Background Summary: Native-Telemetry Investigation of Terrain LOD and Photogrammetry Effects on MainThread/Graphics Queue Load in MSFS 2024

Prepared for Asobo Studio engineering review

User-side diagnostic log and methodology, rebuilt to rely exclusively on MSFS 2024's native Developer Mode telemetry — submitted as supporting evidence for a community-reported engine issue

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1. Purpose of This Document

This document summarizes a user-conducted diagnostic investigation into a reproducible performance characteristic in MSFS 2024: periodic, elevated MainThread and Graphics Queue activity associated with Terrain LOD value, photogrammetry state, and scenery location. It is written for engineering review rather than as a support request. This version of the report supersedes an earlier draft that relied in part on third-party frame-capture tools (MSI Afterburner/RTSS percentile-low statistics) and a SimConnect-based companion utility's own display panel. At the requester's instruction, every figure in this version is sourced exclusively from MSFS 2024's own in-sim Developer Mode telemetry, and the test sequence was re-run from scratch with a default aircraft and no add-ons or mods, specifically to remove every external tool and every payware aircraft/scenery variable from the evidentiary chain.

Every screenshot in Section 3 is the user's own capture, taken directly from MSFS 2024's in-sim Developer Mode FPS overlay (Options → General → Developer Tools). No images have been altered other than the addition of a banner above each one stating the exact test condition; the underlying screenshot pixels are unmodified. Because this rebuild uses only native telemetry, the severity metrics available differ from the prior draft: MSFS's Developer Mode overlay does not report 1% / 0.1% percentile-low framerate, so this version instead uses three metrics the overlay does report directly — MainThread time (ms), Graphics Queue range and median (ms), and the MarkersFailed counter — as the primary evidence of severity throughout.

2. Investigation Method

This rebuilt sequence holds aircraft (default A320neo, no mods or add-ons of any kind) and location (iniBuilds EGLL, cockpit camera unless stated otherwise) fixed throughout, and varies one setting at a time: Terrain LOD (TLOD) value, Object LOD (OLOD) value, camera mode, and the Photogrammetry on/off setting. Object LOD and camera mode were each tested twice, where the first result was either ambiguous or confounded by an unintended difference between runs (see Sections 3 and 5), to check whether the effect repeated before drawing a conclusion from it.

Variables eliminated in earlier rounds of this investigation, prior to this native-metrics rebuild, are summarized here for context but are not re-illustrated with new screenshots in this version, since they were not in question for this rebuild:

- Aircraft type, beyond the default-vs-payware comparison repeated here (multiple different aircraft tested in the earlier round)
- DLSS vs. FSR upscaling mode
- NVIDIA shader cache (cleared)
- Head-tracking hardware (confirmed inactive)
- Hardware peripherals (Thrustmaster throttle quadrant unplugged)
- MobiFlight (fully closed, not just disconnected)
- Live Weather (switched to preset weather)
- Rolling cache size and storage medium (confirmed adequate size on SSD)
- AI traffic (set to zero during the original airport-comparison tests)
- A specific scenery add-on, //42 FlowPro (controlled inclusion/exclusion)
- Scenery location generally (EGGP smooth vs. EGLL severe, with all other variables matched, in the earlier round)

This rebuild's purpose was narrower and more rigorous than re-confirming all of the above: to verify, using only sim-native telemetry and a default aircraft with zero mods, which of the four candidate variables identified in the earlier round (TLOD, OLOD, camera mode, photogrammetry) actually hold up as controlling variables. As detailed in Section 5, two of the four — TLOD and photogrammetry — were confirmed; the other two — OLOD and camera mode — did not replicate as originally stated, and this report describes that outcome directly rather than carrying the earlier conclusion forward.

3. Annotated Test Sequence

The following figures are presented in the order the tests were actually run. Each banner states: the camera mode and altitude, aircraft, location, the specific setting changed from the previous relevant test, and the resulting native-telemetry readings. All figures use the default A320neo with no mods or add-ons, at iniBuilds EGLL, unless otherwise stated in the banner.

