N E W S L E T T E R

What the Engine Shop Visit Rate Reveals About Current-Generation Engine Durability

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By late 2025, one-third of the GTF-powered Airbus fleet—636 aircraft—was grounded or in storage, according to Cirium data reported by Reuters. That is not simply a maintenance statistic. It is an economic event.

And the GTF is not an isolated case. Across the three major current-generation engine programs, the same pattern has emerged: engines that delivered the fuel-burn improvement the market wanted, but whose durability maturity has lagged commercial expectations. That gap is now most visible in one metric: the engine shop visit rate. For operators, lessors, investors, and MRO providers, the question is no longer simply whether an engine is efficient. The question is whether that efficiency is durable enough to sustain the economics.

Three Programs, Three Stages of the Same Problem

It is important to be precise. The Pratt & Whitney GTF, CFM LEAP, and Rolls-Royce Trent 1000 are not the same problem in equal measure.

The GTF remains the most acute case. Pratt & Whitney has positioned both Hot Section Plus and the GTF Advantage around materially better durability, with HS+ intended to nearly double time on wing for today's PW1100G-JM and to bring most of the GTF Advantage hot-section durability benefit into the current fleet. That matters because it shows how durability shortfalls eventually force OEMs into major upgrade paths whose purpose is not simply incremental product refinement, but restoration of economic credibility.

The LEAP is better understood as a durability-maturity and retrofit story, especially in hot-and-harsh environments, rather than a GTF-style recall event. By late 2025, CFM said it had shipped more than 1,200 LEAP-1A durability kits, installed reverse bleed on nearly half of the LEAP-1A fleet, and was working toward LEAP-1B improvements in 2026. The commercial pattern is similar, even if the severity is not: when durability maturity lags, the market begins to pay closer attention not just to the engine family, but to the specific improvement standard embedded within it.

The Trent 1000 sits further along the recovery path, but it offers the clearest example of how durability problems can spill beyond maintenance economics and into future sales campaigns. Rolls-Royce said the phase-one Trent 1000 XE durability package was certified in June 2025, with fleet incorporation on track to be completed by the end of 2027. Yet Aviation Week reported that 787 customers had selected GEnx engines for 677 aircraft versus Trent 1000s for just 71, and quoted Rolls-Royce engineering chief Simon Burr as saying the company had lost market share on the engine because it was "not sufficiently durable."

Several high-profile follow-on selections illustrate the point. Aviation Week reported that Air New Zealand and ANA were among the most visible early defections to GEnx. More recently, LATAM selected GEnx

for additional 787s, Thai Airways selected GEnx for its new Dreamliner order, and British Airways chose GEnx for six incoming 787s. The point is not to overstate the case against Rolls-Royce. It is simply to acknowledge that durability shortfalls can impose a second-order cost: they can alter future engine selection behavior even before the technical recovery is complete.

The Trent 1000 also illustrates a more subtle consequence of high UERs: fleet fragmentation. Package B, Package C, TEN, and now XE should not be treated as economically interchangeable simply because they sit under the same family label. Aviation Week reported that Rolls-Royce's durability remedies were variant-specific, with about 250 aircraft powered by Package B and C models, and about 120 powered by the TEN.

As illustrated in **Figure 1**, once durability problems emerge, the market stops focusing on a single nominal engine family and starts evaluating a series of package cohorts—each having its own durability history, remediation path, and residual-risk profile. For operators, that can mean different removal behavior and off-wing expectations within the same nominal fleet. For lessors and investors, it can mean the market no longer underwrites a single Trent 1000-powered 787, but rather several distinct sub-fleets, each carrying different maintenance risks and value implications.

Figure 1: *Trent 1000 package evolution and the emergence of sub-fleet economics*

Source: Author

Different engines. Different timelines. Same economic pattern: when durability lags, removal rates rise, spare demand increases, maintenance cash burn accelerates, and the assumptions underpinning leases, utilization, and residual value become less certain.

