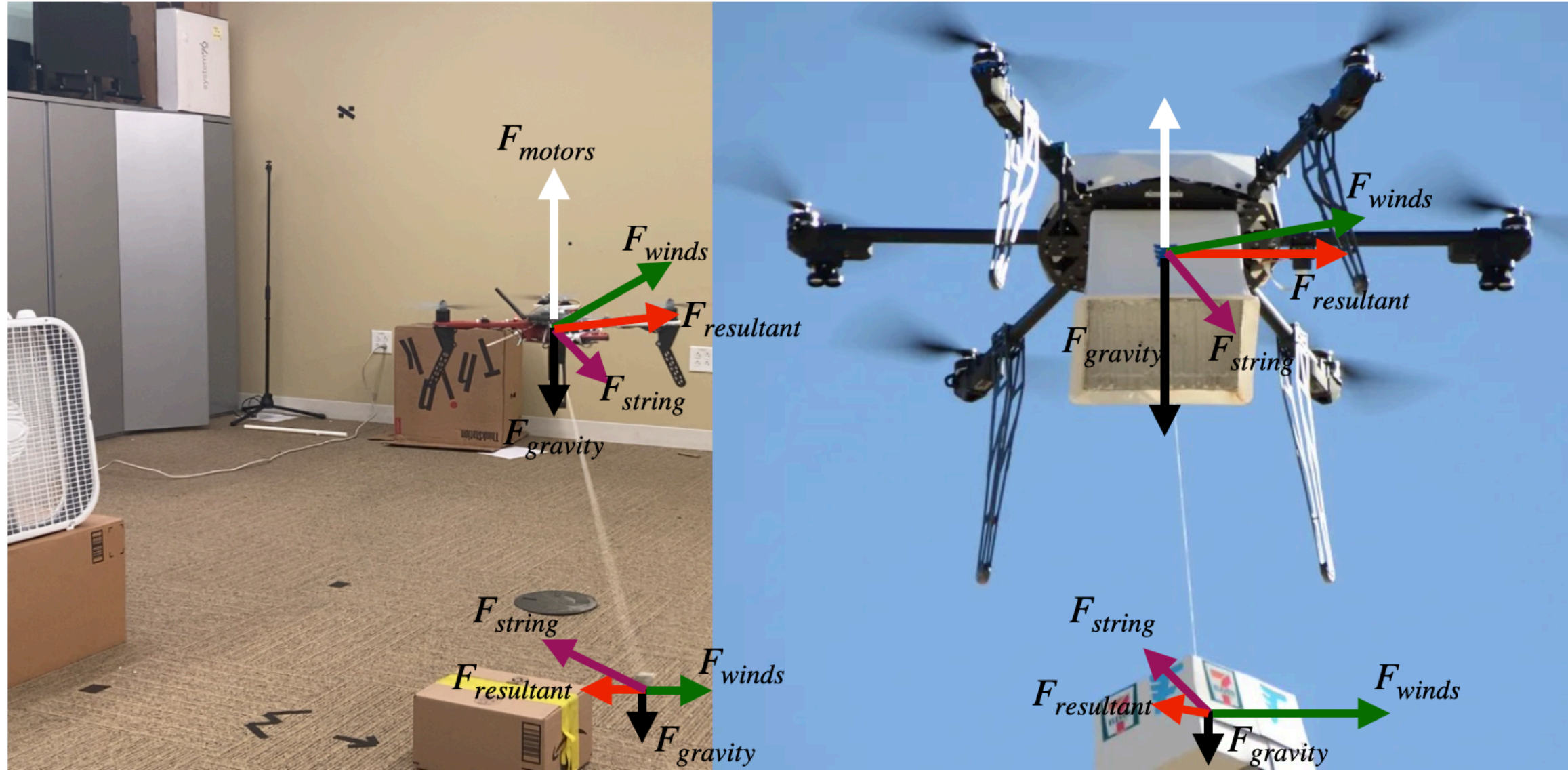


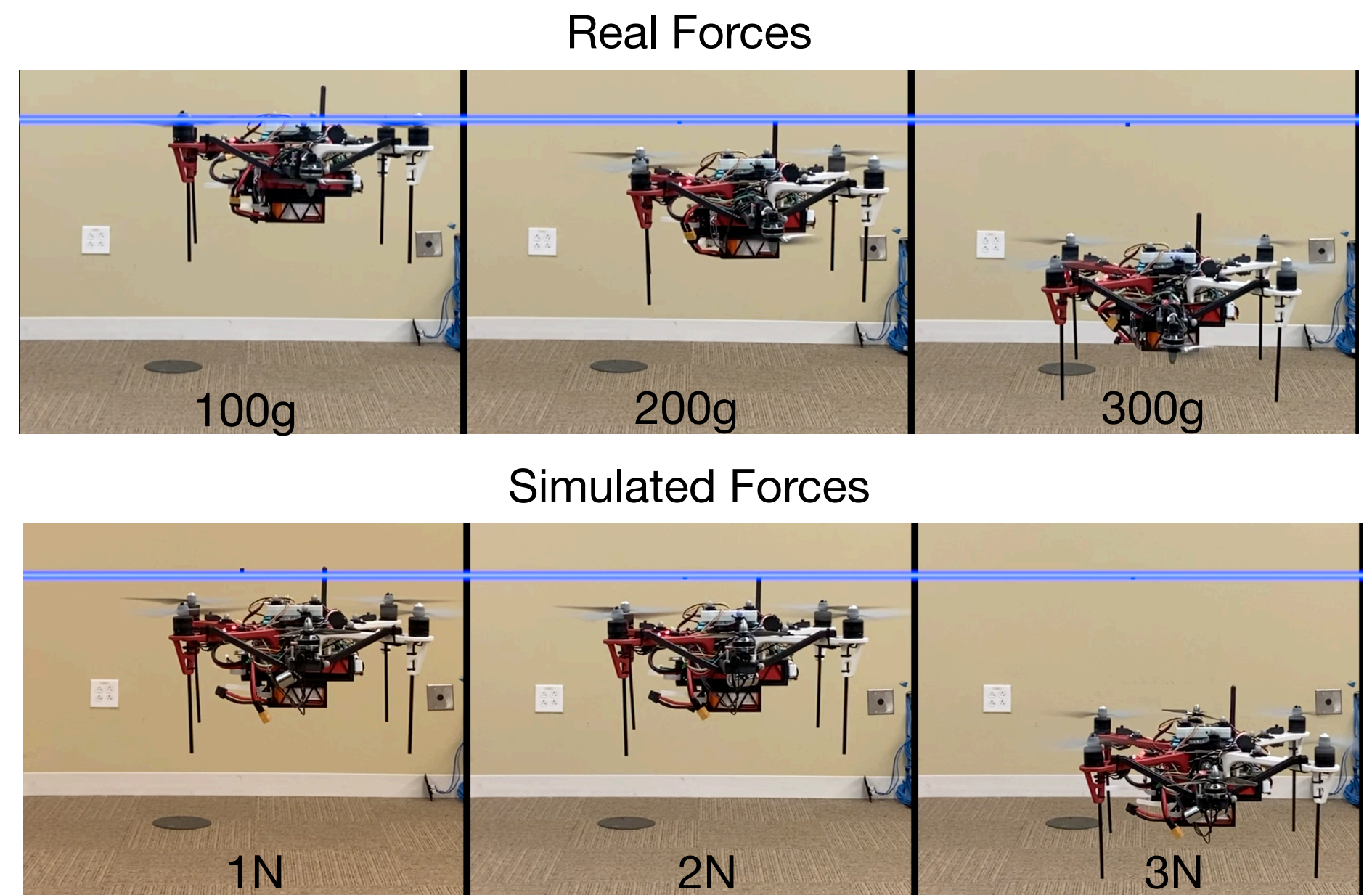
## Problem

Drones operate under a variety of external forces. Validating that drones can adequately behave under those external forces is critical to ensure their correct and safe operation.



