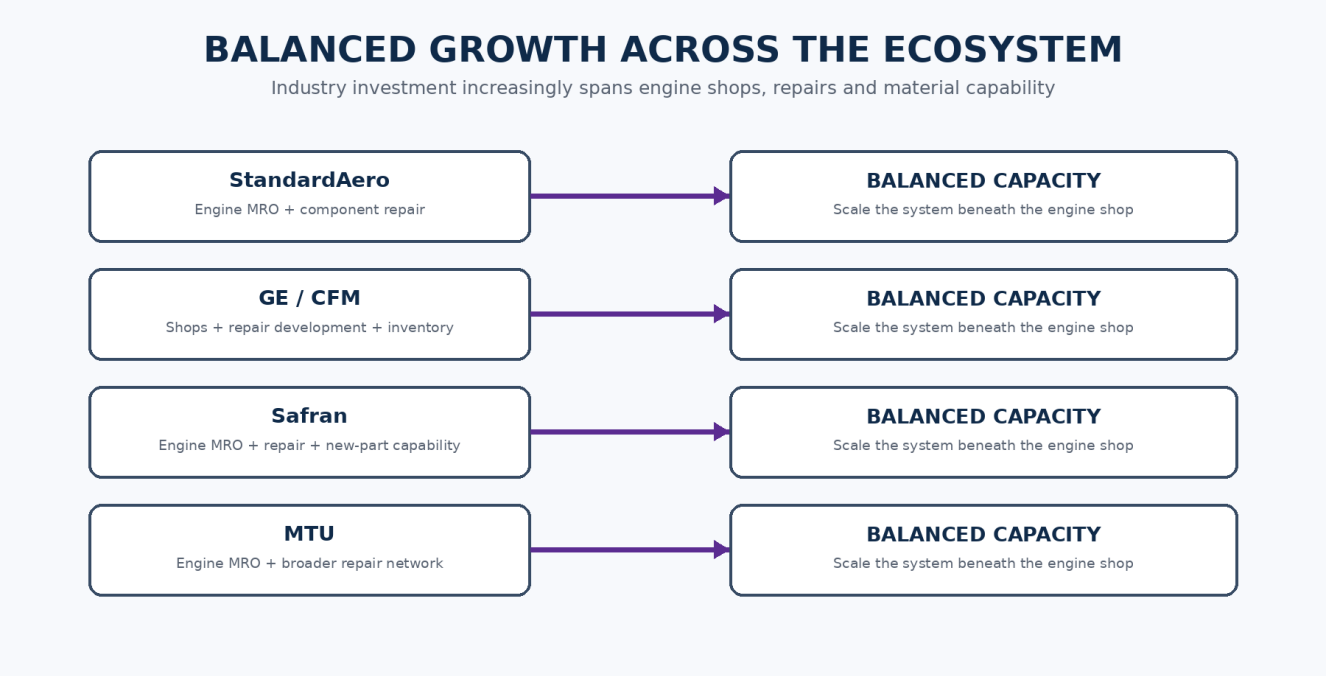


Repair, new material and USM/exchange are connected recovery pathways. When new material is constrained, more existing hardware is pushed toward repair and USM. When repair TAT becomes incompatible with the engine need date, demand shifts toward replacement material and USM. When both are constrained, pressure transfers again.

Repair capacity and new-material capacity are therefore not independent substitutes. Under constraint, they can become mutually amplifying demand systems.

EERC™ does not measure repair processes alone. It measures the engine-equivalent capability of the complete normal replenishment ecosystem supporting an engine repair event.

13. Balanced Growth Across the Ecosystem



The industry's own investment pattern increasingly demonstrates that engine capacity and component capability cannot be separated. StandardAero is expanding LEAP component repair capability alongside engine services; GE/CFM is investing in shops, repairs, supplier performance and inventory; Safran is expanding engine MRO together with repair and new-part capability; and MTU is expanding both engine-MRO and broader component-repair capacity. [2][3][5][6][7][8]

Flow Path analysis: these investments are evidence of the solution as much as the constraint. Balanced industrialization scales the engine shop and the industrial system beneath it together.

Evidence boundary: Investments are not presented as admissions of current underperformance. Company names are shown in neutral typography; no endorsement or sponsorship is implied.

14. Emerging Capability

Two paths to the same constraint

Aircraft MRO organizations do not enter the aftermarket at the same maturity level.

