Spherical Panoramic Image Payload Design for Stratospheric Ballooning

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Motivation

Arkansas BalloonSAT designed and fabricated a spherical panoramic image payload as part of the national Eclipse Ballooning Project, headed by Montana State University. The payload contained six cameras, mounted on the six faces of a cube in a custom 3D Printed housing, that were set to take time-lapse photos. Photos from the eclipse Flight (ABS 50) and ABS 51 were stitched together using Hugin to create spherical panoramic images.

Fig. 1 displays one of the panoramic photos of ABS 51 stitch using Hugin.

CAD Design and Components

The payload consisted of 6 Hero 4 Session GoPros housed in a custom 3D Printed housing designed using Fusion 360 and printed with a 3D Systems ProJet MJP 2500. The housing was composed of VisiJet M2-RWT, an organic UV-Resin based material.

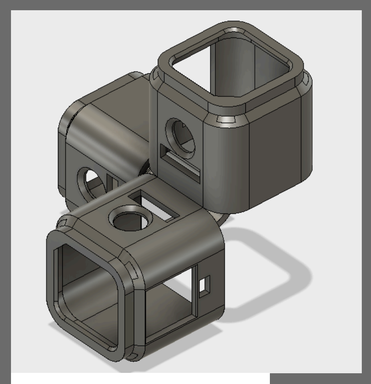

Fig 2. The housing was segmented into halves to expedite print time and for print stability. The halves were coated with polyurethane for additional support and glued together to create an approximately water-tight seal.

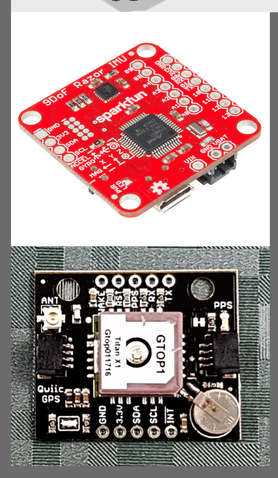

Fig 3. The center cavity of the mount housed a SparkFun 9DoF Razor IMU and Qwiic Titan X1 GPS to record the location and orientation of the cameras. The PCBs were painted with liquid electric tape for additional water resistance. Euler vectors were calculated post flight with an in-house Python script.

Flight Results

During the solar eclipse flight the payload experienced a sudden voltage drop and shutdown prior to achieving the maximum altitude and photographing totality. Our initial assessment of the flight data indicated that this shutdown occurred due to the extremely low temperature. However, ABS 51 flight data showed the camera payload surpassing the coldest point of the flight. This may suggest a battery lifetime limitation or that the payload may have been overheating.

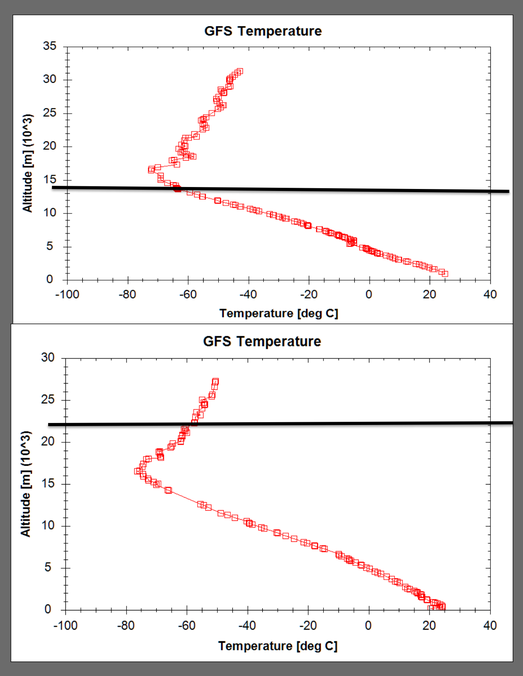

Fig 4. ABS 50 Temperature as a function of altitude provided by the GFS site in Little Rock, AR. The black line indicates the auto-shutdown altitude for each flight (upper Left). The ABS 51 data shows the camera payload shutting down several kilometers after the coldest portion of the flight (lower Left).

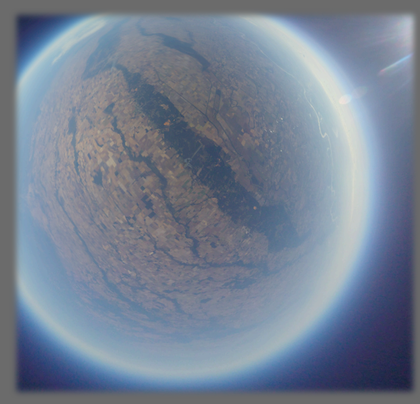

Fig. 5 displays a stereographic panoramic photo of ABS 51 stitched using Hugin (right).

Future Work

Arkansas BalloonSAT will continue processing the images taken by this camera payload to create spherical panoramic images and eventually stitch the images together into spherical flight videos. Future flights will also include an additional PCB and thermocouple to further investigate the mechanism responsible for the GoPro auto-shutdown sequence.

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