## Insight

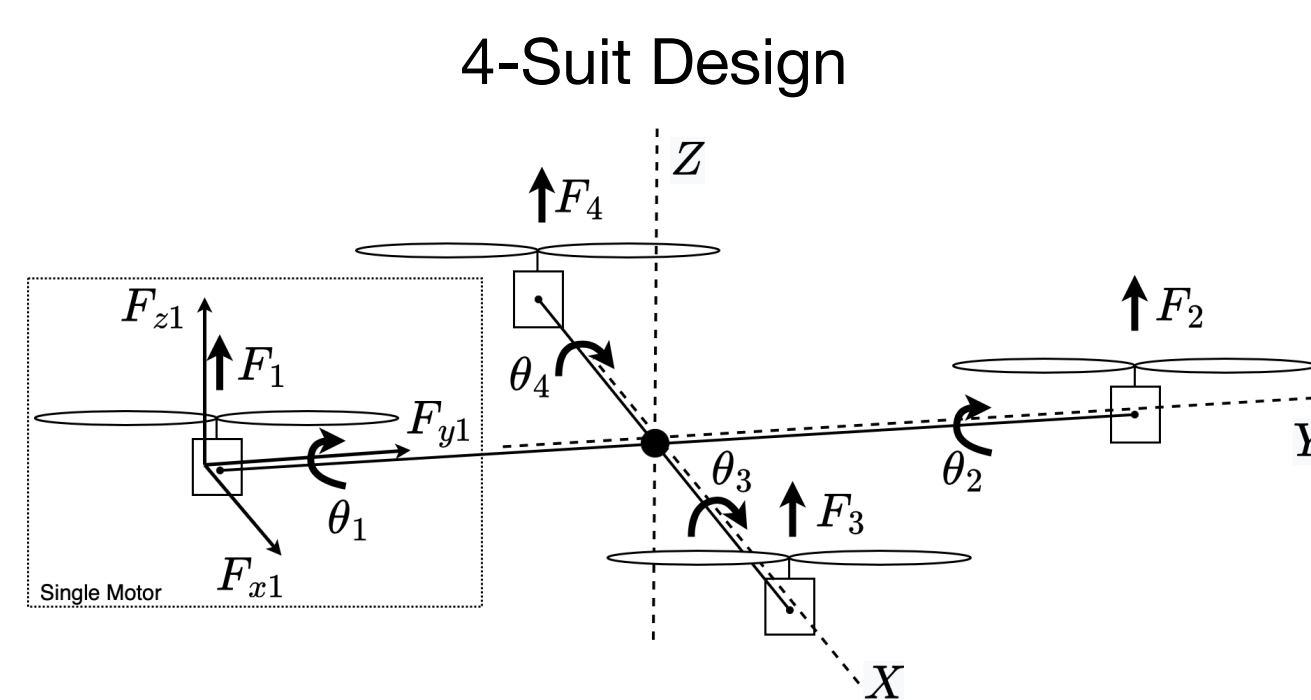
Inspired by haptic feedback, we propose a framework that can create external forces on drones that replicate real world scenarios.



## Solution

The framework consists of:

