Edge of Space Sciences Promoting Science and Education throughAmateur Radio and High Altitude Balloons

Stratosphere

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Science in Action

Pitts Students Launch Balloon for Research

The above headline and the following article as well as a picture of the balloon being launched appeared on the front page of the Sunday Pueblo Chieftain after our Saturday Oct 22nd launch. Another article on the same page was used in a state political T.V. advertisement so our balloon picture had a lot of T.V. exposure.-ed.

By PETER ROPER

The whitish rubber balloon stretched and warped with each gust of wind Saturday morning as two men from the Edge of Space Science group held it to earth, waiting for the signal to release it into the crystal blue sky over the University of Southern Colorado. Around them were dozens of Pitts Middle School students and their parents, watching expectantly for the signal that would send the high-altitude test balloon up.

Attached to the balloon was a long tail of equipment including a tiny television camera that would record the balloon's flight to nearly 100,000 feet. Further along the tail were two experiments created by students in Pitts' New Generation Team program.

- The first would measure ozone layers at various altitudes between 50,000 and 100,000 feet.

- The second would measure the effect of altitude on the electrical output of several small solar collecting panels that were connected to some measuring equipment.

At 10:05 am., the signal came and the balloon was let go. As the students cheered, the balloon leaped upwards, swept over the campus and then climbed into the deep blue sky. The entire fight would last several hours with the balloon being recovered about 50 miles east of Pueblo.

Lou Lile, one of the two New Generation teachers at Pitts, credited the Alliance between District 60 and USC with making Saturday's experiment possible. He said assistant professor Jerry Sweet not only contributed time but sent engineering technology students to Pitts to help the students design their experiments.

"We hear a lot about what the Alliance is doing in the district, but this is a case where there was a direct connection with the classroom," he said. "My students will be working with the data for some time."

The balloon expertise was provided by the Edge of Space Science organization, which is based in Denver and is made up of scientists and hobbyists. They provided the high altitude balloon and the tracking equipment.

Martin Tressell, of the Pueblo Teachers Credit Union, is a member of EOSS and he got the New Generation Team involved with the launch. He also organized a fund-raising campaign to purchase the small television camera that was attached to the balloon.

Merle McCaslin, who retired from Martin Marietta two years ago, headed up the EOSS team that launched the

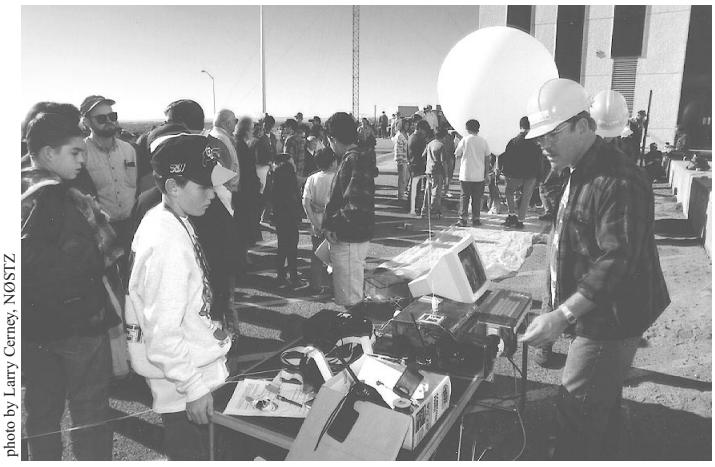

photo by Larry Cerney, NØSTZ

Jack Crabtree, AAØP prepares Shuttle for liftoff as students observe.

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Newsletter of
Edge of Space Sciences, Inc.

Published Quarterly in Denver, Colorado

Nets

The weekly on the air net is held on the Colorado Repeater Association's 147.225/825 MHz Repeater each Tuesday evening at 8:00 PM.

Meetings

The monthly meeting of E.O.S.S is held at the Castlewood Library at the southwest corner of the intersection of Arapahoe ave. and Uinta st. This is just west of I-25 on Arapahoe ave. Talk-in is on the 146.640/040 MHz repeater.

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:

Edge of Space Sciences, Inc.
376 W. Caley Circle
Littleton, Colorado 80120

Submissions

Send articles for publication to the editor of *Stratosphere*:

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Edge of Space Sciences, Inc.
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Littleton, Colorado 80120
Internet:rickvg@usa.net
File Bank BBS: (303) 534-4646

balloon.

"Our basic idea is to let students see science in action. This gives them a chance to see how real research gets done and to participate in it," he said.

Around McCaslin, Pitts students and their parents were watching two television monitors that showed the swirling, twisting pictures of Pueblo being sent down from the tiny television camera hanging beneath the balloon. At that moment, the balloon was 7,000 feet over the city and gaining about 1,000 feet per minute.

McCaslin explained that once the balloon neared 100,000 feet, it would burst. A parachute was attached to the tail, however, and would bring the science equipment down safely.

The New Generation Team is a school-within-a-school program at Pitts made up of sixth, seventh and eighth graders. Lile said the 60 students divided up into teams to participate in all aspects of the flight, from launching the balloon to designing the experiments.

The ozone experiment consisted of a plastic box containing a tiny balloon and some test papers that would change color as they were exposed to various concentrations of ozone. The low atmospheric pressure at 50,000 feet would allow the balloon to expand and open the box lid, exposing the paper. Similarly, the box would close again as the test kit fell below 50,000 feet.

At least that was the plan, according to the students who designed it.

"And we'll be able to watch with the television camera to see if it's working properly," said Sam Pannunzio, one of the students. The other students who worked on the project were Dylan Lile, Zach Johnson, Phil Urban, Jamin Aragon, and Doug Baker.

The solar collector experiment was a little more complicated and Nathaniel Hendrix and Jon Valentine simplified the explanation by just saying that it would test the voltage output of the solar panels at various altitudes. The other members of their team were Andrew Rozmiarek, Brad Gerler, Josh Janoski, Jennifer Fox and Charlotte Bobian.

Watching the television images was a little tough, however. The camera spun as it dangled, sending back swirling pictures of the ground. Of course a tape of the flight could be stopped at any point for study, but watching the live images was a little rough on the stomach.

Lile laughed when he looked at the television pictures.

"That's our project for the next flight," he said. "Figuring out a way to stabilize that camera."

