# Oral History Interview of
# Bobby Green

**Interviewed by: Lynn Whitfield**
**February 12, 2010**
**Lubbock, Texas**

**Part of the:**
***Crosbyton Solar Project/ University Archives***



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# Transcript Overview:

This interview features Bobby Green as he discusses the Crosbyton Solar project. In this interview, Green describes the project in detail.

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| Subject | Transcript Page | Time Stamp |
|---|---|---|
| Background information | 05 | 00:00:00 |
| How he got interested in solar power | 09 | 00:10:11 |
| Criticisms about using solar power | 13 | 00:19:22 |
| Highlights about the Crosbyton project | 15 | 00:27:42 |
| Good Morning America filming the project; problems with the project | 19 | 00:36:58 |
| His memories about the people of Crosbyton | 23 | 00:45:58 |



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**Lynn Whitfield (LW):**
Today is February 12, 2010. This is Lynn Whitfield and I'm interviewing Bobby Green. Bobby, can you tell us about where you were born and your family?

**Bobby Green (BG):**
Yes. I was born in Crosbyton, Texas and grew up in Crosby County. We were farmers. I got out of school—high school—in 1968, went to a trade school in Oklahoma City to learn electronics, came back and started Texas Tech a little bit later than that and continued at Texas Tech.

LW:
Great. What are your parent's names?

BG:
Charles Edward Green Jr. and Margie Green.

LW:
Do you have any siblings?



BG:
Three brothers and a half-sister and a half-brother.

LW:
And what are their names?

BG:
Three brothers that are in my immediate family are Pat Green, Mike Green and Jeff Green. The half-brother was Jerry Green and the sister's Sherry Green.

LW:
Do you have any children?

BG:
Two, a son and a daughter. The son's Seth and the daughter's Elizabeth.

LW:
Great. After—where did you go to high school, again?

BG:
Lorenzo, Texas.

LW:
And then where did you go after high school?

BG:
The school was in Oklahoma City. It was called H.C. Technical something. I forgot. It's been a long time.

LW:
What did you specialize in there?

BG:
It was an electronic technician school so that you could learn to be an electronics technician.

LW:
And why did you become interested in electronics?

BG:
We took an Air Force test and we all scored high in mechanical, electrical and the other things so we took off and went to electronics.



LW:
Is that the ASVAB [**Armed Services Vocational Aptitude Battery**] test?

BG:
I don't know. They gave us a whole battery of tests and I don't remember which one it was. You got four scores and I forget what the other two were.

LW:
I remember taking that one. And what did you do after you got through technical school?

BG:
Went back to Crosbyton, went back to Lorenzo-Ralls area and farmed some more. I was going to go to college out in Longview. Got out there and I wasn't really compatible with the college so I came back and continued farming. Then we talked about going to Texas Tech so I wound up at Texas Tech.

LW:
What kind of farming did you do, cotton?

BG:
It was cotton and maize, sorghum corn; Crosby County farming.

LW:
So, how did you end up at Texas Tech?

BG:
It's close to—Crosby County and Lubbock County are next to each other. So, that's within thirty miles and it was an easy drive.

LW:
And what did you major in when you came to Texas Tech?

BG:
Electrical Engineering.

LW:
Okay. How was the department at that time period when you first came to Tech? How as it kind of set up?



BG:
It had a bunch of good professors. They all taught classes and we all went to school there. Had classmates and had a good time.

LW:
Did they have—was that when the graduate program was first starting?

BG:
The graduate program had been there a long time before that, I'm sure. I started electrical engineering in the seventies, '71 or '72. I'm not sure.

LW:
Okay. That makes sense. And can you talk about, maybe, some of your professors and people that you remember in the department?

BG:
Yeah. Had several of those professors in classes. There were, I think, John Walkup was—taught us circuit theory and those sorts of things. He taught us—he was an optics guy. He was a Fourier analysis optics guy—Fourier optics guy. And that was probably not brand new at the time but he was one of the newer guys on Fourier optics so he was showing us and we would make some

