Paper ID: 64945
student

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

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A PLATFORM FOR ACTIVE STABILIZATION OF HIGH-ALTITUDE BALLOON PAYLOADS

Abstract

In the past few decades, remarkable strides have been made in high-altitude ballooning technology, where scientists can now deploy balloon payloads more cheaply and frequently. The increase in the number of balloon launches has led to a better understanding of the physics of our atmosphere and has further increased the drive to study the climatology of our planet. Scientists have realized that the atmosphere can be violent, causing balloon payloads to be unstable during flight due to high winds and intense wind shear. High Altitude Visual Orientation Control (HAVOC) is a platform of cold gas thrusters designed to control the orientation of high-altitude balloon payloads to counteract high wind conditions.

HAVOC's active control scheme uses valves that direct the flow of gas into two sets of nozzles that generate torque in either a clockwise or counterclockwise direction. This counteracts the rotation induced by wind and other forces encountered during a high-altitude balloon flight. The platform's preliminary flight used liquid carbon dioxide as propellant, and reduced payload rotation to the predefined maximum of 75 degrees/second for 70 seconds at an altitude of 15 kilometers.

The success of the preliminary flight provided data for the creation of the present-day HAVOC design. The current platform now utilizes high-pressure air (HPA) as a propellant, where HPA allows for lighter payloads, longer operation times, and a more reliable and safe payload. The HAVOC platform has been designed to be easily utilized for high altitude experiments that are rotation or orientation-dependent. Whether it be used by scientists, amateurs, or students, HAVOC will aid in fueling the public's interest in atmospheric science and Earth observation.