Background and Technical Interview Presentation

Rick Hudson

June 6, 2025

Rick Hudson – Robotic Systems, Vision & Safety Engineering

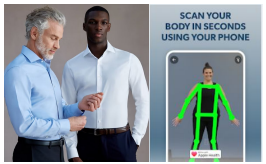
System safety, perception, and control — battle-tested at every scale.

Autonomous Taxis

Cruise
Systems Engineering Manager

Developed physics-based validation methods
6x increase in critical safety issue detection

2023



Body Measurement App

Size Stream
Computer Vision Engineer

Computer Vision for Mobile Measurements
Designed ML-optimized image capture UI
4.8 Star App

2019

IoT Pest Detection

Delta V
Engineering Manager

CV IoT Pest Detection
3 month ROI
Population Suppression

2015

TE Connectivity
Robotics Scientist

Bulk Bin Picking
Precision Handling

Robotic Sensor Assembly

2014

Off-Road Cargo AVs

Sea-Air XUV

Teledyne Scientific
Robotics Scientist

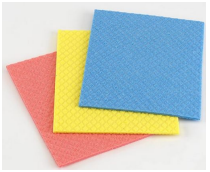
ONS 3D AV path finding
Defined & validated specs for DARPA XUV
Image Processing

2010

Nylonge (sold to 3M)
Engineering Manager

Industrial Automation
10-mile evacuation plan
Sold to 3M for $100+ million (today's $s)
7 US Manufacturers->1

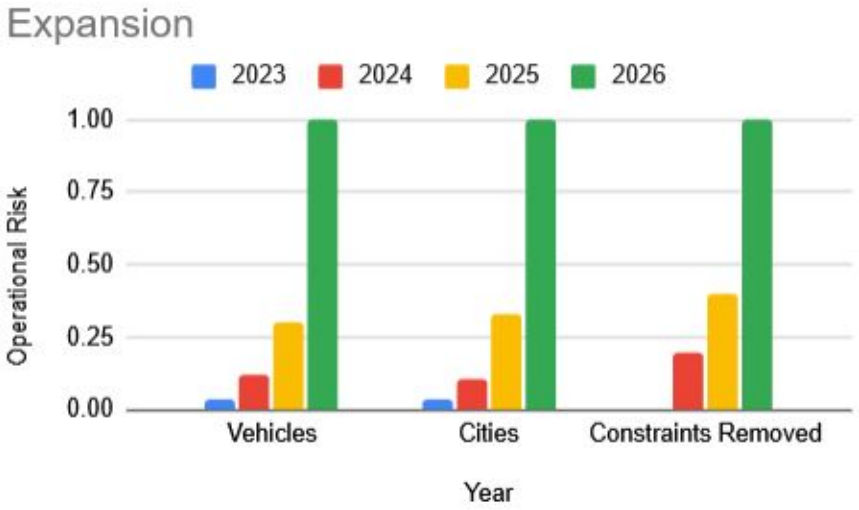
1996



Rayon Manufacturing

BS,MS, PhD Electrical Engineering- CWRU

Why Smarter Perception Safety Testing Became Critical



Expansion Goals Drove Testing Challenges

Complexity rose exponentially, but testing coverage lagged behind.

