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Just before sunrise on September 22, members of a group called HALO (High Altitude Lift Off) gathered at the old airport in Huntsville, Alabama, to fly an unusual balloon mission. This was part of an ongoing series of test flights to prepare for a rocket flight this winter. The rocket is a rocket launched from a balloon platform floating at 90,000 feet. Since this is above most of Earth's atmosphere, the rocket should fly briefly into space (over 60 miles high).

Also attached to the fuel tank payload was a low-power tracking beacon designed by myself WB8ELK, with a 68HC811E2 microcontroller which sent down CW altitude and temperature telemetry via a 147.45 MHz 2 milliwatt FM transmitter (audio CW) based on the Motorola MC2833P chip. In addition, the telemetry was simulcast on 28.800 MHz CW (20 milliwatts) using a keyed clock oscillator.

The balloon used was a special 19k cu.ft. Raven zero pressure balloon, which is quite different from the standard weather balloons used in previous flights.

"It was just like taking an elevator to the edge of space."

The flight system

The experiment payload consisted of a nitrous oxide fuel tank with pressure and temperature probes inside to study the effects of the balloon flight. We need to maintain good pressure in order to fire our hybrid rocket from the balloon. The rocket is a hybrid consisting of a nitrous oxide tank and asphalt. Our ground-based launch of the rocket achieved nearly 30,000 feet last spring.

The ATV/telemetry payload was built by Ed Myszka KE4ROC and consisted of a live color TV camera hooked up to a PC Electronics KPA-5 ATV transmitter on 434 MHz (a microphone was attached to the audio subcarrier), a big wheel antenna built by Gobe W4WAD, and a sensor decode system consisting of two Basic Stamp IIs hooked to a GPS/Pico-Packet combo. Telemetry and position information was sent down in an APRS format on 145.79 MHz.

Ed mounted all of his electronics into a sturdy but reasonably lightweight aluminum frame of his own design and covered it all with Styrofoam™ for thermal insulation.

This balloon is made out of a plastic film with a vent duct in the bottom. At altitude, instead of bursting, it actually vents out the excess helium and will level off until sundown or until we cut it loose with a cutdown device.

Adventures in flight

As we laid out the balloon (70 feet long uninflated) on the pavement of the old airport runway, many of us commented on just how perfect the conditions were for our first attempt at such a large system. Not even the slightest breeze disturbed our efforts as we pumped almost four tanks of helium into the balloon envelope (approximately 1,000 cubic feet of gas).

After about two hours of preparation we were ready to launch. The balloon towered over us and was quite a spectacular sight as it reflected the early morning light. However, just as we were ready for liftoff, we encountered a problem with our rigging and retrieval system which required a trip back to the workshop to get some parts.

We sat there with a huge bag of helium for nearly an hour. Then, just as the crew returned



Photo A. The launch crew prepares the ATV telemetry and tank experiment for liftoff as the balloon is inflated. (Photo by Gene Marcus W3PM.)

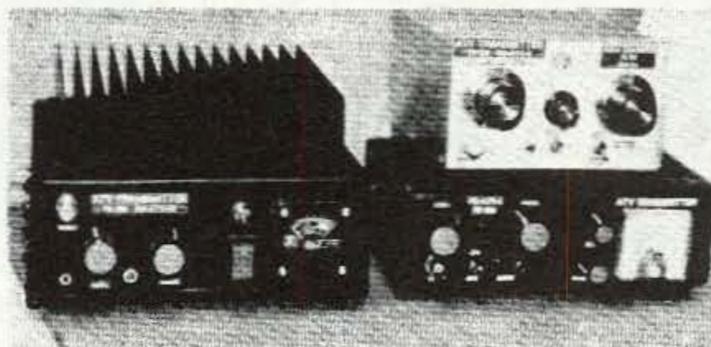
with the parts, Mother Nature finally figured out that there was this big, beautiful balloon just sitting peacefully on the ground. She started to play with it with wind gusts, just like a cat does with a mouse. It was quite a sight to see everyone running around under the balloon trying to keep it from hitting the rough abrasive surface of the old runway. Unfortunately,

one particularly strong gust caused it to graze the runway and tore two large holes in the side of the balloon. We taped the holes shut in the hope that it would hold throughout the flight, then launched it during a brief lull in the wind.