Ballooning over Argentina.

by Gustavo Carpignano, LW2DTZ
M.Rosas 2044
1828 Banfield Argentina

Abstract.

This paper presents a brief description of the flights of balloons over Argentina since 1990 when the first amateur radio balloon was launched. For these flights, we used Kaysam 78G balloons which are easy to obtain. All of the equipment was homebrew as that made more economic sense for these initial experiences.

As you will read, all the payloads were lost over the Rio de La Plata (the broadest river in the world). Financial aspects don't allow searches extending beyond this balloon eating river.

Very recently an EOSS member forwarded via internet the Balltrak program for use as an aid in finding our payloads.

The First Flight.

The first launch of a amateur radio balloon was on June 24 of 1990. The "Pampero" balloon experiment was successful. It was launched from Ezeiza International Airport. The flight lasted for nearly three hours. The balloon carried telemetry and beacon identifications. The frequencies used were VHF 2m FM mode and HF 10m CW mode.

The telemetry format was CW ID by tone. The first audio tone of 4 seconds indicated battery voltage and a second tone of 4 seconds for internal temperature, and the cycle restart on VHF. On HF, we flew a CW identification beacon.

During the flight, reports were received from stations more than 300 km away. The maximum estimated altitude was 20 km.

The last signals transmitted by the payload plotted the package's location at Rio de la Plata, near the Uruguay coast. It never was found.

The package was built by Jose Machao, LU7JCN, with the help of many hams from La Plata.

The Next Flights

This was the first balloon cluster that we launched. It consisted of three little balloons and was launched May 05 of

1991 from Guernica, 20 miles southeast of Buenos Aires.

The AUSTRO-1 experiment consisted of a homebrew CW beacon on VHF with only 20 mW of RF power output with a codestore that permitted the loading of a message. The flight lasted nearly two hours. Reports were received from stations 300 km away in Uruguay and Argentina. The last signals received plotted the beacon at the Rio de la Plata. The payload never was found.

The payload was made by Daniel Dodino, LU9DOG and LW2DTZ.

AUSTRO-2, a second balloon cluster was launched. It consisted of two balloons and was launched again from Guernica on September of 1991. The "AUSTRO-2" carried three homebrew beacons on HF, 10 meter; VHF, 2 meter and UHF, 70 cm. The payload was made by LU7JCN, LU9DOG, LU3EMK and LW2DTZ. We used the same codestore that flew on the previous flight and sent a long message on all the three bands. Very interesting observations in propagation were made.

The total flight duration was 3 hours, and nearly 50 hams participated in the event. The payload was lost in the Rio de la Plata.

PAMPERO-2 was launched from the campus of La Plata Engineering University in La Plata, approximately 30 miles southeast of Buenos Aires.

The payload sported a 2m FM transmitter a CW ID tone and a light sensor mounted over the +Z (top) face of the box. The light sensor sent a tone during the flight which was used to determine the attitude of the payload. It was very interesting to listen to this tone when the balloon burst and started its fall to the ground.

PAMPERO-3, (LU7JCN) This was the first cross band FM repeater launch. The original design included a two tone telemetry system that sent inside temperature and battery voltage. Some difficulties caused us to remove the telemetry module. The repeater was a 2m FM transmitter used for the downlink and 10m FM receiver for the uplink.

During the flight, possibly due to very cold temperature, the transmitter turned off. We experienced loss of signal (LOS) at about 90 minutes after lift off from the campus of La Plata Engineering University.

PAMPERO-4 and 5,(Hugo Lorente, LU4DXT, & LU7JCN) Both of these payloads flew with the same general configuration as flight number three, but with a more resistant payload container to insulate the experiments from the intense cold. Hams from Argentina and Uruguay operated through the repeater from as far away as 600 miles, perhaps a few even further away. The payload was lost over the Rio de La Plata.

CORDOBA-1, (Catholic University of Cordoba, LU9HXV), This was the first lift off of an amateur balloon from this part of Argentina. Cordoba, has terrain very similar to the state of Colorado in the US. The payload was constructed by students from the University using a basic meteorological radiosonde. The telemetry carried downlinked in/out side temperature, barometric pressure and humidity using audio tones via a 2m FM transmitter. This payload was lost.

Nets.

During the flights, we used either a frequency in the 40m band or the 2m band for our launch information net. Listening to reports of the balloon's signals from stations far from the launch site was very interesting.

The Future.

At this time some new informal groups are working on simple payloads. Plans are afoot for a ROKCOON (rocket) flight, placing a little rig in space for a few seconds near an altitude of 160 miles. For this flight we are planning to use a cluster of balloons and powerful rocket motor; a live TV camera and a photographic camera are planned payloads.

EOSS-19 Flight

by Pitts Middle School New Generation Team.

On Saturday, October 22, 1994, E.O.S.S. teamed up with Pueblo Pitts Middle School's New Generation Team (N.G.T.) to launch their nineteenth high altitude, helium filled balloon. N.G.T. is a school within a school which began this fall. It consists of sixty, 6th, 7th and 8th graders integrated into math, science, social studies and English. The programs individualized, interdisciplinary curriculum together with flexible blocks of time lends itself nicely to partnerships like the one developed with E.O.S.S. and the University of Southern Colorado (U.S.C.).

Launch number 19 went 88,000 feet into the air before it burst and came down north of Jon Martin Reservoir (southeast of Pueblo). On the balloon's payload were two experiments created by N.G.T. students. One was to test solar cell efficiency at high altitudes, and the other tested ozone pollution above 50,000 feet. The balloon launch took place at the University of Southern Colorado campus. Dr. Jerry Sweet, a professor at U.S.C. coordinated efforts between the E.O.S.S, N.G.T. students and the university.

The N.G.T. students had eight different teams, each with its own responsibilities. For example, their public relations team was in charge of informing the public about the balloon launch before it took place, inviting people to attend, and keeping all that attended informed about what was going on around them. On the P.R. team were Sean Baca, Katie Fimple, Stacy Haptonstah, Paula Lund, Trish Pacheco, Jeremiah Shields, and Kristen Stewart.

