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TAPE RECORDED INTERVIEW PROJECT

Interview with Vincent E. Lally

Interviewer: Will Kellogg
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Kellogg: This is the 13th of July, 1993, and this is Vin Lally, and the interrogator is a friend of Vin Lally's, Will Kellogg. We are sitting here in Boulder, Colorado, and we are going to hear about what Vin has done.

Vin, I'd like to start out with you telling about the usual things--where were you born, and where did you go to school--then we'll get into the more exciting things later on.

Lally: I was born in Brookline, Massachusetts, back in 1922. I went to school in Brookline, and Brookline High. Then I went to a Jesuit school, Boston College, and while I was there the war broke out and the Jesuits converted us to physics and calculus in order to get us into the Navy V-7 programs. About a week later, I figured out I knew more about calculus than the good Jesuits, so I switched to MIT. I had bad eyes. The only place I could get into the service was as an aviation cadet in meteorology, so I went out to the University of Chicago in 1943. In Chicago in those days Robert Hutchins felt that earning a degree was an impediment to education. If you stayed for more than a few weeks, they gave you a degree. The course was 9 months and I received a degree in meteorology.

Kellogg: A Master's?

Lally: No, a Bachelor's degree. Then I went on to the radar school at MIT and Harvard, and out to the Pacific where I operated a couple of radar sets in the last year of the war.

Kellogg: Did you stop off at the Signal Corps Labs to get training on the radars on the way?

Lally: Yes--well, we just staged pretty much from the Signal Corps Labs. Our radar training was at the MIT-Harvard radar school where we got acquainted with the SCR-584 radar set.

Kellogg: How long did it take to get acquainted with it? How long was the course?

Lally: Seven months. We became the first radar-meteorologists. I came back from the war and returned to MIT for an EE degree.

The thing in those days was business administration, I thought, so I stayed on and received a Master's in Business Administration from the Sloan School. Then when I went out in a business, I decided I liked science and engineering, so I never pursued that part of my education.

That first job was with the Friez Instrument Division of Bendix. I designed meteorological equipment. After two years I went up to the Geophysics Research Directorate of the Cambridge Research Laboratories in 1951 shortly after it was formed, and eventually had a job as chief of meteorological equipment development.

Kellogg: At that point you became a civil servant in the Air Force.

Lally: Yes. That was a lot of fun. People said nasty things about civil service, but in those days, the Air Force was a very gung-ho operation and we did exciting things. Like something you're acquainted with: Project 119-L. I'm not sure whether it's still classified, but we flew balloons over Russia.

Kellogg: I've got to tell you then that you and I were both involved in 119-L, or "Moby Dick," and if you go to the Air and Space Museum in Washington, you'll see all your packages and pictures of the package and so forth, so it's obviously a matter of history.

Lally: It was a fun time. At that time, when you had a project that was important, and people had good ideas, they were allowed to run with them.

Kellogg: What was your role in Moby Dick, or 119-L?

Lally: I was somewhat peripheral to it. Colonel Paul Worthman was in charge of the laboratory from which all of these programs came, and I was in charge of the weather equipment development and its #2 man. So although I was not directly on the 119-L program, whenever he was out I sat at his desk.

During that time, I got acquainted with scientific ballooning and zero-pressure balloons, and figured there must be a better way to fly balloons for long periods of time. I came up with the idea that if you could build a super-pressure balloon, it could fly forever. A balloon which didn't have to have a hole in the bottom of it to let out the gas when it got hot, and didn't have ballast to throw away at night to keep it up--if you just kept it over pressure day and night, and kept enough over pressure-- it wouldn't know the difference between night and day. At the time I presented this concept there were no materials suitable materials available, but they were on the DuPont drawing board. I kept pushing for the concept and we had a lot of fun.

Kellogg: I think you should mention that the Air Force got into the zero-pressure balloons at Holloman for a long time. It was a big program, watching these big balloons.

Lally: Yes, the Holloman balloons were with scientific payloads which flew for a day or two. On the flights over Russia we were trying to fly for five days to get across Russia into the Pacific where the payloads could be recovered.

Kellogg: Were you involved at all in developing the recovery system?

Lally: No. That was a marvelous engineering job that was done by All-American Engineering. Again, I was peripheral to this. To recover the payload they just sent a command up to the balloon which was flying at 50,000 to 80,000 feet. The payload came down on a parachute and was snatched in mid-air by a hook on a C-119 aircraft. In the actual operations, that system was never used. I think they felt that it was too dangerous an operation for the the crew. So they let the payloads go into the water where the C-119's dropped markers and beacons for recovery by basically the entire Pacific fleet.

Years later the technique was used with the Discoverer satellite which took pictures for several days and then dropped a picture packet near Hawaii. The packet was snatched by the C-119 aircraft using the technique developed for Project 119-L.

Kellogg: I rode in a "Flying Boxcar" during one of the earliest efforts to develop that snatch technique...

Lally: I stayed with the Cambridge Research Laboratories for a total of seven years. At that time, a number of the Cambridge people decided it would be pleasant and profitable to set up a profit-making company and move some of the fine people and technologies of the Geophysics Research Directorate (GRD) over to the private sector. At that time, they decided that meteorological equipment was too close to the Air Force to be privatized, and so I was not involved in that switchover. Lured by funds provided by Laurence Rockefeller most of the good people at the left and joined the Geophysics Corporation of America, which I think basically killed the GRD as a great research facility. During that turmoil, a young theoretical meteorologist named Bob White was put in charge of our program of meteorological equipment development, which I thought was obscene, so I left. Which was kind of ironic because many, many years later Bob White came to NCAR and one of the things he tried to push for was a national meteorological equipment development laboratory. He never succeeded, but it was one of the strange fallouts in those days.

I went into a little company in Philadelphia from there, and I kept pursuing this idea of super-pressure balloons.

Kellogg: What was the company in Philadelphia?

Lally: It was called Teledynamics. It was a telemetry outfit, which was hopefully expanding in a lot of areas. Like most other American industries, when things were going well, they decided they didn't need to put money into research: and when things were going poorly, they didn't have any money to put into research. It was an interesting three years of my life there. I was chief scientist and we developed a number of weather equipment devices. We did get a major piece of something called "The Weather System," (433-L), which I had initiated at GRD. It was the big Air Force weather system that was going to change the world. Unfortunately, the rest of the world didn't share the Air Force's opinion that the Air Force should run the national weather system - including all communications, all observations and all forecasts.

At Teledynamics, we tied in with Travelers'--Tom Malone, Bob White and others. We were successful in getting the award for the observing system for 433-L. We built some systems until the people in charge at United Aircraft discovered that our part of 433-L had all of the money in it, and so they started squeezing us. Most of the equipment developments then were transferred to other United Aircraft groups. Eventually the competing interests in the US forced the Air Force out of the whole idea of a military-developed national weather system. But lots of good things came out of it.

Kellogg: In your opinion, was it a good system or was it, as some people have said that really it was too complicated--sort of they tried to do everything at once.

Lally: I think it was a good system. People didn't recognize that it was basically a communications system: the communications system that the National Weather Service is still trying to put in place. Our concept in those days was that all weather data went through a common pipeline and would be pulled off by customers depending on what type of data they wanted. All of the data would be keyed; we had a high-speed pipeline that was designed by AT & T at no cost to the military. But what killed it, I think, was that the FAA had just invested a lot of money in something quite wonderful--100 words per minute teletype. We were promising something like 2-3,000 words per minute capability in our communications system. A gentleman named George Guy who was running the Weather System--

Kellogg: I remember George.