STEP 1 — DEFAULT AIRCRAFT REPLICATION, TLOD 300

Cockpit camera | Default A320neo | iniBuilds EGLL (Heathrow) | No mods/add-ons
TLOD 300 | OLOD 200 | Photogrammetry: ON
MainThread 28.3 ms | Graphics Queue [7.1; 58.3] med 8.0
MarkersFailed: 542
Purpose: direct replication of prior Fenix-based TLOD-300/ON result,
using only sim-native Dev Mode telemetry, default aircraft, zero mods

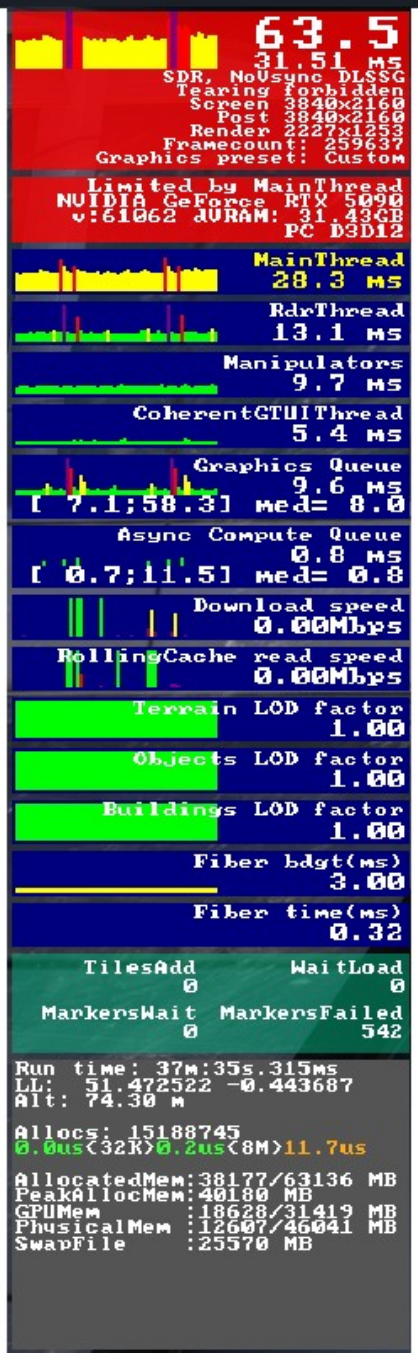

Figure 1. Default-aircraft, no-mods replication of the TLOD 300 / photogrammetry-on condition, using only MSFS's native Developer Mode telemetry (MainThread, Graphics Queue, MarkersFailed) rather than third-party overlay tools.

STEP 2 — TLOD DOSE-RESPONSE, POINT 1 OF 4: TLOD 50

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 50 | OLOD 200 | Photogrammetry: ON
MainThread 21.4 ms | Graphics Queue [6.5; 23.7] med 6.8
MarkersFailed: 139

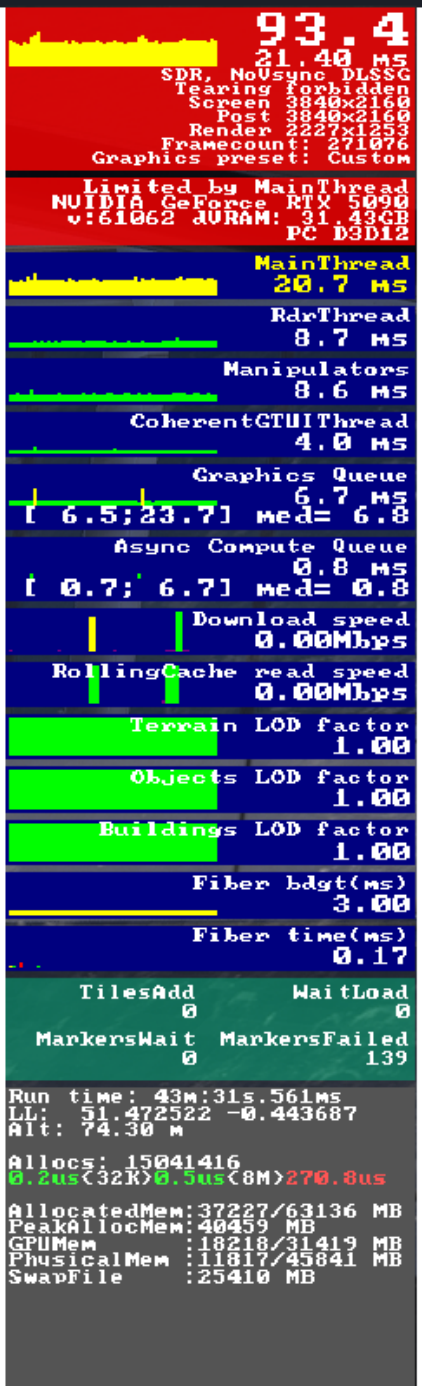

Figure 2. Terrain LOD dose-response, point 1 of 4: TLOD 50, all else unchanged.