A second group of kids to create and experiment was the ozone pollution team. Members were Jamin Aragon, Doug Baker, C.W. Davis, Zach Johnson, Dylan Lile, Sam Pannunzio, and Phil Urban. Their job was to create a device that exposed ozone paper (paper that chemically reacts to ozone pollution) to the atmosphere at 50,000 feet and above. The ozone kit was donated by Science Kit and Boreal Laboratories, a national science supply company that the N.G.T. does much business with. With only five days to work on the project, the team came up with an amazingly simple device that actually worked. The results may have been altered, though, because when the device hit the ground, it cracked and let air inside while

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Thank you !!!

the shuttle was waiting to be recovered. The team is continuing to work on a device which would withstand the payload's impact, and which could possibly be used on a future launch.

The solar cell team's experiment linked solar cells together in a series. Mike Manes (EOSS member) linked the solar cells to the shuttle. It relayed temperature readings back to computers at the ground control center. This team was composed of Charlotte Bobian, Jennifer Fox, Brad Gerler, Nathan Hendrix, Josh Janoski, Andrew Rozmiarek and Jon Valentine. The team converted the temperature to voltage, and plotted it on a graph throughout the flight as they discovered that the voltage varied with altitude changes.

The balloon helpers team assisted Merle McCaslin with the balloon itself, and among other things ensured that it would not be damaged prior to and during the launch. The team helped transport and stabilize the balloon, which was being battered by sudden high winds just before the launch. They were totally excited with this opportunity!

Mr. McCaslin showed Hannah Cruz, Monica Garcia, Chris Gronbach, Mark Lucero, Jimmy Sims, Nick Vegas and Jodie Wodiuk how to use the helium and all of the other equipment needed to get the balloon ready for flight.

The launch helpers team was in charge of the launch check list. Monique Brasselero, Stephanie Bravo, Sheri Dougherty, Matt Gomez, and Jon Ybarra went around the launch site making sure all the other teams did their jobs so the balloon launch and flight would be a success. After everything was checked, the launch team told the balloon launchers to send the balloon on its way.

The radio operations team consisted of five N.G.T. students: Lori Branham (team leader), Kristal Baca, Nathan Archuletta, Grant Morris, and Clint Housh. They actually monitored some radio communication as well as the balloon's position via LORAN C. This information was sent to the command center, which relayed it to the tracking and recovery team, letting them know if the balloon's location had changed. This process occurred every thirty seconds until the payload landed.

The tracking and recovery team was responsible for knowing where the balloon was at all times, by plotting its latitude, longitude, and altitude. Although the global positioning system (G.P.S.) had limited use on this launch, N.G.T. students were familiar with its potential thanks to U.S.C. engineering student Marco Vegas, who brought a setup to school a week earlier and actually demonstrated its use to the kids. Students who helped the E.O.S.S. team track and recover shuttle nineteen were Matthew Carpenter, Tressa Channel, Rebecca Chase, Chris Ferry, Nicole Gist, Christi Kurtz and Andy Nesbitt.

In preparation for their role in the balloon launch, student members of the latitude and longitude team learned how to plot positions on a map using latitude and longitude coordinates, and did so virtually throughout the flight. Students were patiently assisted with this job by E.O.S.S.'s Tom Isenberg who was in charge of monitoring the position of the balloon as he relayed its coordinates to the "fox team" in the field. Student members were Andrea Cochran, Eli Dingman, Keira Martinez, Isabelle Ortivez, Judy Pacheco, and Dynel Smith.

This balloon launch was definitely a first for the students of Pitts New Generation Team. Many people helped make it possible, not the least of whom were all the E.O.S.S. members who brought the launch to Pueblo, and allowed the N.G.T. students to take part. Martin Tressell arranged the fund raising to provide the first color video camera ever on an E.O.S.S. flight. Dr. Sweet of U.S.C. provided the N.G.T. with four excellent engineering students — Marco vegas, Jackie Meinzer, Dan Cardinal, Pat Valdez and Bryan Kinsey. They actually came into the N.G.T. at Pitts for several weeks prior to the launch to assist our students in preparations for the launch, and also arranged for several departments at the university to be open on launch day so the students could learn about U.S.C. when they were not immediately occupied with launch business. Todd Seip of KCSJ news radio lent his expertise to the students on the public relations team. Don Middleton, a former U.S.C. professor spent time with the radio operations team, sharing his wisdom about Ham Radio. Marty Griffin and Merle McCaslin came down from Denver to present the program to the N.G.T. students and got them started. Countless parents worked with teams of students, on the day of the launch, and before. They were just as excited as the students. Middle School principal Lynda Quillen allowed the N.G.T. students to have the Friday before the launch off, since they would be at the balloon launch all day Saturday. Lou Lile, Cathy Blackmore, and Toni Vensor, the teachers of the New Generation Team, guided the effort to coordinate school curriculum with this "real-life", scientific event.

Without the efforts of these, and other people together with the tremendous effort put forth by the Pitts New Generation Team students themselves, this joint effort would never (pardon the pun) have gotten off the ground!

EOSS and US Air Force Academy Join Forces in Balloon Flight

by Larry Cerney NØSTZ

The US Air Force Academy has asked EOSS to act as their sub contractor to test various methods of determining altitude. This is part of the US Air Force Academy's curricula that introduces cadets to the intricacies of project management. The instructor, Captain Bill Nace, has given the cadets the task of confirming which of four methods of determining altitude is most accurate. A device has been given to the students which has a barometric altitude sensor with the four different outputs. The students will contract an organization to take their device to altitude and downlink the telemetry of the four outputs of their device. EOSS will provide the lift for the cadets.

The flight of EOSS-20 is scheduled for December 3rd from the parade grounds of the Air Force Academy. This will also be the maiden flight of EOSS's Shuttle II and the second flight of our new color camera. Shuttle II will have GPS (Global Positioning System) on board for the first time. The cadets will use the altitude readings from the onboard GPS, which will be time stamped, as the standard with which they will compare their readings.

In addition to the Air Force Academy balloon, there may also be a flight with High Altitude Balloon Experiments (HABET)

the balloon group from Iowa. They will be coming to town to fly along with us at the Academy if all goes well with getting the necessary permissions, etc. They too will have GPS on their payload and are looking to demonstrate new software they are working on. Their new software is CD-ROM based. It should receive the packet GPS information from the payload and display their positions on a map on the computer screen. The HABET group will have demo software for those who have CD-ROM drives on their computers and would like to try it out.

Please plan to be there. This is a great chance to check out new technology, get some free software and join in launching two balloons and (hopefully) recovering two payloads. Come join us at the Air Force Academy.

