



# Edge of Space Sciences Stratosphere

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Denver, Colorado

## Spring and Summer Edition

### PRESIDENT'S CORNER

by Jack Crabtree, AAØP

Now that EOSS-12 is behind us, I think it is time for a breather and reflect on our path so far and ponder on where we will go from here. We have done wonderful things. Imagine, 12 flights in only 30 months and that's not even counting to two "short hops" we'd rather not remember.

During our very well received talks at Dayton, it was confirmed that we, Edge of Space Sciences, are the leaders in what we are doing. I'd like for us to continue this role. Our hosting of the National Balloon Symposium will be a crucial test of whether we have the "stuff" to maintain that leadership.

With only days to go until the Symposium, we still have a lot to do. We need to continue spreading the word and promoting attendance at this important forum. I'd sure like to see a sudden surge of registrations. We're still looking for volunteers and I'm sure we can find a job for you to help share the load of the few that have been working so hard so far.

Just where do we go from here? *We need good, educational, and*

*meaningful projects!* We have just scratched the surface of the science and educational potential for our balloon projects.

We also need to spark some new enthusiasm into the continuation of development of Shuttle II. A smaller and lighter Shuttle means that more experiment and science weight will be available. While the improved Shuttle I configuration has made us more comfortable (after all, it's probably the only payload that has flown F O U R times) we still have our occasional problems. Please consider helping out in this area.

Well that's enough for now. You'll find a couple more of my thoughts scattered elsewhere in this issue. Remember, what we learn from our projects is indeed important. We need to put it in writing so that we can share with others. Write for *STRATOSPHERE*.

### A Day in the Life

by Mike Manes, W5VSI

Life for a high-altitude balloon electronics package can be rough. It's born being crammed full of radios, electronic goodies and batteries, its skin perforated with antenna feedlines and emblazoned with ham graffiti. Bits and pieces

are cut away to save weight. It gets flopped around on a workbench for weeks while its guts are tweaked and twisted with accelerating fervor as launch day approaches. At the crack of dawn on the appointed day, it's rustled up and jostled out to some desolate site, where it gets a few more pokes and jabs for good measure before being bound and strung up like a horse thief.

With a sudden jerk and a sigh of relief, it's hoisted up and away from its earthly turmoil. But soon it faces even more grueling insults. As it ascends at over 10 mph, rushing air tugs at its supports, and wind shear tosses and twists it like a small boat on high seas. Its internal gasses

### Contents

PRESIDENT'S CORNER	
by Jack Crabtree, AAØP.....	1
A Day in the Life	
by Mike Manes, W5VSI.....	1
EOSS-12 EXPERIENCES	
CUT-DOWN DEVICE PROBLEM	
By Jack Crabtree, AAØP .....	2
ANALYSIS OF A FOXHUNT	
by Paul A. Terlund, WB3JZV ...	3
EOSS PR TEAM KEEPING BUSY	
By Jack Crabtree, AAØP .....	4
From The Editor's Desk	
by Ann Trudeau, KAØZFI.....	4



# Stratosphere

Newsletter of  
**Edge of Space Sciences, Inc.**

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## **Nets**

The weekly on the air net is held on the Colorado Repeater Association's 147.225/825 MHz Repeater each Tuesday evening at 7:00 PM.

## **Meetings**

The monthly meeting of E.O.S.S is held at Digital Equipment Corporation at 8085 South Chester. This is just west of I-25 and just north of County Line Road on the south side of Metro Denver.

## **Membership**

Edge of Space Sciences Membership is open to all interested parties. Student Membership is \$2.00 per year. Regular Membership is \$10.00 per year.

To join, send a check to:

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belch forth as it rises through ever thinning air. Passing through the tropopause makes New Year's Eve at the North Pole seem like a tropical beach party. Passing up into the stratosphere provides a welcome respite, as the nearly non-existent air becomes calm and everything warms up in the intense, unfiltered sunlight blazing forth from the black sky.