Previously Avoided

Unprotected Left Turns

Traffic Circles

Parking Lots

Now Required

Rain

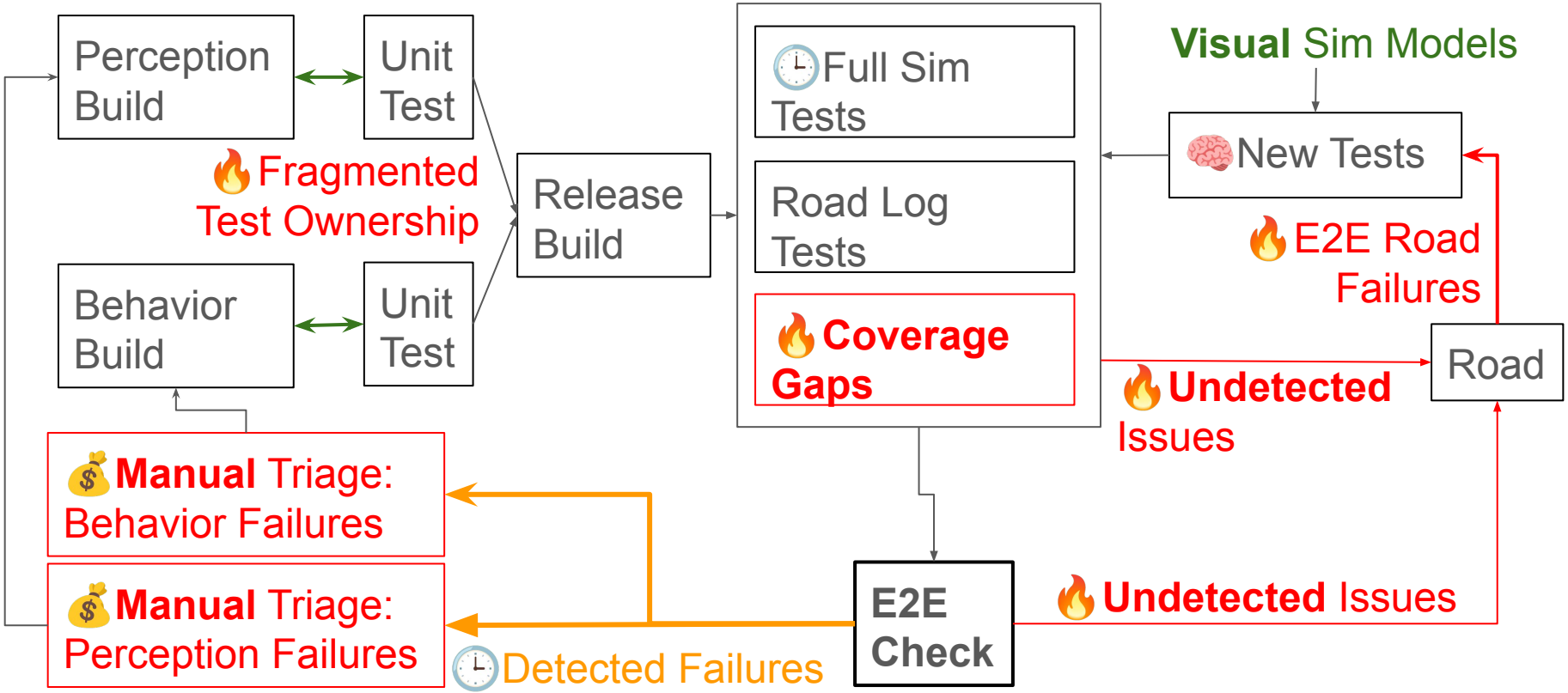
Snow

Pattern Changes

Each vehicle had to get safer and smarter—even as scenarios grew more unpredictable and complex