Lally: --sold out to the FAA that the 100-word-per-minute teletype that they had invested in would be part of the system, and from then on there was no place for it to go.

Kellogg: Too slow for what you wanted.

Lally: Oh, yes. So everything from then on was compromised. Plus everybody else was picking at the system. The Navy backed out...and the way it went. But that was a fascinating time.

About this time along came the word that the National Center for Atmospheric Research was going to be in Boulder, Colorado, with Walter Roberts in charge. So I wrote a letter to

Walter and told him about my dreams of having a national weather equipment development instrumentation laboratory, and this was the right place to put it. So Walt had me come out to visit him and agreed with me that this would be an important facility, but first off, he needed a national scientific balloon facility.

Kellogg: He already saw the need?

Lally: What happened--this is hearsay now because this happened before I got together with Walt--

Kellogg: What year is this?

Lally: This is 1960, going into 1961. Walt had planned to have, as the first NCAR facility, the aircraft research facility. He held a meeting in Washington to come up with ideas on what it would consist of, where it would be located, what it would do. A number of the people, a number of the most influential people at this meeting said, "We know how to fly airplanes, but what we need to be able to do is fly balloons. Right now we're beholden to the Air Force, which has security restrictions with respect to balloons, and we would like you to set up a national scientific balloon facility." So that's how--anyway Walt then proposed that I run the National Scientific Balloon Facility.

Kellogg: In 1960, how many scientists were using these big balloons?

Lally: I would think there were about ten groups in the United States--

Kellogg: That many.

Lally: --that were using the balloons. NYU was big, the University of Chicago, MIT was starting. Of course, the most important user was Minnesota with Nye and Winkler, who were so dissatisfied with the status of balloon development that they did most of the development of zero-pressure scientific balloons as we know them. They wrote the book, and they were sponsored by the Office of Naval Research, I believe.

Those were fascinating days. Then I came out here to NCAR in May, 1961. NCAR did not have at that time any place to put us. Ed Wolff and Thornton Fry arrived on the same 1st of May, and the only other members of NCAR at the time were the NCAR matriarchy --Natalie Miller, Mary Andrews, Harriet Hunter, a few others...

Kellogg: Kay ______________________, whatever she was--

Lally: She was involved with HAO, I think directly.

In any event, I had to go back to Philadelphia for a couple of months until we had a place to work. Our first place that summer of 1961, was the Armory on campus. We then started to establish our little scientific ballooning group and decide where we would put our first major facility.

Kellogg: This was one of the earliest ventures that NCAR undertook.

Lally: It was the first--the only other group that was active was Jim Lodge's chemistry group that came in then, that summer, and they set up in the Armory, three or four people, lab equipment and a few chemicals. That first summer we had a lot of visitors. There were very few permanent staff. We had people like Ed Lorenz who came in as full-time summer visitors for many years. Seymour Hess and other fine people gave NCAR some of its early character. Phil Thompson was in charge of the laboratory science for NCAR, but he did not arrive on the scene fulltime until he finished his Air Force military commitments. He was in, I think, for most of that first summer. Dan Rex had been brought in to set up all of the facilities, but again he had his Navy commitments to complete. It was an interesting summer, and of course Walter Roberts was in the middle of everything in those days. He could not get rid of the habits that he was forced to acquire running the High Altitude Observatory. He had had to run this on a very close budget for many, many years. When we started up, we had rental cars and Walter had all the radios removed from the rental cars to save two dollars a month on rental fees. In any event, his wonderful style permeated the whole organization. The dignity of science, and there wasn't this bureaucracy feeling of "we're going to grow, we're going to be big," and so on. The feeling was "we're going to be good, we're going to bring in good people, and we're going to have various little intellectual cells here which would prosper, and then we will have the community visiting us in this idyllic situation to re-inspire us. Then we will have facilities to serve the university community."

That was Walt's philosophy. That summer all of our meetings were at Walt's home. If we had visitors for a little meeting, we would entertain them at our own homes. Walt had a closet in his house on Bluebell and we had to go to that closet and pick out the liquor that we would use appropriately for the occasion, and then return the excess. But it was great fun, working in that environment in those days.

Kellogg: How many people did you have that summer, just yourself at that point?

Lally: No, no, we built up a staff quite quickly of about ten people. Ernie Litchfield was one of the first, and then we brought in a number of other engineers. Tom Billhorn...we grew from that point. We were spending most of the money. The first year's budget for NCAR, I believe, was $600,000, of which we spent $250,000.

Kellogg: On the instrumentation group that you headed?

Lally: Yes. Because our charter--even then we had a scientific advisory panel of distinguished university people telling us what needed to be done. And they told us at that time, "We need better basic instrumentation for balloons." Telemetry systems, control systems, launch techniques and so on. Not just better, more reliable balloons. So that's where we did this very major development.

Kellogg: Did you anticipate that NCAR was going to run a balloon launching facility as it, of course, did in Palestine later?

Lally: Well, I felt that was essential. Walt wanted us to try to operate out of Holloman Air Force Base jointly, in some way, and I knew that could not work. For one thing, foreign scientists had difficulty just getting onto the property. Martin Schwarzschild, who had the Stratoscope II program, desperately wanted a new facility and so the scientific advisory panel came out strongly that we must have a facility as well as these equipment developments. We started hunting at that time. The decision on going with Palestine was mostly based on the requirements that Schwarzzschild had with his big instrument, at that time the sixth largest telescope in the United States.

Kellogg: Martin Schwarzschild from Princeton?

Lally: From Princeton. Anyway, he was a very aggressive chairman of our advisory panel, among other things, and he wanted a central site so he could fly to the East in the winter months and to the West in the summer months. That restricted us to an area that would be down through Oklahoma, east Texas, Arkansas. Our first choice, actually, was Hope, Arkansas, which had a wonderful airfield and hangar facility. But the FAA would not permit us to conduct ballooning operations there since it was the center of a number of jet tracks. And it ended up with the FAA giving us a large block in the east Texas area, indicating that any area there would be suitable for our launches.

Kellogg: They were willing to cooperate.

Lally: So we looked at a lot of places. We looked at Crockett, in Texas, which was a little too far south; we felt that sometimes our balloons would go into the Gulf. The same with respect to the Texas A & M area where there was a giant airfield. It was too far south.

But then we had tremendous political pressures directly from Lyndon Johnson. He had a political debt, apparently, in Crockett, and Walt asked me--this was one of the wonderful things working with Walt--if Crockett was acceptable, and I said, "No, it wasn't." So he called the intermediary back and basically told him, "If we have to go to Crockett, we won't have a balloon facility. We'll just drop the program." Johnson immediately backed off. He had already paid his political debt. I wish in these days, when pressures like that come along, that we have people with the integrity of Walter Roberts, who basically don't bow.

An incident that came along about that time, you may recall, was the Mohole decision--who the contractors would be for Mohole--where people at the National Science Foundation did back down and paid for it in the long run.

Kellogg: They bowed to political pressure?

Lally: This was actually from the Chairman of the House Finance Committee, who came from Houston, you may recall. But that's another story.

Anyway, we established a facility at Palestine, Texas, and we got tremendous cooperation from the people down there.

Kellogg: Did you choose Palestine because the land was available? Or was there some particular reason for going there?

Lally: It was in the middle of the region the FAA had said that we could establish, and they did have facilities: an airport, where they basically turned over the airport to us at no charge. It was far enough north so that when we flew to the West in the summer, we would stay out of Mexico; and flying to the East in the winter months, we would stay out of the Gulf most of the time. And it was an area that had never had a tornado in recorded history, which we thought was quite important. It may have been an anomaly, because they did have a tornado some years later, but not a very serious one fortunately.