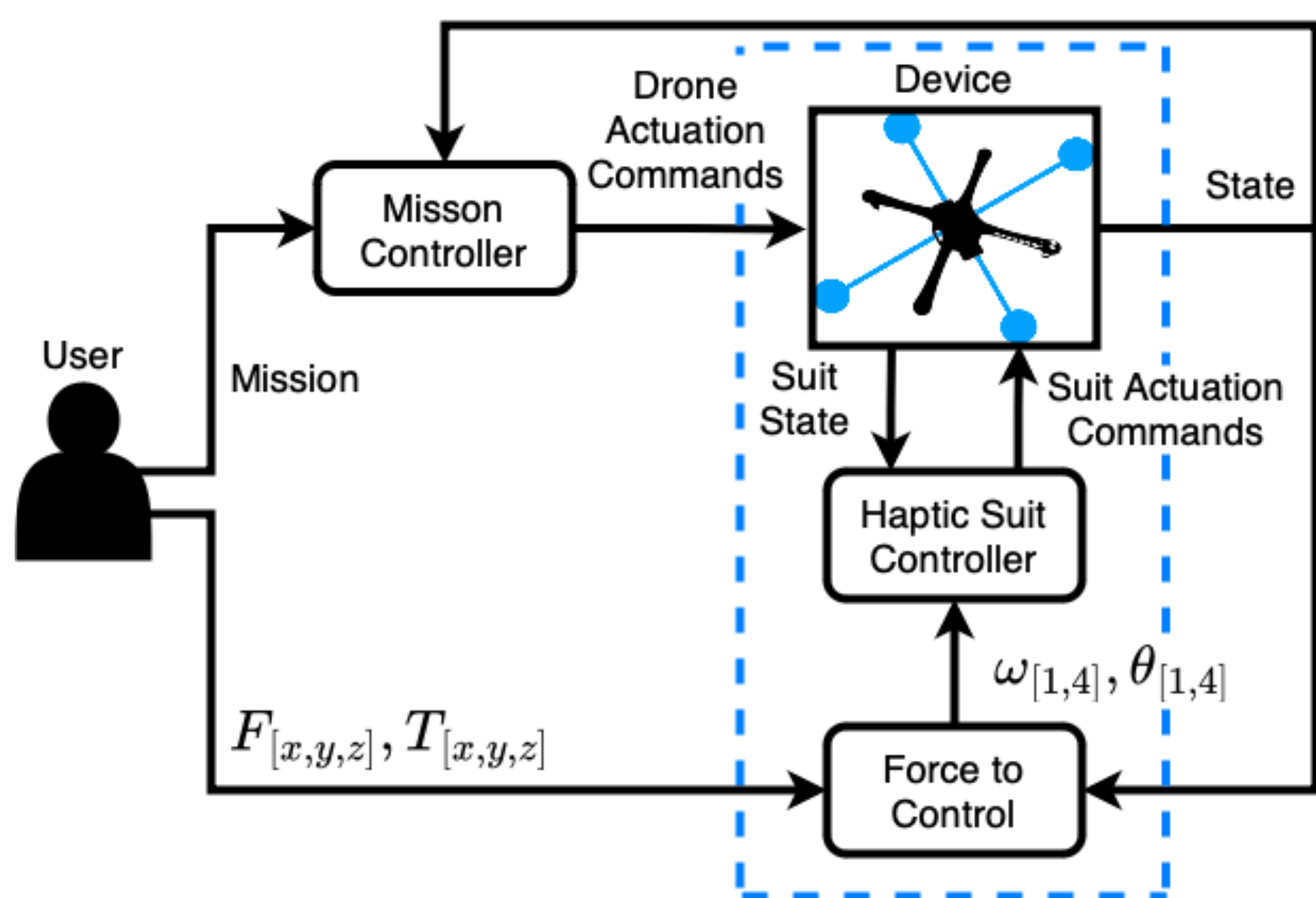
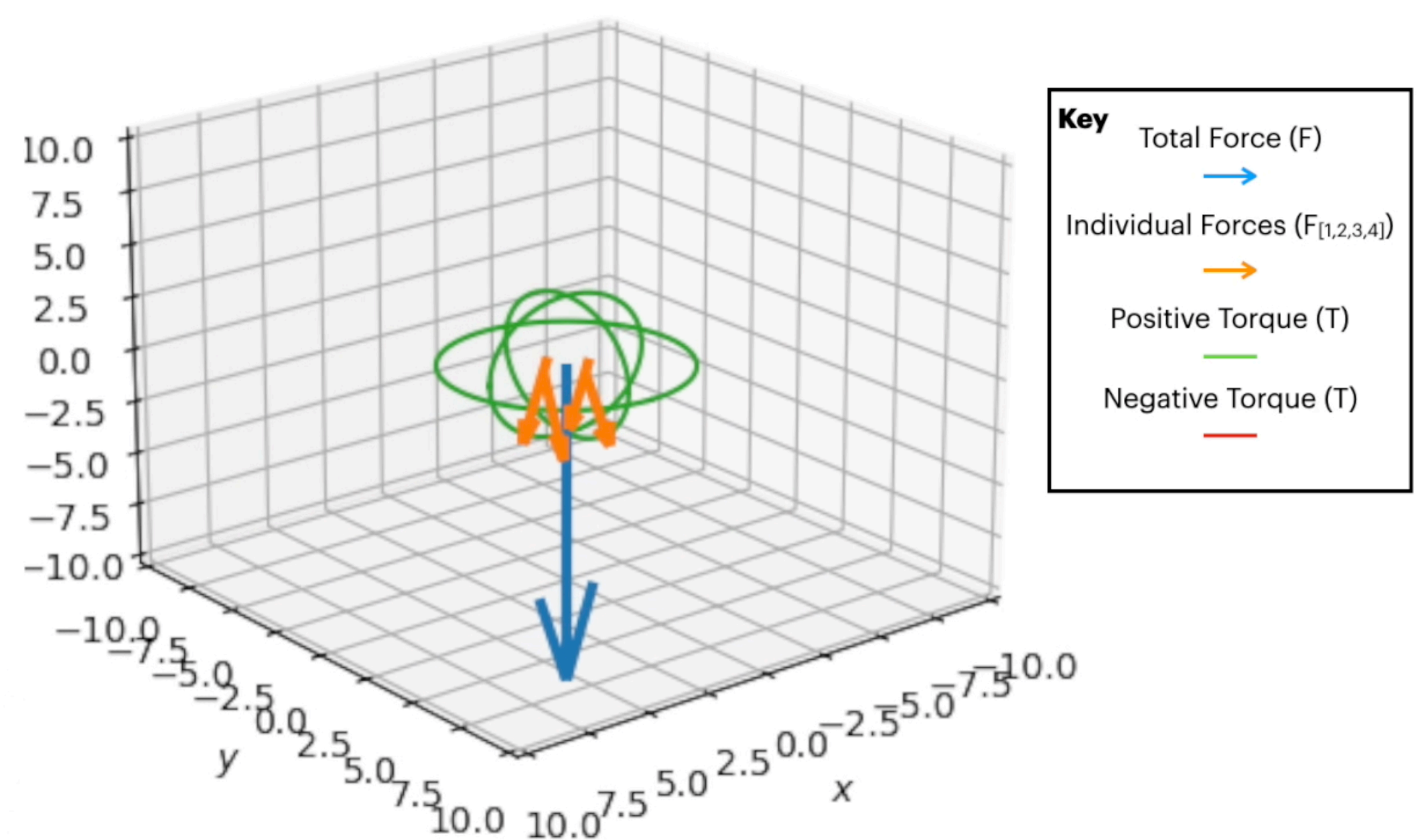
- 1) A haptic suit device with directional propellers, that can be mounted onto a drone.
- 2) A synthesizer to transform intended forces into setpoints for the suit directional propellers.
- 3) A controller allowing the suit to meet those setpoints.



