BW

AVIATION INSIGHTS · REPORT THREE OF THREE

The Engines Wearing Out Too Soon

The shop-visit peak that was dated to 2026 two years in advance, the licensed engineers who are not there to work it, and a new industrial buyer for the cores the aftermarket depends on.

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ABOUT THIS REPORT

The shortage was already there when the fuel shock arrived

An engine that takes three hundred days to come back from a shop is an aircraft that does not fly for three hundred days. This report is about how many of those there are, and who is left to work on them.

2026
THE SHOP-VISIT PEAK, DATED IN JULY 2024

535
UK LICENSED ENGINEERS UNDER 29, FROM 1,068 IN 2019

8 yrs
TO FULL CATEGORY B COMPETENCE

+68%
US CARRIER ENGINE SPEND SINCE 2019, ON 10% MORE FLYING

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SECTION 01

Foreword: the constraint that was already there

In July 2024, twenty months before the first missile flew, a consulting firm published a brief saying that demand for engine shop visits would peak in 2026 and that capacity would not be there to meet it. It was right, and the date it gave has now arrived.

The first report in this series established that two thirds of the 2026 jet fuel increase sat outside crude, and that the cost was transferred to passengers incompletely and with a hard elasticity limit. The second established that the capacity response was small, brief and concentrated in one region, and that the pricing power came from a market that was already supply-constrained plus one competitor's exit. Both reports end at the same place, which is a question neither of them can answer from the data it uses: what exactly was doing the constraining?

This report answers it. The constraint is an engine that will not come back from the shop on time, and a shortage of people licensed to sign it off when it does. Neither of those things was caused by the events of 2026, and neither of them will be resolved by them. The shop-visit peak was dated to 2026 in a forecast published in July 2024. The geared turbofan powder-metal campaign began in 2023. The licensed engineer population in the United Kingdom has been shrinking at the entry end since before the pandemic. The fuel shock arrived in the middle of all three and made the consequences commercially visible for the first time.

> **The biggest constraint for at least the next five years is going to be lack of engines.**
>
> SCOTT KIRBY, CHIEF EXECUTIVE, UNITED AIRLINES — RIO DE JANEIRO, 7 JUNE 2026

Kirby said that at the IATA annual general meeting, having told an investor conference the previous week that between eight hundred and nine hundred aircraft were grounded worldwide for want of serviceable engines, his own round estimate, not a census, and that the problem would last many, many years. Willie Walsh, from the same platform, accused engine manufacturers of gouging. These are the two most quoted executives in commercial aviation describing the same constraint in the same week, and neither of them was talking about the price of fuel.

What follows sets out the size of the queue, the state of the workforce that has to work through it, and a third factor that has appeared only in the last year: a new industrial buyer, outside aviation, bidding for the retired engines the aftermarket has always relied on for parts. Each of the three is measurable. Taken together they describe a constraint with a duration measured in years, and that duration is the single most important variable in aviation planning for 2027 and 2028.

One further point of framing. This report is about a physical constraint, and physical constraints behave differently from commercial ones in a way that matters for how they are valued. A commercial constraint is a decision, and decisions reverse when the incentive changes. A physical constraint is a

SECTION 02

Executive summary

The constraint on aviation capacity is an engine queue and a licensing pipeline, both of which were established before 2026 and neither of which resolves inside the decade.

The shop-visit peak was forecast in July 2024 and dated to 2026. A consultancy brief published on 18 July 2024 found turnaround times already 35 per cent or more above pre-pandemic levels for legacy engines and more than 150 per cent for new-generation engines, wait times for a shop slot up by two to three months and in some cases six, a near-term demand peak in 2026, and cumulative demand exceeding supply by more than 17 per cent through the end of the decade. That is a two-year-old estimate and we date it as one throughout. No later revision has been published.

An April 2026 survey of maintenance providers says the position has not cleared. Narrowbody engine turnaround times are regularly 180 to 200 days or more. Two thirds of respondents report that shop-visit costs for the newest narrowbody engines exceed expectations by 21 per cent or more, and a quarter by 50 per cent or more. Engine work is more than half of all maintenance, repair and overhaul spend. Some 90 per cent of respondents report tariff impacts, particularly on component purchases, repairs and engine overhauls, which is a second cost channel running alongside fuel.

The groundings have peaked and the bills have not. Geared turbofan groundings fell about 15 per cent quarter on quarter by April 2026 and about 25 per cent across the first half. LEAP-related groundings are near zero. Yet engine labour, repair and materials spend at six large United States carriers rose about 68 per cent between 2019 and 2025 against about 10 per cent more flying, and 17 per cent in the first quarter of 2026 against under 2 per cent. Durability improvements reduce the arrival rate of unplanned removals. They do not build a shop.

