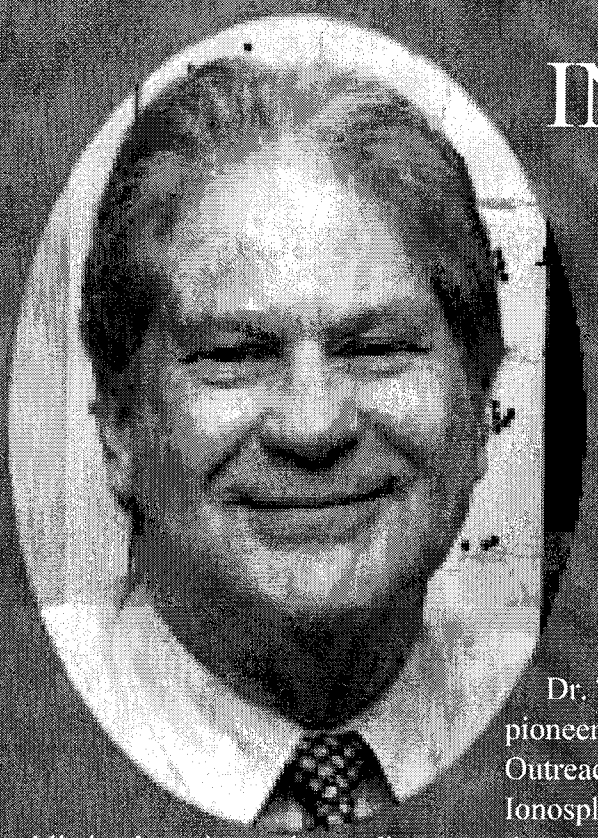
The INSPIRE Journal

Volume 14 December 2005



# INSPIRE Mourns the Passing of Bill Taylor

William W. L. Taylor, co-founder of The INSPIRE Project and leader in space science education died of a heart attack July 16 at his home in Washington, DC. He was 62.

Dr. Taylor was President of INSPIRE, one of the pioneering successes in NASA Education and Public Outreach. INSPIRE (Interactive NASA Space Physics Ionosphere Radio Experiments) engages students and the public in observing and recording natural and manmade very low frequency (VLF) radio waves.

Bill received his BS in physics from the University of Redlands in California in 1965 and an MS in 1967 and PhD in 1973, both in physics, from the University of Iowa. His research focused on wave-particle interactions in space plasmas.

From 1975 tp 1978, Bill worked at NASA headquarters in Washington DC as program scientist for Spacelab 1. In 1978, he moved to Redondo Beach, CA, to work for TRW as department manager for space sciences. He returned to NASA headquarters in 1990 as chief scientist for Space Station Freedom. In 1996, Bill accepted a position with Raytheon as project manager for the Goddard Space Science Data Operations Office contract. He later moved to the QSS Group Inc. in the same position.

In 1992, students from nearly 1000 schools set up a network of ground stations across the country to record data from an experiment on the ATLAS-1 space shuttle mission. "It's a great science fair," Bill said at the time. "I don't think anything like this has ever been done. The students are helping us do research in space physics to an extent not possible without them."

This issue of *The INSPIRE Journal* is dedicated with admiration to the memory of Bill Taylor. The INSPIRE Project, Inc., will continue as his legacy.

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The INSPIRE Journal Volume 13 December 2005

*The INSPIRE Journal* is a publication of The INSPIRE Project, Inc., a nonprofit educational/scientific corporation of the State of California. The purpose of the INSPIRE Project, Inc., is to promote and support the involvement of students in space science research. All officers and directors of the corporation serve as volunteers with no financial compensation. The INSPIRE Project, Inc., has received both federal and state tax-exempt status (FEIN 95-4418628).
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Contributions to the *Journal* may be sent to the editor:

Bill Pine
1348 N. Quince Ave.
Upland, CA 91786

email: pine@mail630.gsfc.nasa.gov

## The INSPIRE Journal On-line

This issue of The INSPIRE Journal is the first that will appear on-line on the INSPIRE web site:

**http://image.gsfc.nasa.gov/poetry/inspire**

An important feature of the on-line version of the Field Report article will be the inclusion of sound files for each data session and for any additional analysis that is done. All photos will also appear in color on-line. In the future it is hoped that the on-line version will be available in December of each year when the printed version is mailed. This year it will take some time to get the bugs ironed out, so the issue will appear on-line as soon as possible. Check the web site for new links to the on-line *Journal*. If you would like an email message when the on-line *Journal* is ready, send me a message at: pine@mail630.gsfc.nasa.gov

## Observation Information Provided in the *Journal*

Schedules and log forms for observing are provided as the "Observer Packet" starting on Page 43.

## Check Your *INSPIRE Journal* Subscription

Even though The INSPIRE Journal has changed its publishing schedule from two times per year to once per year, the number of issues on your subscription has not changed. The number of remaining issues on your subscription is shown on the right of the name line on your address label. Those whose subscriptions were scheduled to end with the November 2005 issue have one additional issue remaining – the December 2006 issue. Additional years of subscription have been credited at the rate of two issues per year of subscription. Please check your address label to make sure this has been done correctly for you. Contact the editor with any questions.

## Write for *The INSPIRE Journal*

The procedure for contributing articles for *The INSPIRE Journal* could not be simpler! Just send it in! Any format is acceptable. Electronic format is easier to work with. A Word file on disk for either the PC or Mac platform is preferred. An email message will work, too. If that does not work for you, a paper copy will do. Any diagrams or figures can be scanned in.