The balloon glided across the runway and the bottom payload promptly snagged on what

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Photo B. The inflated Raven balloon stands nearly 40 feet tall. (Photo by Gene Marcus W3PM.)

appeared to be a power line near the edge of the runway (see **Photo C**). There it was 20 feet up with the balloon sailing out like a kite. Fortunately, this turned out to be an unpowered audio line to some loudspeakers, so I got a long pole out of my car and was able to hook the radar reflector and drag the whole thing off the line. Ed

KE4ROC grabbed hold of the payload, ran forward and gave it a big push. Everyone cheered and yelled when everything finally headed off smoothly on its way to the stratosphere after narrowing missing another set of real power lines. When we played back our videotape recording of the payload's point of view, it was quite entertaining to hear and watch everyone running around like crazy under the payload as we tried to free it from the line.

Elevator ride to space

The payload rose upward at a very leisurely 620 feet per minute. The video image was very stable, with absolutely *no* twisting or turning of the payload. Those zero-pressure balloons are nice! It was just like taking an elevator to the edge of space. Since it was a very clear day, the TV camera view of downtown Huntsville and the surrounding suburbs was fantastic. The APRS telemetry worked great and everything was operating

smoothly except that telemetry from the pressure and temperature sensors inside of the nitrous oxide fuel tank was intermittent. At 39,000 feet we noticed that the balloon was starting to descend slowly (around 500 feet/minute). Apparently the taped-up holes had sprung leaks and were slowly letting the helium out.

Unidentified floating object

Since the payload was descending so slowly, we decided not to fire the cutdown mechanism to allow the system to fly farther into Georgia and land it closer to the Atlanta area foxhunters who were preparing to chase the payload.

Ralph Fowler N4NEQ organized a chase team to track down the payload. He had an APRS system in his car and we could not only track the balloon's position on our ground station back in Huntsville, but we could track his chase vehicle closing in on the payload as well.

After traveling 108 miles from the launch site, the balloon landed at 1:59 p.m. in a kudzu patch behind the back yard of a house southwest of Dallas, Georgia.

The owner of the house was washing dishes and saw the payload land in a field behind her yard. She thought that a UFO had landed and called the TV and radio stations in the area to report the sighting. She turned on her scanner to see if anyone else had

reported the UFO, actually ran across the chase crew on 2 meters—and realized that aliens weren't invading Georgia.

The payload survived the landing in good shape and was handed over to Robert KE4GNN, one of our group, who had chased after the balloon from Alabama.

Post-flight results

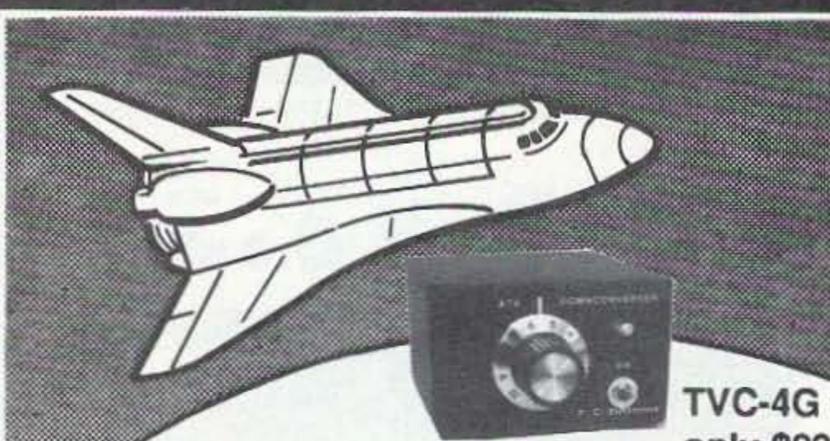
We learned a lot about flying large balloons and received enough telemetry data to consider the flight to be a success. A balloon flight of this size requires lots of planning and coordination with the FAA. Launch permission needs to be received in advance and we were in constant contact via cell phones to both the local airport's tower and the regional FAA center. They were able to track the balloon system on their radar screens; apparently our radar reflector worked just fine (the reflector is available from Kaymont, 800-644-6459).

For more info about the balloon flight (complete with photos and charts) and details about the telemetry system, check out my home page at the following Internet web site:

<http://fly.hiwaay.net/~bbrown/>

This page also contains many links for balloon information and other groups. 73

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Photo C. The balloon is shown attached to our telephone pole test facility to allow for a photo opportunity and final system testing. Attaching the payload to the phone line requires pinpoint accuracy during the initial launch phase. (I work for the government, so I can put a positive spin on just about any disaster!) (Photo by Gene Marcus W3PM.)