STEP 3 — TLOD DOSE-RESPONSE, POINT 2 OF 4: TLOD 80

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 80 | OLOD 200 | Photogrammetry: ON
MainThread 21.6 ms | Graphics Queue [6.7; 33.0] med 7.1
MarkersFailed: 173

Figure 3. Terrain LOD dose-response, point 2 of 4: TLOD 80.

STEP 4 — TLOD DOSE-RESPONSE, POINT 3 OF 4: TLOD 150

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 150 | OLOD 200 | Photogrammetry: ON
MainThread 21.5 ms | Graphics Queue [7.0; 51.7] med 7.6
MarkersFailed: 258 | Download speed 2.97 Mbps (first nonzero reading)

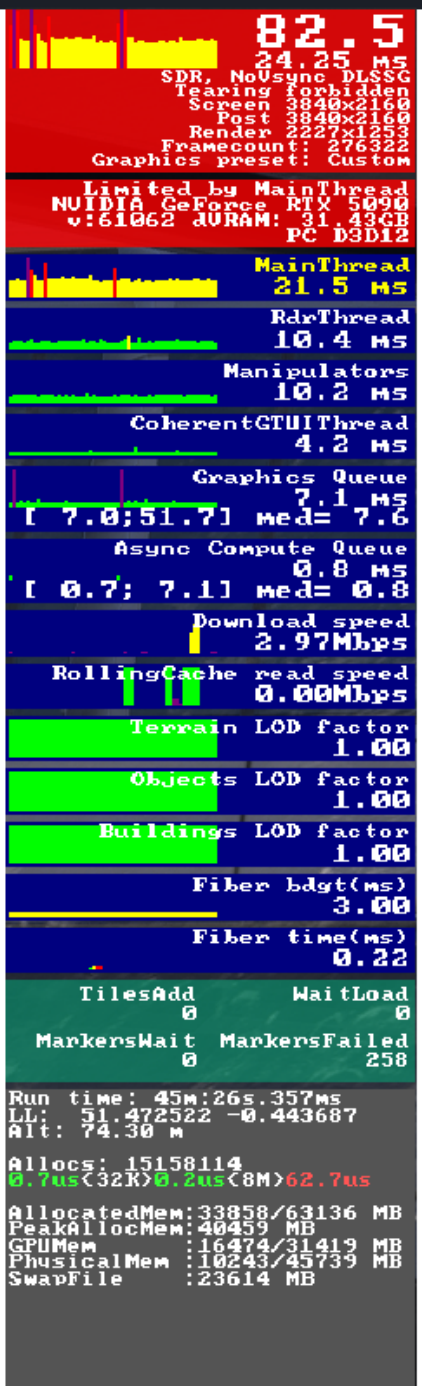

Figure 4. Terrain LOD dose-response, point 3 of 4: TLOD 150. First nonzero Download speed reading (2.97 Mbps) in this sequence.

STEP 5 — OLOD COMPARISON, RUN 1: TLOD 150 / OLOD 50

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 150 (unchanged) | OLOD LOWERED to 50 | Photogrammetry: ON
MainThread 24.4 ms | Graphics Queue [6.7; 54.0] med 7.4
MarkersFailed: 282
Compare directly with Step 4 (identical TLOD, OLOD 200)