The winds in Palestine--though they have something called a "low-level jet" down there--it isn't nearly as severe as it would have been further north. Except for the tremendous heat in the summer, in terms of the comfort of scientists, we were always happy with the selection of Palestine. When we started our launch program in Palestine...

Kellogg: What year did you actually get into operation there?

Lally: In 1963. We had our first flights, I remember it was mid-August because it was the Perseid's shower period. The first flight was for a scientist named Hemingway, from the University of Buffalo. He had a dust collector, to collect dust from meteors on top of the balloon. It was a nice, simple, easy flight. The only problem was the cutdown system didn't work and the balloon made news by flying out into the Pacific. The next flight was a microwave telescope for MIT, which was supposed to weigh 250 pounds and came in about 600 pounds. And on the launch for that, we blew the top off the balloon. Unfortunately, the payload had just been released just as the top blew off, so the payload was cut and then went rolling down the runway. We repeated this about two days later, and then I made probably my most important decision as director of the Balloon Facility. We had a balloon that we had purchased for some $10,000 for Gordon Newkirk to fly Coronascope II, which had been Martin Schwarzschild's Stratoscope I. The balloons for MIT cost us, I think, about $1500 apiece. I made the decision we would use Gordon's balloon because, if we had one more failure with national television watching these payloads rolling down the runway, we would be out of business. So we flew a completely over-designed balloon quite successfully for our first launch, and from then on, the operations have been basically as successful as ballooning operations can be.

Kellogg: Who was your balloon contractor initially?

Lally: We had Raven Industries. They were the contractor that supplied the people there. The ballooning industry wanted very much not to have us supply the people, since they had been doing launching. We had a competition and Raven won the award. Then later on, other balloon manufacturers made accusations of sabotage whenever they had a competing company fly--

Eventually, NCAR then took over the complete operation.

Kellogg: Those initial launches from Palestine were contractor launches then, before NCAR took over?

Lally: We had an NCAR management team there, and basically the bodies down there were supplied by Raven Industries. We did have problems with NCAR management down there with a couple of retired military until we eventually brought in a fellow who had worked with me for many, many years named Al Shipley, who had been a master sergeant in the Air Force in weather equipment development. He turned out to be far superior to our retired colonels in running this--

Kellogg: So Al Shipley was the director of it then?

Lally: Yes, he was the director for many, many years, I'd say twenty years.

Kellogg: I remember Al.

You were starting to talk about your interest in super-pressure balloons. Now these Palestine launches were zero-pressure balloons, weren't they?

Lally: Yes, they were all very large zero-pressure balloons. Through this time, I was siphoning whatever money I could off the facility to develop super-pressure balloons. After we made some successful flights of super-pressure balloons from Japan--some of them went across the United States and then they were cut down--I made a decision then to withdraw from operation of the Balloon Facility to devote all my time to super-pressure balloon development. And we took a number of the engineers from the Balloon Facility.

Kellogg: When was that, Vin?

Lally: This was in 1964. Well, actually the breakoff was in 1965, when we went down to New Zealand and started our operation with super-pressure balloons. At the time, we called it the Global Horizontal Sounding Technique, or "GHOST" program. The first flight that we made down there was in March, 1966. This was from Christchurch.

At that time, Ernie Litchfield and myself were the two people in New Zealand; we were being supported by some other people back here in terms of building equipment, and we made our first round-the-world flight. I think that was in April, 1966.

During the period that we were developing the Scientific Balloon Facility, we were promoting the idea of a Global Horizontal Sounding System using balloons, with a plan to have 10,000 balloons in the air tracked by satellite, which would then update the giant new computers of the future so that our global forecast would be improved. Jule Charney got very excited about this, and he established a little committee and we wrote a report for the National Academy of Sciences. At the time, the project was called "SABABURA"--"Satellite, Balloon, Buoy, and Radiometer." That was Charney's name for the venture. That wasn't a great name, but it was better than the name he had for the first report he put out, which was called "A Panel on International Meteorological Programs"--"PIMP". When I informed him of it, he had the entire booklet cover re-done very quickly and re-distributed as the "Panel on International Meteorological Cooperation." Plans for implementing the Charney proposal were discussed at a meeting convened in Geneva under sponsorship of ICSU and the World Meteorological Organization.

Fortunately, just at that time in May 1966, when Walt heard that I had flown a balloon around the world, he asked me to fly to Geneva and give a presentation to the group. Tom Malone feels that that was the key element in getting GARP started--the fact that a balloon flew around the world dramatically illustrated the need for cooperation of all nations in studying the global nature of meteorological phenomena.

It was at that time that the great GARP program started. Although I usually get credit for most acronyms, it was Walter Roberts that came up with this acronym, "GARP," for the Global Atmospheric Research Program. There was one dissension, a fellow named Rolando Garcia, who was a key man during GARP. He pointed out in Buenos Aires, that was a particularly obscene word. But the word stuck.

Kellogg: In Argentinian, it is not a good word.

Lally: With support now from the international community, we were able to get lots of cooperation in flying super-pressure balloons and started a number of programs. Probably the most important thing of all in all of the super-pressure balloon development was we needed to be able to locate the balloons reasonably accurately anywhere in the world. This meant we had to have some kind of a navigation system which would tell us where the balloon was. Our original balloons included a 15 Mhz transmitterwhich sent out a Morse code letter; the period of the Morse code letter being a function of the resistance of a little photo-resistor that looked at the sun. That gave us a sun angle measurement within about one degree. By taking all the data for a day, you could come up with a reasonable approximation of the location of the balloon at any one time, but velocities had to be averaged over 6-12 hours. We then developed a more elaborate system in which we used a magnetometer and then later on, a much more elaborate sun-angle detecting system so that we could get down to accuracies of maybe fifty kilometers. But during all of this time we realized that the only way to go is with a satellite.

Kellogg: These transmissions were essentially by ionospheric propagations.

Lally: Yes, just daytime--

Kellogg: Ham radio operators listening, breaking down the code?

Lally: Yes, we had marvelous cooperation around the world from ham radios. We had a man in South Africa, Cecil Sanby, who was just superb. He used to track any number of balloons simultaneously. He had been the world champion in World War II in Morse code transmission, working as encryptor for the South African government. Then we had Hugo Phillips, the operator of a giant rhombic array for AT & T out in Delano, California. It was used for voice and teletype links with Japan and Australia, but Hugo used it to track our balloons as they came off the coast of China or off Africa in the Indian Ocean.

So that's how we got our data back. They would listen, record the period of the Morse code letter with the stopwatch supplied by us and send these to us and we located our balloons. As we got sophisticated, we worked with Goddard Space Flight Center developing various satellite techniques. The first one was a very elaborate system where the balloon transmitter cost several thousand dollars. The receiver was located on the NASA's Nimbus D satellite. We used that to track balloons around the world from Ascension Island. It was at that time we discovered that if you flew a balloon in the equatorial region, above the tropopause, it would fly in a region plus or minus ten degrees of the equator, and there was very, very little chance of it moving out of that region. We got very excellent data in those days on the quasi-diurnal oscillation, flying balloons at 24 and 30 kilometers. We got durations of, typically, 50-70 days on those flights.

Kellogg: Which meant several times around the world.

