Poppy — Engineering Investigation Update

For Blue Robotics Technical Support | 12 October 2026

Scope: observations, logged tests and unresolved questions concerning EKF Bad, degraded handling and disarm events. Hardware-fault theories and proposed component causes are deliberately excluded; the owner will submit these separately.

1. Summary of reported behaviour

Poppy is an eight-thruster ROV operating ArduSub with a Blue Robotics Navigator and Raspberry Pi 4. A second nominally similar ROV, Rachael, is available for comparison. Poppy has experienced intermittent EKF Bad warnings, episodes of sluggish handling and disarms. Some earlier disarms may have been failsafe-related; failsafe settings were subsequently changed. It is not established that the more recent disarm had the same cause.

The first dive on 5 October 2026 was reported to be flawless, whereas a subsequent dive was problematic. This intermittent pattern is a central question. The precise correspondence between those dives and the available BIN filenames has not been verified.

The operator flies in stabilised modes, particularly Depth Hold, and does not normally fly in Manual mode. Consequently, no subjective Manual-mode comparison is available.

2. Records reviewed and limitations

The investigation has considered DataFlash BIN26, BIN27, BIN41–45 and BIN47–50, alongside previously reported findings from BIN34 and BIN35. A ZIP archive of dated MAVLink telemetry covers July–September 2026 and therefore cannot by itself date or identify the 5 October dives. Event, ARM, RCIN, RCOU, ATT, CTUN, BAT and magnetic-sensor records have been examined in earlier analytical passes.

Some intermediate extracted files were incomplete, and several earlier event-count summaries required correction. Original binary logs should be treated as authoritative. The findings below are observations or exploratory calculations, not an independently validated manufacturer analysis.

3. Recorded events

Log	Observation	Interpretive limit
BIN26	EKF Bad at 9538.724 s; disarm at 9555.659 s (16.935 s later). Also an earlier disarm at 2302.338 s.	Temporal association only; not evidence that EKF caused disarm.
BIN27	EKF Bad at 6488.611 s; disarm at 6504.596 s (15.985 s later).	Similar timing; command origin unknown.
BIN41	Disarm at 9474.614 s; re-arm at 9476.034 s; disarm at 9477.214 s.	Short re-arm/disarm sequence; intent and trigger unverified.
BIN43	Multiple EKF Bad messages; magnetic-sensor discrepancies reported in earlier analysis.	Requires manufacturer review of raw measurements.
BIN44	Three literal EKF Bad occurrences reported in direct raw-message count.	Intermediate JSON extraction was truncated.
BIN49	EKF Bad at 5757.048 s; disarm at 5772.533 s (15.485 s later); ~34.69 A near disarm; repeated GCS heartbeat-loss messages.	Electrical load is context, not a demonstrated cause.
BIN50	Repeated GCS failsafe activity followed by disarm; not the same immediate EKF-warning sequence.	Indicates a different event pattern.

Disarm ARM records in several cases have been interpreted as consistent with MAVLink-commanded disarming. This does not establish who issued the command or whether it was intentional, automatic or related to an EKF warning. The applicable failsafe parameters at each incident need to be checked against contemporaneous parameter snapshots.

4. Attitude and control analysis

Early whole-record comparisons produced very large desired-versus-measured yaw discrepancies in BIN42. Further analysis showed that these were concentrated in mode 19 intervals, where that comparison is not an appropriate measure of stabilised heading control. In the BIN42 Depth Hold interval, median yaw error was approximately 1.67° and the 95th percentile approximately 5.86°. These results should not be represented as evidence of sustained yaw-control failure during the dive.

Selected Depth Hold recordings showed active motor outputs, without evidence of widespread sustained PWM saturation under a provisional 1120–1880 μs screening threshold. However, PWM commands do not directly measure thrust, horizontal speed or perceived responsiveness. The reported sluggishness has not been explained or precisely aligned to the onset of EKF warnings.