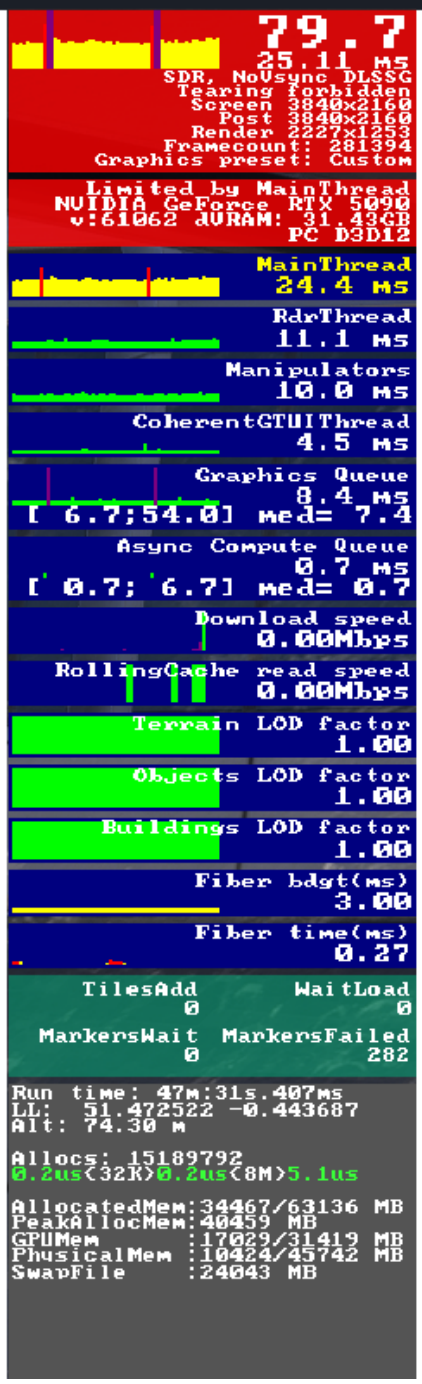

Figure 5. Object LOD comparison, run 1: TLOD held at 150, Object LOD lowered from 200 to 50. Compare directly against Figure 4.

STEP 6 — OLOD COMPARISON, RUN 2 (REPEAT): TLOD 150 / OLOD 50

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 150 | OLOD 50 | Photogrammetry: ON — repeat of Step 5 for reliability
MainThread 24.3 ms | Graphics Queue [6.7; 41.5] med 7.1
MarkersFailed: 278 | Download speed 0.82 Mbps
Result: consistent with Step 5, both runs above the OLOD-200 baseline

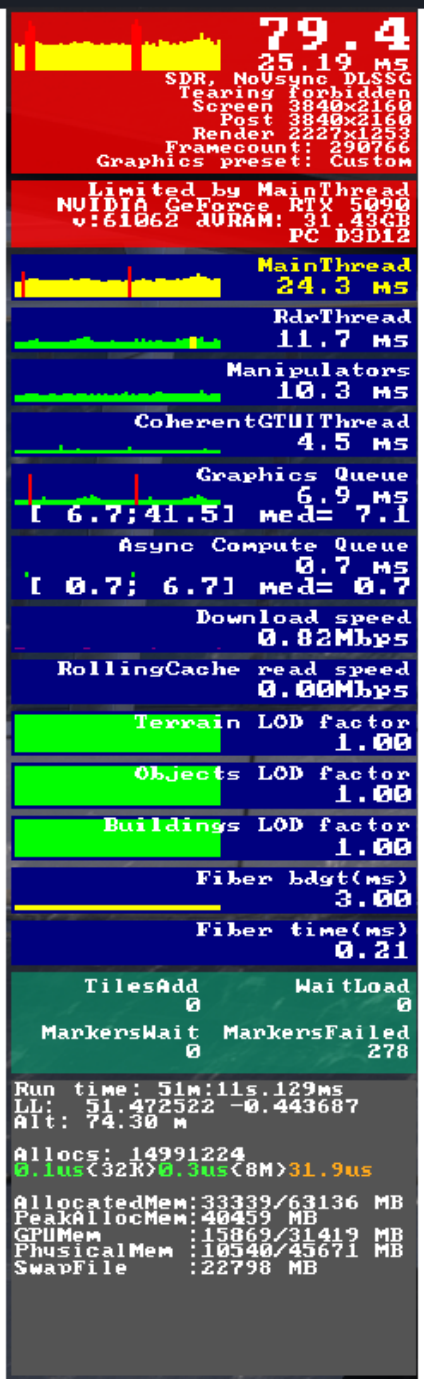

Figure 6. Object LOD comparison, run 2 (repeat of Figure 5's condition for reliability): TLOD 150, Object LOD 50. Result was consistent with Figure 5; both runs read above the Object-LOD-200 baseline on MainThread and MarkersFailed.