Lally: Yes. Because typically it took about 24-30 days in the easterlies. The French became very much interested in super-pressure ballooning at that time, after our first successes. And they even sent a man to work with us, to find out how we were building our electronics, a fellow named Tom Heinsheimer who recently has been involved in design of ballons for Venus and Mars missions. There were two French groups--

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Lally: France had a group called "Service d'Aeronomie," headed up by Jacques Blamont, and he had an assistant named Pierre Morel, who was equally ambitious.

Kellogg: Both became very prominent.

Lally: Yes. I met them first at a meeting of the satellite group which you got me involved in--

Kellogg: COSPAR.

Lally: COSPAR; when we went down to Buenos Aires, they were trying to establish some kind of a French satellite program. They knew they couldn't afford a manned program; NASA had usurped most of the good science programs. As a matter of fact, Blamont was involved in some of the NASA programs. They were looking for some way of making a big splash for France without spending too much money, and they hit upon the idea then of coming up with the satellite system for tracking super-pressure balloons. They called this "Eole." We talked about it at the COSPAR meeting. They wanted to fly at 500 millibars, which was the logical altitude for best meteorological returns. I pointed out that based on our experience, 300 millibars was going to be difficult, 500 was impossible and 200 would probably be optimum.

Kellogg: There was also the problem of the aircraft running into the balloon, wasn't there at the lower altitudes?

Lally: Well, no, because at 200 millibars, we were still in the air lanes. We had run many, many tests with respect to safety. We had jet aircraft fly through balloons, we had balloons ingested in jet engines, and we were flying 100 gram payloads where radiosondes typically at that time were 800-900 grams and the FAA's rules did not preclude radiosondes. So they could not basically say that we were hazardous. The French, by the way, spent over a million dollars in testing and coming up with criteria for what would be hazardous for a jet aircraft at 200 millibars. Their tests were conducted on a jet track where they moved aircraft windscreens through the test objects at speeds up to 500 knots. From these tests they developed criteria for masses and shapes which would not be hazardous to jet aircraft.

France went ahead with its program at 200 millibars, and spent some $50 million over the next two years on Eole. They set up launch facilities in South America at three different locations, tested their balloons very, very well prior to launch.

Kellogg: These were super-pressure balloons made in France...

Lally: An enormous program; a lot of worthwhile data came out of it. At this time, we were working with NASA to come up with cheaper technologies and came up with the idea of a device which would just transmit for one second out of many seconds to a satellite which would measure the Doppler shift of the frequency, and over a period of several minutes, be able to come up with determination of location. Then, on the next pass, another location and a velocity then over a 1 1/2 hour period--

Kellogg: Before that, the balloons were located by this sun-angle magnetic--

Lally: Then the Eole system, which was a transponder. I'd say that the Eole payloads cost about $25,000. There were 600 of them.

Kellogg: Compared to how much did your package cost?

Lally: Our packages ended up costing about $500. But that was the movement of the technologies. France paid their bills and had a successful program.

While all of this was going on, we were busily working on exactly what was going to happen during the Great GARP Global Weather Experiment, which was kind of a moving target that kept going back from year to year. In 1966, I think, it was designed to go in 1971. And eventually, I think it was 1978, the Great Global Weather Experiment was conducted.

It was our plan, as part of the Great GARP Global Experiment, to run a program jointly with France at 200 millibars in the Southern Hemisphere. Russia would not permit flights in the Northern Hemisphere, and indicated they were not necessary since there was good enough coverage. The decision was made by the American--I don't think it was the GARP committee-- it was made by the federal government at some level--that the rest of the world had to pay more of the bills; and therefore, France should assume all of the costs of the GHOST-type of program. The French had not understood that that was going to be the case. They assumed that they would build the electronics for their system because they wanted to develop an electronic capability and we would provide the balloons. For them, their balloons cost many times what it would cost us to produce them in America. As a result, when informed by the GARP committee that they had to pay all of the bills, France gave Bo Döös, who was the GARP coordinator at the time, I believe, a month to come up with the money. Bo Döös went to Saudi Arabia and asked them for $5 million, and they agreed. So France went ahead with their super-pressure balloon program.

In the meantime, we had come up with and demonstrated a different type of system to fill in the big gap in the equatorial regions. In mid-latitudes, the satellites with their radiometers could determine temperatures, and from the temperatures you could determine pressures and densities, and from these data, you could infer the windfield. However, in the deep tropics, the Coriolis parameter is missing. The equations blow up and you can not use the radiometer there to determine winds. So we had a tremendous equatorial gap for the GARP program. We had already learned that we could fly balloons in the stratosphere in equatorial regions and they would stay there. So we came up with this concept which we called "Mother GHOST" where we would fly big super-pressure balloons at 80,000 feet and drop dropsondes from them, and we would track the sondes with a new navigation system called Omega. Omega--when we first tested it had only three stations-- but there was a plan that there would be eight stations and it would be a universal navigation system. So our concept was you fly the balloon, it stays in the equatorial regions, you use the new GOES satellites to interrogate--

Kellogg: Were they already using the Doppler location system or was that later?

Lally: This was being developed at the same time, on the TWERLE system. TWERLE was going on at the time, and the French assumed that there would be a follow-on to TWERLE where we would provide balloons, they would provide electronics based on the TWERLE system for the GARP program. We would then take over this new Mother GHOST program which had been renamed the "Carrier Balloon System" since Mother GHOST did not translate too well. The Carrier Balloon System would have a fleet of superpressure balloons dropping dropsondes on command from the GOES satellites, which would then re-transmit signals from the Omega navigation receivers back to the balloon and then from the balloon back to the GOES satellite through a telemetry link on the satellite. The plan seemed kind of complex, but we were able to demonstrate this in a couple of test flights from Palestine, Texas, and the international community bought the idea. It was, I guess, then at this time that the United States said, "We'll do a carrier balloon, and France will do the entire GHOST-type of balloon at 200 millibars."

Saudi Arabia ran into troubles about this time and they withdrew their $5 million. France, then, made the decision that they were out. No money, no project. So France backed away completely. We went on then to demonstrate the carrier balloon system. We demonstrated it very successfully on about twenty flights, flying from French Guiana—

Kellogg: What year was this?

Lally: I think this would be about 1968. I believe it was in 1968. Those flights were, I thought fantastically successful. Although we only had three Omega stations, when we were in the right areas of the world, we would be able to call up people from Wallops' Island to send a drop command via GOES to the balloon. We immediately could plot on a graph the descent of the sonde, measuring temperatures, pressures and winds on the way down-- 6,000 or 8,000 miles away. By the way, Mike Olson, our chief electronics man, didn't particularly like the GOES satellite de-modulator, so he took one of the channels there, built his own demodulator and installed it at Wallops' and then we had that hard-wired to NCAR, so we were always in direct communication with any of our balloons.

It was a very successful program. The nicest thing anybody ever said, the SPEC Review at that time called it "da Vincian in concept."

Kellogg: Like Leonardo...

Lally: Yes. Anyway, it worked, but there were a number of people who were concerned. Our big plan, by the way, was two aircraft carriers in the Atlantic and Pacific which would be launching the balloons. Each balloon would have 100 dropsondes. There would be 200 balloons flown for a total of 20,000 soundings during the course of the two intensive observing periods of the Global Weather Experiment. A number of people in simulation studies decided that that was fine, but it still wouldn't put enough soundings into the areas of most interest, the most active equatorial regions. They pushed for an aircraft dropsonde capability rather than the Carrier Balloon System. The other thing is, I think there were some fears that we wouldn't be able to pull it off. We had promised 70-90 days on our balloons, and in our final test we averaged 30. We knew what had gone wrong with them-- a little over-pressure valve which relieved excess overpressure produced by the mass loss as sondes were dropped. This little over-pressure valve had been tested at planned float altitude pressures, but in air. During flight as the valve relieved pressure in a helium atmosphere, it oscillated at the reduced density. We solved the problem, we were confident on the 70 day number, but I'm not sure everybody believed us. In any event, a quick decision was made to switch to a dropsonde capability, especially since the Air Force had volunteered to provide at no cost a whole bunch of C-135 and C-141 aircraft for dropsonde deployment. The great concept never became operational.