What about topics? Anything that interests you will probably interest most INSPIRE participants. As long as the topic is related to natural radio or the equipment used, it will get printed. The deadline for submissions is December 1. Don't worry about the deadlines though. If you miss a deadline, you will just be very early for the next edition! Articles will be placed on the web site as soon as they are prepared. The next issue of the *Journal* will gradually appear on the web site during the year.

We at INSPIRE are looking forward to hearing from you!

## Contributions in Bill Taylor's Memory

INSPIRE is accepting tax-deductible contributions in memory of Bill Taylor. The memorial fund will be used to support student involvement in INSPIRE. Details will be reported in the *Journal*. Please make checks payable to "The INSPIRE Project, Inc." and mail to the editor at the address on the Order Form (Page 47).

# My Thoughts About William W.L. Taylor and INSPIRE

Kathleen Franzen, Washington, DC
President, The INSPIRE Project, Inc.

Perhaps the best place to start is to let all of you know who I am. I am Bill Taylor's wife and I have always called him William. One of our very first dates was William introducing me to the magic of an aurora. And after that there was no looking back. William wanted me to know all about the atmosphere and beyond. He wanted to show me what he so respected in his space science world and truly found fascinating and merited exploration.

None of us reading this INSPIRE Journal wants to be reading anything from me because it signals a tragic loss and a major change in the organization. Our tall smiling cheerful big kid who had such a gift of curiosity is closer to his whistlers, chorus, hiss, tweeks and sferics. William is now in our memories like a very bright crackling bolt of lightning.

I want all of you to know that the last day William came home he was enthusiastic, very happy and looking forward to the weekend. There was nothing to indicate that something was wrong with him or that his death was so imminent. That evening he even treated himself to one of his favorite food things, a root beer float!

All of you are components of his respect and drive for making education and public outreach in science a life mission for him both professionally and personally. William's work achieving these goals must continue and this will become his much-deserved legacy.

When Bill Pine, co-founder of INSPIRE, asked me if I would consider becoming the President of INSPIRE I did not hesitate. When the INSPIRE Board gave me their vote of confidence to carry out William's role as president of INSPIRE I was indeed humbled and also gratified. I cannot take William's place nor would I presume to do so, especially in the area of Space Science. However, I can utilize my years in public relations, advertising and customer service to ensure our continuing participation in the DC Space Grant Consortium, maintaining our current corporate partners and actively identifying other science and partner opportunities.

To help me in the identification of other INSPIRE projects I am creating a Science Advisory Council. This Council will have participants from junior high, high school and college/university levels. I anticipate some respective teacher participation to assist the Council's success.

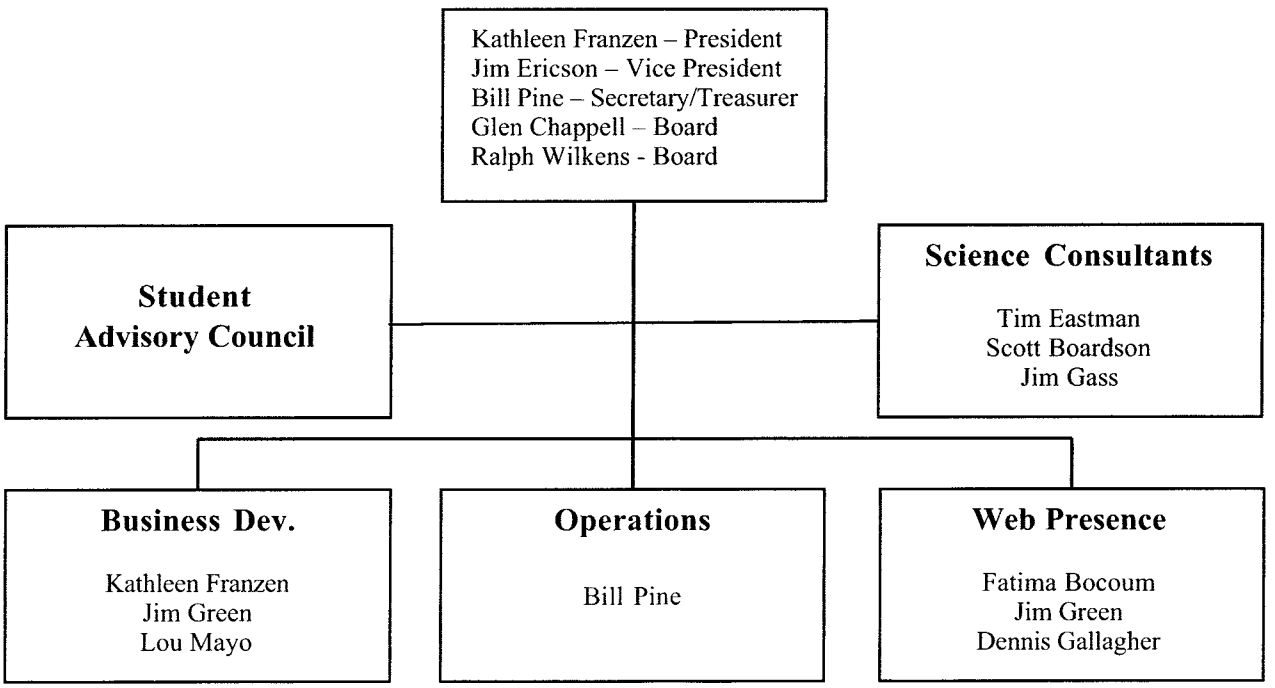
Our Science Advisory Council will have two responsibilities. The most important will be that our members, whose strong academic interests will be in science, physics and math, discuss their creative vision of earth and the atmosphere leading them to develop experiments that would be appropriate to the mission of INSPIRE. The second responsibility is for the members of the Council to learn corporate governance and teamwork involving several generations. This will be a solid experience for their future contribution to the workforce whether it is collegiate, corporate or entrepreneurial.