calculations on a computer and get some lasers to do the Fourier optics. So, that was pretty neat. We had one named Portnoy [?] [0:04:58], Will Portnoy. He was—I took some classes from him. He had me work on an analog computer that was as old as the hills and as big as a house. It worked but, you know, by the time we got it working it was pretty obsolete because it was obsolete when we got it. Had John Paul Craig. He was the power guy and taught classes in electrical power and motors. We had him. Motors were a pretty big deal for electrical power guys so we learned about that. Had Seacat for two or three courses. If you—if Seacat thought you were going to be an engineer, I think he kept you. If he thought you shouldn't be an engineer, I think he'd want you to go someplace else. So, he evidently wanted to keep the guys that we stayed with. And we turned out to be pretty good engineers over the years. I'll remember another—Reichert. Reichert did some classes after—I don't know if I had Reichert as an undergraduate. I knew him, and I may have. So, he was a smart guy. He was a real smart guy. And Sakes [?] [0:06:38]. Had Sakes, Richard Sakes, for some other classes that were high-powered mathematics classes as an electrical engineering student. He was one of the good guys also.

LW:
Were you around when they were trying to set up the project labs or was that already established?



BG:
That was already established. We'd go in as undergraduate students and they would give us a small piece of paper with instructions to build some gizmo that we'd never heard of. So, you were off to the library to find out what the gizmo was, how it worked, and how you were supposed to put something together that worked like that gizmo. I think you had about three weeks, maybe four. Depends on which lab it was. Then there were some other labs but they didn't have very many recipe labs where they had everything laid out and you could just go through a routine and everything would happen properly.

LW:
I think—I can't remember if it was Reichert or Hagler but one of them talks about how unique that lab setup here—the project labs—was at Tech, that not a lot of the schools were doing the same thing at the time.

BG:
Texas Tech was one of the few, probably, engineering—electrical engineering places that the students got hands-on experience. When you went to Texas Tech, you were given the flood of knowledge and dozens and dozens of areas. When you got out, you may not be an expert in a single area—and you couldn't be—but there wasn't a challenge that the Texas Tech students wouldn't address. Then they would become successful and be good engineers because they'd

already been beat up a lot. So, when you go out into the working world, getting beat up wasn't something that surprised you. Solving problems was something that surprised the people you worked for.

LW:
Great skill. Now, did you do both your undergraduate and your master's at Texas Tech?

BG:
Yes.

LW:
What differences did you notice between the two programs, if any?

BG:
There were—as an undergraduate, you were doing a lot of different things. As a graduate student, you narrowed down the focus a little bit but not a lot because you still had to—still got a wide background of information. Whenever we were doing those things, one of my brothers was in—Pat was in Texas Tech. We went to school together at the same—he was in, I don't know, anthropology or something like that. I forgot. Whenever he was an undergraduate student, they were seeing the ceiling of knowledge in that area. When we were undergraduate students, we were nowhere close. As a graduate student, you weren't close to the ceiling of knowledge either in electrical engineering or in engineering. So, there was a vast amount of information and it's increased since then.

LW:
How did you get interested in solar power?

BG:
I was about to graduate with a master's degree and I'd taken a couple of classes from Dr. Reichert. He knew that I had an agricultural background and that I could work hard if I had to. He needed a field engineer whenever they were doing construction out there. He thought I'd make a good one, so he'd ask me if I'd work on that job. I didn't have anywhere to go and sounded good so I did.

LW:
I've been told that Dr. Reichert had this amazing skill where he would talk to students and instead of trying to solve their problems he would try to get them to think—look at the problem in different ways. Is that an accurate statement?

BG:
I'd say it would be, yeah. He could approach a problem from several different perspectives and we weren't quite that bright.

LW:
How did you end up getting involved with the Crosbyton Project?

BG:
When he asked me to go to work for him. I graduated from Texas Tech and went to work for him and I was a field engineer when they were doing the construction, building the stuff out there. Then after they got it built, I helped turn it on and helped operate it for a couple of years.

LW:
Well, when they were getting the dish put together, I guess, do you know how long it took between the design stage and the actual starting of construction stage?

BG:
About a year. Maybe six, eight months, something like that.



LW:
And during that time period, is that when they were testing the mirrors, the construction of the mirrors?

BG:
Yes. Before they started them and putting them out in the field. They were doing that before I got on the job, before I was hired.

LW:
The project, it wasn't just electrical that worked on the project, right? There were other—

BG:
Electrical, mechanical, and civil engineers, and chemical engineers. The whole college of engineering had professors on the project.

LW:
How did they handle the money for that. Was it just one—did Dr. Reichert handle that?

BG:
They had secretaries and accountants and stuff like that did all of the—took in the money and spent the time making sure it got spent in the right places and that sort of thing. I wasn't in on much of that.

