ROBERT LEROY BASKIN

West Valley City, UT

An Interview by

Becky B. Lloyd

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THIS IS THE FIRST OF TWO INTERVIEWS WITH ROBERT LEROY BASKIN, ON MAY 7, 2015. THE INTERVIEWER IS BECKY B. LLOYD. THIS IS THE GREAT SALT LAKE ORAL HISTORY PROJECT, TAPE No. u-3301.

BBL: This is an interview with Rob Baskin at his office in West Valley City. Today's date is April 7, 2015. This is part of the Great Salt Lake Oral History Project. My name is Becky Lloyd. Rob, let's start with when and where you were born.

RLB: I was born in Montclair, New Jersey, or New Joisey, as they like to say.

BBL: You lost your accent somewhere.

RLB: Yes.

BBL: You'll tell us about that as we go along?

RLB: Well, it was a gradual process, I'm sure, because there was no conscious effort to lose it.

BBL: What was your family doing in New Jersey?

RLB: I lived in the northwest corner of New Jersey in a little town called Branchville. Eighteen students graduated from my eighth grade class. It was a very small community surrounded by a lot of dairy farms. Those farms supplied most of the milk for New York City. So it was out in the middle of nowhere. Both parents were teachers. My father was a science teacher and my mother was a substitute teacher who went in a couple/few days a week to various schools and taught. So I grew up in a very rural community compared to today's schools that have four classes of thirty students each in one grade or something even larger than that.

Every summer, we would go to Yellowstone National Park. My father was a park ranger, a seasonal park ranger, and we would pack up the family and go to Yellowstone from the beginning of June until generally the beginning of September and then go back

to New Jersey where we'd go to school, etc. Well, I got a lot of science background, a lot of outdoors sort of experience by going to Yellowstone every summer and being a RK, or Ranger Kid, and hiking all over, being the person at the back of the line as you hiked up Mount Washburn, for example, to make sure no one got lost. I was out every day doing something with the rangers.

BBL: How interesting. What a fun way to grow up.

RLB: I'm sure that's part of how of lost my New Joisey accent in that. I was not hanging around New Jersey all summer long, so I was exposed to school there and then would go and have nature school, as it were, in Yellowstone.

BBL: You did that for how many summers, would you say?

RLB: I think it was thirteen.

BBL: Oh, really, so pretty much your whole growing up years.

RLB: Yes, and including probably all the way through high school until I started college, perhaps even through college to some degree. I haven't kept track of the dates.

BBL: That's interesting. Did your dad continue doing that up until he retired?

RLB: He continued doing that for many years, but I think he went back to teaching. The Park Service had budget cuts or something like that and he decided to go back to teaching, because they cut him back to not full-time, so he went and taught in New Mexico, I think, for a number of years and then retired.

BBL: How many children did your parents have?

RLB: Three. Three boys.

BBL: Where did you fit?

RLB: I'm the middle.

BBL: That's interesting. So you finished high school in New Jersey. Did you have any particular interests in high school, any academic interests or otherwise, sports, music?

RLB: I was in the band. It was a required thing that you have some sort of music in school. I was in the band, got drafted into the musicals, the drama part, when they found out I could carry a tune. But no particular specific direction in terms of studies. It was just all general studies.

But, of course, in Yellowstone, I was exposed to geology and volcanology and fishing, of course. All the various natural environments and how to protect them and preserve them. I also was exposed a lot to how people impact the Park. Because I was there a lot, I could see how things changed over time and how Old Faithful would just be crushed with people, and cars, and people would drive off the side of the road and feed bears. I saw all that stuff and how it changed over time. When I first started going there, we had bears on the hood of the car and you could see people feeding them marshmallows and things like that, but by the end of my stint in the Park, there were no bears on the road because my dad and others, like the Craighead brothers, would transport the bears if they found them on the roadside back into the back country. So that activity stopped. I saw those changes and that probably has stuck with me a little bit. When I go somewhere, I see the effects of myself and others on what's going on around them.

BBL: Interesting to see that in a lifetime, when you go through that as a kid.

RLB: Yes.

BBL: Was your high school much bigger?

RLB: I had 103 people in the four grades of high school with my graduating class.

BBL: So, still, a relatively small school, but much bigger than where you had been for junior high school.

RLB: Yes, but the high school was a regional high school where five or six towns sent their students to that high school.

BBL: What was the name of your high school?

RLB: High Point Regional High School.

BBL: Is that still around?

RLB: It is. Still small towns.

BBL: Really?

RLB: Yeah.

BBL: That's amazing. So you graduated from high school, what did you do next?

RLB: I decided to go to college somewhere. Looked around for something relatively small, because I had grown up in a small town where everybody knew everyone. I looked for a school that was far enough away from home that I wouldn't be returning every weekend like some of the students were doing, but that was close enough so that if I needed to come home, I could drive there in a day. So that was my criteria—along with academics. I wanted to focus more on academics than sports. So I went to Thiel College, a small Lutheran affiliated college, in Western Pennsylvania and it had, I think about 1,100 students in the college, and majored in geology.

BBL: Had that been your plan growing up, to be a geologist?

RLB: Actually, no. Thiel College was a liberal arts college and I knew that I wanted to go somewhere where I got, what is the term they generally use? A well-rounded education? I'm not sure to this day exactly what that means, but where you not only learn

the science side, you learn the art side also. So you can look at the world not through Technicolor glasses, but through a combination of Technicolor and art and history and things like that, because I think my high school was very much like that. They had a big band and they had a choir, and the drama program was more popular than the football program. In fact, half of the people that were doing plays and things like that were on the football team. So I had friends on the football team and the drama team and everywhere else. So I got one of those well-rounded educations, whatever that is, in high school, so I wanted to make sure that I continued along those lines, and Thiel gave that to me.

BBL: So geology was a major that appealed to you, and you just jumped in?

RLB: Yeah. So the format of the college was the first two years you took just general classes, a little bit of everything. Then the last couple, that third year you declared, I decided that geology was something I'd like to do. Then you majored in that and you took classes specific to that particular topic. It was a Bachelor's of Arts; I got a Bachelor's of Arts in geology, just because I combined all the arts classes along with the geology.

BBL: Right. So at that point, did you have in mind a particular career that you wanted to pursue?

RLB: When I declared geology or when I went to school?

BBL: Is there a difference?

RLB: Yes. When I went to school, I just wanted to learn more. After a couple of years, I was probably inspired by my time in Yellowstone, I decided to major in geology and took all of the geology classes I could squeeze in.

BBL: Were you thinking you might be a ranger?

RLB: Not specifically. I don't know if at that point I was thinking of a career, a particular career path when I chose geology. It was just something that was very interesting. But being a ranger, of course, appealed to me, but I wasn't saying, "I'm going to take geology to be a ranger." It was just that it was something interesting. And things were changing so quickly back then. I got through school without a computer, without a calculator, except my last couple of years in college I got a calculator, at least. I'm a little older than most people think. Now days, I've got an eighteen-year-old son who can out-program me just off the top of his head. But, yeah, there was no directed, *this is what I want to do with my life.* It was just an interest in learning as much as I could.

BBL: Right. So you graduated from college with your Bachelor of Arts degree. What did you do next?

RLB: I actually went and got a job with Western Geophysical, which is a geophysical exploration company, or was; it's changed names and owners a few times. Western Geophysical out of Houston, Texas.

The summer between my junior and senior year, I had been talking to a friend of mine and he said, "Oh, this is a good summer job to go out and pound geophones into the ground. Lots of hard work, lots of walking." So I did that one summer to make some money to pay for school. Then after I got out, I contacted Western Geophysical and said, "Are you interested in hiring me?" And sent them a resume, etc., and they said, sure. So I got put on a Vibroseis crew, which is basically two-ton vibrating trucks that move along the ground and introduce energy into the earth. These geophones pick up the echoes and you basically do sub-bottom or reflection mapping of the geology. They hired me as a

clerk that basically took care of the hiring, all the books, all the planning for these geophysical exploration lines. So I did that for about a year-and-a-half. Then they gave me my own crew and put me in charge of about twenty-five people to do my own work and I did that for a number of years.

BBL: Wow. That's pretty young to be put in charge of a big crew.

RLB: I think I may have been the youngest crew leader with Western Geophysical.

BBL: I bet you were. So you did that for a bunch of years, you say?

RLB: I'm not sure how many exactly. Three or four years, something like that, I think.

BBL: Did you like that work?

RLB: It was great. It was outside. I got to hire the people I wanted to hire. In fact I'm very good friends with a few of them still that I've kept in contact with over the years. You're outside; you're out in the middle of nowhere frequently. I got to train the people in how to do the job. I crawled underneath freeways through twenty-four inch culverts on my belly in the middle of winter with a cable in my mouth to demonstrate to these guys that's the way you do it. You don't want to put a cable across the freeway and get it torn up by cars and trucks, or have it perhaps flip up and hurt someone. So just detour a little bit and do it. Of course, I had the opportunity then to go back to the office and get warm because it was wet and icy and everything else. But of course I explained to them that if they do that sort of stuff and they get wet, cold, etc., that they just need to call me on the radio and I'll come and get them, take them back and they can get changed, warmed up, etc. The crew was the most productive crew for a number of years with Western Geophysical. We did very well.

BBL: What was the outcome of what you were measuring?