I am well aware that most people don't embrace change. Unfortunately some of our experience over that past few months cannot be changed. We can only re-commit to making INSPIRE William's legacy. We are fortunate to have in this effort the continuing partnerships of our members, colleagues, students and friends

Many thanks for all your work and many contributions. Your acknowledgements of support since William's death have been very appreciated. If you have any questions, please do not hesitate to send me an email at womanfriday@dcaccess.net.

Bill Pine and William spent a great deal of time around our dining room table in Redondo Beach in the first years of INSPIRE as it took shape. I will always feel privileged that I was included and that we all were able to see its success and contribution to education and public outreach. As the INSPIRE mission states, "Stimulating students to learn and understand science and technology is key to them fulfilling their potential in the best interests or our society." If we remind ourselves of this our work ahead will have clarity and indeed be inspired.

## INSPIRE Organization



# Remembering Bill Taylor

James L. Green, GSFC, Greenbelt, MD
"Celebrating William Event"
October 1, 2005

I first met Bill Taylor at the University of Iowa in 1975. I was getting my PhD under Stan Shawhan. Bill, who had graduated in 1973, was a Research Associate at the University of Minnesota. He was working on a paper with Stan who had been his advisor. He found me in the computer room and we chatted. He wanted to use a ray-tracing program that Stan and I had been working on and I was delighted to get him on the computers there. We hit if off right away. Was it because we had the same advisor, or that we were both deeply interested in magnetospheric plasma waves, but in thinking back it was probably because he had one of the most welcoming, engaging smiles that you can imagine. I remember his smile as he walked into the computer room. It is the type of smile that says, "I know something that you don't." You naturally want to get to know him right way because you want to know that secret. I finally figured it out. It is the secret of enjoying life in the moment, every moment, and he did.

As time went on we kept track of each other's career. I met Kathleen for the first time at a Radio Science Conference held in Florence, Italy, in 1984. A year later I was looking for a job and Bill gave me a job offer to work with him at then TRW in Redondo Beach. I vividly remember my conversation with Bill when I told him I had accepted the position to head the National Space Science Data Center (NSSDC) at Goddard Space Flight Center. He was delighted and tremendously supportive. He said that it was better for everyone if I went to the NSSDC than to TRW.

In 1988 Bill Taylor and Bill Pine started INSPIRE (Interactive NASA Space Physics Ionosphere Radio Experiments), a unique and important way for high school students to learn and get excited about science. In 1990 Bill came to NASA Headquarters as Chief Scientist for Space Station Freedom. Bill decided to talk to the NASA Public Affairs Office and see what they could do to help him with INSPIRE. At that time, the NASA Public Affairs Office was the only public outreach group in NASA. Bill briefed them on INSPIRE but was not prepared for the reception he got. His request for help was not only turned down but he was flatly told that he should not be doing this at all since he was not a professional educator and he knew nothing about how to deal with the public: that should be left to them. Since INSPIRE was not invented by PAO they were just not interested. But that didn't stop Bill. From this experience Bill learned what the educational standards were and found how INSPIRE would be able to fit in.

With Bill in the area we started working together on INSPIRE. The climate at NASA was changing; Education and Public Outreach was becoming important since NASA was trying to find relevance with the public. Bill and I were able to obtain a very small, but important set of funding for INSPIRE starting in 1994. This continued through several proposal cycles.

In addition to working with Bill on INSPIRE we formed a team and began to find ways to promote a unique science experiment, something that hadn't been done before, radio sounding in the magnetosphere. We performed simulations, gave presentations, and educated the science community on this new technique until finally the Radio Plasma Imager team (or RPI) was on the winning Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite selected in 1995.

The RPI instrument went through some severe community criticisms, casting a major doubt as to whether this instrument could do something never before done. Throughout this period of intense discussions and community criticisms Bill was like a rock of strength helping us at every step. A Non-Advocate Review requested by NASA Headquarters was set up to determine if RPI would be on IMAGE or not. At the end of the review it was declared that RPI was a pioneering instrument that should be flown. RPI has been a tremendous success. It has produced over 65 science papers and that, on the average, is one paper per month since IMAGE was launched in March 2000. In many of these papers you will find major contributions from Bill Taylor. He was a careful, insightful, and outstanding magnetospheric scientist.

Another major contribution from Bill on the IMAGE mission was that he invented POETRY. POETRY stands for Public Outreach, Education, Teaching, and Reaching Youth. IMAGE was the first NASA mission with a fully funded Education and Public Outreach program and it was headed by Bill. The goal of POETRY is to explain how solar storms affect the Earth and why we have aurora. POETRY has been the model for every mission EPO program since.

At every science meeting Bill and I went to, during the breaks, Bill would dash outside and walk around with hand stretched out above his head with what looks like an old style '60s portable radio with a long expanding antenna jetting straight out (the iPOD in that era). Anyone who didn't know Bill would think he was trying to find the best reception for his AM radio, but instead of tuning into a station, he was tuning into the magnetosphere with a modified INSPIRE kit. He would always use two earpiece earphones so that if he heard some neat sferics or a whistler or two he would motion me over and I would listen. His eyes would light up and we both would smile then estimate how far these signals had come from. "That was a good one," he would say as we would listen for the return hop.