NOSTS-1 (Near Outer Space Transportation System): Clear Lake Amateur Radio Club's First Balloon Launch

by John Maca, AB5SS and Dan Feeback, KJ5MX

Defn: Balloon Launch (n); the ultimate game of hide and seek.

October 9th will go down as one of the most exciting days in Clear Lake Amateur Radio Club (CLARC) history — our first balloon launch! We successfully launched a 16 ft diameter experimental weather balloon from the airport in Wharton, Texas carrying a package packed with amateur radio payloads and recovered it in Pearland, Texas. Launch occurred at 11:06AM, the balloon envelope burst at about 12:30PM with a touchdown around 1:40PM — a total flight time of 2 hours 34 minutes! The package was recovered with the help of the Pearland ARC in a field with 5' grass just 200 yards from a ditch full of water. We did get just a little rain the day before the launch but the payload was dry and in pristine condition at recovery —as if someone had just walked in and set it down.

This project really began about a year ago when Dan, KJ5MX, started collecting the "right stuff" to construct and launch a balloon. Around the end of August, Dan enlisted the help of John, AB5SS, to assist with the payloads and other logistics. John solders better than Dan anyway, a fact well-known in the amateur radio community. During the next 6 weeks we learned A LOT about launching a balloon and predicting where it would go.

After many late nights, a lot of fun and a few beers, we assembled several payloads including a 2m packet station utilizing a Kantronics KPC-3 TNC as well as a 10 meter double sideband transmitter (with help from Jason Levy), and a digital voice chip IDer. Other payloads included a 220 MHz beacon and a 29.420 (147.10) MHz "Fireball" transmitter. We also built the world's best quarter-wave 2m ground-plane antenna (from piano wire at a cost of less than 2 dollars), put together the payload cargo bay, contructed a stabilizer fin and a 10m coaxial dipole antenna. We tested and modified as we went along to optimize our payloads. We even carried out a successful integrated simulation of the package with all the payloads operating to test their operation; all was GO at L-7! Next, a plethora of logistic challenges were met: acquisition of helium, working a notification scenario with the FAA, acquiring permission to use the Wharton airport, getting tracking software, wind data and learning to make flight predictions, chosing payload and coordination frequencies — the task list seemed endless.

The night before launch day (L-1) found KJ5MX and AB5SS up all night in KC5ITR's mobile home with final integration of the package. The packet TNC decided to stop responding to anything sent to it and it required the static RAM chip to be pulled to clear the problem and a complete reprogramming of parameters. David Fanelli, KB5PGY, stopped by for a while to help with testing but missed the parachute assembly and testing at 4 am. A quick shower, change of clothes and acquistion of our DFing equipment and off we flew to the designated launch site —Wharton. Airport. Soon after our trip began, Bob, KA5GLX assumed role of Launch Net Control on 2 meters, 70 cm, and 40 meters.

We arrived at Wharton about 8:30AM and, after a quick chat with the folks at Wharton Airport, we secured some space in the main hanger and started setting up. We planned on launching at 10:00AM but the 2m packet payload acted up and Dan had to adjust it's attitude again. We called Randy, N5SVW, in Fort Worth to get final flight predictions. About 10:50AM (15 minutes before anticipated launch), we contacted the FAA to inform them of the impending event. With the balloon package ready to go, AB5SS handled the balloon, WB5WOW held the parachute, WB5PWG carried the payload package and George Garza kept the 10m antenna straight. The balloon was first out of the hanger where it was met by 20+ knot winds adding yet another challenge to a successful launch. Sheer determination and intestinal fortitude prevailed and the team eventually reached the end of the taxiway beyond the hangers. The balloon which has been completely vertical and quiescent in the hanger now had a mind of its own. The surface wind stretched the envelope horizontally to an unbelievable length and shape which constantly changed with the wind shear forces. Team members were rapidly deployed downwind and the launch sequence was completed. We had successful launch of NOSTS-1 at 11:06AM CDST (1606Z). We all watched first unaided and then with binoculars as the balloon rapidly attained altitude and headed in an almost due southerly direction. Within minutes though, and according to flight predictions, the balloon assumed a ENE trajectory and disappeared eventually into the relatively high cloud ceiling.

Within just minutes of launch, KA5GLX in Clear Lake connected to the packet station followed by many others. Connections to the packet station came from all over including such places as Hazelhurst, Mississippi (near Jackson); Louisiana, Tulsa, Oklahoma; Fort Worth, Amarillo, Magnolia, Benbrook, Pearland and of course Houston. It's amazing what 0.75 watts will do from near space! The 10 meter beacon was heard in both far NW Houston and La Marque, unfortunately the band was pretty much dead so no DX was likely. The following calls were heard on packet: KA5GLX, N5QJE, N5SRC, WA5POK, KB5WYY, WD5GAZ, KA5IFU, N5ZDF, W5BRY, N5SUB, KB5UHS, WB5HJV, K5ZTY, N5RPQ, KI5MB, NØKGK, WA5NOM, KC5FMZ, KC5ZXE, N5JVV, KB5AQV, KB5AWM, WT5U, N5MFK, N5EXT, WB5UUK, KI3L, N5RRA, KB5MFM, WB5RTT, KC5DWS, N5JDE, WA5DWX. There were 13 messages left in the "20 Mile High Mailbox".

Now that we had it in the air, the next step was to go recover it when it landed. But first, a stop at Whataburger in Wharton as our stomachs reminded us that we forgotten to eat in all the excitement.

The people in the restaurant thought we were escaped lunatics with our radios blaring packet and talking at top of our lungs. The balloon burst about 84 minutes after launch putting it near or over 100,000 feet. The descent took longer than the ascent with a total flight time of 2 hours, 34 minutes with a landing time of 1:40PM. BALLTRAK using 36 hour NOAA data predicted it would land 48.1 miles downrange at 67.2 degrees. Randy's (N5SVW - Fort Worth) flight prediction which used the 7:00AM wind data put it downrange 46.8. miles at 70.5 degrees (Manvel near 288). It actually landed 57.0 miles downrange at 67.2 degrees or 1.2 miles N of Pearland Airport, approximately 9 miles ENE of where my BALLTRAK data predicted. We had a bearing from a satellite station putting it West of Manvel. We concentrated our search in and to the North of the Manvel area. NOT! After it seemed like we had covered every square inch of Manvel it was near 5:30PM and we were exhausted. We decided to pick it up in the morning.