5. Magnetic / estimator observations

Earlier investigation of BIN34 found EKF magnetic rejection during a period when the two magnetometers were reportedly in close agreement (field magnitudes approximately 501.7 and 501.1 mG; vector directions approximately 1.8° apart). Earlier investigation of BIN35 found episodes of more substantial disagreement, including at low current. These contrasting cases warrant review of the actual estimator innovations, compass selection and sensor status.

A later raw-MAG comparison of BIN42–45 reported that BIN43 had greater disagreement between its two magnetic sensor streams than the other selected recordings. Some BIN43 EKF-warning windows exhibited large differences in

measured magnetic-field magnitude. These results identify measurements worth investigating, but do not by themselves establish the cause or any defective component.

6. Outstanding questions for Blue Robotics

1. Can Blue Robotics review the EKF Bad episodes and explain the exact estimator health criterion being failed, including innovation tests and compass-instance switching?
2. What explains the contrasting BIN34 and BIN35 behaviour: EKF rejection despite close magnetometer agreement in one case, versus substantial disagreement in another?
3. Which existing DataFlash fields and diagnostic messages best identify the onset of estimator degradation, sensor health changes and yaw realignment?
4. Can the 15–17 second intervals between EKF Bad and disarm in BIN26, BIN27 and BIN49 be explained by expected operator/system behaviour, or do the logs suggest a common automatic sequence?
5. How can the originating MAVLink system/component for disarm commands be captured conclusively, and how should these be distinguished from configured failsafe actions?
6. Which additional logging or parameter snapshots should be collected to determine why one 5 October dive was normal and the next was not?
7. How should RCIN, RCOU, attitude targets, controller outputs and estimator status be correlated to distinguish subjective sluggishness from a genuine change in commanded response?
8. Are there specific ArduSub/Navigator firmware diagnostics or known issues relevant to repeated EKF Bad indications across the firmware versions represented by the supplied logs?

7. Suggested evidence package and next analytical step

Provide original DataFlash files, the corresponding telemetry where available, full parameter exports and exact firmware/build information. In particular, identify the two 5 October dives by reliable timestamp or operator record. Blue Robotics is asked to review the 60 seconds preceding and 30 seconds following selected EKF Bad events, with the magnetic sensor streams, EKF innovations, compass selection, attitude, RCIN/RCOU and event messages time-aligned.

The owner will provide separate comments on possible causes and hardware-related hypotheses. This document intentionally makes no recommendation to replace or test any particular component.

8. Addendum — physical peripheral isolation tests

This section records physical tests already undertaken, omitted from the earlier 12 October evidence-only update. The tests concern the intermittent InvalidCRC messages observed in Poppy's BlueOS/ArduPilot communications. They must not be treated as proof that the CRC messages caused EKF Bad, sluggish handling or disarming.

8.1 Isolation sequence — 10 October 2026

- The DWE exploreHD USB camera was disconnected.
- The Ping360 sonar was disconnected.
- The Blue Robotics 4K camera was disconnected.
- The Cerulean Tracker 650 Gen2 was disconnected.
- The Raspberry Pi 4, Navigator and core BlueOS/ArduPilot system remained operational for the isolation observation.

With all four peripherals disconnected, 15 new InvalidCRC errors were observed from 11:58:49 to 12:12:20 UTC. A later count reached 26 by 12:15:30 UTC. The persistence of these errors demonstrates that none of those connected peripherals is individually necessary for the observed InvalidCRC condition in that test configuration. It does not establish the source of the erroneous packets or their relationship to underwater handling.

8.2 Cockpit connection comparison

During a separate observation on 10 October, Cockpit was connected from approximately 10:20:04 to 10:25:25 and then closed from approximately 10:26:45 to 10:32:23. No new InvalidCRC errors were observed in either window. Because the errors were intermittent, these two negative windows do not establish that Cockpit has no involvement; equally, they do not demonstrate that Cockpit is the trigger.