STEP 7 — CAMERA-MODE TEST, DRONE (HIGH ALTITUDE)

Drone/external camera | Alt 200.62 m — NOT altitude-matched to cockpit baseline
Default A320neo | iniBuilds EGLL | No mods | TLOD 150 | OLOD 50
MainThread 21.7 ms | Graphics Queue [6.6; 7.1] med 6.7 (tightest range recorded)
MarkersFailed: 289
Note: altitude differs sharply from cockpit captures (~74 m) —
see Steps 8–9 for altitude-matched retests

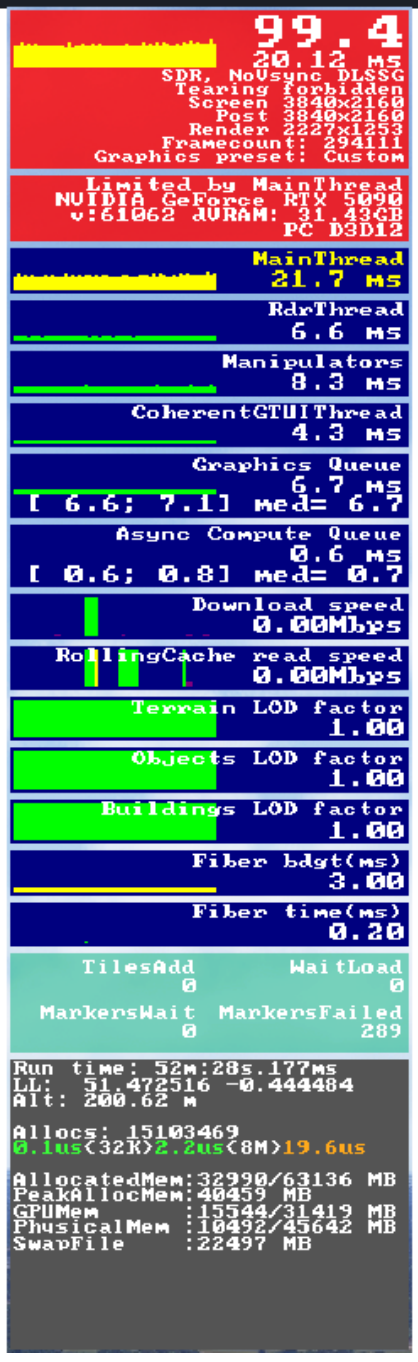

Figure 7. Camera-mode test, drone/external camera, captured at high altitude (200.62 m). Not altitude-matched to the cockpit baseline (~74 m); included to show the initial result before the altitude confound was identified and corrected for in Figures 8–9.

STEP 8 — CAMERA-MODE TEST, EXTERNAL CAM (ALTITUDE-MATCHED)

External camera | Alt 81.38 m — closely matched to cockpit baseline (74.30 m)
Default A320neo | iniBuilds EGLL | No mods | TLOD 150 | OLOD 50
MainThread 25.7 ms | Graphics Queue [7.9; 24.8] med 8.1
MarkersFailed: 289
Result: at matched altitude, MainThread and Graphics Queue are NOT calmer than cockpit — contradicts the Step 7 high-altitude reading

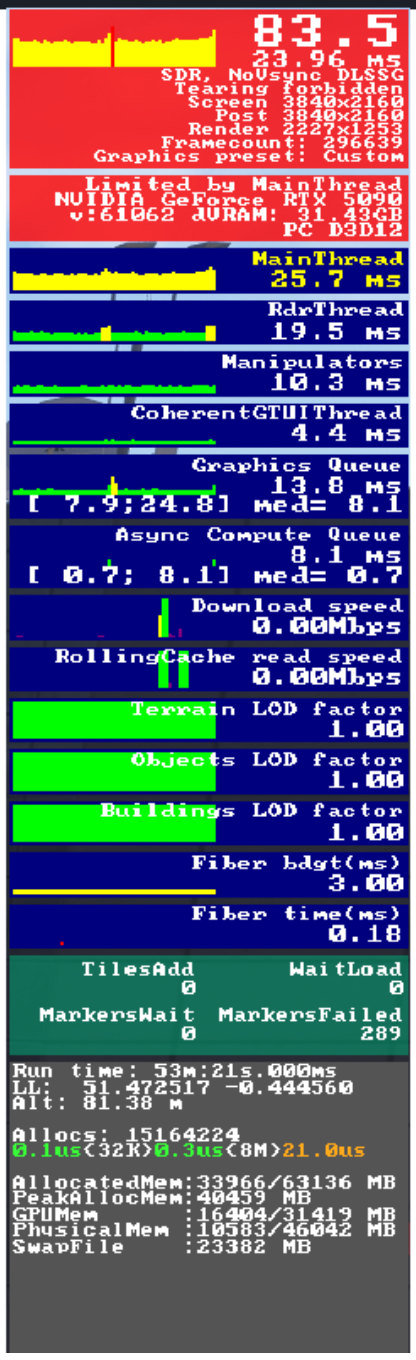

Figure 8. Camera-mode test, external camera, retaken at an altitude (81.38 m) closely matched to the cockpit baseline. At matched altitude, MainThread and Graphics Queue are not calmer than the cockpit reading, contradicting the high-altitude result in Figure 7.