After a 2 hours plus drive, we finally made it back to Clear Lake; KJ5MX dropped AB5SS off and was on the way home when N5QJE, Harris Milton, reported reception of a packet burst on 145.75. This event mobilized the Pearland hams who immediately began a frenzied search-and-rescue campaign. They quickly and methodically tracked it down to a field just NE of the Pearland Emergency Management Center (EMC). Harris and Dick Wilke, N5SPU (our previous CLARC President) jumped into Harris' 4X4 with portable packet and spotlights and took off into the field. After several minutes of RF tracking — they could hear the audio beepers. Triumph!!! — They found the payload at 10:10PM in perfect shape and returned it to the EMC. All payloads were still operational, we powered the package down , and then went home and powered down too. It had been a long and glorious day!

We would like to thank the following for their help in making our first balloon launch a success:

* Andy MacAllister, WA5ZIB and the South Texas Balloon Launch Team (STBLT) for the consulting and use of some of the STBLT payloads.
* Lou McFadin, W5DID for use of some very high tech lab equipment.
* Doug Howard, KG5OA and Randy McKinney, N5SVW of the North Texas Balloon Project (NTBP) for providing us with prediction software and landing predictions up to the last minute.
* Gary Shane, WB5WOW for contributing connectors, radios and for help with the launch, tracking and recovery.
* Tom McElhinney, KC5ITR, and his son-in-law, George Garza, for the RV, donuts, video tape and recovery support.
* Mike Davidson, KC5CP for the video coverage, DF expertise and recovery support.
* John Doman, Wharton Airport
* Stan Martin, FAA
* Jason Levy and Dave Flanagan for early parachute testing and deployment designs.
* Bob Biekert, KA5GLX for serving as Balloon Launch Net Control before launch and during flight and for finding just the right repeater for the recovery efforts.
* Other members of CLARC who helped during the launch and recovery: David Fanelli, KB5PGY, Neil Gimemes, KL7HQR, Robert Sorge, KC5FMZ, Jim Heil, KB5AWM, Marwynne Kuhn, WB5PWG and Nick Lance. - Also John Cross, AB5OX who helped during early testing.
* Members of the Pearland ARC who helped during recovery: Craig Boegler, WB5TSN, Marty Haley, AB5GU, John Matejek, Jim Mathis, KC5ADN, Jimbo Mathis, KB5YXP, Sean Mathis, Harris Milton, N5QJE, Jerry Venable, KI5MB, Little Jerry Venable, KB5RGI, Bill Venable, N5RRA and Dick Wilke, N5SPU.
* The owners, trustees, custodian and users of the W5XC 70 cm (444.15 MHz) repeater in Missouri City.

We learned a great deal in the process of getting NOSTS-1 up in the air. NOSTS-1 had to be designed to operate in a fairly harsh environment. At altitude, the payload is at -70 degrees C but at the same time the air pressure is 1/100th that at sea level and thus there is less air to conduct heat away from the electronics. We were putting transmitters and receivers in very close proximity and RF is radiating everywhere. Shielding and decoupling capacitors become your best friend. Weight is a critical factor, although not as much on NOSTS-1, we learned that a little weight here and there adds up quickly. The batteries are very high power density LiSO2 variety. Antennas need to be mounted on the bottom to get the radiation angle back down toward earth. They must also be extremely light. The list goes on. Technically, the project went very well. We know of a few areas to improve upon, but thanks to the South Texas Balloon Launch Team and the North Texas Balloon Project, we averted a lot of beginners mistakes. What we learned was mainly in the organizational area. Some of these lessons learned are listed below:

* Start your logistics preparations about a month before launch.
* Have a person at the launch site dedicated to communications with the outside world or net control.
* Keep the people at the landing area and others monitoring the event informed.
* Coordinate with satellite stations in the landing area to provide the recovery team with bearings on the package before and hopefully after landing. This saved our !@# on NOSTS-1.
* Work out your logistics (launch site, helium, FAA, etc. well before launch day. We pulled this one off but bearly!
* Establish payload frequencies on quiet areas of the band.
* Don't pick coordination frequencies in the Extra or Advanced portion of the bands.
* Get to the launch site earlier.
* You can never have too much help.

What's next? The ideas for NOSTS-2 are already flowing. GPS, ATV, cameras, 10 Gig, ATV, crossband repeater and more are possibilities. We don't know what the payload manifest is just yet, but we promise it will be even more exciting than NOSTS-1. Stay tuned and sharpen up those DF skills. More fun to come!

A Protocol for Coordinating the Tracking and Recovery of Instrument Packages Borne by High Altitude Balloons.

(or "Where the heck is it now?")

By George F. Riedmuller, NØNJM

Edge of Space Sciences, an Amateur Radio group headquartered in the Denver, Colorado metro area has (at this time)

launched and successfully recovered 19 high altitude (approximately 100,000 feet) balloon borne instrument packages (Shuttle I). The shuttle, containing an ATV camera with 70 cm (centimeter) downlink, microprocessor, 35 MM camera, 2 meter beacon, as well as other miniaturized experiments is a valuable package that can be re-flown after minor repair and reconfiguration over and over again. Therefore, its recovery is essential to the continued operation of EOSS. The tracking and recovery group (T & R) has developed and improved its procedures to ensure the greatest probability of recovery.

I - Communications

A. Not less than a week prior to launch the T & R chairman and the logistics coordinator select potential repeaters to be used by the hunters during and prior to the flight. Permission is requested from the clubs operating these repeaters since the T & R effort usually monopolizes the repeater for several hours or more. Usually these are wide area 2 meter repeaters, although a recent flight utilized a 70 CM repeater most successfully. In addition, we have used a portable "field repeater" which can be set up anywhere if the flight extends beyond the range of permanent repeaters .

B. We have also experimented with an airborne 70 cm repeater and a cross band repeater actually flown on the balloon package.

C. We are extremely fortunate to have repeaters along the front range of Colorado which are located at 8,000 to 14,000 feet above sea level. Needless to say, these repeaters have superb coverage 40, 50, 60 or more miles to the east. Nevertheless, we must be prepared to have adequate communications beyond these repeaters should the flight exceed this distance. The T & R teams are supplied with a map indicating the location of repeaters on the eastern plains including the border area of Nebraska and Kansas. These repeaters are few and far between.