LW:
When they setup the projects, was—one professor would handle like the mirrors, pistons, would work on that project, and another would handle, say, the construction of the bowl—so it was all these different units working together?

BG:
Well, E-Systems designed all that stuff. The students, a lot of the time, would do some background work on maybe the mirrors themselves. They did a lot of background work on the stresses that were in the glass. Civil engineers did that, and graduate students did those sorts of calculations. Then some of the other professors would study the wind interaction with the bowl and wind interaction with some of the pieces that went into the bowl, like the solar receiver and the support director and that sort of thing. Then they would study the steam cycle that was going on in the bowl because it was a one pass-through steam generator. It didn't get to run it back through several times. So, you made all the steam you could, send it back and made all the steam again. So, they had a lot of civil engineering went in. A lot of mechanical engineering went in, and some electrical engineering went in, and construction. Reichert was a physicist so he was pretty well-versed in most of that stuff, maybe all of it.



LW:
Could you kind of, like, describe how this works here maybe in as much of layman terms as you could. I know there's a computer room of the side, right? There's a building where all these computers were next to the bowl.

BG:
Yes.

LW:
And how did it—how did the steam run through here and then feed back.

BG:
This was a one shot-through steam generator. Since it was solar powered, when the sun shined you could make steam. This is a small portion of a bowl. It's a sixty-degree piece of a bowl. It's not half a bowl. It's less than half a bowl, half a spherical section. And you have all of this structure back here, these three legs, to hold up the structure that holds the receiver. The focal region is down close to the surface of the glass. As you can see, it's brighter at the top of the

focal region, close to the center of the bowl, than it is at the bottom. That's characteristic of a spherical reflector. What that meant was you could start cool water in the bottom and as it circulated up, it received more and more energy and the water got hotter and hotter. Then it would turn to steam and you'd get steam out. When we hooked it up, it was a research device so you were trying to find out how efficient it would make water into steam. If it made water into steam and you could get turbine quality steam—steam turbine quality steam. Then after you got steam turbine quality steam, you could calculate how much electrical power you could get out because electrical power generators had been working on steam turbines for a century. So, you just made calculations and as soon as you got the steam out, you could say how good the thing was going to be.

LW:
Did the water feed in from the back side of this or did it come down here and then go back up?

BG:
The water went up to the center pivot point of the spherical bowl, it went down to the bottom of the receiver, then it circulated around the receiver in a couple pipes, really small pipes, that went around in a helix up the receiver. Then at the top of the receiver, it was superheated turbine quality steam. The steam would go back up to the center of the bowl and then go down to the steam load that would simulate a turbine load. Then we would cool it off, cool off the steam, and send the water back up to there so it was a closed-cycle steam generator. You could use the steam to turn a turbine if you—later on we turned turbines and made electricity. It was closed-cycle so you could cool if off after it came out of the turbine, send it back up and continue the cycle.

LW:
Was there lots of evaporation due to the steam?

BG:
In steam turbines, you never let the water go. What you have is a cooler and you send the hot water from the steam generator through a cooler and the cooler has water in it and that water evaporates because the water in your steam turbine has to be very, very clean. You can put nasty water on the outside and let it evaporate and keep the steam turbine water clean then you don't have to regenerate clean steam turbine water all the time.

LW:
So did you have to have several filters due to how hard our water is here in West Texas?

BG:
We had a whole water treatment process. The first thing that we did was go through a reverse osmosis water cleaner and then from the reverse osmosis water cleaner, we went into some deionizing units. The deionizing units would clean the water up. We changed the water every so often. But, even those sometimes didn't clean the water as well as they should, or as well as they could, or they'd get contaminated. Then the water would get some dirty stuff in it. We would have to go back and re-clean the water again. Steam turbine water in all steam turbines is a pretty important part of the steam turbine process. It's really important to keep that water good and clean for steam turbines.

LW:
Some of the articles I'd read about solar power, the criticism was that some of the systems would end up using more water than some areas might be able to give, like New Mexico and places like that. Would that have been a problem for West Texas?

BG:
All steam turbines use a lot of water, okay? Doesn't make a difference where they are. The electric power plants, all of them run on steam, except for maybe the wind turbines now. You have to have a cooling system. You have to cool off the—you first use the steam to go through a steam turbine to extract the energy and make electrical power but when it comes out, it's still warm water—warm steam—so you want to cool it back off so that you could re-boil it. To cool it back off, you have to have another source of water, some sort of cooling. The best cooling is to put cold water on your hot steam in a pipe. The water will evaporate, steam will condense into water, and then you can pump it and you can make steam again. So, it's a closed-cycle and you're always generating—you're always evaporating the cooling water. So, you see that and it takes a lot of water to evaporate that but not millions and billions of gallons. If you have a really big electrical generator, it might take millions and millions of gallons but that's over a long period.

