DOCUMENT 04 / FIDELITY ASSESSMENT

Simulation limitations and hardware feasibility

Assumptions, observed boundaries and work needed before physical design

Scene revision 9 | Exploratory only | 23 Sep 2026 UTC

What the run supports

- In this scene and one simulated 50 s run, GPS/IMU/altimeter feedback and independent thruster commands guided the rigid platform through all three targets.
- The reviewed run showed no hardware ground-contact message, escaped body or invalid numeric state. This is a result of this run and geometry, not a clearance certification.
- A four-corner trim arrangement stabilized roll and pitch in the run. The original five centerline thrust directions do not provide complete attitude control.

Key fidelity and hardware gaps

Area	Scene assumption or gap	Consequence / needed evidence
Cold-air performance	Thrusters use an idealized 30,000 m/s exhaust velocity to achieve rated forces with small finite fuel stores.	Not representative of ordinary compressed-air hardware. Recalculate nozzle, pressure, mass flow, tank size and impulse from real components.
Lift margin	Scene mass summary ~104.03 kg; nominal weight at 9.81 m/s² would be ~1,020 N. The final logged center lift command was ~570 N plus four trims near 70 N each.	The apparent force balance depends on model semantics and needs an independent force-budget reconciliation before hardware sizing.
Attitude authority	Four added corner trims supply roll/pitch torque; no independent yaw control.	Yaw may drift under asymmetric disturbances. Define yaw requirement and actuator solution.
Aerodynamics and losses	Scene-specific drag, gravity, residual damping and contact behavior were not independently characterized for these PDFs.	Measure/configure those settings, then run a sensitivity sweep. Do not infer damping from the surrounding medium.
Structure and integration	Simplified rigid body and devices, without structural failure, power, heating or wear.	Develop loads, thermal/electrical budgets, clearances and mount design outside this simulation.
Sensing and software	One nominal route with no injected GPS/IMU/altimeter faults.	Test noise, bias, dropout, latency, bad fixes and actuator saturation.

Priority evidence to obtain

Priority	Evidence	Decision unlocked
1	Realistic cold-air propulsion and mass-flow calculations	Whether the lift and travel concept is physically feasible

Priority	Evidence	Decision unlocked
2	Independent force/mass and center-of-mass audit	Whether the model's hover and torque response are credible
3	Fault and disturbance test series with saved telemetry	Whether closed-loop control is robust
4	Mechanical, electrical and safety engineering review	Whether a physical prototype can be designed and operated

The observed ~0.146 m final target distance is a position result in the modeled scene. It is not a claim of GPS accuracy or real-world landing precision.

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