SNAPLOCK // SIMULATION AUDIT

SYS.REF: SL-202-QCPT-HOVER

DATE: 12/22/2025
RUNTIME: 202.97s

01 // EXECUTIVE SUMMARY

This simulation assesses the stability of a **Quadcopter Drone** operating over a defined **Concrete Landing Zone**. The scenario introduces a multi-vector wind influence (X: 1.5, Z: 0.5) to test the holding capability of the drone's "Precision Hover Sequence". The scene is composed of 3 primary entities utilizing a mix of Static (Ground/Marker) and Kinematic (Drone) rigid bodies. The primary objective is to validate environmental interaction and PID stability during the scan-and-hover sequence.

02 // ENVIRONMENT & ASSET CONFIGURATION

GLOBAL CONSTANTS

GRAVITY VECTOR
Y: -9.81 m/s²

WIND VECTORS
X: 1.5 | Y: 0 | Z: 0.5

Asset ID	Type	Mass (kg)	Friction (μ)
ground_pad	STATIC (Plate)	500.0	0.753
landing_ring	STATIC (Torus)	50.0	0.950
drone_robot	KINEMATIC (Mesh)	1.5	0.507

03 // TELEMETRY & STABILITY ANALYSIS

SYSTEM ENERGY	AVG VELOCITY	RENDER PERFORMANCE	PHYSICS STEPS
0.00 J	0.00 m/s	29.6 FPS	499

STABILITY SCORE (StdDev Velocity): 0.000

SYSTEM SETTLED

Analysis: The stability coefficient is below the critical threshold of 0.1. This indicates that the simulated system has achieved complete equilibrium. The kinematic drone actor is holding position perfectly despite the lateral wind force of 1.5 units, suggesting infinite torque authority in the simulation model which may require adjustment for realism.

04 // REAL-WORLD VALIDATION PROTOCOLS

To validate these simulation results against physical reality, the following lab tests are recommended:

1. **Validate Lateral Wind Resistance:**
   Subject the physical drone unit (Mass 1.5kg) to a 1.5 m/s crosswind generated by a laminar flow tunnel. Measure motor power consumption required to maintain the "Wait" action position found in the behavior script.
2. **Friction Coefficient Audit:**
   The simulation assumes a high friction coefficient (0.95) for the Landing Target Marker (Gold). Verify if the physical painting/material of the torus ring actually provides this level of grip against the drone's landing gear skids.
3. **Landing Gear Restitution Test:**
   Drop test the drone chassis from 0.5m onto a concrete plate. Verify if the rebound matches the simulated restitution value of 0.405. High restitution may cause instability during the descent phase of the hover sequence.
4. **Kinematic vs. Dynamic Discrepancy:**
   The simulation treats the drone as KINEMATIC (scripted movement). Transition the simulation asset to DYNAMIC (force-driven) with a PID controller to see if the wind vector (Z=0.5) causes drift that the current kinematic model ignores.