LW:
So you think if the Crosbyton Project had gone to fruition and had been installed as an electrical plant component that it wouldn't have needed an excess of amount of water?

BG:
Not any more than any other steam turbine.

LW:
Okay. Great.

BG:
All the steam turbines have to have that water.

LW:
What about cleaning the dishes? Because I've got photographs of people with brushes going in there. Did the water, like when it rained, did it leave the spots and things on the mirrors? Was that a problem, keeping the mirrors clean?

BG:
West Texas is a dirty place. We have a lot of dirt, and sand and different kinds of material in the air. When the mirrors would come up in the morning and have dew on them and they would get dew all over the surface of the mirrors, the dust would dissolve in the dew, in the moisture, then the dew would evaporate and leave a thin film of dirt scum on the mirrors. Wasn't terrible but it cut the efficiency down probably 15 percent or more, something like that, depending on how long they were dirty and what kind of dirt it was. If you cleaned them, then the efficiency would come back up. We would clean them every once in a while. One of the things about having reflectors in any solar power device, you need to be able to clean the reflectors. So, everybody had trouble no matter what solar powered reflector you had. You had trouble with cleaning the mirrors. We had a lot of experiments on how to clean the mirrors. It was a tradeoff. You could spend a lot of money cleaning the mirrors and you might not get a return on the power that you would like and you might find some optimum dirtiness for the mirrors that you could live with and it would still make good power.

LW:
I have a question about the design, like the Barstow Project, which we did seem to favor.

BG:
Like that a lot.

LW:
That design seems to be a flat panel like this.

BG:
Yeah.

LW:
Why did we use a bowl shape versus the flat?

BG:
The Barstow Project was a heliostat. There were a bunch of mirrors out there. Those mirrors

weren't flat. They were slightly curved. They were point reflectors. They would reflect the sunlight into a single focal point like a magnifying glass does when you look at the sun on a piece of paper. So, there were just a lot of those out there and they were a distributed—parabolic reflectors is what they were. So, you had to move those all day long. I think they had about eighteen-hundred of them. Had two motors in each one: one to move it north and south and one to move it east and west. All of those had to be precisely aligned. They had some very large mirrors that they had bent to heliostat shape. They would focus those on their central receiver. Ours was a spherical section. This was a test model. This was a thirty by forty-foot across test model. Since it was a spherical reflector, all the pieces of the sphere are in there so you get to see something that looks like a bowl. The Barstow Project was a distributed parabola so it was very, very big. It just—everything was on a flat surface so it didn't look like a big parabola. It would look—just put it together, it'd probably look like the Arecibo, Puerto Rico radio antenna. It'd be big. But they could make little pieces and distribute the pieces and it acted big.

LW:
Why do you think DOE [**Department of Energy**] favored the Barstow Project over the Tech project?



BG:
It was a high-tech aerospace project. The bowl was—it had a lot of high-tech stuff—and it may be—but it wasn't nearly as high-tech as the heliostats. We boiled water and they were going to heat salt, some sort of salts, which is not a bad idea but steam turbines were pretty well understood technology. Heating salt was brand new. So, DOE likes brand new things.

LW:
Okay. I thought maybe they felt that the Barstow Project could be used on a more massive scale and could be turned over to, say, a corporation that'd take over whereas this project was geared to help a local community and it would be more geared towards one entity.

BG:
They might've felt like that. I don't know how DOE felt about a lot of stuff because I was in the echelons. This was a test project and it was a small one. The big one was supposed to be ten two-hundred foot bowls. It was supposed to make five megawatts of electricity. The heliostat made ten megawatts of electricity and if you looked at the footprint for each one, how many acres of land it took to make ten megawatts, then the solar bowl probably beat the heliostats pretty badly. The heliostat could send all of their power to a central location and have all of their heating and cooling in the central location. The bowls, if you had a bunch of them on five or ten acres of land, then each one of them had to send steam down a transmission line to go to a turbine generator and that was going to be lossy. Nobody ever had the chance to—it's a technology

online so that you could start practicing it and improving it so all of the solar powered things kind of went by the wayside except for maybe photovoltaics.