The published summary of the workforce data understates the problem and mislocates it. The Royal Aeronautical Society reports that 50 per cent of UK licensed engineers are over 50 and 22 per cent over 61. Adding up the licensing table the same paper publishes gives 45.9 per cent and 18.7 per cent, and the over-50 share has barely moved since 2019. The population is not ageing in aggregate. **The entry gate has halved.** Licence holders aged 18 to 29 fell from 1,068 in 2019 to 535 in 2026, a fall of 49.9 per cent, while the total population grew 3.5 per cent. There are now 2,570 licence holders aged 61 and over against 535 under 29, approaching five to one.

The lag largely closes that arithmetic. Average time to full Category B competence is eight years. On that average lag, the certifying population of the early 2030s is already in the system today, and there are 535 people at the entry end of it. Individuals qualify faster than the average and some will; a cohort does not.

The binding constraint on training is money and instructors, not applicants. One major defence contractor received over 30,000 applications for 1,200 vacancies. Half of surveyed organisations have the capacity to train more apprentices and cannot afford to; 73 per cent would offer more if the funding barriers were removed. The Level 3 standard costs £36,000 to deliver against a £27,000 funding band, a £9,000 shortfall per learner. Two independent providers with more than 190 years of combined experience have stopped operating in eighteen months. Further education instructors earn £38,000 to £46,000 against £80,000 to £100,000 for a licensed engineer.

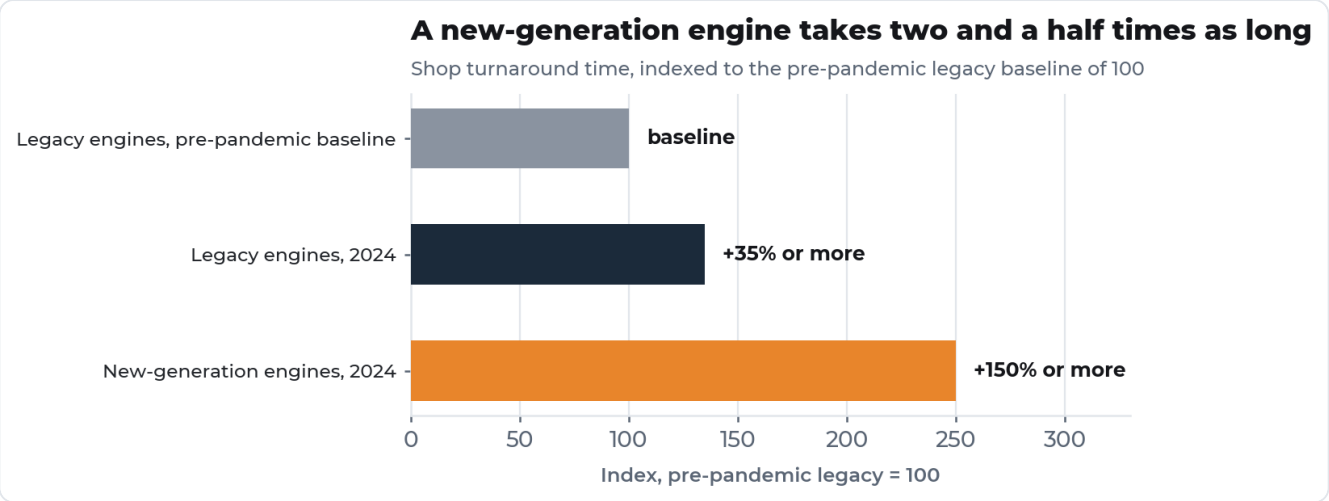


Figure 1 — A new-generation engine takes two and a half times as long. Shop turnaround time indexed to the pre-pandemic legacy baseline. The new-generation figure is the one that matters for 2027, because the fleet is becoming new-generation whether or not the shops are ready. Source: the July 2024 brief; full citation in Section 13.

The ratio in that chart is the whole problem stated in one line. The industry is replacing engines that took a certain time to overhaul with engines that take two and a half times as long, at the same moment as the installed base of those new engines reaches the age at which it needs its first heavy visit. The 2026 peak in that forecast is that arithmetic arriving.

What has changed since, and what has not

The nearest subsequent primary survey, of maintenance providers, was published in April 2026, and it is not encouraging. Narrowbody engine turnaround times are regularly 180 to 200 days or more. Engine work accounts for more than half of all maintenance, repair and overhaul spend. Two thirds of respondents report that shop-visit costs for the newest narrowbody engines are exceeding expectations by 21 per cent or more, and a quarter by 50 per cent or more.

A COST CHANNEL THIS SERIES HAS NOT PREVIOUSLY COUNTED

The same survey found that some 90 per cent of respondents are experiencing tariff impacts, particularly on component purchases, repairs and engine overhauls. The first report in this series traced one cost shock through the fuel bill. This is a second, landing on exactly the parts and overhauls that this report is about, and it does not move with the oil price. An operator modelling 2027 maintenance cost from a fuel-price scenario is modelling the wrong variable.

The cost evidence from the carriers themselves is blunter. Across six large United States airlines, engine labour, repair and materials spend rose about 68 per cent between 2019 and 2025 while flying rose about 10 per cent. In the first quarter of 2026 the same measure rose 17 per cent against under 2 per cent more flying.

