DOCUMENT 05 / PROPOSED TESTS

Next-stage verification plan

Repeatable tests for navigation, control authority, sensor faults and model fidelity

Scene revision 9 | Planned - not executed | 23 Sep 2026 UTC

Test method

For each test, save the exact scene revision and environment settings, reset to the same authored start state, run bounded simulated-time segments, record the complete MCU telemetry and Simulation Log, and rewind exactly. Report repetitions, not just the best run. The acceptance criteria below are proposed engineering gates and are not results from the current scene.

Nominal and robustness matrix

ID	Test	Proposed pass criterion / evidence
V01	Nominal three-point mission, ≥10 independent runs	All flags reach 1/1/1; each arrival within 0.3 m, speed <0.12 m/s, height error <0.2 m; no contact or invalid-state log.
V02	Initial position and heading variations	Repeat V01 from documented offsets and headings; record settling and route error.
V03	Crosswind / lateral force disturbance	Document maximum recoverable force and return time; no sustained attitude loss or collision.
V04	Mass and center-of-mass sensitivity	Sweep realistic payload mass and offsets; identify saturation, instability and loss of hover margin.
V05	Waypoint geometry and tolerance	Sweep point spacing and arrival thresholds; confirm no premature completion or persistent hover outside threshold.

Fault and resource matrix

ID	Test	Proposed pass criterion / evidence
V06	GPS fix loss, noise, bias and latency	No uncontrolled horizontal command during invalid fix; quantify drift and reacquisition behavior.
V07	IMU bias, noise and dropout	Stable fail behavior; no unbounded trim output or excessive tilt. Define safe-mode command.
V08	Altimeter dropout and wrong return	Bounded transition to GPS-only height estimate; no ground contact or large altitude transient.
V09	Single side or trim thruster failed/off	Detect loss of control authority; halt mission or enter defined safe mode.
V10	Fuel depletion and actuator saturation	Log remaining fuel and saturation; define an abort before lift margin is lost.
V11	Yaw disturbance	Measure drift and prove need for yaw actuation or a justified yaw-free operating envelope.

Model and physical-design gates

Gate	Required work	Deliverable
G1	Capture gravity, drag, residual linear/angular damping, contact and device collision settings	Versioned environment record and fidelity register
G2	Replace idealized 30,000 m/s cold-air exhaust assumption with component data	Pressure/mass-flow/impulse/tank sizing and sensitivity study
G3	Reconcile modeled mass, apparent hover force and full thrust vectors	Independent free-body model and force-budget review
G4	Engineer structure, mounts, wiring, pressure system, electrical supply and failure response	Hardware safety and integration review before fabrication

Minimum evidence package per run

- Scene revision/hash, environment settings, controller version, initial state, test inputs and deterministic run identifier.
- Time series of GPS, IMU, altimeter, target error, body velocity, orientation, each throttle, fuel state and reached flags.
- Simulation Log warnings, contacts and errors; summary metrics including closest approach, dwell, peak attitude, peak speed and command saturation.
- Observed result, pass/fail against the predeclared criterion, anomalies and a saved exact rewind check.

The V01 nominal test is partially informed by one completed 50 s run; the required repetitions and V02-V11 have not been carried out.

Mandatory simulation notices

The following notices were supplied for this documentation set. They apply to every result, figure, design statement and proposed test in this PDF.

Simulation results may differ from real-world conditions and outcomes. Verify critical results independently.

Exploratory simulation only. PrototypeX scenes and charts are not engineering blueprints, measurements of real hardware, safety analyses or certifications. Results are generated from the current scene, numerical models and assumptions; material properties, construction differences, tolerances and omitted physics can produce materially different real-world behavior.

Motion-loss assumptions: Environment → Advanced Physics sets residual linear and angular damping for all dynamic bodies. A nonzero rate is a simplified, user-selected loss, not a value inferred from gravity, vacuum, atmosphere, water or a particular bearing; it may double-count separately modelled drag or friction. Setting it to 0 removes only that artificial loss, not contacts, fluids, bearing friction or numerical solver error, and does not guarantee perfect momentum or energy conservation. Older scenes keep their former rates until changed. See Environment settings and the Fidelity register.

PrototypeX models kinematics, mass properties, selected aerodynamic and buoyant forces, and control logic. It does not model material strength or structural failure, fatigue, thermal behavior, electrical supply losses, manufacturing tolerances, wear or corrosion. Nothing in the simulation establishes that a physical design can carry its loads, survive its duty cycle, remain within temperature limits or be manufactured safely. Aerospace alloy presets change density only.

Hardware devices can be visually mounted where they touch or pass through the ground even when the simplified physics model does not give that device its own collider. During Play, PrototypeX reports a red **POSSIBLE HARDWARE GROUND CONTACT** message for this condition. Treat it as a clearance and likely-damage warning; PrototypeX does not simulate the resulting bent mount, broken sensor, wiring damage or other physical failure.

Reference links supplied with the notices

Environment settings: https://app.prototypestudio.invalid/reference.html#environment

Fidelity register: https://app.prototypestudio.invalid/technical-specifications.html#register