Kellogg: Were you disappointed?

Lally: Yes, but there were a lot of, I think, wonderful spinoffs from it. For one thing, the biggest campaign I ever had in my life was getting the Japanese and the European community to agree that their satellites, which had been designed differently than our GOES satellites, would have telemetry channels which would be identical with the GOES channels. These would be called "international channels" and there would be six of them. And they would be devoted to the transmission of the balloon data as we went around the world. Those systems were implemented, and they have now been very successfully used over on the ASDAR-type of program So that for once, all the communities agreed on something. We also had the first successful demonstrations of a dropsonde that could get winds. It was the technology that was developed for the Carrier Balloon System that was moved over into the aircraft dropsonde program. It would have been great fun having a couple of aircraft carriers and 200 super-pressure balloons, but it didn't happen. So we burned a lot of extra fuel.

Kellogg: Is the mother balloon and the dropsonde-from-balloon still alive?

Lally: No. There's no agency any longer, anywhere, that has a mission, really, for development of ballooning capabilities. The National Science Foundation, in a money-saving program some years ago turned over the National Scientific Ballooning Facility to NASA. NASA was the biggest customer, there was no question about that.

But I think the university community lost a lot when it was turned over to NASA because it's treated as a NASA facility with lots and lots of paperwork, with much, much less interaction with the scientists. And that was the beauty, of course, of scientific ballooning programs that people could go from concept to flight in a few months. A complete flight and analysis program takes up a time span appropriate to a doctoral thesis-- and many theses have been produced from balloon flight programs. Where anything that's involved with NASA takes years--

Kellogg: That used to be the main objection to working with the Department of Defense too.

Lally: So there's very little initiative left in the ballooning business. The only ideas that are being pursued at all now are in the very long duration business. They've given up on something we call the "Anchor Balloon," which was a technique we developed to carry very large payloads at high altitudes for very long periods of time, when you couldn't, because of sizing you couldn't build a super-pressure balloon to go there. They've given up on that program because they ran into some launching difficulties. NASA is presently using something that I call a Radiation-Controlled Balloon (RACOON)--this is a zero-pressure balloon which you fly in the tropics or in the summer mid-latitudes at very high altitudes and you don't ballast it at all. The balloon flies along when night comes; it descends but it descends from the temperature of zero degrees where it's flying towards a temperature of minus 80C. And as it's moving down, the radiation environment doesn't look very much different to it, but the actual temperature of the air is then getting much, much colder, which means much, much more lift. And so the balloon can just yo-yo back and forth twice a day. It goes up in the morning and goes down at night...

Kellogg: That's a zero-pressure balloon.

Lally: That's a zero-pressure balloon.

Kellogg: Has that been demonstrated?

Lally: Yes, I've made three flights around the world from Kourou with that type of balloon. We just took cheap $1,000 balloons, put a few instruments and flew them around the world.

I think frankly that the place for the future in ballooning would be with that RACOON type of balloon. With respect to climate programs and other programs for the deep tropics, you could make soundings in the equatorial region using GPS where you would have an exquisite wind accuracy. You would make two soundings a day, day and night, and there's no limit to the amount of payload you can put on these. So you could be measuring ozone, anything you wanted--

Kellogg: I suppose there's an advantage to the fact that it goes up and down...

Lally: So you take what most people consider, the scientists would tell us what to consider a disadvantage and make an advantage out of it. There's no group any longer that's dedicated to pursuing ballooning. The people back at Wallops' Island who are now involved in ballooning are doing a job--they're supporting requirements--requirements documents that have been written three years previously.

Kellogg: When you say Wallops' Island--

Lally: Well, NASA has assigned the ballooning responsibility to its Wallops' Island facility which is now in charge of Palestine. And there's no development going on at Palestine itself so that the initiatives are not there unless you get a particular scientist who's terribly aggressive who needs something and then pushes very hard for it with support from one of the NASA agencies. But that seems to be a dying breed. So I don't think that there will be many more advances in ballooning itself simply because there's no agency that's been given this responsibility to do something about ballooning.

Kellogg: If there were an agency that had this kind of responsibility, would there be scientists who would like to take advantage of it?

Lally: Oh, I'm sure there would be. I still think that the program of soundings in the Southern Hemisphere, like we had proposed for the GARP program, could be maintained on a continuing basis. And now that we have the GPS system to provide exquisite location as well as the French system that is still being used--the one that was developed for TWERLE which is still being used then for locating any objects.

Kellogg: Buoys and elephants and things like that?

Lally: But with GPS we could do so much more in terms of the basic instruments on the balloon. And to keep, say, two hundred balloons in the air continuously year-round would not cost more than a million dollars a year. But who's to do it?

Kellogg: The meteorologists who would use this information in their synoptic analysis, do they feel this would really be useful? Because I remember there were some tests to find out whether this kind of balloon information would help in the analysis and in the forecasts?

Lally: There was a lot of interest about ten-twelve years ago, Will, with the gentleman who was in charge of the European Centre for Medium-Range Weather Forecasts, whose name I've lost.

Kellogg: Lennart Bengtssten.

Lally: Yes. Bengtssten had great interest in this, and had demonstrated how much it would help. But at that time, he got no support. The National Weather Service, NOAA, after finishing up on the GARP program, turned its resources to the mesoscale. Except in the last two or three years, when the global climate has become a magic word again, it may just be possible through the global climate initiative to re-develop an interest in ballooning. But I would think that the most likely candidate would be the RACOON balloon doing equatorial surveys. People can propose new satellite programs at a cost of $2 or $3 billion, you know, for similar objectives.

Kellogg: Vin, what's the situation regarding flying balloons in the Northern Hemisphere where they'd go over what used to be the Soviet Union, whether or not over Russia? I'm sure you remember the meeting you had with academician Federov in my office, in fact, [and you] briefed him on the balloon program. And we asked if Russia was always going to be against flying over Russia.

Lally: Well, I think that there will probably be concern now not so much [with] Russia, but China. You know, we did get approval during the GARP Program to overfly China because after the French dropped out of their program, a program for tropical soundings to go above the level of the aircraft was put in--this was called the Tropical Constant Level Balloon System, or the EWE program (the Equatorial Wind Experiment). With that program, we flew 600 balloons, and we had magnetic cutdowns so they would cut down if they went over Russian areas. But the way the magnetic field was, we felt there would be lots of times when we would not like to cut down over China. We got agreement from the Chinese which permitted overflight at that time.

But I would think they would be suspicious right now with respect to overflight more so than Russia. But the way to solve the problem, just as this fellow was trying to fly around the world on a manned balloon on something called "Earthwinds," just as that fellow solved his Russian problems by bringing as one of his crew members the head of the Russian astronaut program, and he got instant approval. I think that that could probably be done in other areas, too, where there would be a joint interest.

Kellogg: It's hard to see why a country would object anymore to balloon overflights because everybody knows that the satellites are flying over all the time. What could a balloon do that would be harmful?

Lally: You know better than anybody why Russia had an antipathy to balloon overflight, which dates back to the late 1950s.