II - Flight Estimates

A. On the evening prior to a launch winds aloft data is received from the NSW (National Weather Service). This data is processed by WB8ELK's Paratrak program resulting in a range and azimuth estimate from the launch point, The logistics coordinator (L C) plots this data on a standard map (used by all T & R team members) and a grid overlay is placed such that the projected flight path is contained within this 90 by 70 mile grid.

B. The logistics coordinator calls an informal net for the T & R team members (usually at 8 pm Friday evening) and disseminates the grid location utilizing 3 widely spaced reference points, noted by their X, Y coordinates. The launch point coordinates and the predicted touchdown are also noted. (See figure 1- previous page)

T & R team members can locate the grid on their own maps and determine if there are any roads in the area and where they would like to initially position themselves. However, specific spots are not selected since experience shows that some change will probably occur based upon the next morning weather data. In addition, the logistics coordinator usually announces the launch point and predicted touchdown in geographical terms (such as "2 miles north of the intersection of highway 86 and country road 19") for the benefit of hams who do not participate, but who enjoy listening to the progress of a flight, Other sections of EOSS, such as launch team, technical committee, etc. are invited to present any last minute update. If the predicted flight and or touchdown are questionable (such as landing in a metropolitan area or ceiling below minimum) the logistics coordinator brings this to the attention of the launch team.

III - Weather update

A. The morning weather data is processed similarly to that described above and the logistics coordinator plots the new predicted touchdown and begins his drive to a high spot near the predicted touchdown. The logistics coordinator may or may not ride in same vehicle with the computer data analyst. Occasionally it has proved helpful for the logistics coordinator and the data analyst to be able to communicate without consuming valuable air time.

B. As T & R members come on frequency the logistics coordinator advises the new predicted touchdown and changes grid location if necessary. The T & R teams affirm their proposed tracking location. The L C may request that some members relocate and some members may request that they be assigned a location. Unless there has been a significant, unexpected change in the winds aloft (such as a change in the jet stream) this is usually a calm, orderly process.

IV - On Site

A. As each T & R team arrives in their areas, they select a convenient hill top or high point with line of sight to the mountains for repeater access. They then determine their exact grid location and report to the logistics coordinator who plots the locations on his map, Ideally, this results in two concentric circles about the touchdown point at 10 to 20 miles

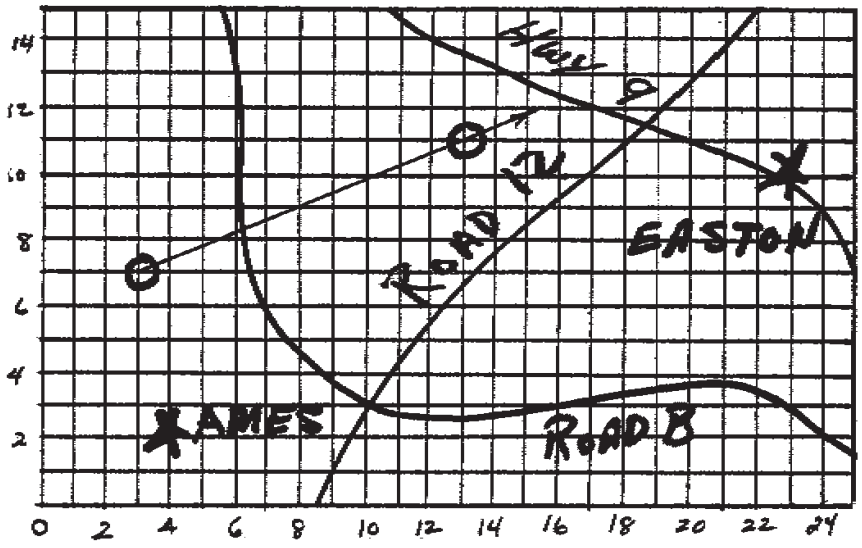


Figure 1.Locating the Grid.
Ames is at 4, 2.
Easton is at 23, 10.
Road B & Road 12 intersect at 10, 3.
Launch point is 3, 7.
Predicted toughdown is 13, 11
Flight is predicted to be 68° true, range of 10.7 miles (statute)

radius, each location with good access to all weather roads in all directions. In reality, we are delighted if 3 or 4 teams have access to something better than a cow path that dead ends in a corn field. The LC may request some teams to quickly relocate to get the best possible tracking data and to eliminate the possibility of several stations "looking down the same pipe". While it is desirable to have 12 to 16 T & R teams, successful recovery is possible with as few as 6 good teams. The logistic coordinator should be near the predicted touch down for best simplex communications (if needed) and to be able to move in any directions as needed.

At this point, the only thing we know for sure is that the predicted touchdown is the one point in the State of Colorado where the pay load will not land. Trust me!

V - Launch

The launch point team is advised by the logistics coordinator that T & R is in place and ready, and requests an update on launch time. There may be a scrub, a delay, or an on time launch. This allows a few moments to relax, check your direction finding (DF) equipment, study the map and reflect upon why you didn't go fishing this morning. Finally launch point advises, "Standby for launch". "Launch at 0812 hours" or some such time. The logistics coordinator notes the time and announces the first beaming will be taken at 0830 and every 15 minutes thereafter. T & R teams announce acquisition of the beacon signal. Any stations with irreparable equipment problems can be reassigned or attached to others.

The logistics coordinator announces 5 minute and 2 minute warnings and then "mark" to ensure that bearings are taken simultaneously. Logistics Coordinator turns the frequency to the computer analyst who waits about a minute and then calls for data. T & R teams report their positions and azimuth to the beacon. The computer crunches the data and provides a best approximation of location for the logistic coordinator (and other team members to plot). The launch point may be able to advise altitude and or a Loran or GPS location, depending upon what experiments are being flown. The computer can compare fox hunter plots with Loran to determine if there are any systematic errors or if a particular tracker has a repeatable error. (an underground pipe or wire can wreak havoc with your compass).

VI - Flight

A. By the time the third bearing is taken, the logistic coordinator must decide if the balloon is traveling in accordance with the flight path estimate or if the balloon has chosen to go some where else. The logistic coordinator may now suggest that the stations farthest away may begin moving to some new location. It is not possible to move the "Circle", so those farthest away should be relocated. This must be done judiciously so that a significant (minimum) number of trackers are able to provide adequate data while others are in motion (see figure 2). Experience tells us to ignore surface winds as they are insignificant when compared to the winds aloft.