LW:
There's a lot written about those, too. Can you talk about maybe some of the highlights or moments that you kind of remember about the project?

BG:
Yes. When we first turned it on, we were working through the time frame to get it up and operational. We had—there was a major solar power conference coming to Lubbock, Texas, Texas Tech. Reichert wanted to go out and show off the bowl but it wasn't quite operational. We didn't have all the parts up. It was hard to get the controller to operate the way we wanted it to because everything was new and you're learning everything. So, they showed up and we hand-operated the bowl; didn't have an automatic controller on it. There was a fellow that was standing on the back side with a welding mask—uh-huh, a lot like that fellow right there, except this was the first time it'd ever operated and made steam. John Paul Craig was in the control room looking at all of the electronic controllers and he had a switch next to his leg. He would turn the switch on and the receiver would move to the location it needed to be in. The guy with the welding mask had a radio or a telephone and was telling John Craig when to move the thing. And every few moments he would say, "Move it right," and John Paul Craig would bump the switch and it would move to where it belonged. All of the big, old hotshots from the DOE and everybody, they were out looking. E-Systems guys knew that we were bumping it because they were part of the builders and everybody else thought it was operating like it was supposed to.

LW:
I thought he was cleaning the glass. I didn't realize that—

BG:
He was watching us clean the glass that day but on the first day—there's probably a picture of that somewhere and you see a little bitty head right up here that nobody can see because they were all on this side. They were on the south side of the bowl down here and we had a bunch of signs across there—"Danger", "Don't go here", "Don't go there"—so that we could herd all of the lookers in so that they could look and they wouldn't see the guy in the back telling them when to bump the switch. The other thing that was—scared them—Reichert—we got a big snow the couple of days before the conference. So, the bowl was full of snow. When they came out, it warmed up a little bit and all of the snow had slid down to this bottom of the bowl so you couldn't see it. Since the bowl is a good reflector everywhere else, it still reflected and made superheated steam. So, you couldn't see the snow in the bottom of the bowl. You can see a little bit of it right there. So, they operated the bowl, it made steam, blew a steam whistle. Everybody was happy and back they went to the conference.

LW:
So, there's no, like, little gaps here or there to let water go through if it was raining or anything like that?

BG:
Oh yeah. The water would go through but snow doesn't go through until it melts.

LW:
Okay. That makes sense. Well, that's interesting. How long from that point to when it was actually operational?

BG:
After that conference it was probably about three, four weeks before we started testing it. It was not a finished test facility at that time. We hadn't—didn't have all of the software and the controller operating the way we wanted it to. We didn't have some of the other stuff. There was still a lot of stuff to do. We had—when it was first tested on a small scale, much smaller than this, a man would run the bowl and he would control the flow rate of the fluid in the steam generator. When something happened, he could instantly go over there, adjust it and operate the thing. A guy can fly a space shuttle, he can make that thing go. But when you have to build a controller to make it go, the controller has to have a little bit of an advantage that the men don't—men have that the controller don't have. So what we had to do was try to build something that would operate without going unstable. The operation, whenever the sun was on there and bright, you had a certain load and you could have the water flowing at the rate you wanted it to. If the sun went away then suddenly the flow rate was way too high, water flow rate, so it would cool off and it would not work right. So, you'd turn of the water. Now the sun would come back out and you would try to turn the water on and you couldn't turn it on far enough fast enough because the load changed and it was a dynamic load. So, we had to develop a gizmo that would compensate for that. The fellows that were on there built a flow valve. The flow valve, if you turn the valve on and off—if you stop it up, the flow slows down. They had to build a flow valve that if you turned it off, it wouldn't—water would not slow down. So, it was a spiffy valve. We probably were some of the few people that had those.

LW:
Did it ever get to a point where it was always automated or did it always need a human there to—

BG:
There were always humans there because it was a research project but the things you see here in these pictures, that was completely automated. It operated from daylight till dark. We would—probably have some pictures here with the receiver up out of the bowl a good ways. It would

operate with the receiver out of the bowl because it's a spherical section. Then it would operate all day long and we—the focal region in the bowl moves as the sun moves. The nice thing about a bowl was it only had two moving parts: one moving part that went east and west and a smaller moving part that moved it north and south because the sun moves north and south throughout the winter and summer. So, if you had ten two-hundred foot bowls, you had twenty little motors and that was it. With heliostats with eighteen-hundred reflectors, you had thirty-six hundred motors. With nine-hundred reflectors, you have eighteen-hundred motors. So, every time you have more complexity, you have more parts to break. So, the bowl was a pretty good design and a pretty good device.