STEP 9 — CAMERA-MODE TEST, DRONE RETEST (ALTITUDE-MATCHED)

Drone camera | Alt 83.34 m — closely matched to cockpit baseline (74.30 m)
Default A320neo | iniBuilds EGLL | No mods | TLOD 150 | OLOD 50
MainThread 24.4 ms | Graphics Queue [7.7; 21.4] med 8.2
MarkersFailed: 297
Result: matches cockpit baseline closely on all three metrics —
camera mode does not separate once altitude is controlled for

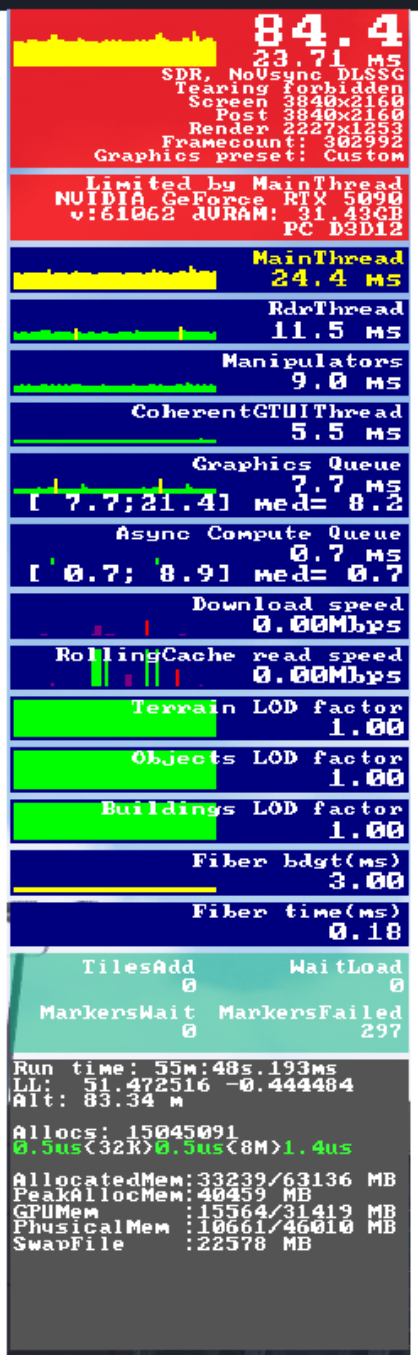

Figure 9. Camera-mode test, drone camera, retaken at matched altitude (83.34 m). Result closely tracks the cockpit baseline and the matched-altitude external-camera reading in Figure 8 on all three native metrics.

STEP 10 — PHOTOGRAMMETRY ON, TLOD 300 / OLOD 200 (REPEAT)

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 300 | OLOD 200 | Photogrammetry: ON — second run, compare with Step 1
MainThread 25.1 ms | Graphics Queue [7.2; 76.2] med 7.6 (widest ceiling recorded)
MarkersFailed: 458
Note: differs from Step 1's reading (31.5 ms / 542) despite identical settings — indicates real run-to-run variance in this telemetry

Figure 10. Photogrammetry-on repeat at TLOD 300 / Object LOD 200, for direct comparison against Figure 1 and against the photogrammetry-off condition in Figure 11. Differs from Figure 1's reading despite identical settings, indicating meaningful run-to-run variance in this telemetry.

STEP 11 — PHOTOGRAMMETRY OFF, TLOD 300 / OLOD 200 (MATCHED PAIR)

Cockpit camera | Default A320neo | iniBuilds EGLL | No mods
TLOD 300 (unchanged) | OLOD 200 (unchanged) | Photogrammetry: OFF
MainThread 25.2 ms | Graphics Queue [8.0; 8.5] med 8.1 (narrow, stable band)
MarkersFailed: 341
Result: Graphics Queue range collapses from wide/spiky (Steps 1, 10)
to tight and stable — the clearest signal in this dataset.
MainThread itself does not drop comparably; effect is concentrated
in Graphics Queue variability, not average MainThread cost