What the Shop Visit Rate Actually Measures

The shop visit rate (SVR) measures the rate of engine removals over a given operating period, typically expressed as events per 1,000 engine flight hours. Its real value is not in the headline number alone. It is in the mix beneath it.

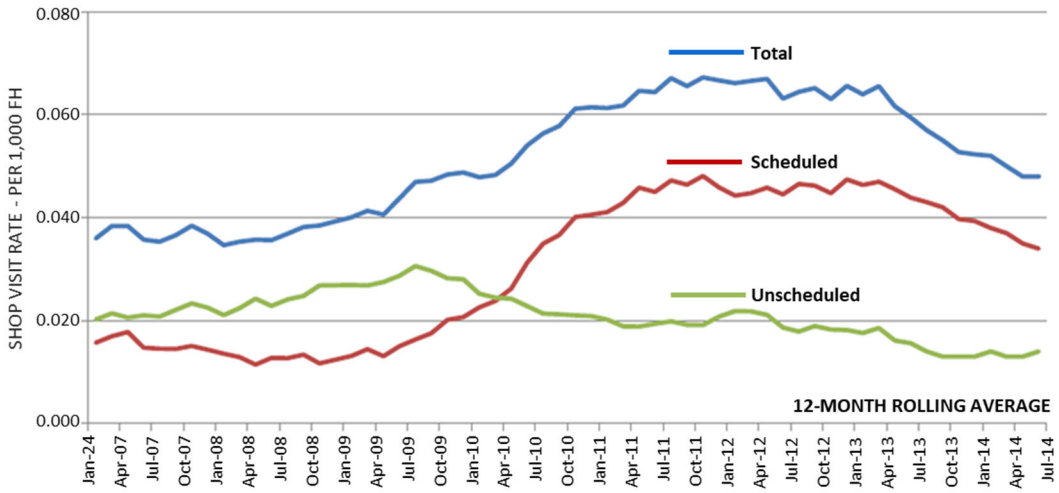
The **Scheduled Engine Removal Rate (SER)** captures removals the operator can broadly anticipate: LLP-driven events, performance restoration, service bulletin compliance, and other planned maintenance actions. These events are manageable. They can be planned into spare positioning, shop capacity, and network schedules.

The **Unscheduled Engine Removal Rate (UER)** captures removals that happen early, unexpectedly, and usually at the worst possible time. These trigger AOG exposure, emergency logistics, premium labor, and schedule disruption.

Total SVR is the scoreboard. UER is the warning light.

Figure 2 illustrates that total SVR is not a single signal but a combination of scheduled and unscheduled removals; a distinction that becomes commercially important when durability problems drive unscheduled engine removals higher.

Figure 2: *Decomposing the Shop Visit Rate—Total, Scheduled, and Unscheduled (12-Month Rolling Average, per 1,000 EFH)*



Source: Author

Why the Present Environment Is a UER Story

The durability issues affecting current-generation engines are not primarily about engines arriving at scheduled maintenance intervals earlier than expected. They are about a meaningful share of engines failing to reach those intervals.

Air Astana's 2025 disclosure illustrates the point concretely. The carrier reported 22 unscheduled engine removals during 2025 due to Pratt & Whitney engine design shortcomings, in addition to the powder-metal issue. Those UERs grounded up to 13 aircraft during peak season, with the airline's working assumption remaining an average off-wing time of 18 months before full normalization.