Earlier examination associated recurring InvalidCRC reports with traffic attributed to the ArduPilot/Navigator process (PID 537 in that observation), involving loopback UDP 127.0.0.1:56618 → 127.0.0.1:8852. This is a software/traffic observation rather than proof of a defective hardware component. The specific packet path and message parser should be reviewed by Blue Robotics against the relevant BlueOS/ArduPilot build.

8.3 Scope of inference

The isolation exercise investigated InvalidCRC communications errors. It was not a controlled submerged trial reproducing EKF Bad or sluggish handling with each peripheral removed. It therefore narrows the requirements for the CRC symptom but does not, on its own, isolate the EKF fault.

9. Rachael — comparison vehicle and control evidence

Rachael is the owner's nominally equivalent second ROV and serves as the control vehicle. Historical Rachael telemetry from May 2025 was reviewed alongside Poppy's recordings. The comparison is observational rather than a simultaneous, identical-load A/B test.

The reviewed Rachael sessions contain ExternalNav aiding stop/start behaviour, compass degradation or switching, and yaw realignment without the same literal EKF Bad pattern seen in Poppy's reviewed events. In one reviewed 10 May session, 14 compass switches were noted without a literal EKF Bad warning. Rachael has also been observed to display an incorrect compass heading while physically continuing in a straight line. These observations demonstrate that compass switching, displayed heading discrepancies and aiding transitions should not automatically be equated with physical loss of control or an EKF Bad warning.

The available comparison does not establish that Rachael is immune to all of Poppy's symptoms. Nor has a matching physical peripheral-disconnection test on Rachael been confirmed in the evidence reviewed for this addendum. No such test result is asserted here.

10. Additional navigation and payload controls already performed

The Cerulean Tracker 650 DVL was physically absent from Poppy from 2 July until 4 August 2026. Early ArduSub 4.5.7 logs therefore cannot be treated as like-for-like submerged controls for later DVL-assisted dives. On 26 August, a 4.5.7 surface/bench telemetry session with DVL fitted did show odometry fusion and relative aiding; it was not an operational submerged control.

The 5 October BIN41–45 operational series was conducted on ArduSub 4.5.7. BIN41 was the good operational dive; BIN43 captured the later poor/delayed response episode with repeated EKF Bad indications. BIN44 and BIN45 covered comparable routes with differing geolocation treatment, without reproducing BIN43's sustained fault. The DWE Explore3D/SVC Pro and AquaLUX Max strobes were fitted and operating throughout BIN41–45, with an independent battery and a 4UTP connection to Poppy. Similar EKF anomalies had occurred during earlier granite-quarry dives without this payload, so its presence was not necessary for the historical fault.

The prior controlled geographical-origin tests also established different origin-restoration behaviour between ArduSub 4.5.7 and the 4.7.x builds. The BIN44/BIN45 comparison showed that an incorrect recorded origin was not, by itself, sufficient to reproduce sustained EKF Bad. This observation should remain distinct from the separate magnetic/yaw investigation.

11. Further factual questions for Blue Robotics

9. What does the InvalidCRC diagnostic specifically mean in this BlueOS/ArduPilot build, and which parser and packet source produced the reports on the local UDP path?
10. Can Blue Robotics identify which core processes remain capable of generating the observed errors after the exploreHD, Ping360, 4K camera and Tracker 650 were disconnected?
11. Which logs or packet captures would establish whether InvalidCRC events are independent of, precede, or coincide with EKF Bad, delayed control response or disarming?
12. Can Blue Robotics review Poppy and Rachael using matched firmware, parameters, sensor status and operational conditions, while accounting for the historical difference in dates and payloads?

Evidence boundary: This report deliberately excludes the owner's separate hypotheses concerning particular hardware faults or replacements. It documents observations, tests already carried out, limitations and engineering questions only.