2-Suit Implementation



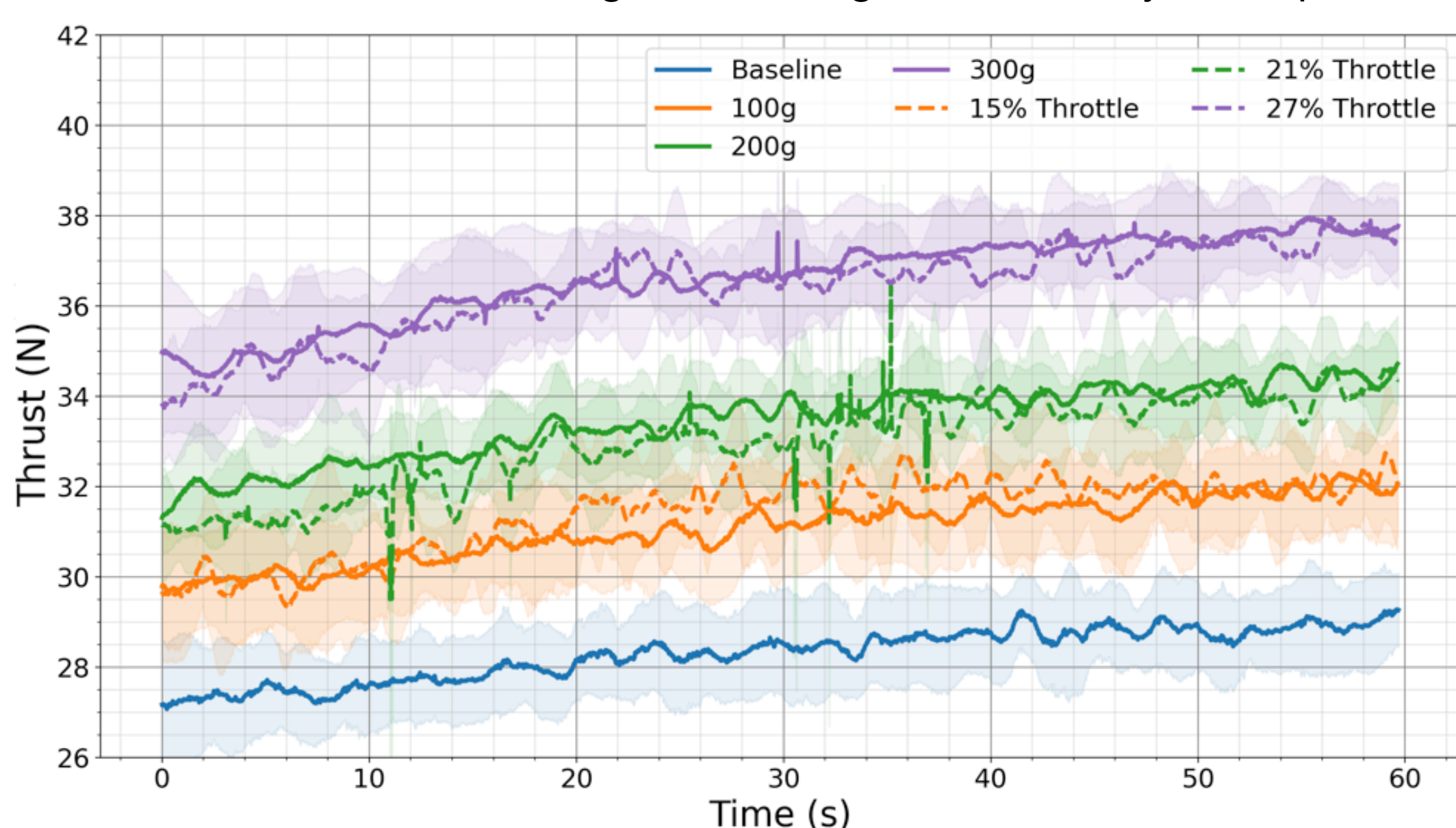
Force to Control Kinematics



## Results

The drone's thrust, altitude, pose, and behavior under real and haptic suit induced forces appear to be very similar. This provides evidence that the haptic suit can recreate real-world forces on the drone.

Thrust at different real weights and weights induced by the haptic suit



Altitude induced using real weights and weights induced by the haptic suit