LW:
And the bottom structure of the bowl was completely stable, it did not move, right?

BG:
Never moved.

LW:
It was just this part that moved.



BG:
Just that receiver moved.

LW:
Okay.

BG:
As the sun moved across, the receiver moved across to track it.

LW:
Now what about the structure that was—the house or building that was next to it? What all did it house?

BG:
This structure had the steam cooling system. We'd send superheated—it was a load, steam load, because you had to have a load to find out how well you were doing generating steam. So, it would go in there and you had something that was a simulated steam turbine load and so you continued to have that thing operate. Then after you found out how much energy you had in the steam, you had to cool the steam off, make it water again like a regular steam generater, and send it back out to be cooled in the air. Then you took the water back and sent it back up to the receiver to be boiled again. We had about two hundred gallons or so of steam turbine water, took

it out of the tanks, boiled it, brought it back, cooled it off and put it back in the tank. These two things right here were the coolers. We had to have—when it came to us, there was only one of those fans and it wasn't enough to cool the whole thing so we had to get a second fan.

LW:
Now, were you there when Good Morning America came out and filmed?

BG:
Yes.

LW:
Because they filmed, I think, on one day and then the event was the next day.

BG:
Yes.

LW:
Then the sun didn't show.



BG:
Well, the sun was there when we were—whenever they were there, the sun was there. When the big guys came out for the conference, the sun was shining then also. We were always very fortunate that the sun shined when we needed it to shine.

LW:
Back to the project here. What are some other things you remember about the project?

BG:
It was a lot of fun. That was the best job I ever had in my life. It was fun doing the research. It was fun working with the people that I worked with. I worked with people all over the world. We had—since it was a bowl—the Arecibo, Puerto Rico radio antenna—radio telescope—is a bowl so the fellow that was the director of that, Frank Drake, came out for a visit because he thought we were going to be building ten bowls and he wanted us to use them as radio telescopes at night. So, he came by, we visited, had a wonderful time and talked about radio antennas and talked about radio telescopes. That would've been a distributed radio telescope and he would've loved to have had radio antennas on that baby.

LW:
Interesting.

BG:
But this one, it was too small for a radio antenna because Arecibo, Puerto Rico had—I think theirs is a thousand feet across. So, that was fun. You know, we found out probably not everything you could find out about solar reflectors with that bowl but we solved a lot of problems that came up that we didn't realize were going to come up. Whenever they put the mirrors in, part of the focal region was on the glass itself because it's a spherical section. Those glasses were bent to a thirty-five foot radius for a sphere. The stresses in the glass are on the ragged edge of fracturing the glass. So, as soon as you would change the energy level in the glass, like focus a bunch of sunlight on it, they would start cracking. If they were a two-hundred foot radius that would never happen. So, we had to solve a cracking problem in the glass that wouldn't exist on a big system. We worked like dogs to solve it, and did, and stopped all the glass from cracking.

LW:
Did you have problems getting parts for the bowl?

BG:
Yes. All the steel there that you see is bent to a spherical radius. Then you had to have some manufacturer bend all of that steel to the—pretty close to the correct radius. It didn't have to be perfect but it had to be pretty close. So, everything on there's a special part. Now, once all the parts were made, you didn't have to worry about it very much after that because it wasn't going to go anywhere but the mirrors, they were going to be there for thirty years—a power plant lasts thirty years—then you would have to have the mirror manufacturer. I think Reichert and the guys went out to talk to Pittsburgh Glass about making glass mirrors—glass for our devices. We would have to have several thousand square feet of really nice glass. That glass right there was plain, old mirror glass. Had some iron in it so it's lossy. If you got glass with less iron, then it would be a lot less lossy and you could have more power. So, they talked to Pittsburgh Plate Glass and they said they wanted low iron glass and they said, "Great. How much?" They said, "This many thousand square feet." Pittsburgh Plate Glass people—sorry, I stuttered—almost laughed because they put that much glass out in about an hour. So, that was not worth their while to try to find some low-iron sand for—

LW:
Such a small—

BG:
Yes, too small a part of their manufacturing process.

LW:
Who actually produced the mirrors in the bowl here?

BG:
E-Systems built those mirrors. They had glass and then there was some Hexcel—paper Hexcel material behind the glass that they dipped in epoxy resin and a piece of steel behind that. They bent it, held the shape bent until the epoxy cured then it was a glued structure. That structure, they tested and could hit it with, I think, an inch hailstone or something like that at a hundred and twenty miles an hour and it wouldn't break.

LW:
Now, let's talk a little bit about what happened towards closing the project. There was a situation where John Reichert was removed as the principal investigator and then Dr. Hagler was made chairman of the department because Seacat resigned.

BG:
Yes.

LW:
But he stayed with the department after his resignation, didn't he?

BG:
For a little while, yeah. In that time, they kind of ran out of money and I left the project and went to work for a consulting firm then I came back to the project after all of that turmoil occurred.



LW:
What effects did it have on the department?

BG:
You lost of pretty good professors. They left Texas Tech and some of them stayed. There was turmoil in the department and they had to do some rebuilding. So, it was probably not a—it wasn't a good thing.

LW:
Was it just engineering that was affected by this or was there backlash on the campus as well?

BG:
I don't know much about the backlash because I was gone at the time. So, there might have been but I was away and I came back after all the shooting and shouting was over.

LW:
When you came back, was the bowl still in existence?

BG:
Yeah.

LW:
Okay. What happened to the bowl eventually when the project was starting to wind down?

BG:
When I came back, we went through an iteration of some more research and then the bowl was taken apart. The director at that time wanted to send it to Pakistan so that they could practice with one.

LW:
And who was that?

BG:
That was Ed O'Hare. He was running the project at that time. He ran into a bunch of roadblocks to get the bowl dismantled and sent to Pakistan so whenever it came time to turn it off, they dug a hole, buried everything, stole the steel and it was gone.



LW:
Really?

BG:
Um-hm.

LW:
So, this thing's buried?

BG:
Mirrors were taken over to a place and buried in a hole, yeah. The steel was good steel. It was sold to the steel people. Concrete was broken up, put in a hole and buried, and it turned back into farmland.

LW:
So nobody actually kept any parts of the bowl as a souvenir?

BG:
We kept a few souvenir parts but they had—they couldn't be the size of mirrors and stuff because those were big. We had a few little things. I have a stapler. We had some whistles, steam whistles, and I kept the steam whistle that made the first solar powered steam for years in my

office then I sent it to John Reichert because it was his project. It should've been his whistle. So he has that whistle. They brought a Roundhouse whistle from a train station, big, old train station. We were going to blow that one but that thing was bigger than a thirty-gallon drum so hooking it up with—it would make a big noise, though.

LW:
Everybody would hear it.

BG:
Yeah. We sent that one back because that really belonged to the Roundhouse guys.

LW:
What do you remember about the folks of Crosbyton? I mean, this was originally their project and it was set out to solve a problem for the small town.

BG:
Crosbyton had some pretty progressive folks in there. One of them was Norton Barrett. He was their city secretary. They had a really good crew of mayors and that sort of thing. In 1973, when the cost of fuel shot up, shot up a couple of times, they looked around—they had their own power plant in the city and the power plant was—used big piston-driven engines and everybody else around, they were on Southwestern Public Service power or somebody's power like that. One year they had a power outage and Crosbyton was the only star on the horizon that was still going. Lubbock Power & Light was also probably operating. But if you lost a big generator then you were down and dirty. And so, they thought they'd like to have some supplementary power to reduce their energy costs because fuel was going up. So, they went to their Congressman and solar power was becoming an issue then, so they thought they'd like to see a solar powered gizmo in Crosby County making Crosbyton go and some other towns as well. So, they worked real hard to get a solar power project and they won one and got it—the research part started out there at Crosbyton and they were going to put five megawatts of electric power in Crosbyton at the end of the project, if it operated properly and if it was a good project. And it did and they just—the money ran out before they built the five megawatts.

LW:
Is one of the big problems with solar projects is feeding the power into the grid?

BG:
No. Depends on the kind of power you use. If it's steam turbines, then once you get steam, all the power guys know how to turn steam into electricity and get it on the power grid. We made steam and we put power on the power grid also. When you make the steam after you're—after you get the steam there—you have to be careful putting it on the power grid because you've got

to get it synchronized with all the other—with the power grid. Once the power guy tells you how to do that, you do it and there goes the power.

LW:
Let me see what else. Did working on this project influence you to become a professor or did you just—how did end up becoming a teacher?