Kellogg: I think for the record you could see why. Mention "Moby Dick" again.

Lally: At that time, there were 3,000 balloon systems developed to overfly primarily Russia, and they were located all through Europe, Turkey, all through England, Germany, Italy. There were, I believe, a total of 1,000 balloons launched; they flew about, I believe, 40-45,000 feet. It was just above what was considered the top level of fighter aircraft, although some of the airplanes got to them, I understand. Anyway, 500 of these balloons did survive overflight of Russia, taking a picture a minute along the way, and this was used basically as the pioneer reconnaissance prior to the U2 with the Gary Powers incident.

Kellogg: It was also before they had good reconnaissance satellites.

What year was that?

Lally: It seemed to me it would be the winter of 1956-57, for the first flights, the 1,000 flights over Russia and the recoveries in the Pacific. In any event, people with reasonably long memories will look askance at overflights who have that history, but most of those people are retired or dead by now. Present company excepted.

Kellogg: Overflights aren't as sinister as they used to be.

Well, Vin, you already told me what your prognosis is for scientific ballooning, that is, the long duration in scientific ballooning. Tell me a little bit about the work your group did to develop radiosonde launching from shipboard, because that seems to me to be a very imaginative development, too.

Lally: Our little group had always been interested in various navigation schemes to track our super-pressure balloons, and we worked on the development of Omega navigation systems. There was a fellow named John Buekers back East who was working--

Kellogg: You might explain for the record for future listeners what Omega is.

Lally: Omega is a navigation system that was developed by a fellow named Pierce at Harvard University around the end of World War II. It was called "Omega" because it was going to be the ultimate system. It consists of eight transmitters located around the world, transmitting at very low frequencies so that there's a ground-wave propagation that goes around the world. At any point in the world, you should be able to pick up three stations and from the measurement of the phase of the three synchronized transmissions you can compute your location. It's accurate to about 2,000 meters absolute, but about 200 meters differential so that if you measure for three minutes, you can determine what your movement is within a meter per second accuracy. And the idea here is you fly a balloon, you put an Omega receiver on it and translate a signal to the ground, Since you take differences of phase data, all of the other delays in the system cancel out and only relative differences in range to the stations come out. So you can make a decision on your position as if your ground electronics were actually on the balloon. This is the way the LORAN system also works, which is a higher-frequency system which covers only regions of 2-3,000 miles rather than globally, but is quite a bit more accurate.

In any event, we were working both with LORAN and Omega, and got involved in trying to make a simple radiosonde system. We were asked by the Canadians to build a system to test the ability to use a navigation signal from ships at sea. The reason the Canadians wanted to back this, they decided they couldn't afford to keep their stationkeeping ship in the Gulf of Alaska. It was called "Station Papa." There were two ships involved, because they couldn't stay there all the time. One coming and then one going. The two ships cost them over $10 million dollars a year in fifteen years ago money.

So they put up the money, and we then demonstrated this capability on a Japanese car carrier, which was going between Japan and the West Coast and we then built three systems for Canada. Since then, the European community has been using these in the Atlantic. The system we developed has been copied by the Vaisala Company and sold commercially. As far as I know, there are probably a couple of dozen such systems providing data in the Atlantic and in the Pacific.

Kellogg: So it's still being used. And your balloon launching system was also a part of that development.

Lally: Oh, yes. The tube has gone through many generations.

At the time we started this work, we were concerned at NCAR with the availability of radiosonde systems for research programs. Twenty or thirty years ago all scientists had relied on the Air Force to provide military radiosonde systems and field operators. The Air Force had an entire squadron based at Tinker Air Force Base with the mission of supporting research programs.In the course of years, they cut this back. The competent people retired and it looked like this capability would no longer be available. The atmospheric research community asked us then to come up with a new radiosonde system. The old one, the military AN/GMD-1, dated back to just after World War II, so was getting on to forty years in age. We found out that a manufacturer of the LORAN navigation equipment had come up with some new algorithms that could combine stations from several chains, rather than just a single chain, which provided limited coverage.This gave us the promise of being able to cover the whole United States with LORAN with its improved accuracy over Omega. Instead of averaging winds for three minutes, we could now average winds for thirty seconds.

Kellogg: In other words, over the U.S., you could use LORAN instead of Omega.

Lally: So we then developed this system. We had been working on another technology, which actually looks very much like what's now the Global Positioning System, except ours was based on putting transmitters on top of posts ten miles apart instead of in space. But when we found this new Loran capability, we immediately dropped what we were doing and we then put a system together, which we call "CLASS"--the Cross-Chain LORAN Atmospheric Sounding System. We built this system in four months and put it in a mobile van. We wanted to test it out for something called the GALE program, brought it down to the Outer Banks, set it up and on our first test night, we had one of the worst storms ever. But with our new launcher, we were able to make soundings every hour.

Kellogg: Even in the storm?

Lally: In one of the worst storms imaginable. So we probably had a pretty good system going. We built probably fifteen of those systems since, including systems for Taiwan. For the National Severe Storms Lab, we built mobile versions of CLASS so they can take soundings in severe thunderstorms --they launch a balloon, try to get it in the bottom of a storm, and then start running while they're tracking so they can be taking data.

Kellogg: The system, does it occupy a van or does it occupy a suitcase?

Lally: No, it's bigger than a suitcase, it's as big as say, three bread boxes. But it's a couple of racks of equipment. We repackaged the system for aircraft use and called it "L2D2," the Lightweight LORAN Digital Dropwindsonde. This is now the standard system for all research aircraft dropsondes and the Air Force has contracted with us to convert all of their systems to this capability.

Kellogg: Is this still going on?

Lally: Yes, we have several of these systems. We've outfitted NASA's DC-8 with this capability and the NCAR aircraft and the National Weather Service P-3's from time to time have used this.

Kellogg: So NCAR is very definitely still in the business of developing the sondes?

Lally: That's right. We now have our latest venture with the DLR laboratories in Germany which have contracted with us initially to design but eventually to build a dropsonde system into their new research aircraft which will be flying at 80,000 feet. This is what takes me to Munich next week. So that program is still very active and in the next generation of these systems, we'll be using the new navigation system, the Global Positioning System, as opposed to LORAN: Omega was accurate to 2,000 meters, Loran to 200 meters and GPS to 20 meters.

Kellogg: That's based on satellite transmissions.

Lally: There are 24 satellites now, and so we have global coverage 24 hours a day. It will be universal [for] all kinds of activities.

Kellogg: One of the remarkable things is that the balloon has enough sensitivity to receive these signals. I remember in TWERLE there was a big antenna...

END OF TAPE 1, SIDE 2

Interview with Vin Lally

TAPE 2, SIDE 1

Kellogg: We were talking about--

Lally: We were talking about the sensitivity of receivers on balloons.

Kellogg: What never ceased to amaze me as an amateur to this kind of thing is that a satellite and a balloon can listen to each other with these intensely tiny signals that are coming.

