APPENDIX D
Integrated Balloon Imaging System II (IBIS II)

The Integrated Balloon Imaging System II (IBIS II) is the second digital camera system design to fly on BOREALIS. The original IBIS was a 1.3 megapixel digital camera that used compact flash cards to store the image files. The IBIS II not only reduces the mass of the system but also increases the resolution to 3.2 megapixels. Additionally, the image files are stored on secure digital (SD) memory cards. While being a significant upgrade, the IBIS II retains the simplicity of the original in the timing of pictures and powering of the camera.

Costs

This camera, a Pentax Optio S, costs significantly more than the first IBIS would cost to build today. The camera itself cost about $400. Ours was purchased from Costco in a kit that included a 128 MB SD memory card. We chose to purchase a larger 256 MB memory card for an additional $65. Although there are SD cards with even larger capacities, the 512 MB card is typically $400 and we decided the increased capacity was not worth the cost. The timing circuit can be made for about $5 and our mount uses about $25 worth of materials. Without including the cost of labor the IBIS II totals $495. Today, the original IBIS would cost about $90 for the camera, the same as IBIS II for the mount and timing circuit materials, and $45 for a 256 MB CF card. Therefore, the older IBIS could be built for around $165.

Camera

The camera used is a Pentax Optio S 3.2 megapixel digital camera. While also being one of the lightest cameras on the market, the Optio has a rectangular shape, which makes mounting the camera much easier than with the old (curved front) IBIS HP 215C. The new camera also has easy access to the case and the shutter switch. The Optio camera has an optical zoom. This disadvantage increases the mass of the camera while also causing some mounting problems due to the barrel of the lenses being fairly long. As the picture of the complete system (below left) shows, this problem has been solved while also improving the images generated by the camera. Below right shows the camera when hooked up to the power board and the battery.

Figure D1: Close-up of IBIS II (Left) and a picture of IBIS II connected to the power supply (Right).
Mount

This camera mount has several advantages over the older model. First, the camera’s tripod mount is only used to keep the camera in place. A panel running the length of the camera supports its weight. The front of the panel also has a sunshade that doubles as impact protection for the lenses. The mount also angles downward 5° to improve the balance between sky and land in images (both IBIS camera mounts have been designed to take pictures horizontally from the command module). The mount is constructed from ¼” balsa wood and quick drying, high-strength glue. The entire mount was painted flat black after assembly. Additionally, a cardboard tube was used to make a closed mount around the lens assembly on the internal side of the mount. Since the camera is smaller and lighter than the old IBIS, the lengths of the balsa panels are short enough to keep the panels from flexing.

Memory

The IBIS II uses the newer Secure Digital (SD) flash memory cards. These cards are currently more expensive but much smaller and lighter than any other memory card. The mass of a typical SD memory card is less than two grams. They also have a very wide operational temperature range in addition to being designed to withstand a ten-foot fall to a hard surface. Currently, they are available in capacities up to 512 MB. A USB 2.0 reader for the cards will run $20 to $40 dollars and most 6 in 1 card readers will read SD cards. The cables and software included with the camera will also suffice in most cases and also are necessary if the camera took images on the internal memory.

Figure D2:  BOREALIS’s two SD cards. The left card is in a protective carrying case.