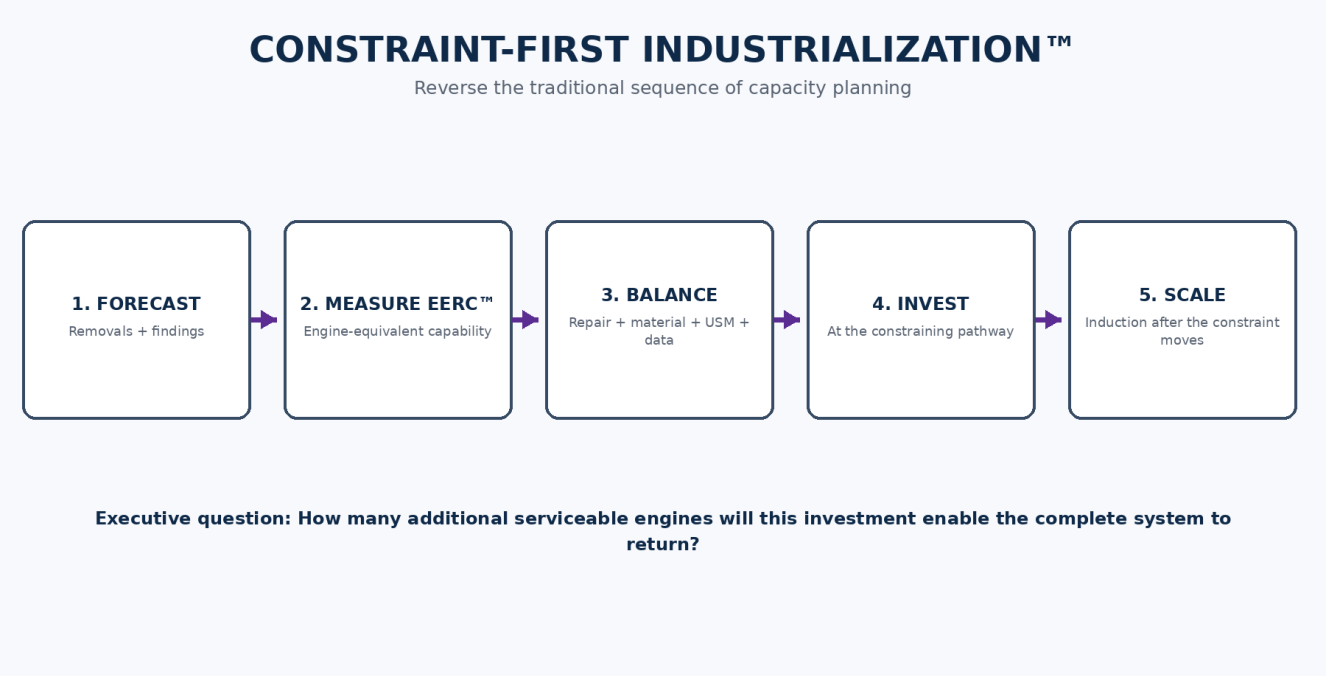
AIM in Arizona demonstrates progressive capability expansion. Public information supports full CFM56 overhaul and modular-maintenance capability, while AIM's publicly stated LEAP offering is narrower and centered on inspection, targeted engine repair and module-level support. The strategic question is how progressively deeper capability reduces the amount of work that must leave AIM's controlled value stream. [9]

Hawk Precision MRO in India represents an earlier stage. Public information supports a planning/development-stage independent engine-MRO effort rather than an operating LEAP overhaul facility today. Once an independent shop gains the ability to induct, disassemble and inspect engines at scale, the next constraint becomes the approved piece-part repair, technical-data and replacement-material ecosystem required to resolve the findings it generates. [10]

The two organizations occupy different maturity positions but lead to the same EERC™ question: how much of the expected finding population can the industrial ecosystem resolve within the engine production need date?

Capability should be measured by how far the system can carry the engine toward serviceable output - not simply how far it can disassemble it.

15. Constraint-First Industrialization™



Flow Path proposes reversing the traditional sequence of capacity planning. Forecast removals and findings. Measure true engine-equivalent capability. Balance repair, material, USM/exchange, logistics, data and approvals. Invest at the constraining pathway. Then scale induction.

The executive investment question becomes: How many additional serviceable engines will this investment enable the complete system to return?

An additional engine bay can create little incremental output if the constraint remains elsewhere. A repair approval, qualified process, material source, yield improvement or regionalized capability can sometimes create more effective engine capacity than visible upstream expansion.

Build to the constraint - not merely to the forecast.