Just as life seems to be getting a bit cozy, the support lines suddenly go limp, and our package finds itself plummeting, twisting and turning down into the sky below. Whatever vestige of warmth may have penetrated its skin is ripped away by 200 mph winds, and the frigid tropopausal air forces its way into every crack, chilling its guts to the core. After surviving another roller-coaster ride through the jet stream, the still infiltrating air begins to warm, allowing it to carry quite a bit of water. In fact, the welcome shade of a cloud can fill our package with fog which readily condenses all over its well-chilled contents.

The ever-calming ride back to the planet ends with perhaps the most severe assault of all: a collision with the ground which would total a car. The surface wind has picked up since the launch, so the still deployed parachute keeps on plugging, bouncing its dazed passenger across the varied terrain until something strong and stationary catches the package and wins the tug of war.

After what seems like an eternity in such a desolate spot, a swarm of fiercely-armed transmitter-hunters converge on our lonesome traveler. The dying batteries are sending plaintive cries for help though an antenna that is buried clear up to its

feedpoint. After a primitive ritual, the hunters load their quarry into a vehicle, this time with much less ceremony and for a considerably longer jostle back to the spawning grounds.

The next day, its creators begin their poking and jabbing again, scratching their heads in search of an explanation of how such a quickly crafted package could have survived its ordeal without dumping its contents all over the recovery site or showing even moderate signs of wear.

"Foamcore", they finally proclaim, "It must have been the foamcore!"

## **EOSS-12 EXPERIENCES CUT-DOWN DEVICE PROBLEM**

**By Jack Crabtree, AAØP**

When EOSS-12 was initially launched at 7:40 A.M., we at the launch site thought all of our problems were behind us. The balloon and its payloads looked quite spectacular as it ascended just north of the CU campus. Then there was the shout, "The payload is coming down!" Terror filled our minds as we watched the payload, minus one balloon, drifting down over a populated area.

Fortunately, with the help of the Boulder City Fire Department, we were able to extract the parachute and the four payload packages from the tops of two tall trees. Once back on the ground, the Shuttle was given a quick check-out and was found to be operating properly. The student GPS required a repair of its downlink antenna but with the healing hands

of Dave Clingerman, W6OAL, the repair was quickly completed. The GPS from the Atmospheric Instrumentation Research in Boulder, Colorado, suffered no damage. The beacon for Bob Ragain, WB4ETT, required only some minor antenna straightening. The decision was made to try another launch.

But what had caused the payloads to separate from the balloon on the first launch? It was clear that the separation device had been activated. The nylon cord was definitely burnt by the device's nichrome wire and the tape over the wire was burnt as well. A check of the telemetry indicated no separation command had been sent. The separation process requires two commands to be received by the shuttle—one is an ENABLE and the other is the EXECUTE. Both of these commands are confirmed by return telemetry and in this case, neither was confirmed. A further check of the telemetry however did find a stream of extremely abnormal temperature measurements for several minutes after the separation. It was noted that the controller had also undergone a reset. Our on-the-spot assessment was that for some unknown reason, the flight controller had experienced an upset and a "glitch" had appeared on the separation circuit output—an open collector interface. Because the cause was not known, the decision was made to disconnect the separation circuit from the controller and let the balloon burst at maximum altitude.

Approximately four hours after the initial launch, the second flight of EOSS-12 began. At 96,000 feet, the balloon did indeed burst and the payloads safely parachuted back to earth. This event was captured on

the ATV video and may be some of the most unique footage captured to date. What had started out to be almost a disaster turned out to be one of our most successful flights as confirmed by the video and the telemetry data.

Testing is continuing to find the cause of the premature separation experienced by EOSS-12. It is important to identify the cause so that a reoccurrence does not happen. Having a reliable separation device is a high priority for EOSS and in some cases—larger payloads— it is an absolute regulatory requirement by the FAA.

The technical committee is seeking ways to provide additional security to the EOSS command system including payload separation while enhancing the separation process reliability. If you are interested in assisting in this effort, contact Mike, W5VSI.