I must tell you that Bill and I with others just published a paper in the Journal of Geophysical Research and it showed that the lightning whistlers are probably responsible for shaping the Van Allen Radiation Belts into two major bands around the Earth. This answers one of the oldest questions in space physics: Why are there two electron radiation belts? The answer is that if it wasn't for lightning, there would only be one. Lightning carves one radiation belt into two halves

and it is done by the whistlers that Bill constantly listened to and brought to students all over the world with INSPIRE.

In the mid-'90's, Bill became the project manager for a major contract at GSFC and this placed him in daily contact with me all the way up until his untimely death. As a contract manager, he was the best. Every morning Bill would stop by my office when he came in. We would discuss the upcoming day's activities and especially the challenges. In particular Bill would identify the top things that he would do for the organization. Some of Bill's top qualities were his ability to listen and his ability to get things done. Bill was an outstanding leader and manager.

Bill was like a brother to me. I learned a lot from Bill ranging from the physics of VLF emissions to how to manage major NASA projects and contracts. It is important to know that what Bill did mattered. It mattered here for many of us in NASA. What he did also matters for students in schools all across the country that use the INSPIRE receivers and are allowed to see our world in a different way. It matters in ways we may never know. Putting together INSPIRE kits inspired my son. Electrical engineering at the University of Maryland is his favorite topic. You can bet that is happening to kids all across the country.

To me, Bill was just irreplaceable and I will miss him every day in some way. Bill Taylor did live life to the fullest. He excelled at many things. This is a quality that few of us have. We each saw a different side of Bill. He was a true friend, colleague, husband, scientist, mentor, educator, innovator, leader, manager, businessman, and a pretty great human being all in one. It was a privilege to know him.

# My Friend, Bill Taylor

Bill Pine, Upland, CA
Secretary/Treasurer and Co-Founder
The INSPIRE Project, Inc.

Note: The following is an approximate transcript of a talk given in Washington, DC, on October 1, 2005, at the Columbus Club in Union Station. The occasion was the remembrance gathering celebrating the life of Bill Taylor and the impact he had on so many.

I met Bill Taylor 44 years ago. It was a September weekend in 1961 as the new freshman class at the University of Redlands moved into their dorms. That morning I met my roommate, John Herrell, who is here tonight with his wife, Connie. That afternoon, John and I met Bill and his roommate, Toby Scott, who could not be here tonight. We sat around and talked for a while and then went to dinner together. The four of us went to dinner together almost every evening for the next four years.

We formed a special friendship that endures to the present. I hope you have formed friendships like this because then you will know how lucky we are.

Bill and I were half of the physics majors in our class at Redlands. We were lab partners in all of our physics labs. Lab partners have to work together to determine what equipment to use and what measurements to make to address the topic of each lab. This involves a lot of brainstorming and sometimes some disagreement about the exact procedure to use. Bill and I developed a procedure for resolving any issues that arose: we argued! Some weeks there was a lot of argument! A benefit of this process became evident later in our careers when we found ourselves once again working together – this time on education and public outreach projects. We found that we had developed the ability to divide responsibilities and trust the other to do the job the right way.

In our undergraduate years I noticed two defining characteristics that Bill had. One was his seemingly unlimited ability to learn. Bill knew more about more topics than anyone I know. The other characteristic was his willingness to work. There was no limit to the time and effort Bill would put into a project that was important to him.

I have done some thinking about what I could tell you about Bill Taylor that you might not know. Since most of you know him from graduate school in Iowa or from his career as a scientist, educator and manager, I thought back to our time at Redlands. You might not know that Bill was an athlete.

In our sophomore year Bill went out for football. That may not surprise you because Bill was a big man, built like the offensive tackle he was. What was surprising was that this was Bill's first

experience with organized football. The first football team Bill was on was at the intercollegiate level. Bill was not a starter, but he played on special teams and few regular series. From the sidelines I could hear his teammates encourage him when he got in. They knew his level of experience at the start of the season and they were proud of his accomplishments.

Later that year, Bill was recruited by the soccer team as a goalie. Bill had no experience playing soccer at all. In 1963, soccer was not the popular sport in the US that it is today. Bill may have played goalie in the first game he ever saw. I know it was the first organized soccer game I ever saw. Bill's ability to learn and willingness to work turned him into an excellent goalie and he played on the team for two seasons.

Another example of Bill the athlete was when he became a surfer. I had been surfing for a few years when I got to college. Some friends and I surfed most Saturdays through the year. Bill decided he wanted to give it a try. Bill was from Oregon, so you can be sure he had not done any surfing there. Now winter surfing in California can be trying. The water is cold and the weather is often dreary, but Bill persevered. He had a 12 foot long surfboard (long even for the "longboard" days) that was painted orange. To see Bill cutting across a wave was a sight. He was probably the biggest surfer on the beach with the longest board ... and the worst tan! For Bill, a tan just meant more freckles.

In 1988, over 20 years after we left Redlands, Bill to his career as a PhD physicist for NASA and TRW and me for my career as a high school physics teacher, we again found a chance to work together. We had gathered in San Francisco for the wedding of John and Connie's daughter. Bill and Kathleen and my wife, Beth, and I had a great time around town before the wedding. At the reception after the wedding, Bill said he had an idea he wanted to tell me about. He drew a block diagram on the wedding program showing a loop antenna, a preamplifier, an amplifier and headphones and he told me about natural radio. I had followed some of his research efforts when he was at Iowa, but I will admit I really did not understand much about wave behaviors in space plasmas, but it sounded interesting. Bill's idea was to make these radio receivers available to students – specifically high school students – and invite them to make observations of sferics, tweeks, whistlers and the other sounds of natural radio.

He had a simple question for me: Did I think high school teachers and students would be interested in participating? My answer was that I did not know if others would be interested, but I was. This conversation led to what became The INSPIRE Project.