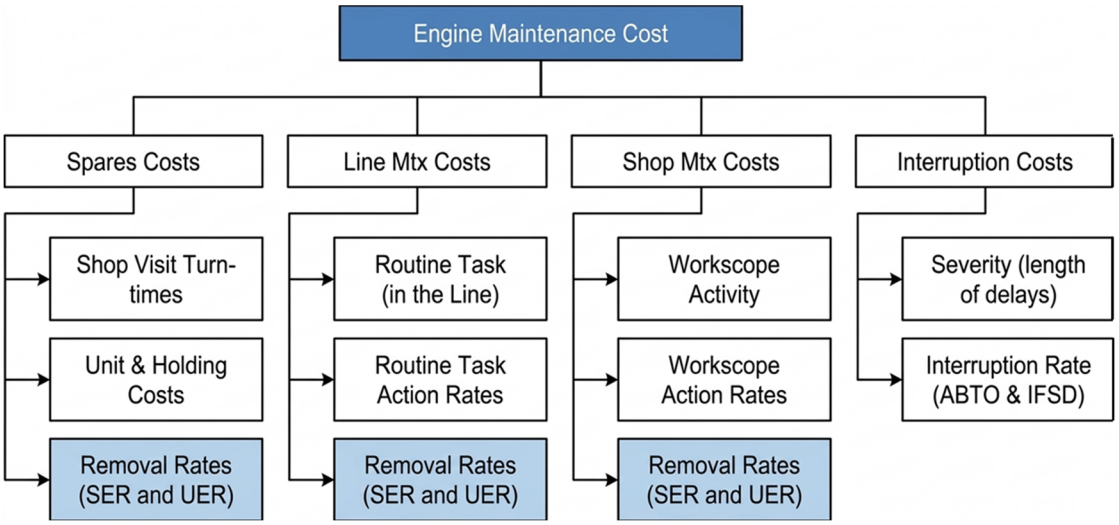
That is what elevated UER looks like in commercial terms: lost capacity, impaired schedule integrity, trapped working capital, and reduced earnings.

There is also a broader industry context. The economics of building commercial engines have long depended on recovering development investment through decades of aftermarket parts and services rather than through the initial engine sale alone. That means current-generation durability shortfalls are not just disrupting airlines and lessors; they are also accelerating shop visits, remediation expenses, and support costs, thereby straining the OEM business model itself.

Why High UERs Act as a Cost Multiplier

The maintenance-cost framework below makes the central point immediately: engine removal rates do not fall into a single cost bucket. They drive three of the four major cost pillars directly and indirectly amplify the fourth. As shown in **Figure 3**, removal rates sit at the base of the spares, line-maintenance, and shop-maintenance cost structure, while also feeding the operating conditions that increase interruption costs.

Figure 3: *Why High Unscheduled Engine Removal Rates Act as a Cost Multiplier*



Source: Author

At the top level, engine maintenance costs are broken into four pillars: spares cost, line maintenance cost, shop maintenance cost, and interruption cost. Removal rates sit at the base of three of those four pillars.

High UERs do not simply raise maintenance expenses linearly. They push the entire maintenance system into a more expensive operating state. Here is how:

Spares and Line Maintenance: Buffer Capital and Reactive Operations

A scheduled removal can be aligned with a known spare position. An unscheduled removal cannot. As UER rises, operators need larger spare pools to preserve dispatch reliability, tying up more capital in multi-million-dollar assets. In today's constrained aftermarket, that burden is more burdensome than it would normally be. Reuters, citing Bain, reported that turnaround times for new-generation engine maintenance had risen by more than 150% from pre-COVID levels, compared with about 35% for legacy engines.

The line maintenance impact compounds the problem. Unscheduled engine changes often happen at outstations, under time pressure, with premium labor, urgent tooling moves, and emergency logistics. What should have been a planned event becomes an operational recovery exercise. UER does not just increase the number of removals; it changes the cost profile of each one.

Shop Maintenance: Broader Workscopes and Lost Life

Unscheduled removals arrive with less predictable workscopes, higher secondary damage risk, and less flexibility in slot timing. They also pull forward cash outflow that the operator or lessor expected to incur later. When an engine comes off wing before its LLP stack, or planned interval has been economically exhausted, some portion of that remaining life is stranded. The event compresses asset value into an earlier maintenance bill.

Interruption Costs: The Indirect Multiplier

Interruption costs sit outside the direct SVR formula, but they are closely tied to the same conditions that drive UER. When durability issues shorten on-wing intervals, the probability of revenue disruption rises—delays, cancellations, passenger re-accommodation, aircraft substitution, and brand damage are all downstream consequences.

