

# Post-Actuation Verification

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## What Post-Actuation Verification Specifies

After an actuator command commits, the verification stage observes the sensed effect through whatever readback channels are available (encoder feedback, sensor response, environmental observation, downstream telemetry). The predicted effect comes from the planning and control models that produced the command.

The discrepancy classifier produces one of: nominal (sensed matches predicted within expected envelope), expected-noise (discrepancy within sensor and environmental noise floors), anomaly (discrepancy exceeds noise but doesn't match a known fault or adversarial pattern), fault (discrepancy matches a known fault signature), adversarial-interference (discrepancy matches an adversarial-attribution pattern). Each classification is a credentialed observation that propagates through the mesh.

## Why Actuation Should Not Terminate at Commit

Current autonomous architectures typically treat actuator commit as terminal. The command is sent, the actuator responds, the planning loop proceeds. Sensor feedback flows into the next planning cycle but isn't architecturally tied to the previous actuation as verification.

This produces structural blindness to failure modes that depend on actuation-effect mismatches. An actuator that drifts from its command, a control loop that introduces

delay, an adversarial intervention that displaces the effect — all produce sensed-vs-predicted discrepancies that the architecture has no first-class concept for.

## **How Verification Composes With Mode Selection**

Verification runs after every commit regardless of mode. In full mode, verification confirms the action proceeded as predicted. In partial mode, verification confirms the partial commit produced the expected partial effect. In stage-gated mode, verification at each stage gates progression to the next.

Discrepancy classification feeds back into the next admissibility evaluation. A unit producing anomalies receives reduced confidence weighting in subsequent computations. A unit producing adversarial-interference classifications triggers cross-system alerts.

## **What This Enables for Cross-System Coordination**

When verification observations propagate through the mesh, downstream consumers gain awareness of upstream actuation reality. A vehicle whose lane-change actuation produced an anomaly broadcasts the anomaly; following vehicles modulate their response accordingly.

Forensic reconstruction becomes structurally tractable. The lineage of any incident includes the sensed-vs-predicted discrepancies of every actuation in the moments before, with classifications and supporting computation.