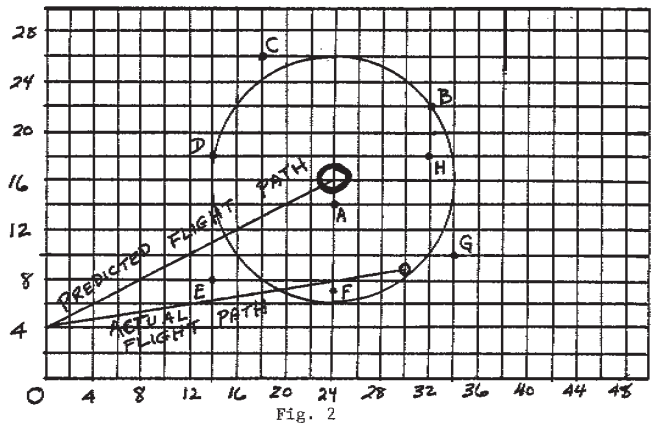


Fig. 2

Predicted toughdown 24, 16. Circle indicates 10 mi. radius

Location of Trackers:
A. 24, 14
B. 32, 22
C. 18, 26
D. 14, 18
E. 14, 8
F. 24, 7
G. 34, 10
H. 32, 18

It can be seen, early in the flight, that the balloon is traveling further south than was predicted. Charlie, Delta, and Bravo are candidates to relocate to the south & southeast. When Echo is overflown, he can start to the East.
In the last 15 minutes of descent, Foxtrot & Golf are candidates to "DF on the fly" and try to be under the package when it lands. (Hard hats are recommended.)

B. The logistics coordinator reminds everyone to keep transmissions brief and to keep the frequency as clear as possible.

C. Several rare bearings can be taken until the balloon reaches maximum altitude and bursts. This is noted by altitude telemetry and or ATV of the burst. The launch point advises the exact burst time and the logistics coordinator notes this time and the positions plotted by the T & R teams at the time closet to burst. The logistic coordinator now has "experienced" the latest weather data. Utilizing the ascent flight profile and time and the decent time estimates (the shuttle and its parachute drop like a stone for 30 or 40 thousand feet before the chute significantly retards the fall). The logistics coordinator now climbs way out on a small limb and announces the predicted touchdown based upon ascent data. Tracking and recovery also goes into "rapid fire" mode of data acquisition. Instead of 15 minutes reports we drop to 10 minutes, to 5 minutes, to as fast as possible at the discretion of the computer analyst. The briefest possible transmissions are required so that hunters can be given instructions while data is rapidly pouring in.

D. When the parachute descent is in its last 15 minutes or so the logistics coordinator makes his last estimate of touchdown and asks one or two of the closest teams to head in the proper direction and DF on the fly. It is imperative that the logistic coordinator attempt to position someone close enough to hear the beacon. Terrain features, a broken antenna, or other problem caused by the impact of a parachute landing can easily attenuate the signal so distant stations cannot detect it. It is also imperative that some stations hold their positions and give the best data possible so that if the beacon is disabled upon landing we know where to begin a visual search. Some of the teams put into motion earlier may have to stop to provide additional bearings. If the aircraft is assisting, the logistic coordinator can vector it in for both RDF and visual tracking (the parachute is fluorescent orange and the shuttle is reflective copper). This is the most exciting part of the chase and coordination is largely an exercise in futility. Miraculously, as stations begin to report LOS (loss of signal) some semblance of teamwork returns.

VII - Recovery

We await with high hopes that at least one station announces he still has the signal. The logistics coordinator requests that station to stop where he is and give his location and azimuth and not move until another team acquires the signal. By plotting these two bearing the rest of the hunters can be vectored in. Shortly thereafter, someone announces, "I have a visual on the chute". this is usually followed by his location or perhaps we DF

on the transmission. All that is left is to get permission to enter the private property and recover the payload. Sometimes finding the land owner is more difficult than finding the payload.

VIII-Problems and Imperatives

The recovery described above is typical but...

A. We've had balloons fly 90 deg. from the predicted flight path. On a long flight there is not enough time to reset a circle around the new predicted touchdown. Hunters must DF on the fly and hope for the best.

B. If the balloon out runs repeater coverage, it is imperative that all T & R teams switch frequencies together. Even if you have to revert to a backup Simplex, everyone has to be able to communicate. (One flight went to North Platte, Nebraska.)

C. Since we are all hams, it is a given that we like to talk on the radio. During tracking and recovery we must contain ourselves and severely limit transmission to the briefest possible. It is well to think to ourselves, just prior to keying the microphone.

"Does anyone need to know this?"

In addition, the logistics coordinator must be prepared, in his role as net control, to remind others who want to use their favorite repeater that a recovery is in progress. In my experience, those hams have made the briefest of calls and continued on another frequency. This behavior speaks volumes of the courtesy hams show one another. We greatly appreciate this.

D. When everyone announces LOS the logistics coordinator looks for a glimmer of hope on the map board and advises the probable touchdown locations and fervently hopes the shuttle isn't proudly transmitting its beacon 30 miles away. As the hunters converge, everyone listens for the beacon. If we fail to hear the beacon, the hunters meet in person or on the air to determine a search pattern. Since many ranches are miles from roads, the aircraft is invaluable at this juncture. The logistics coordinator gets to direct a ground search operation. Perseverance is a virtue.

IX - Appreciation

The success of the Tracking and Recovery group at EOSS is a function of the effort and expertise of the members. I would like to acknowledge just a few of the fine people who have provided us with the tools of success.

A. Paul Ternlund, WB3JZV, who developed the computer triangulation program which analyzes the tracking data, comparing and rejecting, and finally selecting the best data with which we plot our fixes; and which provides most accurate possible data in 1/10,000 of the time plotting by hand would take. See QST August 1993 "Persistence gets the Derelict".

B, Bob Ragain, WB4ETT, who built the two meter radio beacon which performs so dependably that we forget the environment in which this rig must work. This (miniature) lightweight unit begins its flight at 60 deg. or 70 deg. F and transitions then 60 deg below zero and back again to 70 deg. F above and then absorbs the impact of a parachute landing. Then we change the batteries and expect it to work flawlessly again on the next flight...and it does.