Lally: The signals on the TWERLE program that you were referring to were--remember on TWERLE, we were not listening to the satellite. We were making a transmission back to the satellite. We were sending as little as 100 milliwatts back and the satellite had a very sensitive receiver. In the case of the new Global Positioning System, we have these giant satellites weighing 4,000 pounds, which have enormous power capabilities, and they were putting out very, very strong signals. The band in the signals is quite narrow and the receivers nowadays are much, much better than they used to be. So there's no problem at all these days. The nice thing about the Global Positioning System is where we had to use a rather large antenna on the TWERLE program and other programs--because we were operating at 400 megahertz and we had to have a system that was a half a wavelength in dimensions as an efficient antenna--now we're operating at 1,500 megahertz. We're using tiny little antennas--surface-mount, they call them--and I envision in less than five years, people will have these kinds of systems on their golfcarts. What they'll be doing, there will be the GPS signals coming in to the golfcart and there will be a separate signal coming in from the clubhouse, which will put into a computer the present location of the pin on each hole, and the golfer will just put his golfcart over the ball and read off the exact distance to the pin. This may sound ludicrous, but these are people who are paying $100 just for covers for their golf clubs. For an extra hundred dollars, they'll have one of these systems. So GPS is going to change the world. And it's certainly going to change the ballooning world, and the instrumentation world.

Kellogg: Why does a special development have to take place for this German research aircraft--why can't they use the same dropsondes that ordinary aircraft, reconnaissance aircraft use?

Lally: They've asked for closer tolerances on measurement accuracies. They want GPS, and we have not yet implemented GPS in the American dropsonde. This will be the first one, and from then on, everything else will follow. The other thing is they don't have room in the cabin because they will have to have scientific instruments that have to be monitored, so they don't have room in the cabin for a dispenser and for storage. So all of this will be in the non-pressurized part of the airplane and it will all have to happen automatically. There will have to be a dispenser, which will look like, strangely enough, our old carrier balloon system dispenser, and where, upon command, then, a sonde will drop out through this unpressurized cabin and then the data will be recorded. But most of the features of the sonde will be very similar to what we've done and that's why the Germans want us to do it rather than re-inventing things.

Kellogg: Sounds as though NCAR really has not a monopoly, but at least a leg up on this whole technology.

Lally: It all came from the technology we developed for ballooning. It's just unfortunate we've lost our balloons. The only active area in ballooning right now that I'm involved in is with the attempt for a manned balloon flight around the world.

Kellogg: You're a consultant to that one. Are they going to go again?

Lally: Yes, they'll be going again in November. But again, they'll be going with a very complex system. I think if they get it in the air, they'll succeed. But I think they'll still have launch problems.

Kellogg: It sounded very elaborate when you were telling me earlier. I'm not sure you told for the record as to what this kind of thing consists of. Just briefly, what is this round-the-world balloon?

Lally: This is the last frontier basically for people who want to do crazy things, and that's to fly a balloon around the world. People have recently flown a little airplane around the world. Actually, flying a manned balloon around the world is a very simple thing to do. We've probably made 10,000 orbits of the world with all of our unmanned balloon systems on super-pressure balloons. The problem comes from the--and there have been maybe twenty attempts to fly around the world with various groups--but each group is concerned as somebody else is about to fly and being second is no good, so "I have to do things in a hurry," so they have to do it on the first try--they can't make a test flight, the kind of things that any reasonable person would do. So there have been many, many attempts going. One of the most famous was Malcolm Forbes; I don't know if you recall that he had fifteen super-pressure balloons and a gondola underneath them. Tom Heinsheimer was his pilot and they were going to fly around the world. Each one of these balloons that would pick up a few hundred pounds was pulled out and then assembled and then the wind came up. Somebody fortunately cut everything away before they all got killed. But there have been a lot of attempts like that where there wasn't proper testing of all the pieces--

Kellogg: So they never got off the ground...

Lally: It's a strange thing now, that Malcolm Forbes flight probably goes back about twelve years, twelve-fifteen years. But he had to do it immediately because there was somebody else about to fly. Prior to that, there was a guy named Tom Gatch who tried to fly around the world on a similar multiple super-pressure balloon. He went out across the Atlantic and disappeared and never was heard from. Anyway, this particular very well-financed program--NASA has been backing it to the extent that it can legally do so because at least as long as the head of NASA was this astronaut-admiral (he's just retired recently)--he has backed this particular program with whatever legal NASA support he can put into it. And they have lots of commercial support--there's ESPN and others. But they're in a hurry again because there are two other groups that are almost ready to fly.

Kellogg: That, as I understand it, was a zero-pressure balloon and under it, a super-pressure balloon that was filled with air.

Lally: The idea here is that you fly a zero-pressure balloon which will carry unlimited payloads if you make it right with multiple caps and so on. This balloon can only fly for five to six days if it's ballasted, because each night you have to throw away ten percent of your ballast. That's ten percent of everything, including the people. When you get to the seventh day, you've got to throw people away or give up. So this zero-pressure balloon can't go around the world. We figure it should take 12-15 days but safely you want to be prepared for three weeks.

What an Anchor balloon does--it's a big bag underneath the zero-pressure balloon. It has to be very big to work. It could be filled with helium and super-pressured. Daytime you would go to an altitude at which the super-pressure balloon would become too heavy because the air is less dense, and you would fly at that level and then at night you would come down about two to three kilometers. That would be a pure Anchor balloon, and there have been a number of those flown. We made the first demonstration with that in 1966. The Scientific Balloon Facility has made a few attempts but they had problems launching.

In this configuration, you have a super-pressure balloon filled with air. You use air because now you can add air or subtract air. If you want to go up, you valve air out. The bag does not become under-pressured; your system just goes up and maintains--

Kellogg: You can't just let the air out, or it won't fly. You must have--

Lally: You get your lift from the zero-pressure balloon above you.

Kellogg: So the zero-pressure balloon has the helium and the super-pressure balloon just has air in it.

Lally: Yes. So it's basically an anchor and you have to pay the penalty of the weight of the fabric of that super-pressure balloon, which is very heavy. The weight of the air just balances with the air which it's displacing, but the excess air is then what is giving you the control. The excess of air that you're pushing into it and out of it, which makes you go up or down. But this type of design is not as efficient as a pure super-pressure balloon design. But it does give you the ability to go up and down, to control your altitude. So it has been selected for this Earthwinds project and the gondola, which was supposed to weight about 3,000 pounds, now weighs about 5,000 pounds. Various other things...

Kellogg: How many other people will be in it?

Lally: There will be three people in it.

Kellogg: Who is the person that's pushing this, who's the leader?

Lally: A fellow named Larry Newman, who's a pilot for Southwest America Airlines. He's a hot air balloonist and the co-pilot will be the head of the Russian astronaut program, and I'm not sure who the third man is this year. The previous time, the third man was the fellow from England who controls Virgin Airlines and Virgin Records--I can't think of his name, but...

Kellogg: Someone who's willing to put out money.

Lally: Well, he's kind of a wild character. But he's no longer involved. I'm not sure who the third man is. But there is a marvelous new material, Spectra, which is used in this super-pressure balloon, which makes the whole thing quite feasible if they can get it off the ground. But it also makes the ability to fly around the world as many times as you want until you get tired just a simple engineering task if people would accept--

Kellogg: There's no loss of helium from the zero-pressure balloon up above?

Lally: If it has holes in it, there will be losses.

Kellogg: But they don't have to vent any.

Lally: No, they don't have to vent because their variable ballast is provided by this device.

Kellogg: That's remarkable. Let's hope they do it this time.

Lally: I'd like to see them do it.

Kellogg: November you say they may try?

Lally: They'll try again in November from Reno. Anyway, that's kind of the only action in exotic ballooning at the moment.

Kellogg: Vin, we've covered a lot of ground. I must say that I certainly have enjoyed listening to all of this and having been in on some of these adventures of yours, I can appreciate what you're talking about very well. I think the people who listen to this tape will also get a sense of excitement over all of the things that you've done. Is there anything that we should cover that we haven't?