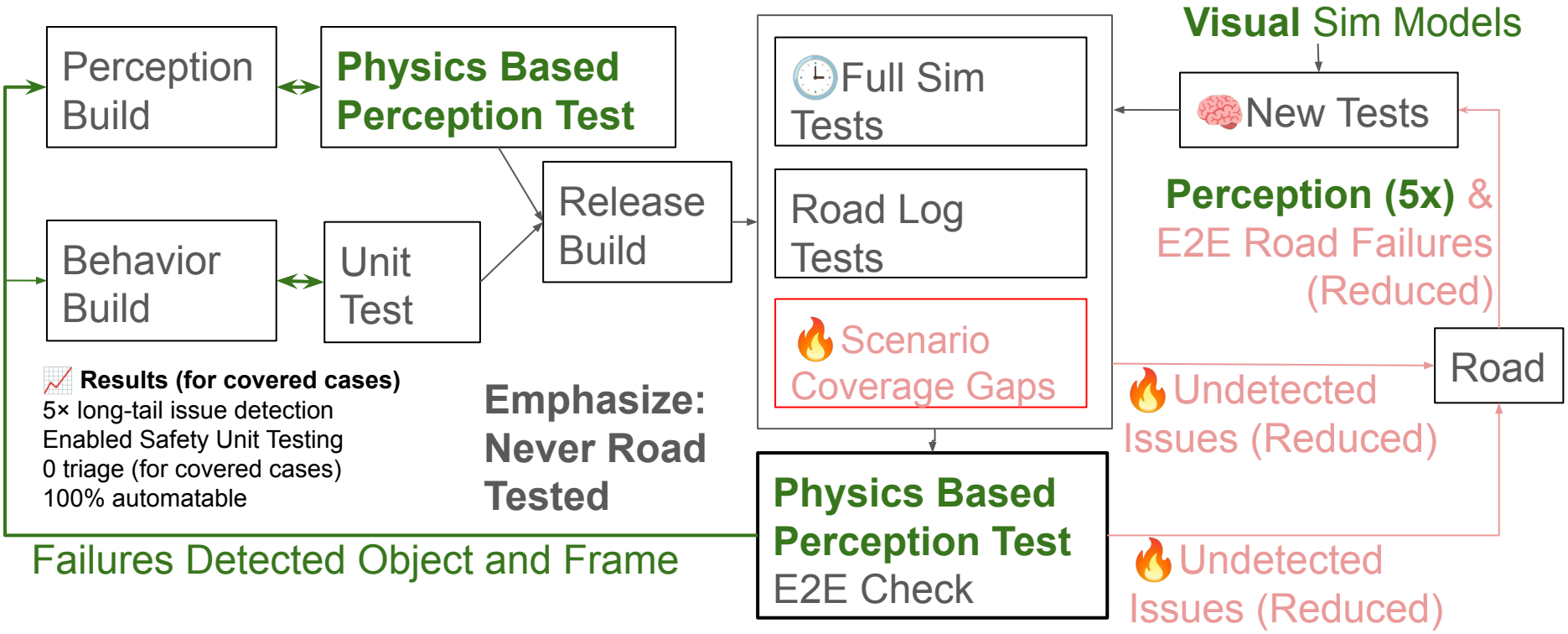
Illustrative data for concept only

Why Simulated End-to-End Testing Wasn't Enough



Failures were either missed entirely or passed to manual triage — late, expensive, and unscalable.

Catching Sub-System Failures Before E2E Risk

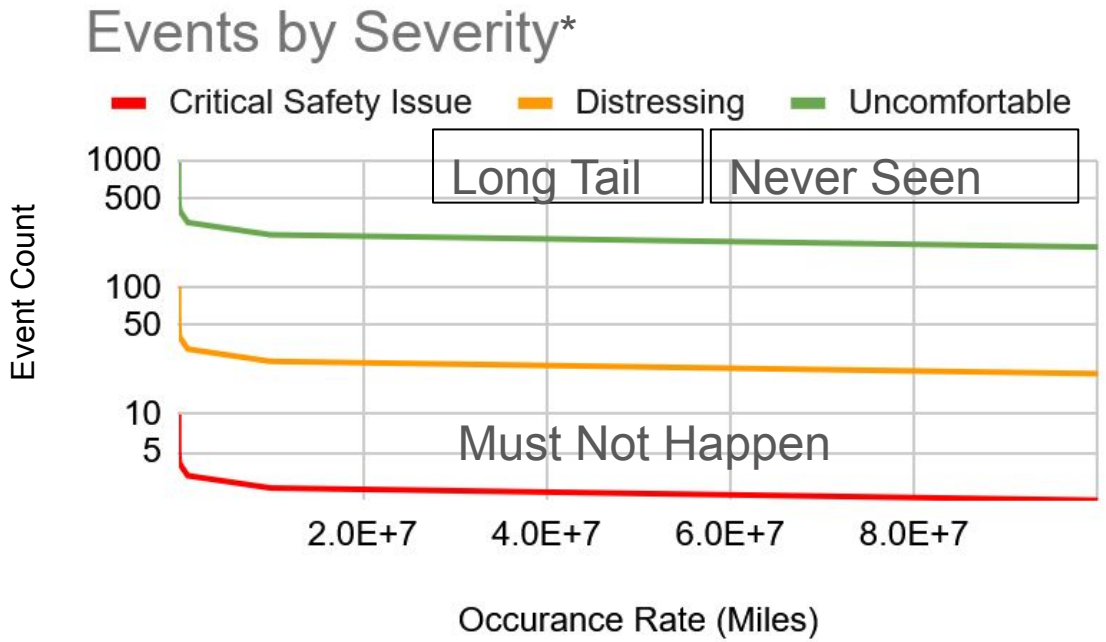


Physics-based constraints existed- we just didn't test against them. Injecting them completely changed the calculus of risks required to achieve acceptable level of performance.

System Impact: Safety, Engineering, and Risk Reduction

📈 **Critical Safety Benefits**
🚨 Caught +40% Critical Failures on tested scenarios
📉 Identified 5× more long-tail pedestrian road events
Fully automatable or used with ground truth labels
Successfully scaled to new scenarios in internal tests
Potential use as on-AV perception warning**

📈 **Engineering Benefits***
Detect Non-Safety Performance Issues
Eliminated Manual Triage for use Cases
Perception Issues Identified Object & Frame

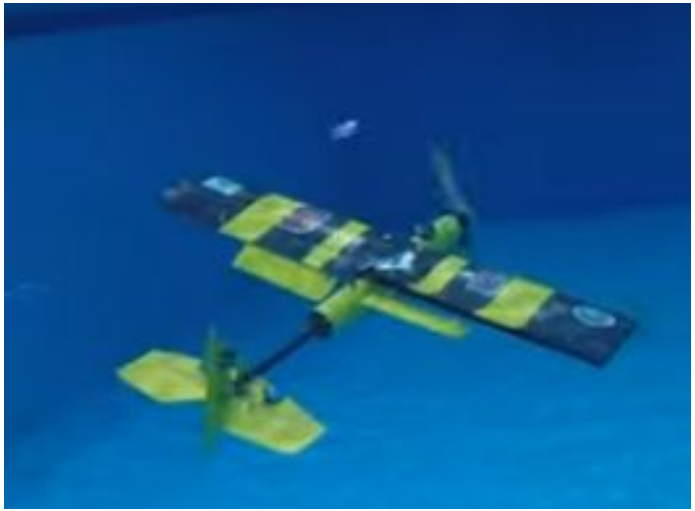


This system caught what we didn't even know we were missing - faster, earlier, and without labels or human review.