## ANALYSIS OF A FOXHUNT

by Paul A. Ternlund, WB3JZV

On Oct. 11, 1992, my partner Tim Moffitt, NØNXI, and I were two "foxes" sitting on top of the Hogback just west-southwest of Denver. Seven radio direction finding (RDF) teams began to bear down on us competitively from about 14 miles away. We offered bonus points to any hunter who provided accurate bearings along the way. We had six takers. Since the hunters were coming from the same basic direction, their bearings fell within 25 degrees of one another. This situation was much like the afternoon of Aug. 29, 1992, just before the landing of the EOSS balloon launched from the Colorado

State Fair Grounds. Most of the RDF teams at this time reported bearings that were within 36 degrees of one another.

In both instances, bearings were less than optimum for good triangulation because bearing-line pairs crossed at acute angles. This was due to poor hunter geometry, i.e., most hunters were clustered southwest of the balloon. One favorable difference the foxhunt presented, however, was that we knew exactly where the fox's transmitter was, so we could calculate the errors in the ten bearings provided by the foxhunters. These errors ranged from a smashing 0.84 degree, to a not-so-smashing 14.6 degrees.

Using all ten bearings provided during the foxhunt, a Macintosh computer running augmented triangulation software located the fox to within 6 miles. Using only the best bearings (there were 4 bearings with less than 4 degrees of error), the fox's position error was reduced to about 2.4 miles.

I repeated these two calculations with more optimum hunter placements to see if the calculation results improved. I moved the hunters (hypothetically) to locations surrounding the hidden transmitter. However, I maintained the same bearing error magnitudes from the actual (sub-optimal) locations in the new more optimal geometry. Finally, I recalculated the results on the Mac, first using all 10 bearings; then with only the 4 best bearings.

The transmitter location error reduces to about 0.5 mile when running all 10 bearings from the more optimal locations surrounding the fox. This is true even though 6 of the 10 bearings were between 5.84 and 14.60 degrees off the mark!

The error reduces further to 0.2 miles when running only the 4 best bearings from the more optimum hunter positions.

The conclusion reached is that RDF teams produce better triangulation results when taking their bearings from positions scattered about a transmitter.

## **EOSS PR TEAM KEEPING BUSY**

**By Jack Crabtree, AAØP**

The Public Relations Team has been busy spreading the word about EOSS and what we are about. On Tuesday, May 18th, we showed our video and telemetry data from EOSS 12 to the Boulder Amateur Radio Club. On Wednesday, May 26th, the “show” was moved to Littleton for the Denver Radio League. June 9th was the day that the Rocky Mountain Radio League had its

turn to see Colorado from the Edge of Space.

Recently we have made it to print as well. Amateur Television Quarterly ran a plug for the Symposium in its last issue. The June issue of 73 Magazine ran a pretty good description of EOSS and our activities as well as a promotion for the Symposium. In July, we had another pitch in one of the QST STRAYS just behind Warren Williams’, NØPBY, excellent story about our problems with EOSS-6 and the chase to Nebraska. Paul Ternlund, WB3JZV, also had a great sidebar in QST for his RDF tracking program and its use. We need to keep the pressure high as we approach our Symposium. If you know of a forum for pitching our “show,” let our Vice-President Jim Libhart, NØPSQ, know, we’ll do our best to present an interesting and entertaining program.

## **From The Editor's Desk**

**by Ann Trudeau, KAØZFI**

Taking over the helm of the *STRATOSPHERE* is a pleasure and a challenge. We all certainly have appreciated the efforts of Tim Kelliher, our past editor, for his efforts. Good luck to him and his bride, Dina Springstead, who was also an EOSS member and active team participant.

Just keep the stories coming in folks. We have a lot of interesting ones out there and one person can’t cover them all. Your contribution would be really appreciated. Also, do encourage the students to do a story as part of their post-launch wrap-up. That’s it. How good the *STRATOSPHERE* will be depends on your submissions. Let’s get them in fast.

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