That is why high UER should be understood as a cost multiplier rather than a mere maintenance statistic.

SER and UER Are Not Economically Equivalent

Table 1: *SER vs. UER Cost Impact Comparison*

Cost Category	Scheduled (SER)	Unscheduled (UER)	Commercial Consequence of High UER
Spares Costs	Planned logic; engines pulled when spare confirmed available.	Reactive logic; creates immediate, high-priority demand on the spares pool.	Extreme: Forces higher buffer inventory of multi-million-dollar assets to avoid AOGs.
Line Mtx Costs	Performed at primary hub with standard labor and tooling.	Often occurs at outstations with AOG premium labor and shipping.	High: Drives up routine task action rates via emergency mobilization.
Shop Mtx Costs	Workscope is predictable; focuses on timed-out parts.	Often involves secondary damage and wasted life on LLPs.	Severe: Increases workscope activity and reduces ROI on Life Limited Parts.
Lease / Asset Economics	Broadly forecastable within reserve and transition planning.	Creates reserve shortfall risk, bridging capital needs, transition uncertainty, and residual-value pressure.	Significant: Weakens confidence in lease assumptions and can impair asset liquidity and value.
Interruption Costs	Minimal if planned into the operating schedule.	High: More likely to lead to ABTOs and IFSDs.	Severe: Includes passenger hotels, re-booking, and brand damage.

As shown in **Table 1**, SER and UER may both contribute to total SVR, but they are not economically equivalent. Two fleets can show similar total shop visit rates while presenting very different commercial risk profiles. A fleet dominated by scheduled removals is burdensome but manageable. A fleet with a high unscheduled engine removals consumes spares inefficiently, forces premium logistics, widens shop workscopes, and impairs schedule reliability. That is the hidden weakness of depending solely on total SVR.

What This Means for Operators, Lessors, and Investors

For operators, elevated UER consumes the fuel-burn benefit faster than many planning models assume. Air Astana's experience—22 unscheduled removals and 13 grounded aircraft during peak season—is what happens when UER overwhelms spare provisioning, accelerates shop cash outflows, and fragments the operating schedule. In the Trent 1000 case, the burden can go one step further: the same nominal engine family may carry different package standards, different durability remedies, and different maintenance expectations, making fleet planning and spare provisioning more complex than the engine designation alone suggests.

For lessors, high UER raises the risk of reserve shortfalls, bridging capital needs, transition complexity, and residual-value pressure. The Trent 1000 experience shows how these pressures can persist even as technical recovery progresses, because the market may not value all package standards equally. In practice, that can bifurcate a nominally common fleet into economically distinct sub-fleets with different liquidity and lease-risk profiles.

For investors, strong aftermarket demand may be good for OEM and MRO revenue, but it does not necessarily imply healthy economics for operators or asset owners. High removal rates can create revenue for the supplier while eroding value for the user. And when durability issues lead the market to distinguish between package cohorts—a Package B-powered 787, and an XE-standard 787 may sit on the same lease portfolio but carry very different risk assumptions—investors are no longer evaluating one engine family as a single exposure.

For MRO providers, durability fixes matter, but so do slot availability, parts flow, and turnaround time. If the repair system remains capacity-constrained, even improving engines can remain commercially painful in the near term.

Bottom Line

The current generation of engines has not invalidated the promise of better efficiency. It has been shown that efficiency and durability maturity do not always arrive on the same timetable. That timing gap is where the shop visit rate becomes commercially useful.

Used properly, SVR is not simply a reliability measure. It is a way to see how engineering shortfalls transmit into spare-engine demand, maintenance cash burn, schedule risk, lease assumptions, asset value, and—in some cases—future customer selection behavior. And within that framework, the unscheduled engine removal rate matters most.

Total SVR tells you how busy the maintenance system is.

UER tells you how much stress the business is under.

Selected Sources and Further Reading

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