CanSAT: SOLVING ITS OWN PROBLEM

John D • October 17, 2025

In the realm of our very existence, there is a quiet fascination in how certain things find balance without ever stopping to think. A leaf does it when the wind changes, a bird does it when the air turns uncertain, a bridge does it when the earth beneath begins to tremble. Each survives by listening to itself. Well, Humankind has always built reflections of itself, objects that learn, adjust, and endure where instinct alone once sufficed.

Now, what if our CanSAT model could do the same?

HEAR ME OUT!

What if a small satellite could sense the first signs of its own instability before anyone on the ground even noticed? What if it could feel turbulence not as confusion but as information, a message to adjust, to stabilise, to keep going? Imagine a payload that does not just record what happens to it but understands what those changes mean. A miniature system that faces the same problem every CanSAT comes across, losing balance during descent, and quietly learns how to prevent it. That is what we set out to build. Our model carries a payload that listens to the air, reads its own vibration, and acts before instability turns into failure. It is, quite literally, a machine solving its own problem while falling through the sky.

HOW IT WORKS

The Aero-Dynamics and Aero-Elasticity payload, or ADAE, is the experimental core of our CanSAT. Its purpose is to observe how air and structure interact during descent and to process that information in real time. The payload brings together three main systems: the aerodynamic sensing unit, the structural sensing unit, and the onboard data-processing unit that links them through lightweight artificial intelligence.

The aerodynamic unit measures the behaviour of air around the CanSAT. It uses a fast-response thermistor and a miniature pressure sensor to capture local changes in temperature and pressure that appear when the flow shifts from laminar to turbulent.

These sensors let the system detect when the air begins to separate from the surface or when turbulence increases near the body. The data describe the aerodynamic environment frame by frame as the CanSAT moves through the atmosphere.

The structural unit focuses on how the model's body reacts to those aerodynamic changes. A strain gauge mounted on a thin structural beam measures the smallest flexes or vibrations in the frame, while a tri-axial accelerometer records overall motion and oscillation. Together they show how aerodynamic forces are transferred into structural stress. When the airflow becomes uneven, vibration amplitude and strain energy increase, signalling a possible loss of stability.

Both sets of signals flow into the processor at high speed. The processor continuously analyses them, calculating parameters such as vibration energy, frequency content, growth rate, and correlation between air pressure changes and structural movement. This is where the AI component begins to act. A small machine learning model, trained beforehand on test data, recognises characteristic patterns that appear just before instability develops. The model receives the processed features and estimates the probability that the CanSAT is entering a turbulent or oscillatory state.

If the probability exceeds a safe threshold, the processor marks the event as an instability onset. It can then send a warning to the ground station through the telemetry link or trigger a minor corrective action, such as adjusting a trim servo to restore balance. Every decision is logged to the onboard memory card, allowing detailed analysis after recovery. The artificial intelligence does not control the flight independently but serves as a predictive layer that helps the payload recognise what is happening slightly before it becomes critical.

NO INFRINGEMENT

The design stays comfortably within the competition boundaries. Everything can be planned around weight, cost, and safety, using light materials and accessible components so the entire build remains well under the budget and mass limits. Power and communication will follow the standard setup, meaning no extra systems or risky hardware were needed. The software can run every flight sequence in simulation, allowing complete ground verification before launch. All materials are safe, all mechanisms are contained, and nothing about the payload risks violating the competition's safety or operational rules.

EDIT

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