There was much to be done and, once again, we were working together. A refreshing difference was that his time there were no arguments! The INSPIRE Project is organized around two features: all work is done by volunteers to keep overhead down and kits are sold at cost to make them affordable to more students.

When it came time to choose a name for our project, Bill and Kathleen had moved back to Washington DC, so our meetings were on the phone. We decided that we needed an acronym (after all, this is NASA...), so we agreed to work separately to come up with two good

possibilities and meet again on the phone in a week. During that week I discovered that I was terrible at coining acronyms. What I found out on the next phone call was that Bill was really good at it. When we talked a week later, I had come up with two pitiful candidates for names and Bill said he had "one good one and one so-so one". I suggested that he go first with his best name. He suggested INSPIRE; Interactive NASA Space Physics Ionosphere Radio Experiments. I said that sounded great. I never heard Bill's "so-so" name and he certainly never heard my efforts!

Now, with Bill gone, the question arises: How can INSPIRE go on? In talking to Kathleen on that fateful Saturday morning, she expressed her desire that INSPIRE continue as Bill's legacy. I said that I would do what I could to make that happen, but I knew that finding a replacement for Bill and all he did for INSPIRE would be nearly impossible. In talking with people at Goddard at the end of the summer it became clear that replacing Bill would require many people – but there were people willing to help. There was plenty of expertise available in the natural radio area; I would go on with my work in the day-to-day operation of the corporation, but we needed someone to act as President and represent INSPIRE within the NASA organization and on the DC Space Grant Consortium. After some consideration, a person came to mind who would be a perfect fit to lead the organization as it continues as Bill's legacy. I am very pleased to announce tonight that the new president of INSPIRE is Kathleen Franzen, Bill's wife.

I look forward to working with Kathleen and to the future of INSPIRE.

Finally, I would like to tell you what INSPIRE has meant to me. Last June I retired after 35 years of teaching, the last 34 at Chaffey High School in Ontario, California. INSPIRE came along about halfway through my career. I had often wondered how the latter part of my career would feel. Would I burn out and stop doing the kind of job that teaching deserves? I had seen this happen in some colleagues.

INSPIRE revitalized my career just when it might have gotten dull. INSPIRE changed the way I interacted with my students. Field trips to the mountains to record natural radio became treasured experiences that allowed me to know my students better and in a different way than is possible in the classroom. I had students who took physics so they could go on the mountain trips. I had students that performed better in the classroom because of their involvement in INSPIRE. My students packed kits for shipping and helped with all aspects of the operations. I looked forward to my last year, not because I was glad my teaching career was coming to an end, but because I was eager to see what would come next. My replacement as physics teacher at Chaffey is a former student who has taught freshman science for 12 years waiting for me to get out of the way. He will do a terrific job and Chaffey will go on just fine without me. And INSPIRE will go on as Bill Taylor's legacy.

I owe all of this to Bill Taylor and I thank him.

Thank you for listening.

# The Venture Crew Experiment on the 2005 Deep Space Test Bed High Altitude Balloon Flight

Jeremy Myers, Huntsville, AL
Dennis Gallagher, Huntsville, AL
MSFC Venture Crew

## Introduction

Man aspires to travel to the farthest regions of the universe. Yet we are confined to the necessities of the environment in which we dwell here on planet earth. NASA has recognized these limitations and hopes to have an ever increasing hold on what systems must be in place to support life outside the confines of planet earth.

One of the dangers of space is the radiation levels. For this reason NASA has worked the past few years to create a test bed on which to test different sensor and material reactions to radiation. The Deep Space Test Bed (DSTP) is designed to fly by balloon to altitudes of 120,000 feet in the polar regions, areas with a large influx of radiation here on earth.

Weighing nearly 5000 pounds it is not a small structure, but contains a great amount of electronics and robust design to sustain launch and landing loads. The scientific balloon used to lift the test bed, when at full inflation, has a diameter of two football fields.

## Background

In June of 2005 the NASA vehicle Deep Space Test Bed performed a test mission flying out of Fort Sumner, New Mexico. Since the purpose of this flight was to test the operability of the flight systems, NASA had no plans for payloads. However, any high altitude flight is a good opportunity for scientific data, therefore, a call for proposals was sent to students and educators on possible payloads. A portion of the Marshall Space Flight Center Venture Crew, (Sam Bryan, Debbie Chatterjee, Amit Chatterjee, and Carlos Perez-Silva, along with their NASA Mentors, Jeremy Myers and Tia Ferguson, DSTB Designers, and Dennis Gallagher, Space Scientist) assembled a plan to fly an INSPIRE VLF receiver (http://image.gsfc.nasa.gov/poetry/inspire/) and downward pointed video camera with real-time transmission of the video/audio signal to the ground. This would allow a comparison of VLF signals at altitude to those found on the ground. The Venture Crew made up of high school seniors is shown in Figure 1, where they are learning how to operate their VLF equipment in the field. That's literal in this case as they were practicing in the soccer field at Grissom High School in Huntsville, AL.

Figure 1:

The MSFC Venture Crew is shown practicing use of their VLF equipment at Grissom High School in Huntsville, AL. From the left are Amit Chatterjee, Sam Bryan, Debbie Chatterjee,, and Carlos Perez-Silva.