Conclusion — Measure the Exit.™

Aircraft engine MRO will continue to grow. New facilities, additional engine bays, test capacity, tooling and workforce are necessary investments. But the central argument of Purple Rain is that installed engine capacity and sustainable engine output are not the same thing.

Every additional engine inducted creates a downstream population of findings. Those findings must move through repair, material, technical approval, logistics and replenishment pathways before the engine can return to service. If those capabilities do not scale with engine induction, the organization has expanded its ability to generate demand on the constraint faster than its ability to resolve it.

That is False MRO Growth™.

The solution is not to stop expanding engine MRO. It is to industrialize the complete system.

Build the engine shop - but build the repair capability with it. Develop the material pathways. Expand technical approvals. Strengthen regional supply chains. Build the workforce and technical depth required to execute. Most importantly, measure those capabilities against the engine requirement they exist to support.

EERC™ provides that discipline. It asks a fundamentally different capacity question:

How many engines can the complete repair-and-material ecosystem sustainably support within the production need date?

That question matters to every participant in the aftermarket.

For the OEM, it exposes where industrial investment can unlock additional fleet availability. For the MRO, it identifies the constraint actually controlling sustainable engine throughput. For the operator, it focuses the entire system on the outcome that matters most: receiving a serviceable engine when promised.

The industry will continue announcing new shops, new bays and additional induction capacity. Those investments matter. But the ultimate measure of MRO capacity should not be how many engines can enter the system. It should be how many serviceable engines the complete system can reliably return.

An induction measures activity.

A serviceable engine measures output.

MEASURE THE EXIT.™

Precision. Direction. Impact.

Evidence & Methodology Notes

Purple Rain separates evidence into distinct classes so that documented facts, firsthand experience, calculations, models and Flow Path conclusions are not blended together.

- Publicly Documented Evidence - facts supported by primary or authoritative published sources.
- Flow Path Firsthand Industry Experience - direct observations, explicitly identified and not presented as public fleet data.
- Illustrative Flow Path Models - hypothetical values used to demonstrate system behavior; not actual OEM, MRO, operator or fleet performance.
- Flow Path Calculations - disclosed arithmetic based on stated assumptions.
- Flow Path Analysis - conclusions drawn by Flow Path from the documented evidence, experience or models.

EERC™ is time- and demand-mix dependent. It should be stated for a defined period, engine population, demand mix and operating model. Normal planned inventory, exchanges, USM and customer-furnished material may be included when they are part of the defined operating model.

The Repair 5 case is firsthand experience and is not presented as evidence of current conditions or fleet-wide frequency. The 100-engine and 150-engine scenarios are illustrative. The TAT pipeline arithmetic is a theoretical average and is not a spare-engine recommendation. MTU repair-network evidence is used to demonstrate broader component-capability investment; this paper does not assert an unverified Fort Worth-to-Serbia LEAP routing path.

Selected Sources

[1] International Air Transport Association (IATA), "Urgent Action Needed to Ease Engine MRO Bottlenecks," Press Release No. 34, 24 June 2026, iata.org.

[2] CFM International / GE Aerospace, "CFM Expands, Strengthens Open MRO Ecosystem," 18 July 2026, geaerospace.com.

[3] StandardAero, “LEAP Component Repair & Overhaul,” current capability page, standardaero.com.

[4] StandardAero, Inc., Annual Report on Form 10-K for year ended 31 December 2025, filed 26 February 2026, Note 24 / segment information, ir.standardaero.com.

[5] MTU Aero Engines, "MTU Maintenance’s 2025: Growth readies MRO network for future success," 16 March 2026, mtu.de; and MTU Maintenance Fort Worth facility information describing its LEAP Premier MRO ramp and network support, mtu.de.

[6] Safran, "Safran invests over €1 billion to develop global MRO network for its LEAP engine," 29 October 2024, safran-group.com.

[7] Safran, "Safran finalizes acquisition of engine parts repair company CRT," 23 January 2025, safran-group.com.

[8] Safran, "Safran Turbine Airfoils," Rennes industrial-site information describing precision casting of LEAP turbine blades and LEAP turbine-blade repair, safran-group.com.

[9] AIM Services LLC, public CFM56 overhaul, modular-maintenance and LEAP repair capability pages, aimservicesllc.com.

[10] Hawk Precision MRO, public company and project materials describing development of an independent engine-MRO capability in India, hawkmro.com and company public materials.

Primary-source preference: company-specific claims in the body are traced to the originating company, regulatory filing or industry organization wherever practical; selected source details were rechecked during final publication proofing. Flow Path analysis is intentionally distinguished from the literal language of those sources.