BG:
By accident. I was working on this project and it was about to be over. I was going to go hunt for another job. Just before I started job hunting, somebody quit in another department. I'd worked with the chairman of that department because he was a civil engineer that was chairing another department, an engineering technology department, and he needed an electrical guy real quick. So he came over and said, "Hello," and I said, "Hello." He said he needed an electrical teacher, electrical engineering technology teacher and would I like to do it. And it was easier than hunting for a job so I told him, "Yes." Then I wound up over there as an electrical engineering technology professor.

LW:
And you've been there how long?



BG:
Since 1986.

LW:
Do you know the story behind this or what some of the symbols mean for the logo?

BG:
The logo, I think John Dee wrote a whole article about that. That's a six-color logo. I know that the part on the top is the sun and the arrow points at the sun and then this part down here is the receiver with the—the receiver had two coils of tubing on it, okay. And the receiver is only half a radius long for the sphere. That's where all the power goes. And when you're looking at what size the receiver needs to be, it's a cone. The cone goes through the center of the bowl, center of the sphere, and the sides of the sun come down through the cone and then those are the edges. They spent a lot of time calculating that stuff. He did some serious calculations on this, he and his graduate students. So, the receiver was a cone and this the cone and the yellow part's the receiver and it gets more concentrated as it gets up to the top then those two things are the pipes. He has, you know—medical guys have—

LW:
Snakes.

BG:
—snakes around their things so there they are. Then there's the center of the receiver. The hot—the brightest part of the sun is in the center. The edges are not quite as bright and we don't get as much power from those but you get power from the edges also. And then this is the—this cone—there's the sky, blue sky, and this part right here is where the receiver can go. Then there, I think, this is water or something. There's the surface of the bowl that you're receiving power from.

LW:
Cool. Well, are there are like last thoughts or anything that you want to talk about on this project or any people that you want to mention?

BG:
Not right now. Long time, I forgot some stuff.

LW:
Okay. Well, thank you very much. I'm going to go ahead and stop the recorder.

[pause in recording]



LW:
The following comment was added by Bobby Green while looking a photograph. We'd finished the interview and this was just an addition.

[Pause in recording]

LW:
Go ahead.

BG:
I think that was E.L Short, the state Senator at that time. That's the city manager. You can see his back. All these guys are Councilman. That's the local doctor at the Crosbyton hospital.

LW:
Was this for a special event or was it just a—

BG:
It was a special event. I forgot which one it was. That may have been—see that rope? We had it roped off so people couldn't walk—see that guy right up there?

LW:
Yeah.

BG:
He's the one that's watching—this was that day, and that thing is in the focal region because he has told the other guy—and they practiced this the day before.

LW:
Okay. So, it's Sakes [?] [0:53:28] that's in the operating—

BG:
No, it's Craig that's—

LW:
Craig, okay.

BG:
John Paul Craig is the one that's operating the receiver. Now, this is before we put the foot piece on there. This isn't the receiver. The receiver only down to about here. This is the reflection of it.



LW:
Oh wow. It looks like a compulsive—

BG:
I know, because this is a mirror. You're getting to see the reflection of that receiver.

LW:
Wow. That's cool.

BG:
So, it stops right about here somewhere and that fellow is hunkered down, they can't see him from here. We could see him from—we were on the top of the building. He's watching the spot up here to make sure when the sun moves—it moves about fifteen degrees an hour. So, the sun is coming across this way and when that moves and gets a little bit out of line, he's telling John Paul Craig to bump one of the switches. The north-south switch doesn't have to be bumped. It's already lined up. East-west switch, you only have to bump it a little bit one way. And so, you'd bump it and it would back into the focus. And he'd have them drive it a little past so that you could leave it there for a minute or two. But in two minutes, you need to move it again. So, that was making it super easy to steam. That is snow. That's snow and frost right there. This is frost

on the mirrors. I think I have—that snow, it didn't slide down. So, there's a little frost on those mirrors. And that—

LW:
So, is it—just about to here is the actual piece and then the rest of it is the reflection?

BG:
Um-hm.

LW:
Okay.

BG:
Right about there.

LW:
Okay.

BG:
And then it comes down here.



LW:
You'd almost have to diagram the photograph to know that because it looks—

BG:
Looks just like it's a long receiver, doesn't it?

LW:
Yeah. It's amazing. Well, thank you very much.

BG:
You're welcome very much.

***End of Recording***