Along with the flight unit which flew at an altitude of about 38,000 meters, a third of the way to the ionosphere, it was planned for the students to build an INSPIRE VLF-3 receiver kit and operate it near their home in Huntsville, Alabama. The planned mission was announced to the Yahoo VLF discussion group (http://groups.yahoo.com/group/VLF_Group/) and two long-time VLF enthusiasts volunteered to perform separate recordings of their own. David Jones operated his receiver and recorder near Phoenix City, Alabama, (at 32.5n 85w) and Michael Mideke operated his equipment in Rosedale, New Mexico. The goal was for the students to gain experience building the receiver, participating in a flight experiment, and analyzing data. The data analysis involved comparing VLF data at altitude to that at various ground locations.

## Setup and Flight

In building the experiment, a VLF-3 receiver kit (donated by the INSPIRE Project), a fifteen-foot single wire antenna, and a short ground stay were used. Before looking for a testing location, the crew learned how to operate the radio with the universal time code station, how to set up the antennae, and use a recording device (a Radio Shack cassette audio recorder). In order for the receiver to function correctly and pick up useful signal without much 60Hz interference, the crew found a site one mile from any power line. To accomplish locating this testing area, the crew utilized Google Earth software which provides 1 meter resolution for urban areas. Using these satellite photos, locating appropriate test locations which are a proper distant from power lines and their 60Hz hum was quite easy. At this resolution, buildings, roads, and high tension power lines are easily located. Therefore using a 2 mile diameter circle (Figure 2), a location was found on the banks of the Tennessee River in farm land close to Huntsville urban center (at 34.515n 86.5349w).


Figure 2: This shows Google Earth Software and its use in finding an appropriate recording location in an urban area.

Scientific Ballooning Flights require pristine conditions to ensure a safe flight. Therefore, flights were attempted for over a month before appropriate flight conditions appeared. Because of the nature of these flights and its dependence on hourly weather data, those recording at the three ground locations had to be ready at any time to head to the field to record their data. The DSTB flew for ten hours on June 18, 2005. During this flight it traveled nearly 450 km across the state of New Mexico (Figure 3).

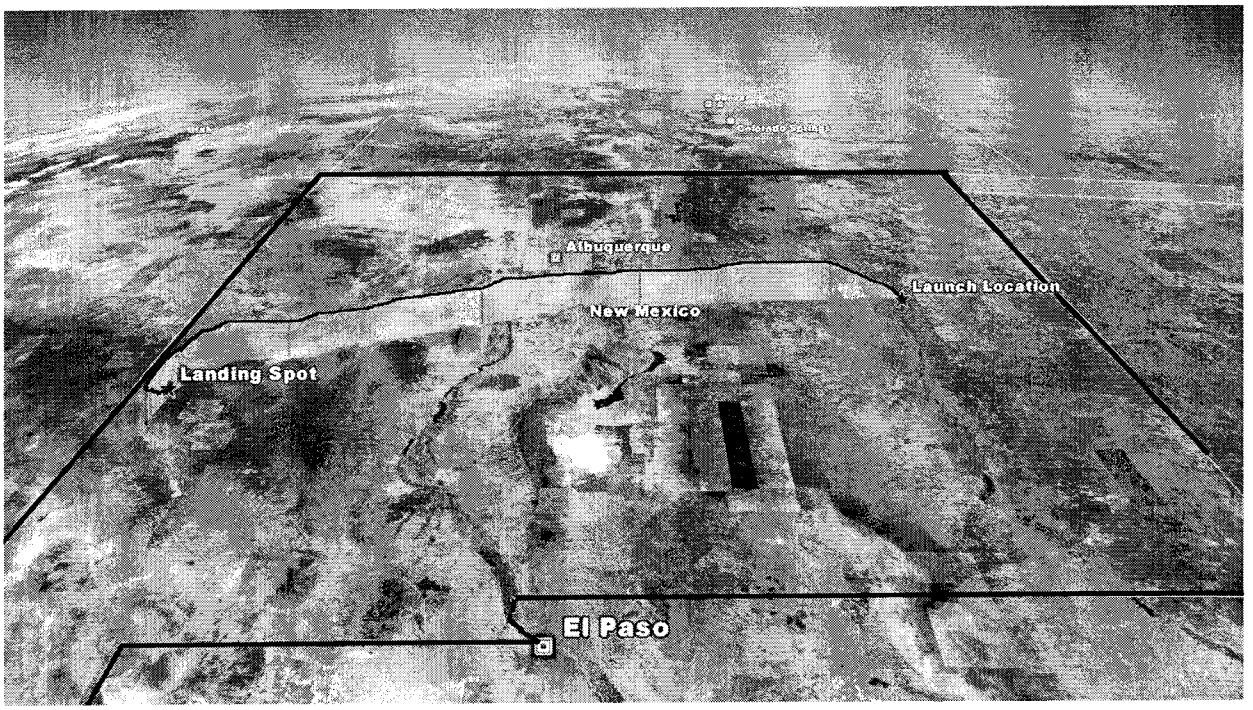



Figure 3: This shows the trajectory of the VLF receiver at altitude.
DSTB traveled across most the state of New Mexico.
The short-vertical green lines represent the location of the gondola
every 2 hours, indicating the changing speed during various portions of the flight.

Data transmission was achieved through the entire flight. The onboard camera and VLF receiver sent a live signal to the ground through two analog radio frequency transmitters provided by the National Scientific Balloon Facility (NTSB). The Venture experiment package also included a GPS receiver and video overlay board that was used to annotate corrected universal time, altitude, direction of travel and speed on the video signal. The output of the VLF receiver was carried on a separate transmitter to the NTSB Tower (through most of the mission) and to a secondary control ground station (late in the mission) where the two were combined into standard NTSC video/audio. Because of the nature of video transmission, some frames were lost for various reasons; however the audio transmission was maintained consistently through the entire flight. Since the times for VLF reception were derived from the overlaid time on the video transmission that caused some uncertainty in assigning time to the VLF. An uncertainty up to about a half second is thought to be the result. The error estimate was obtained by closely examining portions of the video, frame-by-frame, assuming the audio signal was uninterrupted.