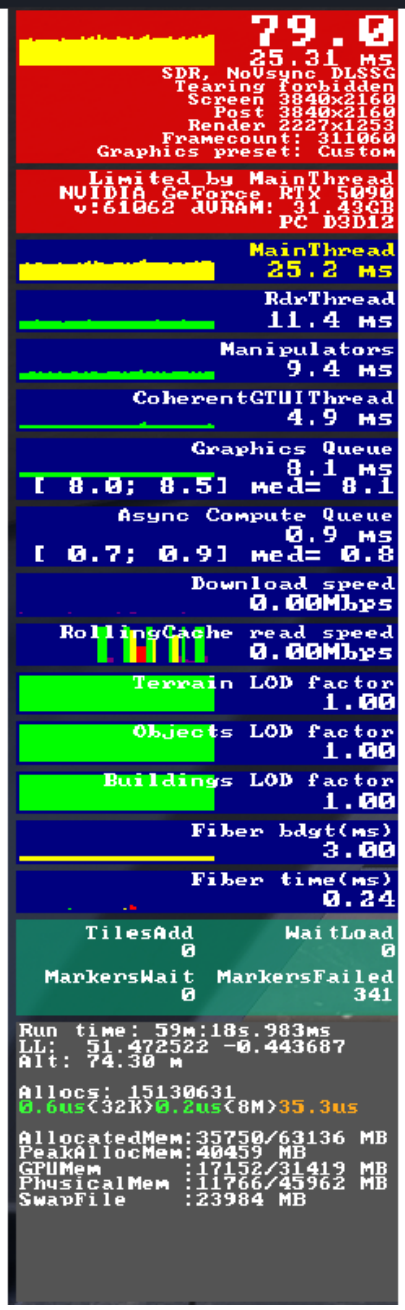

Figure 11. Photogrammetry disabled, with Terrain LOD and Object LOD held at the same values as Figures 1 and 10 (300 / 200). The Graphics Queue range collapses to a narrow, stable band, while MainThread itself does not drop by a

comparable margin — the photogrammetry effect in this native-metrics dataset is concentrated in Graphics Queue variability rather than average MainThread cost.

4. Consolidated Results Table

All values below are read directly from the in-sim Developer Mode overlay shown in the corresponding figure. No third-party tool or derived statistic is used anywhere in this table.

Fig.	TLOD	OLOD	Photogram.	Camera / Alt.	MainThread (ms)	Graphics Queue [range] med	MarkersFailed
2	50	200	On	Cockpit, 74.3 m	20.7	[6.5; 23.7] 6.8	139
3	80	200	On	Cockpit, 74.3 m	21.6	[6.7; 33.0] 7.1	173
4	150	200	On	Cockpit, 74.3 m	21.5	[7.0; 51.7] 7.6	258
1	300	200	On	Cockpit, 74.3 m	28.3	[7.1; 58.3] 8.0	542
10	300	200	On (repeat)	Cockpit, 74.3 m	25.1	[7.2; 76.2] 7.6	458
11	300	200	OFF	Cockpit, 74.3 m	25.2	[8.0; 8.5] 8.1	341
5	150	50	On	Cockpit, 74.3 m	24.4	[6.7; 54.0] 7.4	282
6	150	50	On (repeat)	Cockpit, 74.3 m	24.3	[6.7; 41.5] 7.1	278
7	150	50	On	Drone, 200.6 m	21.7	[6.6; 7.1] 6.7	289
8	150	50	On	External, 81.4 m	25.7	[7.9; 24.8] 8.1	289
9	150	50	On	Drone, 83.3 m	24.4	[7.7; 21.4] 8.2	297

Note: Figures 1 and 10 are nominally identical conditions (TLOD 300, OLOD 200, photogrammetry on) run at two different times; the spread between them (MainThread 28.3 ms vs. 25.1 ms; MarkersFailed 542 vs. 458) is included in the table as a direct illustration of this telemetry's run-to-run variance, and should be kept in mind when judging the size of any other effect in this dataset.