Lally: There's all kinds of things in the background. One item: we made all of our initial flights from New Zealand, and a lot of people have asked, why New Zealand? The first reason is we were not able to fly from the Northern Hemisphere simply because Russia and China would not permit overflight and under the ICAO convention of 1944, which we signed, as well as the Russians, you cannot fly an unmanned aircraft over another person's country without his permission. And a balloon is considered an unmanned aircraft. So we had to get the permission from the Southern Hemisphere countries. We picked New Zealand simply because when we decided to go down there, the wives got involved and they all looked over things and decided that New Zealand would be the best place to bring up children. So we went to New Zealand and then my oldest son didn't come back home, so now we have three grandchildren in New Zealand.

Kellogg: And Marcel Verstraete?

Lally: There's a whole bunch of people, of course--

Kellogg: He was there the longest, wasn't he?

Lally: He was in New Zealand for eighteen years. But a lot of the people from our original group have unfortunately passed on. There was George Mellor and Bob Frykman and Neil Carlson and there's lot of others that contributed along the way in terms of ballooning.

Kellogg: Sig Stenlund.

Lally: Sig has been our balloon designer and in recent years--Ernie Lichfield was our original electronics man--a fellow named Ken Norris and Dean Lauritsen have done most of the hardware on these exotic dropwindsonde and radiosonde programs. And Hal Cole has been involved, too; there's lots of other names I've probably forgotten. The one thing, of course, I don't know whether you didn't bring up on purpose or not, and that was our great balloon which had the code-name "HI" which accidentally overflew Russia.

Kellogg: It's funny, one of the things we have not talked about was the "time when." Tell us about what happened.

Lally: This was back in 1965, I believe, no, it had to be 1966. We had already made our round-the-world flights in the Southern Hemisphere, a number of them; and then Ernie Litchfield was going to go down to the South Pole with Marcel Verstraete to make some South Pole super-pressure balloon flights. We had to re-build our electronics and the solar panels for very low sun angles instead of overhead sun angles, since we couldn't be up there to switch them around. Anyway, Ernie came back to Boulder and he built the new solar panel for the Antarctic and we decided we should test it by launching it early in the morning. We flew it on a super-pressure balloon in which we had put a pinhole and at that time, we had a little soap-bubble test like for tires. It was a crude test, and we checked the hole and it was truly a nice hole, there were bubbles coming out of it, and I told Brewster Rickel, who was one of our good engineers, to put a mark around it with a crayon so that we could maybe check back in case we wanted to put another hole, because we wanted to make sure we came down in no more than two days somewhere over the Eastern Atlantic. Anyway, as far as we could figure out later, Brewster's pen mark must have gone over the puncture hole and sealed it with wax. We flew this system the next morning--Ernie and I got up real early--made sure we picked up the dawn and the low sun angles--and Ernie had set up the code; it had a double Morse code. We used the double code for Antarctic flights. He had little diodes that you just clipped to make dots or dashes. If you didn't clip anything, it came out all dits. So this came out "dit-dit-dit-dit-----dit-dit": "H-I," "Hi," which unfortunately for us turns out to be the exact same code that the amateurs used on their little amateur satellite, which was a quite legal device that was going around the world.

Kellogg: What's an amateur satellite?

Lally: NASA launched a satellite for the hams of the world.

Kellogg: For the hams, you're right.

Lally: It was just a simple little device so they could track it and check signal strength. And it just put out a Morse code letter, and they put out "Hi," you know, just to tell the world that they were there--HI--it couldn't be simpler. I think it was a little one pound satellite.

Anyway, our balloon went off, beeping away its "H-I," and it went out across the Atlantic. We tracked it for a couple of days, forgot about it, figuring it would come down. Twelve days after launch, we were checking out something else on one of these systems, and there it was: "Dit-dit-dit-dit-dit-----dit-dit." So we alerted Cecil Sanby--

Kellogg: Did it come back?

Lally: Yes. It had come over. We alerted Cecil Sanby in South Africa to listen for us, and then the fellow, Hugo Phillips, out at the AT & T facility, which gave us with our own systems pretty much global coverage. So we quietly monitored it figuring this is going to go away...and then for a brief period during the middle of the winter, it did go away, but then it came back. By now, it was too embarrassing to tell, because we were violating all kinds of conventions.

Kellogg: By this time, it had been over Russia several times.

Lally: Many, many times. What happened here is that Walter Roberts, who liked my office up on the Mesa better than his, because it had the best view up on the fifth floor, had taken Bob Turner up to show him the view of the mountains from my office, and then he said to Bob, "And by the way, they've got receivers here, they can receive these balloons they're flying in the Southern Hemisphere." And he turned it on. Of course Walt was a kind of amateur radio man anyway. He turned it on, and the needle was pegging, "Dit-dit-dit-dit----dit-dit." He looked up at our board and that wasn't listed on the board, so the next morning, he called me into his office and said, "Say, do you have something in your lab going? It was blasting there. 'H-I.' It sounded awfully close." I said, "Yes. It was. It was over Minnesota." Walt, being absolutely totally honest with the universe, then called the Science Foundation and explained the situation.

But then panic came up. The head of the Science Foundation at that time was the former AEC head who was very sick, I've forgotten his name now. It turns out he died some months later. Anyway, he had come in from a trip and was feeling very poorly apparently when he got this word. Somebody apparently called him at night. He immediately called the White House and the meetings were set up there. It was a big crisis. The Air Defense Command was given, as its number one priority, to shoot this thing down. The State Department hand-delivered notes of apology to Russia. They were just afraid this would just be considered some kind of an American trick...

It turns out, as far as I can tell, that the Russians were well aware of the things we were doing. Especially, they were very balloon-sensitive. They were flying zero-pressure balloons at the time and were negotiating to get a balloon that had flown into Europe back. Fortunately for me, they apparently reacted diplomatically, and didn't get too excited. It was just the State Department and others. Anyway, this went on for three more months while NORAD attempted to shoot the balloon down. They could not get radar fixes on it. They were chasing birds all over the world. They worked a deal with the FCC people, which used to (it's no longer in business) do direction-finding on signals to locate illicit transmitters. These people would come to us. We could tell them where the balloon was as it circled the globe with the help of Cecil Sanby and Hugo Phillips. The FCC then knew when to activate their networks of DF stations. Everything was classified, top-secret, we weren't supposed to know anything. We had told the NORAD people that if they just let us put a little 15 megahertz DF on the wings of one of their old Constellations--which had the big radar underneath--we could get it close enough to where they'd get the skin track. Then they could fly a fighter plane through it. They were very upset that we would tell them how to do their business.

Kellogg: It was a very small radar target.

Lally: It looked like a tiny little white hardhat with a black solar cell top on it...it gave practically no target. Anyway, that one got a lot of people upset for a long time. It circled the earth for 7 months and NORAD never got a fix. It finally came down in the Pacific.

Kellogg: I'm glad we remembered to talk about that. I hadn't heard some of the details of that story, but it's a wonderful story.

Lally: The other thing is that back in those days, we had some nice people at the Science Foundation. Earl Droessler, other people who didn't panic.

Kellogg: Well, Vin, that about does it. I certainly appreciate your giving us--NCAR, AMS--so much time.

Lally: It's been fun. I've rambled, I know, but I've enjoyed rambling.
Kellogg: You're supposed to do that in these interviews.

Lally: Thankyou, Will.

Kellogg: It's been fun. We'll call it a day. This is the end of side one, tape two, of the interview with Vin Lally. It's July 13, 1993, and I'm Will Kellogg. With that, we'll sign off.

END OF INTERVIEW