The DSTB gondola launched on June 18, 2005 at about 9:45AM Mountain Time. As you might imagine, handling such a large payload and balloon takes large equipment. The launch vehicle on the day of flight is shown in Figure 4. Even though the balloon rose to an altitude well above 100,000 feet, it remained easily seen from the ground throughout flight. The Venture INSPIRE VLF receiver was operated with a 15 meter antenna. Large balloon packages are launched from a wheeled vehicle, because it is necessary to position the gondola directly below the balloon (after release of the balloon) to keep the gondola from crashing into the ground after release of the gondola and before the balloon has time to rise in altitude. As a consequence it is not possible to

drag the antenna around on the ground while the launch vehicle is essentially "dancing" below the balloon just prior to release. The solution was to wind the antenna onto a reel that was held to one of the long gondola "arms" by a short string passing through a cutter that was driven by a small pyrotechnic device. The pyrotechnic was triggered by a radio signal from the ground while the balloon was still over the Fort Sumner, New Mexico, airport where the package was launched. The Venture video camera captured release of the antenna deployment reel. A frame showing the reel falling away from the gondola is shown in Figure 5. A one minute frequency versus time spectrogram is shown in Figure 6 that covers the release and extension of the antenna below the gondola. Clearly release of the antenna made a big difference in the ability of the VLF receiver to detect natural radio emissions.

Figure 4: The NTSB high altitude balloon launch vehicle is shown holding DSTB just prior to release of the balloon on the morning of June 18, 2005. The Venture Crew experiment package is the white box that can be seen on the right side of the gondola near the top.

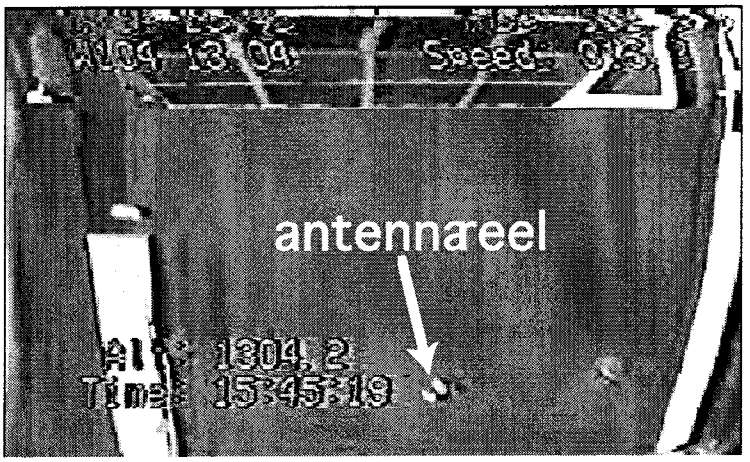



Figure 5: The Venture VLF antenna deployer reel is shown falling away from DSTB in this frame from the Venture flight video. The reel was release by a radio commanded pyrotechnic while still fairly low over the Fort Sumner, NM airport. The altitude shown is in meters and the time is corrected universal time.