C. KØELM, Greg Burnett is the leader of the T & R group and the glue that keeps us together. He arranges technical meetings that help us improve our methods, coordinates the repeater usage and molds our members into a dynamic force. Greg is gifted with a superb analytical mind and the ability to solve problems "on the run" that would cause may of us to despair.

D. Marty Griffin, WAØGEH, who shares the duty of logistics coordinator and fox hunter extraordinaire, who has the ability to calm every one down when disaster strikes and sure enough, we find a solution.

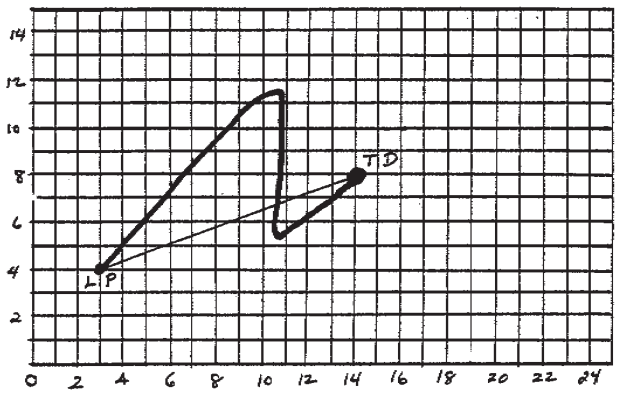
E. Dan Meyer, NØPUF, who's efficient and intuitive solo RDFing accomplishes more than many three man teams are capable of.

F. And all the other tireless fox hunters who don't know the meaning of quit. Dave Galpin KBØLP, Colleen NØQGH and Dawn NØQCW Ragain, Ed Boyer NØMHU (Air One Pilot and crew), Greg DeWit NØJMH, Ian Zahn KBØHKY, Lonnie Jamison NØPCZ, Marv Jones ADØY, Richard Shaw WB5YOE, Tom Isenberg NØKSR, Tim Moffitt NØNXI, Rick von Glahn NØKKZ, Larry Cernsy NØSTZ, Maclom Benton KE9S, Mike Doherty KBØJYO, Bill Andrus NØEUL, Roger Smith NØLEQ

X - Conclusion

So why do we do this? Because it is a challenge and it may be the ultimate fox hunt. And it's fun. At EOSS we have launched 19, and recovered 19 as of this writing. We are constantly improving our techniques and we are pretty good at it. Will we always be 100% You bet!!!

FIG. 2 A



The Logistics Coordinator needs to be aware of significant wind shifts that cause the balloon to appear to deviate from the predicted flight path. In this case there is a temptation to start moving T & R teams north before the jet stream causes the balloon to jog south. (This would be repeated on descent.)

Presidents corner

by Merle McCaslin, KØYUK

What a great article Steve Ford wrote in the October QST about ballooning in general and about our group as well as the EOSS-13 picture from 95,000. As a result of the article, I have received forty some inquiries from all around the country and three from Canada. A dozen of which sent membership dues and also several orders for videos (sorry some videos have been delayed due to a VCR failure).

EOSS has had two flights since the last newsletter. EOSS-18 and on August 27th which was launched from near Monument and EOSS-19 on Oct 22 with the Pitts Middle School in Pueblo, Co. Both of these flights went well. EOSS-18 was the first flight using the spin stabilization experiment. It did slow down the spin, but some improvements are still needed. The flight went only 15 miles northeast of the launch point into the Black Forest area. A package from the NAVSYS company came loose some time after the balloon burst and it was not recovered. All of the EOSS standard equipment worked fine and was recovered in short order by the Tracking and Recovery Team. The folks from NAVSYS, one of our sponsors on

flights 17 and 18, provided a barbecue after both flights which was appreciated by everyone after a long day.

The EOSS-19 flight from Pueblo was a real fun one, working with some sixty students as well as their parents and teachers. The original idea was to have a balloon flight in September as a kick off of the New Generation Team (described in the article from N.G.T.) After some discussion a decision was made to delay it a few weeks and let the students get an experiment on board. With Marty Tressel, an EOSS member from Pueblo, doing the interface and Marty Griffin handling the education lead for EOSS an October 22nd flight was scheduled for the flight. The students had two experiments, a solar cell and a ozone experiment which was very ingenious. (See related articles about the schools activity). This also was our first flight of a color camera. I want to thank Marty Tressel for organizing this flight and also getting sponsors for the flight, as well as the donation of the color camera to EOSS. The camera worked well, but we did have a problem with moisture and ice on the mirror. We use a mirror that can be rotated from ground commands to obtain pictures from different angles. The moisture became ice crystals at about 12,000 feet which resulted in very poor video until we got back down to 12,000 feet. This problem appears to be because of a good cleaning job on the mirror and window. This cleaning removed all of the RAIN-X (an anti-fogging agent) and we did not put RAIN-X back on these surfaces. We always learn something the hard way from these flights. As I said earlier, it was a fun experience with all of the student involvement. Several EOSS members said 'this is what it is all about and that it was a rewarding experience.' I received the following letter from Lou Lile one of the teachers that got this New Generation Team started.

Dear Merle: Hello

I want to thank you and all EOSS members for allowing our New Generation Team to assist with your high altitude balloon launch. We really appreciate the time and energy you shared with us. Coming into our school and making a terrific presentation was wonderful. I am sending you an article to edit and place in your EOSS paper as we discussed.

Our students, parents and teachers had a good Saturday at USC with you. The EOSS members were really good with our students. Several kids in particular who are 'turned off' by the traditional methods of education were totally absorbed on Saturday. You really make a difference!

signed - Lou Lile

Lou tells me that the students are continuing to work with the packet data and will for some time. I want to wish Lou and all of the New Generation Team a lot of success.

Submissions to the *Stratosphere*

Stratosphere welcomes any and all articles pertaining to High Altitude Ballooning and Amateur Radio.

Submit your article in a computer readable format. We prefer text files be submitted in plain ASCII. Most formats of graphic files and gray scale photographic images are supported. If you are in doubt contact the Layout Editor.

Should you submit any hard copy materials, be sure to get them in early as they will have to be typed in or sent out for image scanning.

The preferred route for submission is via electronic mail. This will speed our receipt of your materials and give us a return address where we can contact you regarding any questions we might have on your article.

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In this Issue: