

Twelve months of safety-parameter changes in ArduPilot, and what a drone integrator had to review

If you ship a drone built on ArduPilot, every rebase on upstream pulls in changes to the parameters your safety case depends on: geofence, failsafes, return-to-launch, arming checks, remote ID, speed limits. We scanned one year of ArduPilot master to see how often that happens.

531

commits touched the scanned safety areas

16

changed the definition of a safety-relevant parameter

42

parameters affected (16 renamed or re-scaled)

9

commits change how a configuration is written

Window: 2025-09-28 to 2026-09-28, ArduPilot `master`, commits by merge date. Scanned areas: `AC_Fence`, `AP_BattMonitor`, `AP_Arming`, `AP_OpenDronelD`, `AP_AdvancedFailsafe`, `AP_Parachute`, `AC_WPNav`, `AC_Avoidance`, and the failsafe, RTL and fence parameters of ArduCopter, ArduPlane and Rover.

What stands out

Units changed, and names with them. Multicopter return-to-launch, waypoint, loiter and avoidance parameters moved from centimetres and centidegrees to metres and degrees, and were renamed on the way: `RTL_ALT` (cm) became `RTL_ALT_M` (m), `WPNAV_SPEED` (cm/s) became `WPNAV_SPD` (m/s), `AVOID_ANGLE_MAX` (cdeg) became `AVOID_ANG_MAX` (deg). Each of these commits ships an automatic conversion of stored values, prepared for ArduPilot 4.7. What does not convert itself: a parameter file, a production-line script or a technical document that still uses the old name or unit.

One bitmask changed meaning. `ARMING_CHECK` (checks to run) was replaced by `ARMING_SKIPCHK` (checks to skip). The commit includes a conversion and explains the rationale: skipping one check no longer disables the others, and new checks are enabled by default. For an integrator this changes what "our pre-arm configuration" means on paper.

The altitude fence gained an explicit reference frame. New parameters `FENCE_ALT_MAX_TP` and `FENCE_ALT_MIN_TP` set whether the altitude limits are measured above home, above sea level, above the EKF origin or above terrain (default: above home). The 120 m height limit of an EU class C1 or C2 drone is typically implemented with this fence, so the new setting belongs in the integrator's configuration and documentation.

None of this is a defect in ArduPilot. The changes are documented, reviewed, and in several cases shipped with automatic conversions. The point is the other side: every one of them lands on a manufacturer who has to decide, with evidence, whether its certified configuration and technical file still hold.

Where the changes landed

Commits per area: Return to launch **4** · Speed limits **3** · Failsafe (RC / GCS / EKF) **2** · Geofence **2** · Flight termination **1** · Remote ID **1** · Arming checks **1** · Battery failsafe **1** · Obstacle avoidance **1**.

Appendix A. Every change, commit by commit

"Changes the configuration": a parameter was added, removed, renamed, re-scaled or given a new default. "Metadata only": documented ranges, values or labels changed; these guide ground-station editors but are not enforced by the firmware.

DATE · COMMIT	CHANGE	EFFECT
2025-10-22 2a1bee26f	RETURN TO LAUNCH · COPTER copter: pasram docs: fix range on `RTL_CONE_SLOPE` RTL_CONE_SLOPE documented range: 0.5 10.0 → 0 10.0	Metadata only
2025-10-23 9ff7b9c34	FAILSAFE (RC / GCS / EKF) · COPTER global: add Range to EKF failsafe param doc - FS_EKF_THRESH documented range: none → 0.0 1.0 - FS_EKF_THRESH documented values: 0.6:Strict, 0.8:Default, 1.0:Relaxed → 0:Disabled, 0.6:Strict, 0.8:Default, 1.0:Relaxed - FS_EKF_THRESH documented range: none → 0.6 1.0	Metadata only
2025-10-23 27f6e9f20	FLIGHT TERMINATION global: add Range to pin number param doc - AFS_HB_PIN documented range: none → -1 127 - AFS_TERM_PIN documented range: none → -1 127	Metadata only
2025-11-22 f29b062e4	REMOTE ID AP_OpenDroneID: rename EnforceArming to EnforcePreArmChecks (NFC) DID_OPTIONS documented bitmask: 0:EnforceArming, 1:AllowNonGPSPosition, 2:LockUASIDOnFirs... → 0:EnforcePreArmChecks, 1:AllowNonGPSPosition, 2:LockUASID...	Metadata only
2025-12-04 436047600	ARMING CHECKS AP_Arming: turn ARMING_CHECK into ARMING_SKIPCHK ARMING_CHECK (default 1) → ARMING_SKIPCHK (default 0) RENAMED	Changes the configuration
2026-01-13 6f0033af0	FAILSAFE (RC / GCS / EKF) · COPTER ArduCopter: fix spelling in FS_EKF_ACTION FS_EKF_ACTION documented values: 0:Report only, 1:Switch to Land mode if current mode requ... → 0:Report only, 1:Switch to Land mode if current mode requ...	Metadata only
2026-01-23 5e32cdfc	RETURN TO LAUNCH · COPTER Copter: RTL params moved to class and use meters - RTL_ALT (cm, range 30–300000, default 1500) → RTL_ALT_M (m, range 0.30–3000, default 15) RENAMED AND RE-SCALED - RTL_ALT_FINAL (cm, range 0–1000, default 0) → RTL_ALT_FINAL_M (m, range 0–10, default 0) RENAMED AND RE-SCALED - RTL_CLIMB_MIN (cm, range 0–3000, default 0) → RTL_CLIMB_MIN_M (m, range 0–30, default 0) RENAMED AND RE-SCALED - RTL_SPEED (cm/s, range 0–2000, default 0) → RTL_SPEED_MS (m/s, range 0–20, default 0) RENAMED AND RE-SCALED	Changes the configuration
2026-01-26 9064927ed	BATTERY FAILSAFE AP_BattMonitor: change "None" failsafe action to "Warn only"	Metadata only

DATE COMMIT	CHANGE	EFFECT
	<code>BATT_FS_CRT_ACT</code> documented values: {Copter}0:None,1:Land,2:RTL,3:SmartRTL or RTL,4:SmartRTL ... → {Copter}0:Warn only,1:Land,2:RTL,3:SmartRTL or RTL,4:Smar... <code>BATT_FS_LOW_ACT</code> documented values: {Copter}0:None,1:Land,2:RTL,3:SmartRTL or RTL,4:SmartRTL ... → {Copter}0:Warn only,1:Land,2:RTL,3:SmartRTL or RTL,4:Smar...	
2026-02-02 262876c60	SPEED LIMITS AC_Loiter: re-scale parameters to meters <code>LOIT_ACC_MAX</code> (cm/s/s, range 100–981, default 500) → <code>LOIT_ACC_MAX_M</code> (m/s/s, range 1–9.81, default 5) RENAMED AND RE-SCALED <code>LOIT_BRK_ACCEL</code> (cm/s/s, range 25–250, default 250) → <code>LOIT_BRK_ACC_M</code> (m/s/s, range 0.25–2.5, default 2.5) RENAMED AND RE-SCALED <code>LOIT_SPEED</code> (cm/s, range 20–3500, default 1250) → <code>LOIT_SPEED_MS</code> (m/s, range 0.20–35, default 12.5) RENAMED AND RE-SCALED	Changes the configuration
2026-02-12 936baff2e	SPEED LIMITS AC_WPNav: moved tradHeli default Loiter params and added condition for Trad Heli defaults <code>LOIT_BRK_ACC_M</code> default now depends on the build (conditional <code>#if</code>): 1.25 or 2.5; before, 2.5 in this file <code>LOIT_SPEED_MS</code> default now depends on the build (conditional <code>#if</code>): 30 or 12.5; before, 12.5 in this file	Changes the configuration
2026-02-24 6991d8e30	SPEED LIMITS AC_WPNav: convert params to meters <code>WPNAV_ACCEL</code> (cm/s/s, range 50–500, default 250) → <code>WPNAV_ACC</code> (m/s/s, range 0.50–5.00, default 2.5) RENAMED AND RE-SCALED <code>WPNAV_ACCEL_C</code> (cm/s/s, range 0–500, default 0) → <code>WPNAV_ACC_CNR</code> (m/s/s, range 0–5.00, default 0) RENAMED AND RE-SCALED <code>WPNAV_ACCEL_Z</code> (cm/s/s, range 50–500, default 100) → <code>WPNAV_ACC_Z</code> (m/s/s, range 0.50–5.00, default 1) RENAMED AND RE-SCALED <code>WPNAV_SPEED</code> (cm/s, range 10–2000, default 1000) → <code>WPNAV_SPD</code> (m/s, range 0.10–20.00, default 10) RENAMED AND RE-SCALED <code>WPNAV_SPEED_DN</code> (cm/s, range 10–500, default 150) → <code>WPNAV_SPD_DN</code> (m/s, range 0.10–10.00, default 1.5) RENAMED AND RE-SCALED <code>WPNAV_SPEED_UP</code> (cm/s, range 10–1000, default 250) → <code>WPNAV_SPD_UP</code> (m/s, range 0.10–10.00, default 2.5) RENAMED AND RE-SCALED	Changes the configuration
2026-03-04 6eda48015	OBSTACLE AVOIDANCE AC_Avoid: ANGLE_MAX converted to ANG_MAX <code>AVOID_ANGLE_MAX</code> (cdeg, range 0–4500, default 1000) → <code>AVOID_ANG_MAX</code> (deg, range 0–45, default 10) RENAMED AND RE-SCALED	Changes the configuration
2026-03-24 bd4e7e299	GEOFENCE AC_Fence: added FENCE_ALT_TYPE <code>FENCE_ALT_FRAME</code> added (default Location::AltFrame::ABOVE_HOME)	Changes the configuration
2026-03-24 fe483aa8a	GEOFENCE AC_Fence: specify alt frame for min and max fences separately	Changes the configuration