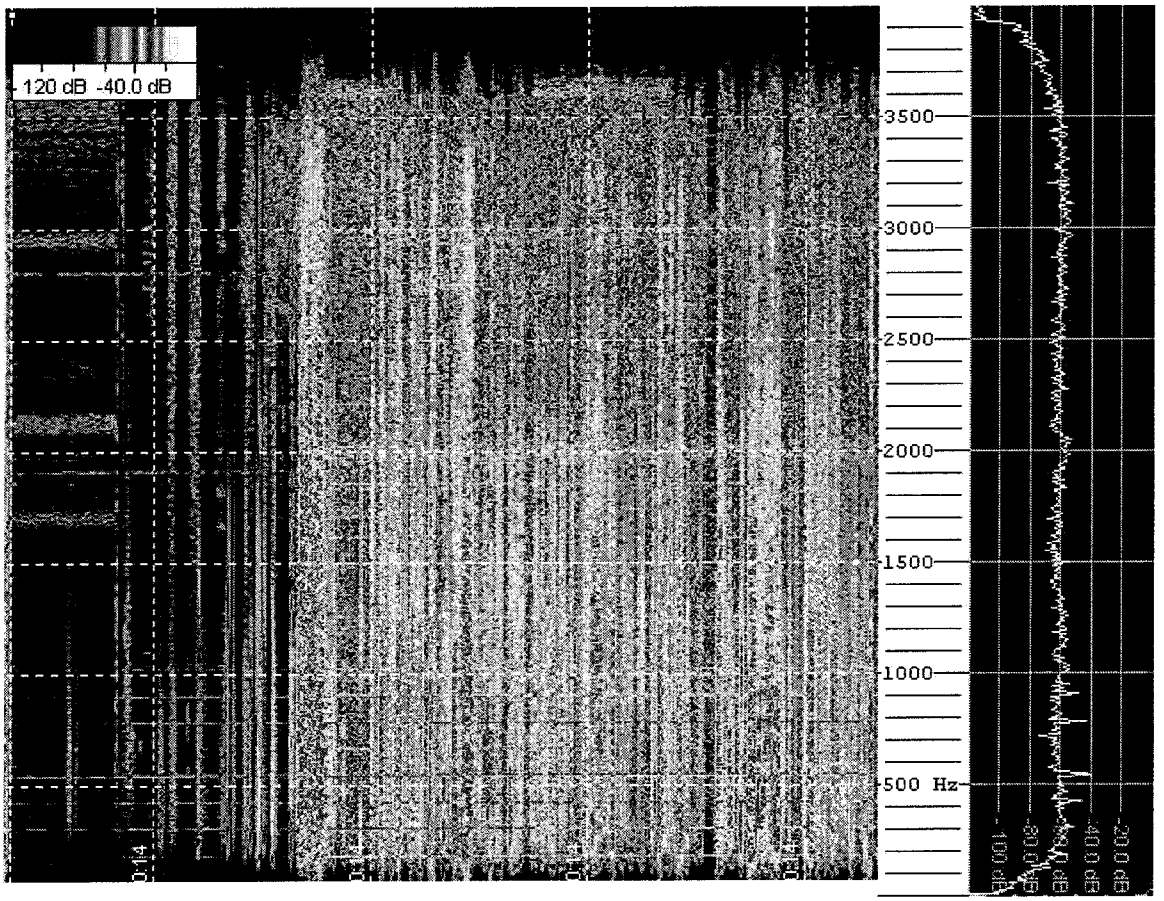



Figure 6: Spectrogram shows about one minute of VLF from DSTB during antenna deployment starting at 15:45UT. This spectrogram was made using Spectrum Laboratory (http://people.freenet.de/dl4yhf/spectra1.html).

In addition to recording VLF signals, Mideke also recorded video of the DSTB balloon during flight after the package reached its operating altitude. A frame from that video is shown in Figure 7.

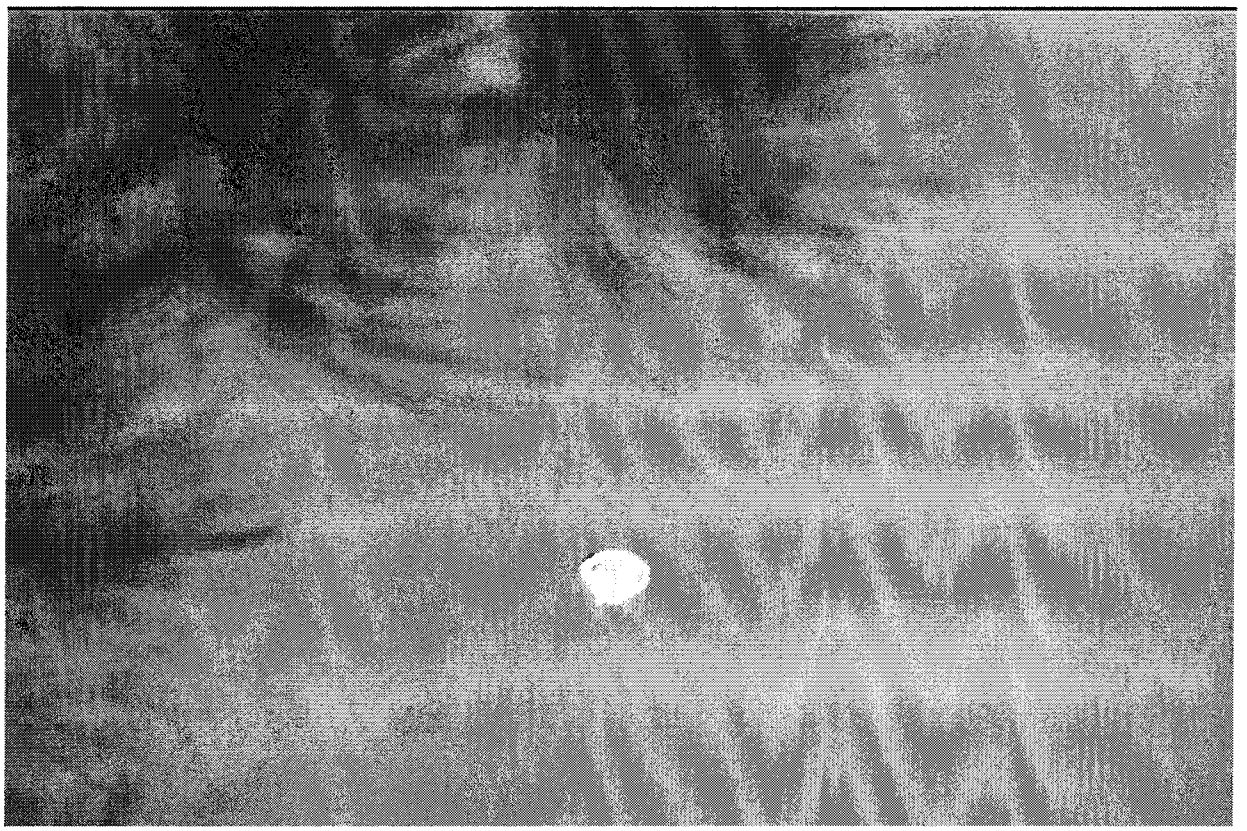


Figure 7: This is a frame extracted from the video of DSTB during flight taken by Michael Mideke at Rosedale, NM. This frame was taken at about 22:26UT. Mideke recorded the video on a Sony TRV510 recorder.

## Results

Whistlers were found in the Venture VLF flight recording at seven different times from 15:49:58 UT to 17:28:44 UT. All of these times were during the assent phase of the flight. Mideke's recordings are available to compare to all but the first two whistlers recorded on DSTB early in the flight. Whistlers were found in Mideke's recordings at nearly the same times as all of the remaining five times. The first and last of these are shown in Figures 8 and 9. Flight and ground recordings from New Mexico are compared in these figures. While it was attempted to extract VLF from exactly the same time intervals from both sources, there remains doubt about the accuracy of doing that from the flight VLF recording as mentioned above.