

The engine’s history, examined

The record points to two current concerns: cylinders 1 and 3 run unusually cool at idle, and takeoff manifold pressure sometimes rises higher when the oil is cool. Most broader cruise trends remain stable.

Executive summary • Prepared for Mark Maunder • A&P; review: Loren Ahrens, Ahrens Aviation

541

flight-bearing logs

419.6 h

recorded engine running

1.57 M

timestamped samples

1 Review the March low-power change

Cylinders 1 and 3 become markedly cooler at idle between February 25 and March 5. C3’s EGT falls roughly 185–207°F relative to its peers in restricted operating bands; its CHT also falls. The difference largely resolves after power is applied. Review the work and ground runs at KBVS in early March. **Pages 4–5.**

2 Review boost with oil temperature in view

The turbo sometimes produces higher manifold pressure on takeoffs with cool oil. All 21 sustained episodes above 40 inHg occurred below 120°F oil, including five in the last 30 days. Warm-oil MAP is also about 0.21 inHg higher than in 2024. Review limits, indications, warm-up and controller response. **Page 6.**

3 Keep the historical heat events in the maintenance record

Reduced departure fuel flow coincided with much hotter exhaust in early 2025. At comparable high-field departures, fuel flow fell from about 37 to 27 GPH while TIT rose about 240°F. Separate 2024 events reached **460.5°F CHT** and **1,716°F TIT**. The logs establish exposure, not resulting damage. **Pages 7–9.**

Reassuring findings and smaller watch items

Matched oil pressure has not declined; a broad CHT warming trend is not robust. July-to-October GAMI spread improved from 1.18 to 0.60 GPH with the same method. Against a fixed 2024 baseline, oil temperature is about 4°F warmer. TAS is about 2.5 kt lower in a limited matched sample; loading and configuration remain unresolved. **Pages 10–14.**

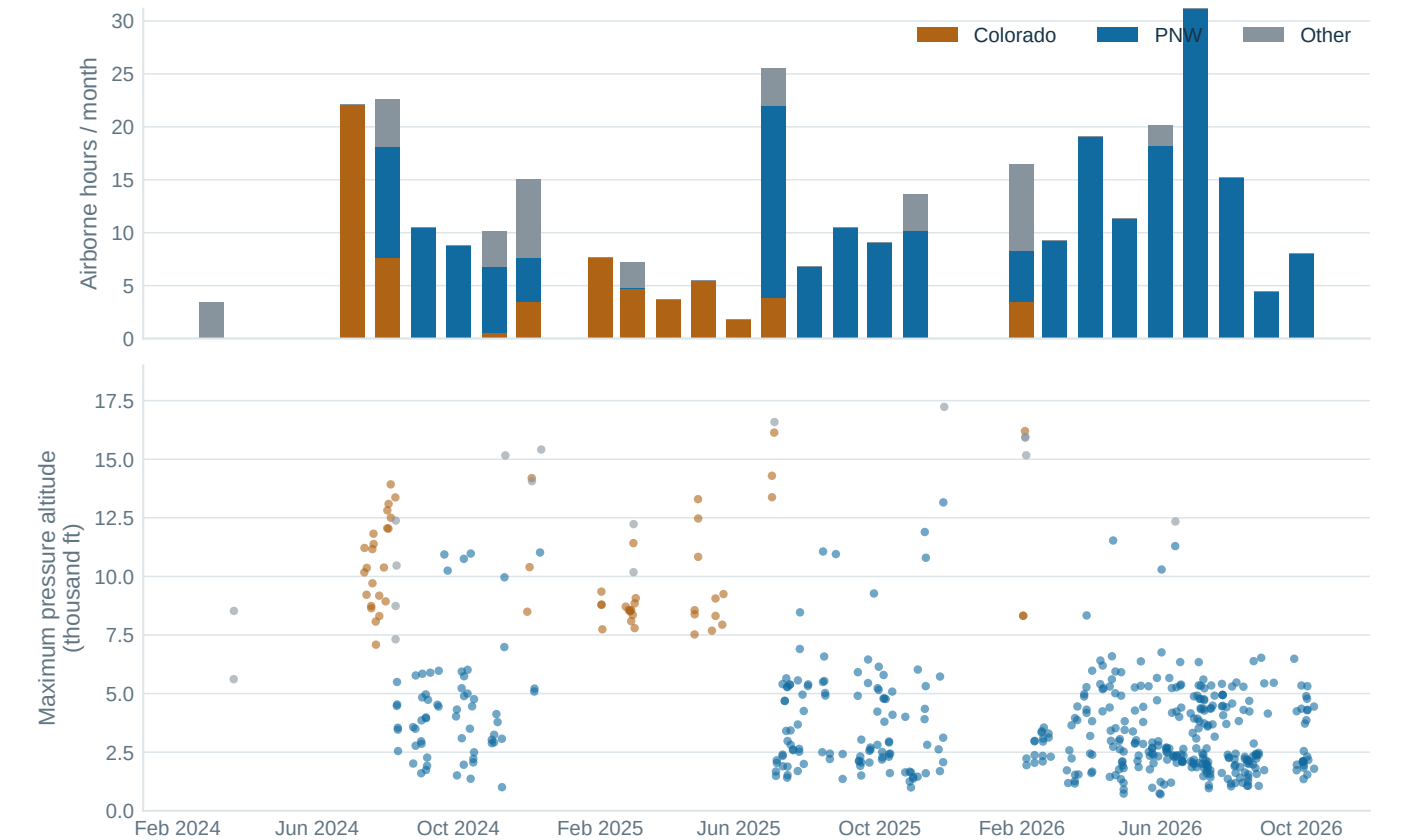
This is a retrospective diagnostic study. Maintenance records, borescope images, oil analysis and verified aircraft limits remain needed to establish causes and airworthiness.

Authored by Mark Maunder and Codex using GPT 6.1 Sol on xhigh.

What the archive actually covers

These recordings follow N6206 from its first recorded flights in 2024 through October 2026. Separating mountain departures from coastal flying helps us avoid mistaking a change in operating conditions for an engine problem.

The first recorded flights are March 20, 2024 at KIDP. The card also contains earlier avionics sessions beginning February 29. The study includes today's three native logs already moved off the card and removes the duplicate July test file.



Departure region	Flight logs	Airborne h	Median field altitude
Colorado	58	64.5	5,805 ft indicated
Pacific Northwest	466	216.4	40 ft indicated
Other	17	38.2	3,806 ft indicated

319.1 hours are classified airborne. A file starts when the display powers on, so 541 is a count of flight-bearing logs rather than a certified count of landings or sorties. Ground running brings recorded RPM-above-500 time to 419.6 hours. These values are separate from tach/Hobbs time. [\[S1\]](#)

The owner identifies the archive as the aircraft's lifetime history. The logs establish the coverage shown here; they cannot prove that every flight was recorded. Calendar gaps are shown rather than filled. Coordinates classify departure region; pressure altitude and OAT are used for comparisons.

How the comparisons were designed

The goal is to find changes in the engine itself while allowing for different altitudes, weather and pilot settings. We compare flights in similar conditions and look for changes that repeat across flights or several measurements.

A lower temperature after moving from Colorado to coastal flying is not enough to establish an improvement. Each method below tests a different explanation, drawing on established trend analysis and comparisons that account for operating conditions. [\[S5\]](#) [\[S11\]](#)

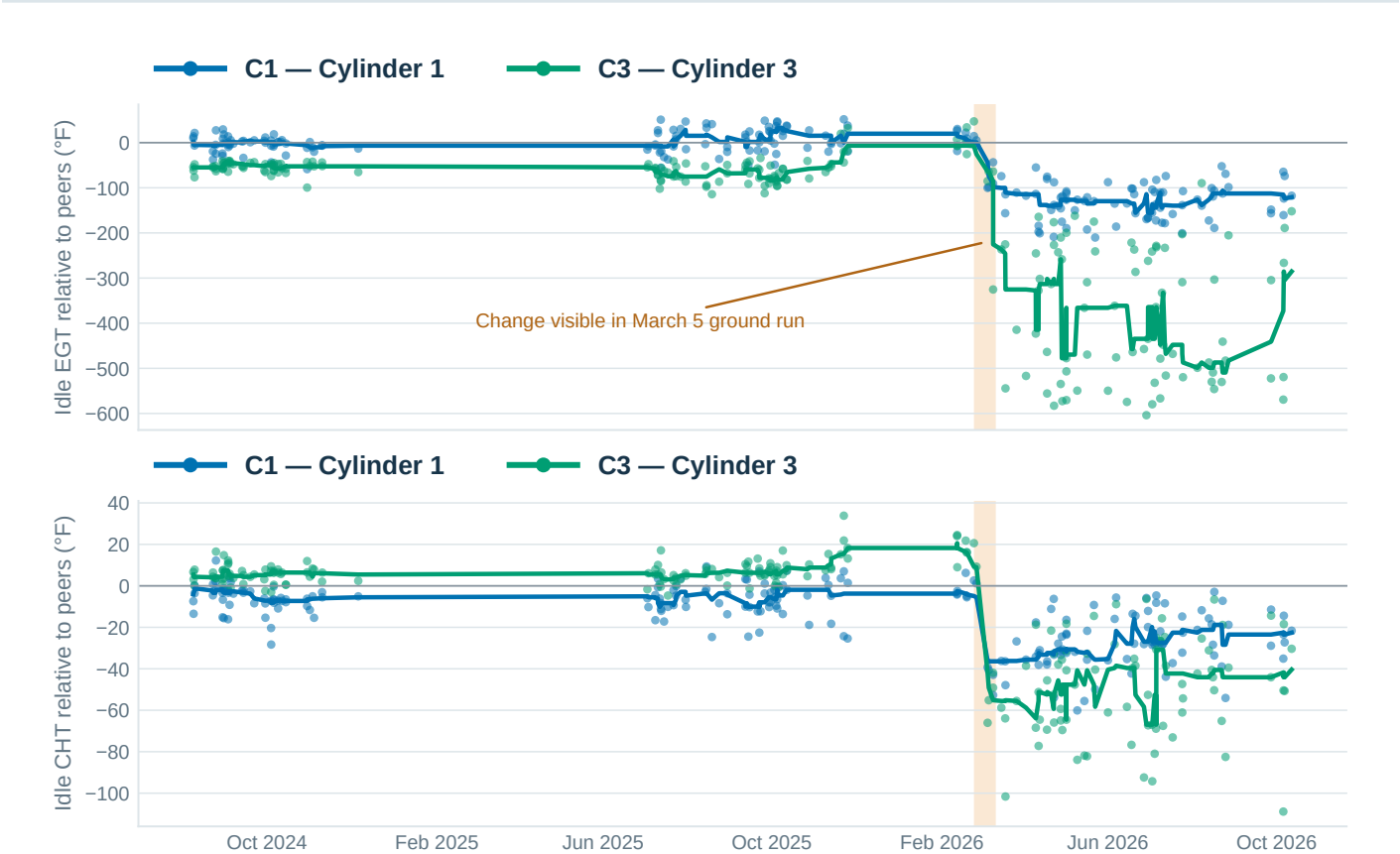
Lens	Why it matters	Implementation
Comparable conditions	Weather, altitude and pilot settings can create false trends.	Match stable windows using MAP, RPM, fuel flow, pressure altitude, OAT and IAS. Oil pressure is matched on oil temperature, RPM and MAP.
Cylinder versus peers	Most environmental changes affect the whole engine.	Subtract the median of the other five cylinders; track the difference by flight, power regime and date.
Natural repeat tests	Repeated starts and departures reveal behavior hidden by cruise averages.	Compare CHT gained during warm-up, then follow the same flights for 15 minutes after departure.
Blind change dates	A maintenance event may alter behavior abruptly.	Use robust change screens and original traces to bracket persistent shifts between recorded sessions.
Event duration and context	A one-second spike and a sustained event have different implications.	Screen the one-second record, measure duration and inspect EGT/CHT alongside power controls.
Matched performance	Raw TAS changes with operating choices and altitude.	Match MAP/RPM/fuel/altitude/OAT; retain weight, cowl position and drag as unresolved causes.
Combustion variability	Averages can hide intermittent behavior.	Inspect cylinder-relative EGT and periodic components only in stable-control windows.

Evidence hierarchy: repeated measurements and corroborating channels first; condition-matched differences second; mechanical explanations remain hypotheses. The models have no labeled failures and do not estimate the probability of an engine failure.

Innovation here is the combination of operating-state matching, within-engine references, blind date bracketing and thermal-response comparisons on this aircraft. These methods extend established condition-monitoring ideas; they are not presented as validated replacements for Savvy FEVA or physical inspection. [\[S6\]](#) [\[S7\]](#)

A persistent low-power change

Since early March 2026, cylinders 1 and 3 have run much cooler than usual at idle, especially cylinder 3. The difference keeps returning at low power, suggesting a change in combustion that needs explanation.



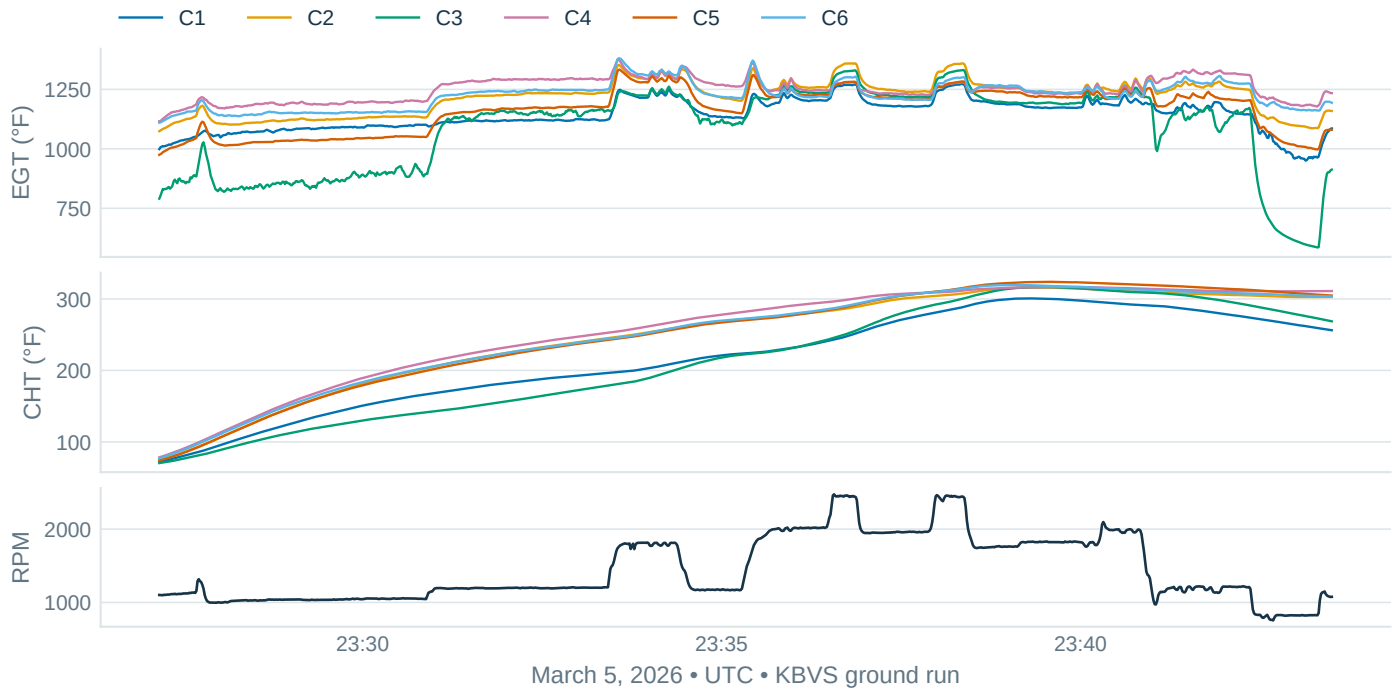
Last earlier behavior: February 25, 2026. **First clear changed behavior:** the March 5 KBVS ground run. Ground runs follow on March 6 and March 9; the March 11 flight and subsequent records retain the pattern. Both EGT and CHT implicate a change in low-power combustion/heat production, while indication changes still need to be checked.

Restricted idle comparison	Earlier: 13 logs	Later: 12 logs	Change
C1 EGT relative to peers	-28°F	-141°F	-112°F
C3 EGT relative to peers	-51°F	-236°F	-185°F
C1 CHT relative to peers	-4°F	-26°F	-22°F
C3 CHT relative to peers	+3°F	-40°F	-44°F

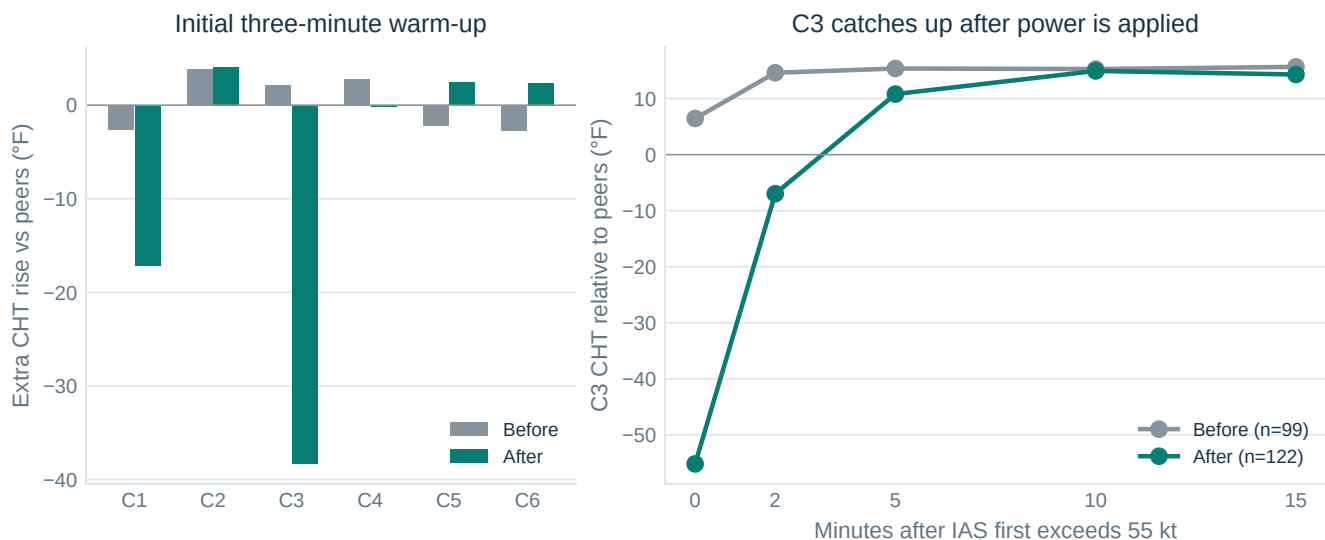
One median per log; changes calculated before rounding. Bands: 950–1,150 RPM; 3–4.5 GPH; oil 80–120°F; OAT 5–20°C; pressure altitude -700 to 1,200 ft. Within-band conditions still differ. A broader 15-versus-32-log comparison gives a similar C3 EGT change (-207°F), so the result is not confined to one narrow selection.

Why cool takeoff CHT can mislead

After the March change, cylinder 3 begins a departure cooler because it warmed up less on the ground. It catches up once power is applied, so its lower takeoff temperature does not by itself mean cooling improved.



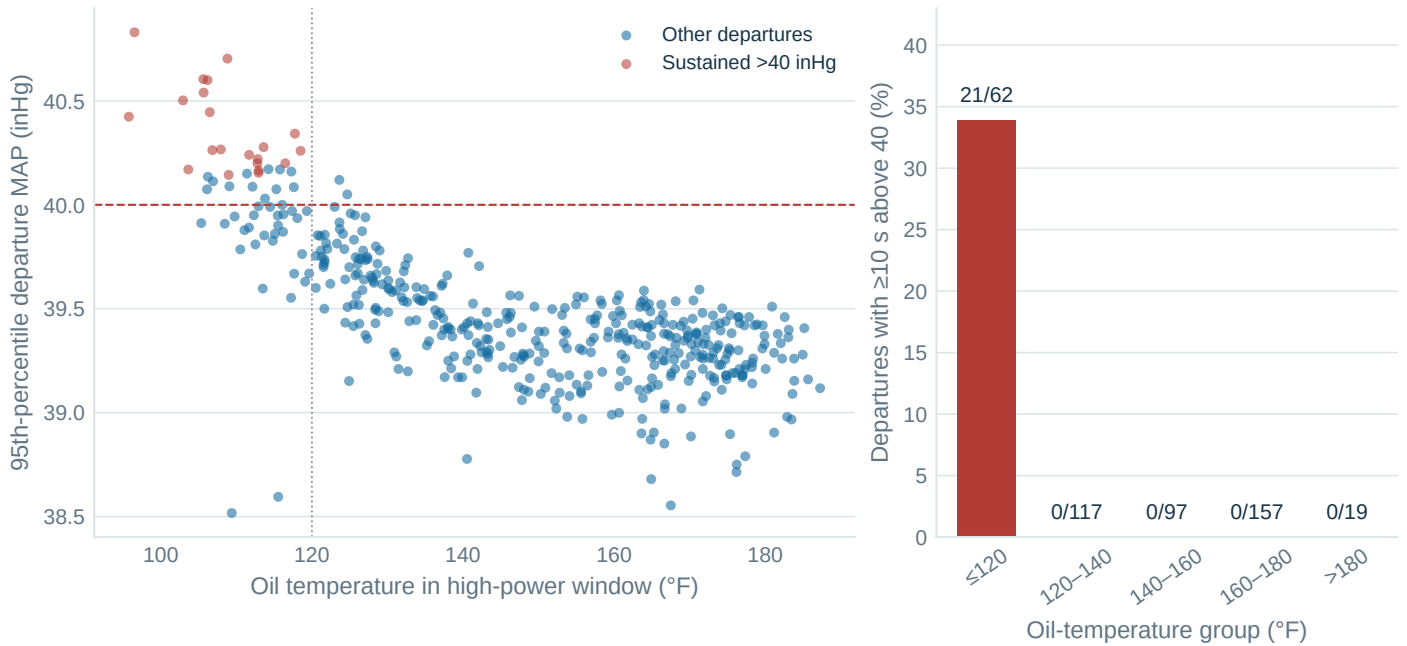
March 5: C1 and C3 warm more slowly than the other cylinders during idle. Their EGTs converge toward the others as RPM rises. C3 falls again when power is reduced. This phase-specific response deserves review of mixture, induction and ignition behavior, with probe verification as needed.



The warm-up comparison uses 11 earlier and 14 later PNW starts with similar initial oil temperature and idle RPM. C3 adds about **40°F less heat relative to peers** over the first three minutes. The departure curve follows the same 99 earlier and 122 later flights at every time point: later C3 goes from about **55°F below peers** to **11°F above them in five minutes**. Its lower takeoff CHT is therefore poor evidence of improved cooling.

Boost is strongly linked to cool oil

Some takeoffs show unusually high manifold pressure while the oil is still cool. The pattern makes warm-up and turbocharger control worth reviewing; it does not identify a faulty component.



Low-altitude, high-flow departures	Below 120°F oil	120°F oil or warmer
Eligible departures	62	390
≥10 consecutive seconds above 40 inHg	21 (34%)	0
All 21 event-window durations	11–43 seconds	—

This association is strong (rank correlation between oil temperature and the departure MAP upper percentile: **−0.69**). Median oil temperature was 109°F on event departures versus 152°F otherwise. The largest recorded MAP was 40.84 inHg in 2024; recent examples include 40.65 on September 30 and 40.76 on October 5, 2026.

Oil temperature does not explain every difference. Among departures with oil **150–180°F**, median MAP rises from **39.08 inHg in 2024 to 39.29 in 2026**, with similar median OAT. Typical departure RPM remains around 2,460–2,470. Check warm settings as well as cold response.

For Loren: verify the installed limits and MAP indication, then review warm-up, throttle application and slope-controller/wastegate response. Lycoming identifies the AJ1A’s oil-operated turbo control; the component maker lists cold oil as a potential cause of inadequate controller oil flow. The data supports that hypothesis without proving a faulty component. [\[S2\]](#) [\[S3\]](#) [\[S4\]](#)

120°F and 40 inHg are analysis bins. Use the aircraft’s approved warm-up criteria and operating limits; these findings do not establish new limits or an inspection disposition.

The low-fuel-flow period is real

Thirteen comparable departures from Centennial or Limon show less fuel flow and higher turbo exhaust temperature during takeoff and initial climb. Each comparison covers 47–193 high-power seconds, not whole-trip fuel use. Later departure fuel flow returns toward its earlier pattern.



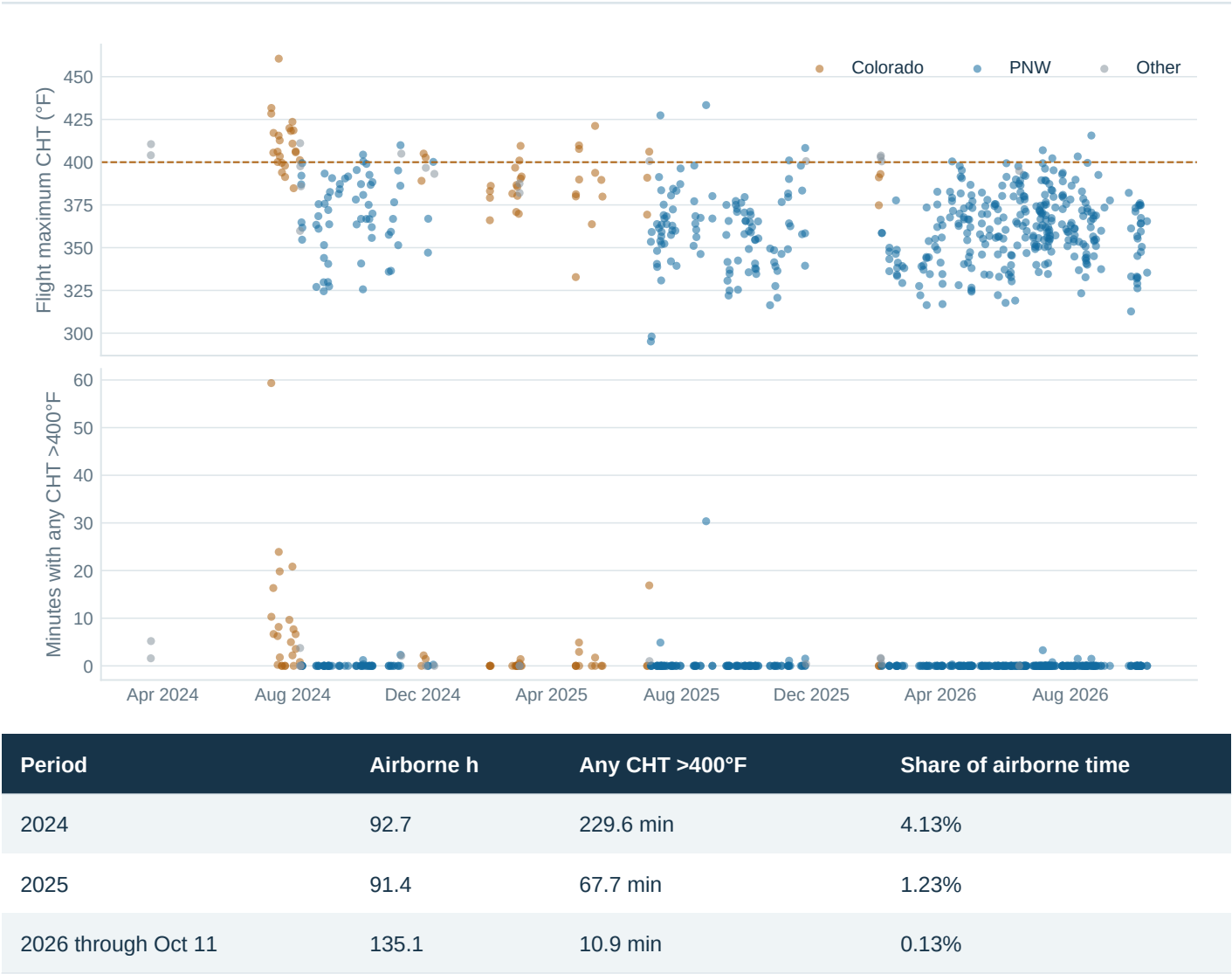
Comparable high-field departures	Earlier	Feb–Mar 2025	Later
Independent departure windows	20	13	14
Fuel flow, GPH	37.30	26.67	36.82
MAP, inHg / RPM	39.05 / 2,476	39.25 / 2,465	39.16 / 2,467
Pressure altitude, ft / OAT, °C	5,923 / 21.1	6,074 / 10.5	5,832 / 11.4
TIT, °F	1,347	1,586	1,340

What to look for: each dot summarizes a short departure window. All 13 period departures measured **24.42–32.25 GPH**, versus the earlier **37.30 GPH** median. Eighteen of 20 earlier departures were 36.7–37.9 GPH; two were also low. The period median fell **28.5%** while TIT rose **239°F**, supporting a real mixture/combustion difference. These are historical readings, not approved fuel settings. Unlogged mixture/throttle positions prevent separating pilot settings from a fuel-system change.

Blind date brackets: onset is between December 11, 2024 and February 1, 2025; recovery is between March 3 and April 23. Review ground runs March 20 and April 19. Selection uses altitude, MAP and RPM, not low fuel flow. [See every trip, the three excluded Texas legs, and the measured takeoff/climb intervals.](#)

Heat exposure has fallen substantially

The cylinders spend much less time hot in recent flying. Much of that improvement accompanies different flying conditions; when similar flights are compared, there is no clear sign that the engine is steadily running hotter.



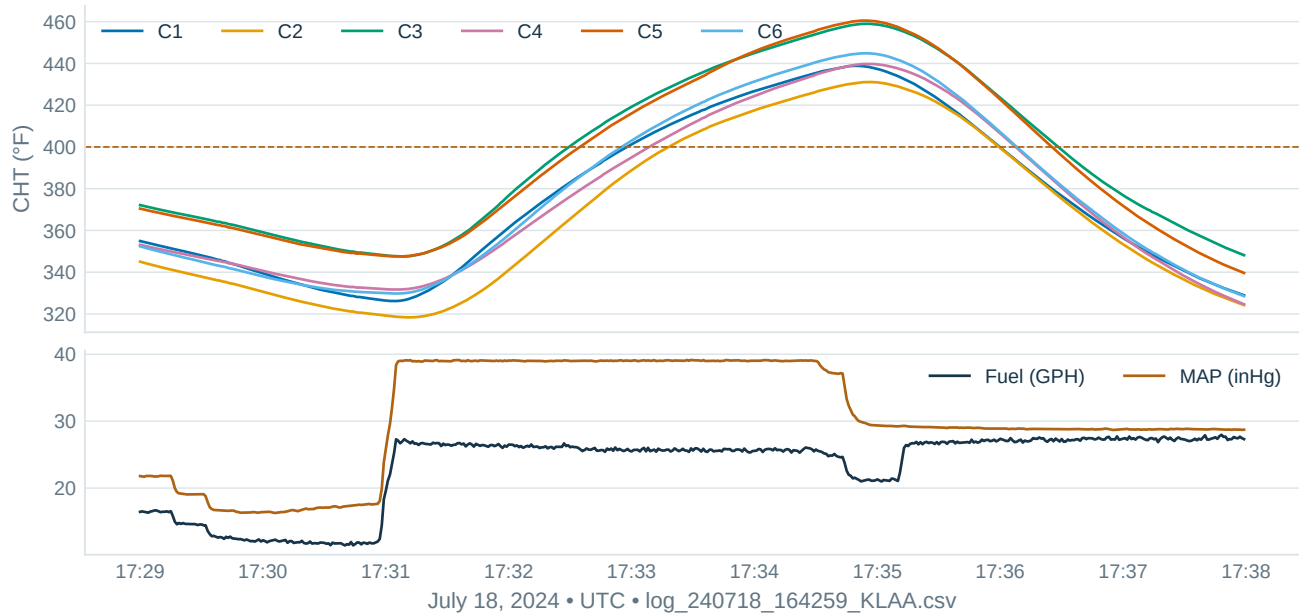
Across the archive, any-cylinder CHT exceeds 400°F for **5.14 hours** and 420°F for **23.8 minutes**. Colorado-origin flights account for 4.02 of those 5.14 hours above 400°F. Their exposure rate is 6.23% of flight time, versus 0.38% for PNW-origin flights. These are departure-region cohorts, with different routes, power settings and climb profiles.

Comparing 46 matched 2026 flights with a fixed 2024 reference pool gives a hottest-cylinder shift of only **+1.0°F**, with a descriptive 95% sampling interval spanning roughly -5 to +7°F. Tighter and wider matches give changes near zero. There is **no robust broad upward CHT trend** in these comparisons.

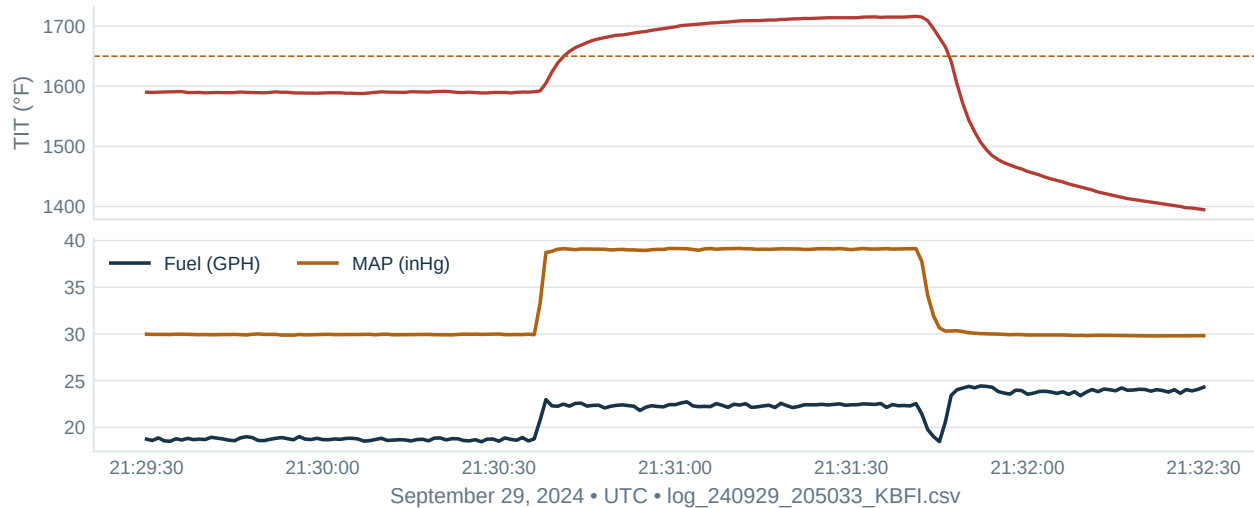
Recent flying is much cooler overall, but the archive includes a 415.6°F maximum after August 1, 2026. The lower recent average does not eliminate the value of reviewing individual climb and mixture events. C3 and C5 are the hottest cylinders in about 97% of airborne samples.

Two historical events to retain

Two flights in 2024 stand out: one heated all six cylinders sharply, and another sent exhaust temperature at the turbocharger unusually high. They document heat exposure worth retaining in the maintenance history; they do not prove lasting damage.



July 18, 2024, 17:31–17:35 UTC: an increase to about 39 inHg and 2,380 RPM, with fuel near 26 GPH, precedes a whole-engine heat rise. C5 reaches 460.5°F and C3 459.1°F; all six peak between 431 and 461°F. Temperatures fall following power reduction and enrichment. Review high-power mixture management and any inspection already performed.

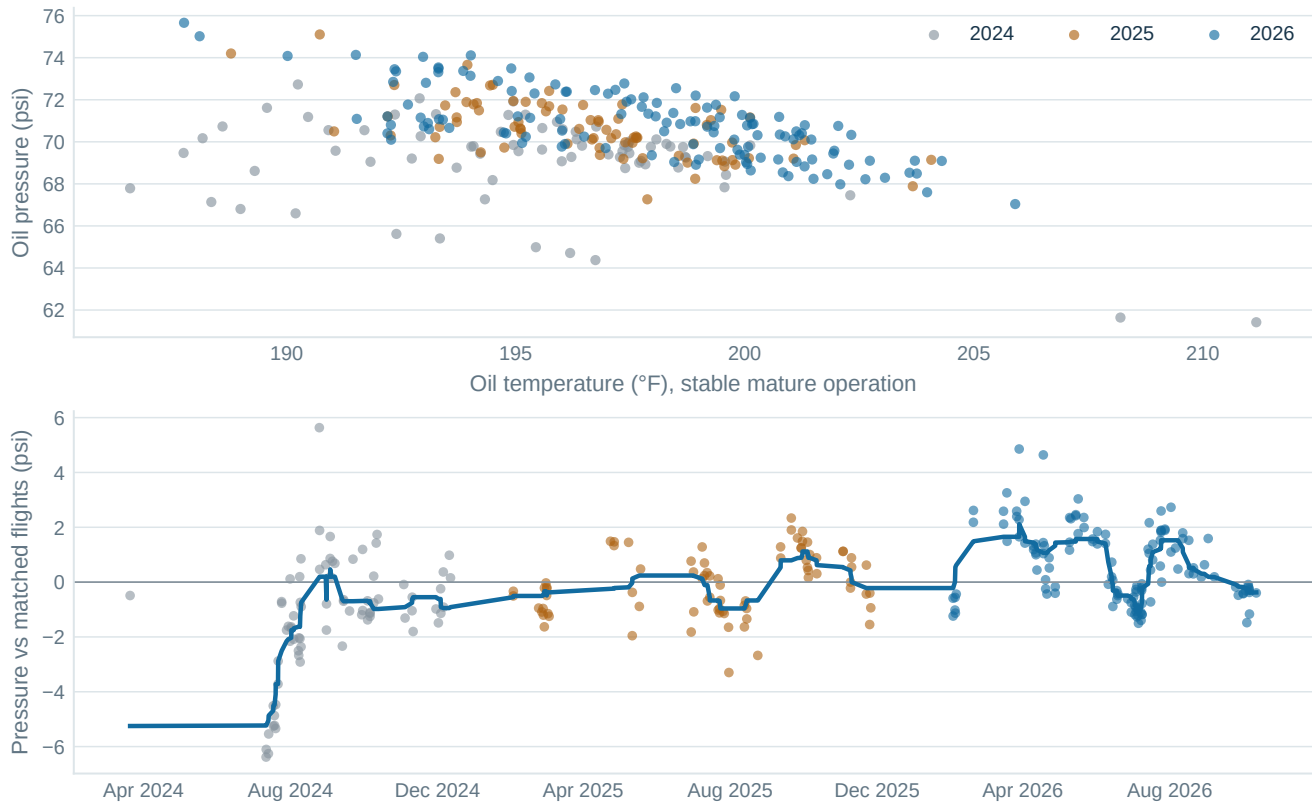


September 29, 2024, 21:30:42–21:31:46 UTC: TIT exceeds 1,650°F for 65 seconds and peaks at 1,716°F, with roughly 39.1 inHg / 2,363 RPM / 22.4 GPH. All EGTs also rise. The archive totals 400 seconds above 1,650°F across 13 flights; the last such event is April 29, 2026.

The plotted 400°F and 1,650°F lines are diagnostic/manufacturer reference levels. The cited engine manual lists 480°F maximum CHT and 1,650°F TIT for the AJ1A; verify the installed aircraft's approved limits and transient allowances before assigning a formal exceedance disposition. [\[S2\]](#)

Lubrication looks stable in context

Oil pressure has stayed stable at similar oil temperatures and engine speeds. Oil runs slightly warmer in comparable recent cruise, so cooling and oil-service history are useful context for this small change.



Oil pressure naturally changes with oil temperature and RPM. The history plot uses **281 flights** with suitable matches. Typical stable-flight medians are 69.6 psi in 2024, 70.6 in 2025 and 70.8 in 2026. A separate fixed-2024 comparison of 128 later flights gives **+1.4 psi** (descriptive interval +0.6 to +1.9 psi), supporting the absence of a pressure decline.

The earliest July 2024 flights sit about 5–6 psi below matched peers. This is a historical difference worth checking against initial setup, oil type and service records; it does not continue as a downward trend. One isolated airborne sample reaches 54.8 psi in that early period; no run of five seconds below 55 psi at RPM above 2,000 was detected.

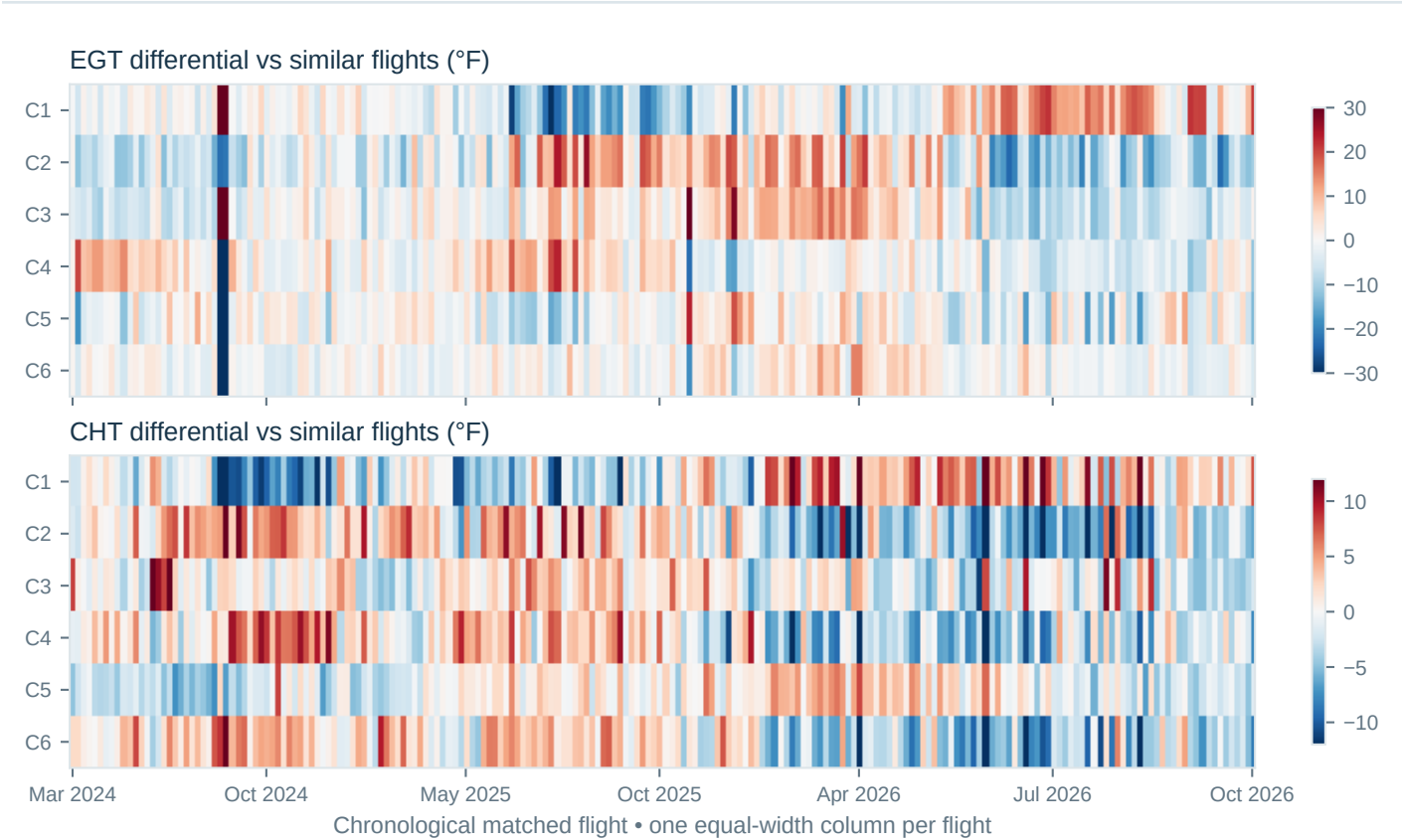
Small watch item: oil is a little warmer at comparable cruise conditions

The small temperature rise persists when similar cruise conditions are compared. Against fixed 2024 references, the increase is **3.6°F** across 46 matched 2026 flights; tighter/wider matches give 3.6–3.9°F. The last 75 flight-bearing logs have a maximum oil temperature of 208.4°F. Check cooling configuration and oil service history.

Pressure matching uses oil temperature, RPM and MAP. Temperature matching uses cruise power, fuel flow, altitude, OAT and IAS. Oil quantity, consumption, grade, filter findings and wear-metal analysis were unavailable; engine-monitor data cannot replace them.

The six cylinders as a reference group

A cylinder developing a problem may begin behaving differently from the other five. These comparisons look for that separation in cruise; they show small shifts, while the large March idle change largely disappears under cruise power.



Blue/red cells show a cylinder's difference from its peers, compared with that difference in flights at similar operating settings. This tests whether one cylinder is separating from the engine's usual pattern. It is **not a chart of GAMI spread**, which requires individual EGT peaks during a controlled sweep. [S6] [S8]

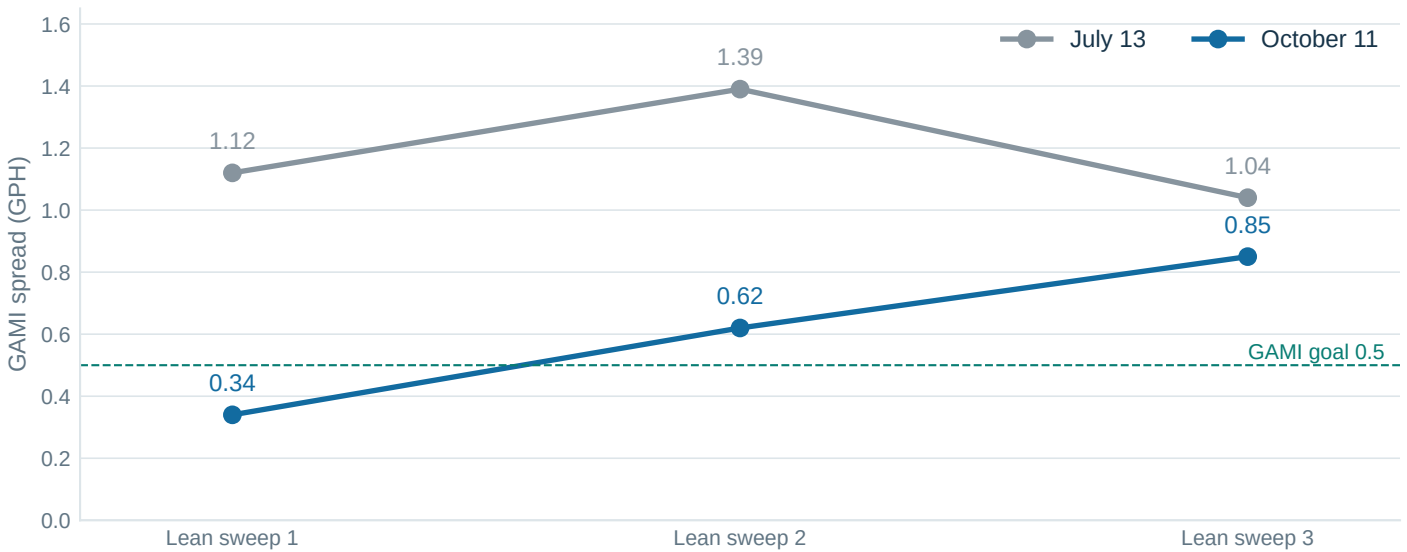
Recent period: Aug 1–Oct 11	C1	C2	C3	C4	C5	C6
Median matched CHT difference, °F	+2.2	−4.2	−2.7	−1.8	−2.0	−3.5
Median matched EGT difference, °F	+4.4	−9.7	−3.9	−2.2	−1.9	−2.4

The large March idle change is absent in the form of a comparable C3 cruise-temperature collapse. C3 and C5 remain the usual hotter cylinders. Small relative shifts persist, including cooler C2/C6 CHT and a modest C1 change, but none of these recent matched medians shows a major new cylinder overheating pattern.

Mixture regime still matters: routine logs do not identify ROP or LOP reliably. Matching fuel flow and power reduces that problem, and the analysis excludes active mixture sweeps from stable cruise. Sensor calibration, cowl position and maintenance remain possible explanations for small residual differences.

Injector balance has improved

The lean tests check whether all six cylinders reach peak exhaust temperature at nearly the same fuel flow. October’s closer grouping shows improved fuel distribution, although cylinder 3 still reaches its peak last.



Three leaning sweeps, same processing	July 13	October 11
Mean spread, GPH	1.18	0.60
Sweep values, GPH	1.12 / 1.39 / 1.04	0.34 / 0.62 / 0.85
Last cylinder to peak while leaning	C3	C3

The same-method comparison improves by approximately **49%**. Alternate reasonable smoothing gives about 35–57% improvement, so “roughly half” is more defensible than a precise percentage. Savvy’s original July report published 1.0 / 1.3 / 0.9 GPH and described poor distribution; its values differ slightly from this reproducible remeasurement.

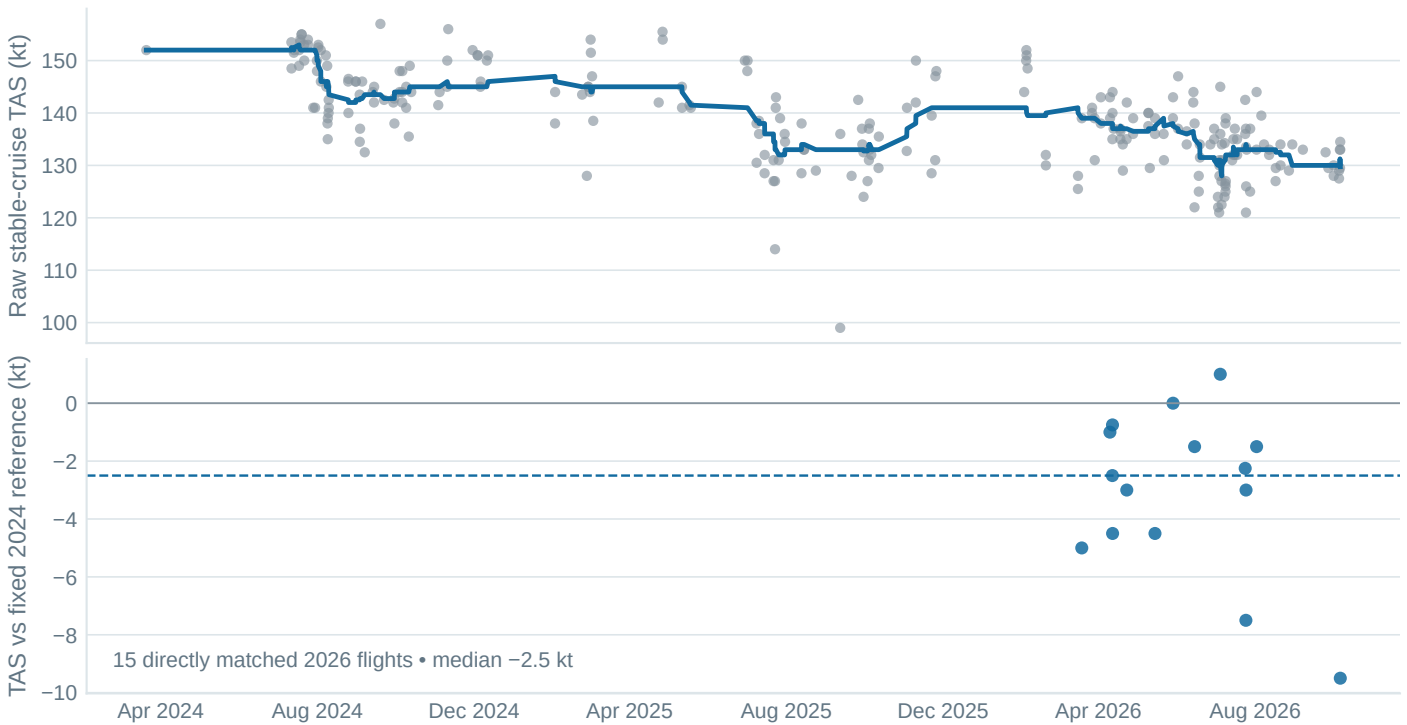
October supports improved LOP capability at the tested reduced-power condition. C3 still peaks last and remains the rich-side balancing target; the approximately 0.5 GPH goal is not achieved consistently. The October lean-mag traces show coordinated EGT rises without a clear cylinder dropout. Applicable installed GAMI guidance, verified power and acceptable smoothness remain the operating basis. [\[S8\]](#) [\[S9\]](#) [\[S13\]](#)

The archive search did not establish an additional comparable pre-July test. It surfaced 18 candidates. Four were rejected after trace review: rapid mixture movement through peaks, incomplete peak resolution, or known mag checks. Accepted candidates belong to the July and October test flights. An apparently excellent 0.27 GPH result on October 6 was rejected because the individual peaks were not resolved.

The March low-power change precedes the July/October test interval. This record cannot identify which nozzles were replaced or date the initial GAMI installation precisely.

A possible performance shift

The airplane may be slightly slower in recent cruise even after allowing for recorded power settings and weather. The comparable sample is small, and loading, drag or airspeed measurement could explain the difference.



Comparison	Evidence
Raw typical stable-cruise TAS	146 kt in 2024; 134 kt in 2026
Fixed 2024 reference comparison	15 later flights; 24 reference flights; median -2.5 kt
Wider / tighter matching	31 later flights: -2.5 kt / only 3 flights: -1.0 kt

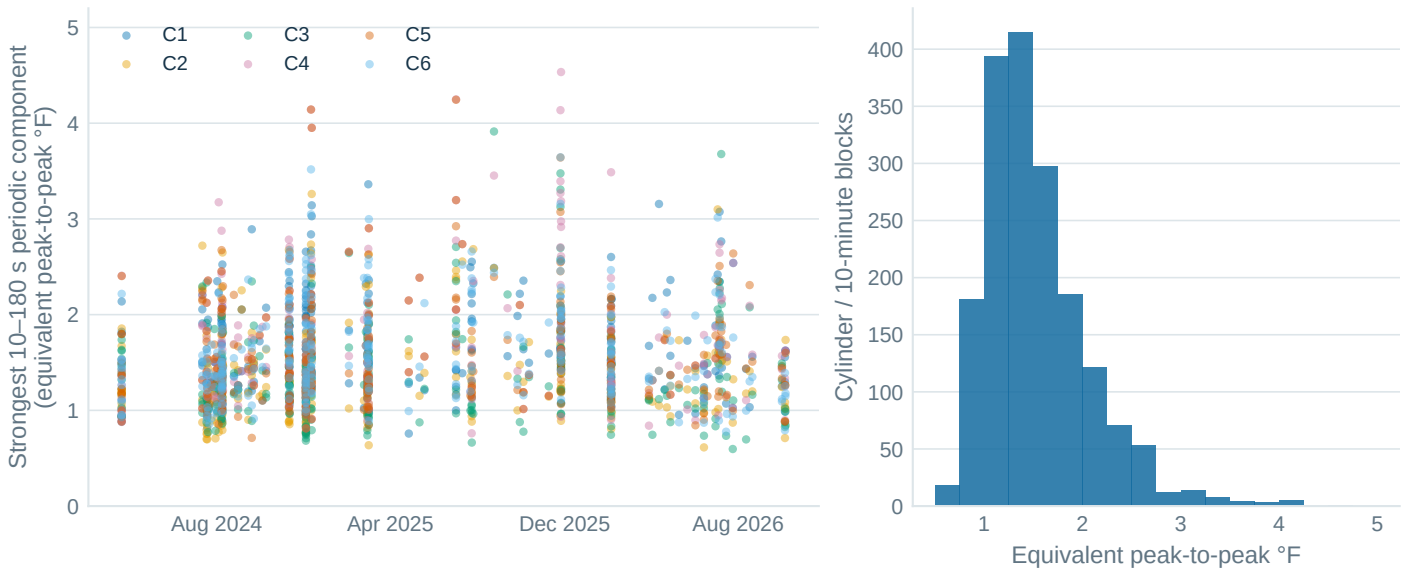
Much of the raw reduction accompanies different altitude, power and mixture choices. The direct comparison matches MAP, RPM, fuel flow, pressure altitude and OAT to a **fixed 2024 reference pool**. Its descriptive sampling interval is -5 to -1 kt, but the tightest match leaves only three later flights and spans zero. Treat this as a **watch item with limited overlap**, not an established performance loss.

Airspeed is a whole-aircraft outcome. Payload, fuel load, cowl-flap position, rigging, external equipment, surface condition and air-data calibration can all affect it, and these are not recorded. Induction-air temperature and actual shaft power are also unavailable. The result cannot be translated into horsepower loss or engine wear.

Useful follow-up: reconcile configuration changes, then compare repeat cruise points with documented weight, cowl position and mixture reference. A stable engine indication set with lower TAS directs attention to loading and drag as well as the engine; it does not justify a component replacement by itself.

Intermittent behavior and other checks

Some engine problems cause brief cylinder-temperature drops or repeated temperature swings that averages can hide. Screening steady cruise found no strong recurring pattern of that kind, but the recordings cannot rule out every intermittent fault.



The periodicity screen covers **297 ten-minute blocks, 49.5 hours and 108 flights**. Each cylinder’s EGT is compared with the other five, then inspected for 10–180-second periodic components. The strongest equivalent peak-to-peak component is 4.5°F; the median is 1.4°F. No large, recurring isolated oscillation emerged in this selected stable-cruise population.

The initial broad scan’s strongest candidate was a brief throttle reduction on July 17, 2026. A stricter control-stability gate removes it. All 23 relative-EGT-drop candidates coincide with substantial changes in surrounding controls. These examples show why an automated flag requires examination of the raw trace.

Other observable systems	Result
Propeller / RPM	Typical departure medians remain about 2,460–2,470 RPM. Peaks above 2,550 RPM last one sample; their magnitude alone does not establish sustained overspeed.
Electrical	Both buses are typically 28.2 V. No airborne period of 15 seconds below 25 V was detected.
Indications / completeness	Airborne EGT/CHT coverage is nearly complete. No broad loss of a temperature channel was found; calibration accuracy still requires physical verification.

This is an exploratory spectral/trace screen, not Savvy’s trained FEVA system. Failing valves may lack an oscillatory signature, and the selected 49.5 hours are only part of the 319.1 airborne hours. Current borescope images, compression trends and physical ignition checks remain complementary evidence. [\[S7\]](#)

A focused review for Loren

The most useful next steps are to explain the persistent idle change and the high manifold-pressure episodes during cool-oil departures. Older fuel-flow and heat events provide context; maintenance records can help connect the observed changes to work performed.

Priority	Evidence to take to the aircraft	Useful next step
1 · Current Low-power C1/C3	Change present March 5, 2026; repeated EGT and CHT depression at idle, with recovery under power.	Compare February 25 with the March 5/6/9 KBVS ground runs. Review work performed; assess idle mixture/distribution, induction integrity, plugs/ignition and indications as the physical findings direct.
2 · Current Boost / oil temperature	21 sustained >40 inHg episodes; all with cool departure-window oil. Five in the last 30 days; warm-oil MAP also about 0.21 inHg higher than 2024.	Verify approved limits and gauge accuracy. Review warm-up and throttle technique; evaluate warm calibration and controller/wastegate oil-flow response using applicable maintenance procedures.
3 · Historical Fuel and heat	Low-flow/high-TIT departures Feb–Mar 2025; whole-engine CHT event July 18, 2024; high-TIT event September 29, 2024.	Reconcile pilot settings, fuel-system service and any inspections already performed. Retain source logs and event durations in the record. Exposure alone cannot determine current damage.
4 · Optimization Mixture distribution	July-to-October spread improves materially; C3 still peaks last.	Give GAMI the original October log and validated sweep results for further balancing advice. Review idle behavior separately from the cruise balance target.
5 · Monitor TAS and oil temperature	Oil temperature about 4°F warmer against fixed 2024 references. Limited TAS comparison suggests about 2.5 kt lower.	Check configuration/loading and oil/cooling service history; establish repeat points with those variables documented.

BLIND DATE LEDGER

These dates narrow down when a lasting change appeared or disappeared in the recordings. They give Loren specific periods to check against the maintenance history.

- December 11, 2024 → February 1, 2025: onset bracket for the persistent low-flow period.
- March 3 → April 23, 2025: recovery bracket; ground runs March 20 and April 19.
- February 25 → March 5, 2026: onset bracket for the C1/C3 low-power change; further ground runs March 6 and March 9.

No maintenance event is confirmed by these dates. The July/October injector-test context was already known and is excluded from the blind discoveries.

Methods, coverage and uncertainty

The findings depend on which recordings can be fairly compared and what the instruments actually measure. This section explains those choices and the remaining gaps, so the strength and limits of each conclusion are clear.

Stage	Selection / calculation	Coverage
Archive audit	786 candidate CSV paths including existing local copies; native bytes hashed; one duplicate July file removed. Latin-1 preserves Garmin navigation glyphs.	775 usable timed logs; zero parse failures; 1,568,810 unique timed rows.
Time handling	UTC offsets honored. Untimed startup rows excluded; duplicate timestamps averaged within a file. No gap is filled for hour totals.	1,702 untimed/invalid-time rows; 909 repeated timestamps; 1,938 missing seconds across gaps.
Observed hours / flight logs	RPM >500 marks running. IAS >55 kt and groundspeed >35 kt marks airborne. A flight-bearing log has ≥120 airborne samples.	419.6 running h; 319.1 airborne h; 541 flight-bearing logs.
Cruise windows	Non-overlapping 180 s; ≥170 records; nearly level; mature ≥15 min; IAS >95 kt. MAP 5th–95th range ≤0.7 inHg, RPM ≤65, FF ≤0.65 GPH.	1,758 eligible windows / 254 flights; 1,048 windows / 208 flights have ≥4 independent references.
Reference matching	Nearest conditions in 4–12 other logs, each ≥30 days from the target; one reference window per log. Scales: 0.8 inHg, 80 RPM, 1 GPH, 2,000 ft, 8°C, 12 kt IAS.	Radius 2 in scaled space; each coordinate ≤1.5 scales. Sparse cases remain unscored.
Oil and TAS	Oil-pressure scales: 100 RPM, 5°F oil, 3 inHg; radius 1.7. TAS scales: 0.6 inHg, 60 RPM, 0.75 GPH, 1,500 ft, 6°C; radius 1.7.	281 matched oil flights; 115 matched performance flights overall.
Year comparisons	Use fixed 2024 references for 2026 changes; all-history residual plots are diagnostic scores, not physical annual differences. One median per later log.	Matched 2026 logs: 46 for cruise temperature, 128 for pressure, 15 for TAS.
Uncertainty	3,000 bootstrap resamples. Fixed-baseline intervals resample both reference and later logs with matching links held fixed. Repeat scales ×0.75 and ×1.25.	Descriptive intervals; no correction for serial dependence, exploratory selection or unmeasured confounders.

Pressure altitude is approximated as indicated altitude + 1,000 × (29.92 – barometer setting). Dry-air density altitude is PA + 120 × (OAT – ISA temperature). Matching uses PA and OAT separately. These context calculations are not aircraft performance planning outputs. [\[S10\]](#)

766 logs end in a partial final CSV record; available numeric fields are retained and missing fields excluded from affected metrics. Raw files remain unchanged. The one-second sampling rate supports durations but not high-frequency vibration analysis. All quoted events are indicated values; instrument calibration is unverified.

Matching is approximate: operating-condition differences remain inside the accepted bands and are tabulated in *anchored_control_balance.csv*. Flight-level aggregation reduces pseudoreplication; serial dependence and unlogged variables remain. This retrospective study does not validate a fault classifier or estimate remaining engine life. [\[S12\]](#)

Research and reproducible evidence

The conclusions combine the aircraft's original recordings with manufacturer guidance and published engine-analysis methods. The sources and saved analysis files below let Loren or another reviewer trace each finding back to its evidence.

S1 · [Garmin G1000 NXi Pilot's Guide, Cessna NAV III, §8.8](#)

One-second logging; a file starts at power-up; altitude channels include GPS and barometric altitude.

S2 · [Lycoming TIO-540 angle-valve Operator's Manual, 60297-23A, §§1–3](#)

AJ1A turbo control, engine reference ranges and operating guidance. The installed aircraft POH/AFM governs.

S3 · [Lycoming SI 1257G: Horsepower, Manifold Pressure and RPM Values](#)

AJ1A rating: 310 hp, 39 inHg, 2,500 RPM; slope-controller setting context. Use current approved maintenance instructions for work.

S4 · [Hartzell Engine Technologies / AeroForce Turbo Troubleshooting Guide](#)

Sloped control description; printed pp. 123–125 discuss cold oil and controller oil flow.

S5 · [Savvy: Report Cards & Trend Reports](#)

Established analysis across multiple flights and related trends.

S6 · [Savvy: When Data Doesn't Look Right](#)

Cylinder-to-peer normalization and corroboration among EGT, CHT and controls.

S7 · [Savvy: FEVA 2.1](#)

Oscillation screening alone cannot establish exhaust-valve health; trained FEVA uses many features and flight history.

S8 · [GAMI: Lean Test](#)

Spread at individual EGT peaks, slow mixture movement and the approximately 0.5 GPH balance goal.

S9 · [Savvy: Flight Test Profiles](#)

Controlled mixture sweeps and ignition checks; the owner's expanded PDF was also reviewed.

S10 · [FAA AC 00-6B, Aviation Weather, §5.5](#)

Pressure altitude, temperature and density-altitude context.

S11 · [Turney & Halasz: Contextual Normalization Applied to Aircraft Gas Turbine Engine Diagnosis](#)

Research basis for comparisons conditional on operating environment; gas-turbine validation does not validate this piston-engine application.

S12 · [NIST: Statistical Process Monitoring for Autocorrelated Data](#)

Serial dependence motivates aggregating and resampling by flight instead of treating seconds as independent evidence.

S13 · [GAMI approved AFMS, Rev IR](#)

LOP operation depends on applicability of the installed supplement, power, smoothness and aircraft limits.

Owner-provided evidence: original Garmin logs; *Savvy-Flight-Test-Profile-Expanded.pdf*; Savvy's July 17, 2026 report on the July 13 flight; the validated October test analysis. Maintenance dates, oil-analysis results and borescope records were unavailable.

Companion package: *lifetime_analysis_2026-10-11/report.html* contains an offline interactive flight explorer. The same directory includes source hashes, event timestamps, selected windows, matched residuals, sensitivity results and reviewed sweep candidates. Scripts in the working directory reproduce the analysis and report.

Authored by Mark Maunder and Codex using GPT 6.1 Sol on xhigh.