*Fictitious Counts for Illustration

Let’s Build Better Systems

- Rick Hudson
- robopuffin@gmail.com
- github.com/robopuffin
- linkedin.com/in/rick-hudson-0463194



Past Project: Teledyne Eagleray

Commercial product

(Still bitter Robopuffin was rejected as the name)

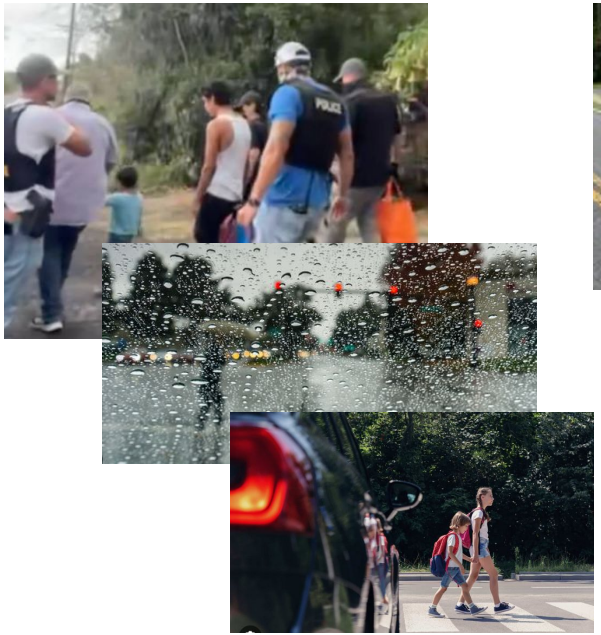
Available to help design safer, smarter robotic systems — from diagnostics to deployment.

Grateful to my colleagues for the opportunity to work on such high-stakes and high-impact challenges in autonomy.

Appendix A: What Physics-Based Constraints?

3 Concrete Examples:

U.S. Customary				
Design Speed (mph)	Brake Reaction Distance (ft)	Braking Distance on Level (ft)	Stopping Sight Distance	
			Calculated (ft)	Design (ft)
15	55.1	21.6	76.7	80
20	73.5	38.4	111.9	115
25	91.9	60.0	151.9	155
30	110.3	86.4	196.7	200
35	128.6	117.6	246.2	250
40	147.0	153.6	300.6	305
45	165.4	194.4	359.8	360
50	183.8	240.0	423.8	425
55	202.1	290.3	492.4	495
60	220.5	345.5	566.0	570
65	238.9	405.5	644.4	645



1: Stopping Sight Distance*
– Based on published roadway safety standards
– Defines how far perception must see to allow safe stop

2: Conservation of Mass
– “Sudden” detections imply prior miss or occlusion
– Physics implies they existed earlier, even if not seen

3: Limiting Items
– Object in blocked path (e.g. behind stopped truck) may not require behavioral change
– Not all false negatives are equal

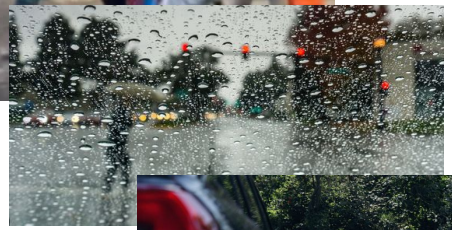
*From “A Policy on Geometric Design of Highways and Streets”
https://kankakeerecycling.com/wp-content/uploads/2023/04/THE_GREEN_BOOK_A_Policy_on_Geometric_Des.pdf

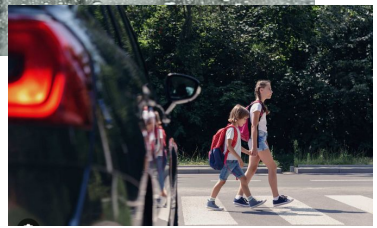
Appendix B: Concrete Perception Test Cases

System detects perceptions errors and prioritizes those that should be fixed first.

1: Police have command power so should be recognized; children require extra caution.

2: Must slow if detection range is being degraded by rain*.





3: Must assume possible child occlusion; reduce speed to ensure stopping margin.

4: Crossing Guard- Must be detected by comfortable stopping distance

5: Crosswalk Right-Of-Way: Car errors only critical if unlikely to stop prior to entering crosswalk

6: Detect frontmost pedestrian in time to stop. At least one actor must be recognized as a child for increased caution.

*I implemented this logic on Terramax (DARPA offroad AV). Instead of demanding Perception see further in low-visibility, Behavior used physics to pull the safe stop distance closer.