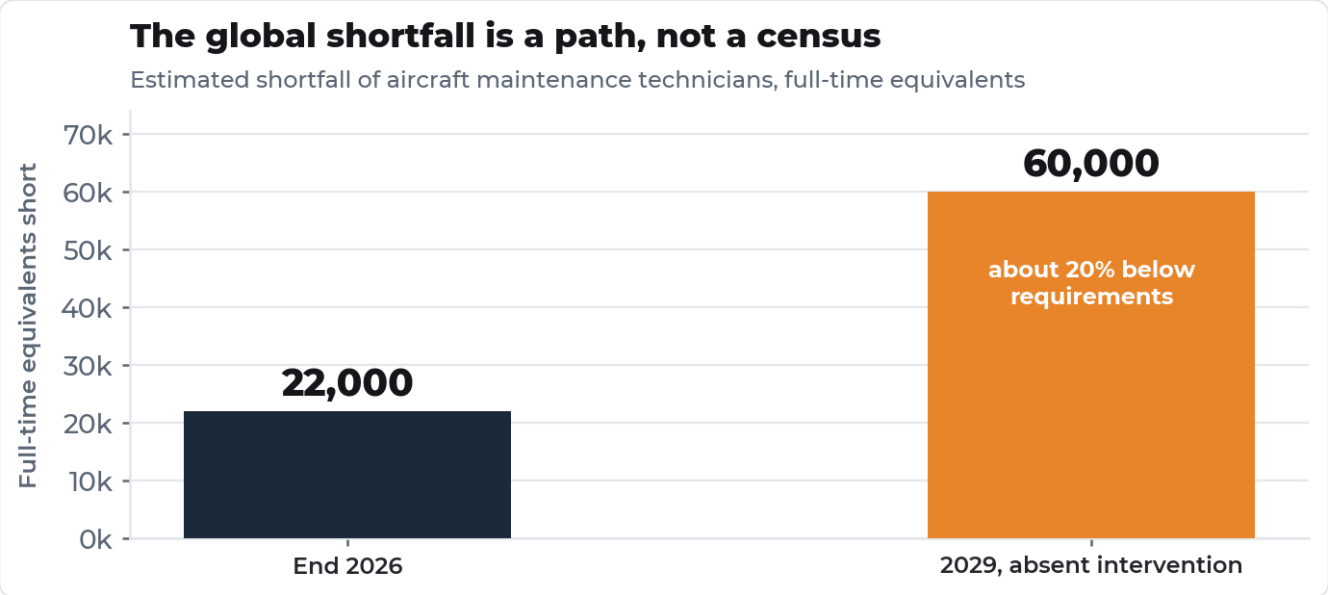


Figure 8 — The global shortfall is a path, not a census. Estimated shortfall of aircraft maintenance technicians in full-time equivalents. The 2029 figure is a projection on the current trajectory, not a measurement, and the assumptions behind it are examined in Section 10. Source: a March 2026 industry study, as set out in Boston Warwick, *The MRO Technician Shortage*, July 2026; full citation in Section 13.

Boeing's 2025 Pilot and Technician Outlook projects a requirement for 710,000 new maintenance technicians between 2025 and 2044, within nearly 2.4 million new aviation professionals alongside 660,000 pilots and a million cabin crew. About two thirds of that requirement replaces attrition and does not serve growth, which is the same point the UK age distribution makes at national scale. The same March 2026 study estimates a shortfall of around 22,000 full-time equivalents by the end of 2026, rising toward roughly 60,000, about 20 per cent below requirements, by 2029 absent intervention.

Our own mid-2026 assessment, published in that report, put the probability of a severe shortage through 2030 at roughly 60 to 75 per cent on the current trajectory, reducible to 20 to 40 per cent with aggressive and coordinated action. Labour is frequently more than 40 per cent of maintenance cost, and contractor premiums of 50 to 100 per cent and above are already in the market.

One qualification belongs here and not in a footnote. A licence is not a located engineer. The RAeS data records that 53 per cent of UK Part-66 licence holders are not based in the United Kingdom, and that the licensing data describes current licences without establishing whether the holder is employed or exercising the privileges. The population of 13,720 is therefore an upper bound on the certifying capacity actually available in the country, and the same caution applies to any national licensing series used the same way.

A second qualification belongs with it, and it is the strongest argument against this report's central exhibit. The register whose 2019 and 2026 composition Table 3 compares did not stay still for reasons connected to training. About 3,000 engineers converted EASA licences onto the UK register after the transition, licences do not lapse cleanly, and a majority of holders are not based in the country. Comparing the two years on that register is therefore comparing two partly different populations, and a sceptic would say the stable total is inflated by conversions and the collapsed entry band reflects young engineers licensing under EASA instead.

We take that seriously and it does not dislodge the finding, for a reason we state as inference, not measurement. Conversions were available to engineers who already held EASA licences, so they arrive in the register carrying the experience that earned those licences: they land in the thirties, forties and