5. Summary of Findings

1. Terrain LOD (TLOD) and severity: across four points (TLOD 50, 80, 150, 300; Figures 2–4, 1) at fixed Object LOD (200) and photogrammetry on, both the Graphics Queue range ceiling and the MarkersFailed counter increase consistently with TLOD (MarkersFailed: 139 → 173 → 258 → 542). MainThread time is not perfectly monotonic step-to-step (it is flat between TLOD 80 and 150) but is clearly higher at the TLOD 300 endpoint than at any lower value. This is the most consistently replicated finding in this rebuild.
2. Photogrammetry on/off: at a fixed, elevated TLOD/OLOD (300/200), the Graphics Queue range collapses from wide and spiky when photogrammetry is on (Figures 1, 10: ceilings of 58.3 and 76.2 ms) to narrow and stable when it is off (Figure 11: 8.0–8.5 ms). This is a real and repeatable signal. However, MainThread time itself does not show a

correspondingly large drop (25.1–28.3 ms with photogrammetry on vs. 25.2 ms off — statistically indistinguishable from one of the two ‘on’ readings), and MarkersFailed drops only moderately (542/458 on vs. 341 off), not collapsing to a low baseline. The conclusion supported by this native-metrics dataset is narrower than originally reported: photogrammetry produces markedly more erratic Graphics Queue behavior, consistent with periodic rendering-queue stalls, without a correspondingly dramatic shift in average MainThread cost.

3. Object LOD (OLOD): contrary to the earlier round of testing, lowering OLOD from 200 to 50 at a fixed TLOD (150) was tested twice in this rebuild (Figures 5–6) and both runs showed mildly higher MainThread time (24.4 ms and 24.3 ms vs. 21.5 ms at OLOD 200) and higher MarkersFailed (282 and 278 vs. 258) than the OLOD-200 baseline. The repeat run made this look like a real, small, repeatable effect rather than noise — the opposite direction and conclusion from the earlier report's ‘OLOD eliminated as a contributing factor.’ The effect size is modest, and this report treats it as an open finding warranting further repetition rather than a settled conclusion in either direction.
4. Camera mode: the first drone-camera test (Figure 7) showed a dramatically calmer Graphics Queue (range 6.6–7.1 ms) than the cockpit baseline, but was captured at a much higher altitude (200.6 m) than the cockpit runs (~74 m), an unintended confound. Two follow-up tests at altitude closely matched to the cockpit baseline — one external-camera (Figure 8, 81.4 m) and one drone-camera (Figure 9, 83.3 m) — both showed MainThread and Graphics Queue behavior broadly similar to, and in one case noisier than, the cockpit reading at the same settings. This contradicts the earlier report's conclusion that camera mode alone gates the effect. The altitude-matched evidence in this rebuild instead points toward altitude or proximity to dense scenery/terrain as a more likely explanatory variable than camera type specifically, though this has not yet been isolated with a dedicated altitude-only test.
5. MarkersFailed as a metric: across every condition in this rebuild, MarkersFailed tracks total TLOD/photogrammetry load reasonably well (rising with TLOD, falling moderately with photogrammetry off) but is not camera-mode-sensitive (289 / 289 / 297 across the three camera-mode tests, despite Graphics Queue varying considerably between them). This suggests MarkersFailed reflects ongoing streaming/marker-resolution workload independent of which camera is currently rendering, rather than being a downstream symptom of the rendering-side stutter itself.
6. Run-to-run variance: the two notionally identical TLOD-300/OLOD-200/photogrammetry-on captures (Figures 1 and 10) differ by 3.2 ms on MainThread and 84 on MarkersFailed despite no settings changes between them. Any single-run comparison in this dataset, and in the earlier round of testing, should be read with this baseline variance in mind.

6. Notes on Authenticity and Verification

This section is included specifically to help an engineering reviewer assess the reliability of this report quickly:

- Every figure in this version is a direct, unedited capture of MSFS 2024's own in-sim Developer Mode overlay (Options → General → Developer Tools). No third-party overlay, frame-capture tool, or companion utility appears anywhere in this dataset.
- Each overlay capture includes the build/version string, GPU driver version, live run-time counter, and exact aircraft altitude (visible in the ‘Alt:’ field) — none of these were edited or cropped out, and the altitude field in particular is what allowed the camera-mode altitude confound (Figure 7 vs. Figures 8–9) to be identified and corrected within this same rebuild rather than going unnoticed.
- Object LOD (Figures 5–6) and camera mode at matched altitude (Figures 8–9) were each deliberately repeated, rather than concluded from a single run, specifically to check whether an initial result was reliable before it was reported as a finding.
- Where a repeat run produced a different picture from the original round of testing (Object LOD, camera mode) or a narrower picture than first reported (photogrammetry's effect on MainThread specifically), this document states that directly in Section 5 rather than carrying the earlier, third-party-tool-based conclusion forward unchanged.

This investigation was conducted entirely through user-accessible settings and MSFS 2024's own built-in Developer Mode tools. No engine modification, memory editing, or unauthorized tooling was used at any point.