DATE COMMIT	CHANGE	EFFECT
	- FENCE_ALT_FRAME (default Location::AltFrame::ABOVE_HOME) → FENCE_ALT_MAX_TP (default Location::AltFrame::ABOVE_HOME) RENAMED - FENCE_ALT_MIN_TP added (default Location::AltFrame::ABOVE_HOME)	
2026-08-03 9ec17d025	RETURN TO LAUNCH · COPTER Copter: RTL_CONE_SLOPE param desc gets angles RTL_CONE_SLOPE documented values: 0:Disabled,1:Shallow,3:Steep → 0:Disabled,1:Shallow (45deg),3:Steep (72deg)	Metadata only
2026-09-08 a1f32da0b	RETURN TO LAUNCH · PLANE Plane: Quadplane: add a loiter stage in VTOL land approach with a loiter time of `Q_RTL_PAUSE_TIME` Q_RTL_PAUSE_TIME added (s, range 0–10, default 0)	Changes the configuration

Method

For every commit in the window that touched the scanned areas, we parsed the parameter definitions before and after the commit (`@Param` blocks and their registration) and compared the default value, documented range, values, bitmask and units, resolving `#define` constants and enumerations to their numeric values. Parameters that appear or disappear are reported as added or removed; a removal and an addition in the same commit with similar names are shown as a rename. The scan is deterministic: every line of Appendix A links to the commit that proves it.

Limits. This scan covers parameter definitions only. It does not see behavioural changes in code that do not touch a parameter, such as a new condition in a failsafe routine; that is what the second pass with a rule document is for. Scope is limited to the areas listed above. Nothing in this report is a legal assessment of any product.

TraceGuard checks every firmware change against a manufacturer's own safety rules, inside its own CI. Diego Macías Vega · diego.macias@traceguard.eu · traceguard.eu
 Data: [ardupilot-safety-parameter-changes.csv](#). Source: github.com/ArduPilot/ardupilot (GPLv3), master at [a11f7351a9bcd860cbdb55bbeb17a5196536ba23](#).