RLB: It was geophysics, so we use sound to look at the layers in the structure in the earth. It's basically, you go down to Southern Utah and you go "hello!" You might hear an echo back from a change in density of what that sound hit. The echo is never louder than what you say. When you say "hello!" it never comes back louder, because that energy is dissipated as it travels through the atmosphere and some of its absorbed into the rock itself. The sound that's absorbed into the rock keeps on traveling until it dissipated or it hits another layer where some of that sound is reflected back. We can do the same thing with the earth, but using a lot louder sound sources, in this case, two-ton vibrating trucks that shake the earth and then we listen for the sound that bounces back. By knowing how fast sound travels, when it left the truck and when it comes back, you can figure out where changes in density—there's other issues involved in there—in the different rock layers are; how deep below the truck they are.

BBL: Right. So who were some of your customers? Who were you gathering this information for?

RLB: The crew that I had, I think we worked almost exclusively for Dow Chemical. They were looking for petroleum and gas resources for the raw materials for the chemical industry. So I think they hired us and they stayed with us for many, probably throughout the entire time I was with them.

BBL: So you would identify where some of these sources were that they could then perhaps tap or whatever?

RLB: Yeah, we identified the structure of the subsurface. So if you know what the structure is and you know what the rock types are from drilled holes, you can guess, educated guess, where oil and gas reserves would be trapped in the subsurface. They're

looking for those traps so they can drill and increase the possibility of hitting oil and gas resources.

BBL: Okay. So your job was to tell them what the structure was. Then from there, they determined…

RLB: Yeah, my job was to collect the data. Then they had scientists that would interpret that data and say, "Well, here's where we want to drill."

BBL: Interesting. So you were with them for a few years.

RLB: Yes, I don't know exactly, three or four years. Then I got bored, because everything had been worked out and it was just "okay, let's do it" and everybody was trained and it was the same thing over and over again. I was looking to learn more so I decided to go back to school to get my Master's degree. I had saved a fair amount of money because I'm on the road all the time, you get per diem, wasn't eating well, working long hours, etc., not spending any money.

BBL: Were you in Texas all this time?

RLB: No. The company was located out of Texas. I was in Arkansas, Missouri and Kentucky. There's a—M-A-K-I-T, I believe it's spelled, Makit area [New Madrid fault], where they had a huge earthquake back in the 1800s, that reportedly reversed the flow of the Mississippi River for a short period of time. They were looking in that general area for these resources, so that's where we were and then just traveling around, staying at hotels, etc.

BBL: So you got tired of that, huh? [laughs]

RLB: Well, it wasn't the travel; I got bored with what I was doing because I had it down, I knew how to plan the lines, I talked to people to get permission to come across

their land, or along the roadside, how to get the permits. The crew was doing fantastic. I had very few problems with my crew and I was just wanting more education to learn more about the process and the geology.

So I talked to the people at Western and they sent me to a couple of geophysical interpretation classes on how to use the data to locate the oil and gas resources. That spurred more interest in me to get more education. So I went ahead and looked around for schools, looked at the University of Oregon and a bunch of schools that had a good, strong geology programs and decided that I would leave Western Geophysical, because I had saved enough money to pay for three or four years of tuition and an apartment, living within my means to get another degree. So I chose the University of Utah because they had a great geology program.

So I left Western Geophysical, but when I left, I left in the springtime and a company down in Houston hired me, and that company was working for Dow Chemical on the data that I collected. So they wanted the insights into how, even though we have extensive notes on how the data were collected, I had surveying crews out there that were actually tying the surveys back to benchmarks. They hired me for the summer, until school started, to come down and work with them and learn how the data were analyzed and discuss any permutations in the data that they didn't understand, or whatever. I went to Houston and worked for them for a summer and then came to the University of Utah.

BBL: Okay. You got a Master's in geology here?

RLB: No, I didn't actually. I started in the geology program and took a bunch of the soft rock, well, took, I think, all of the soft rock graduate classes that they had. Soft rock versus hard rock, hard rock being hard rock; soft rock being sedimentary stuff. But during

my summer with Wynn and Associates, is what the firm was called, I was in contact with a lot of oil and gas people and the big thing that was happening was remote sensing using satellite imagery to look at structure and some basic computer mapping that was going on. That was in the days of the very early computers, when you used punch cards. That dates me, I know. [laughs]

BBL: Tell me about what date are you talking about?

RLB: This would be early, probably '84, '85, something along there. But the big thrust was the use of remote sensing. Back then it was called computer mapping to assist in locating oil and gas resources. I had been exposed to that in Houston while I was there and had learned a little bit about it and I came here to the University of Utah and started taking classes, etc. The Geology Department at that time was not interested in remote sensing or computer mapping. They were doing stereonets and standard geological processes in education. But the geography Department at the University of Utah had a couple remote sensing classes and computer mapping classes. So I starting taking classes over there and had an open interest in remote sensing and the tools and how they work. So I started taking some classes there.

In one of the early computer mapping classes they had us take a map of the United States that had temperature values on it, average temperatures, and they wanted us to take a ruler and measure X and Y locations on this map, and then calculate out contour lines on the map, I don't know, like fifty points. It would have taken forever to do that. So I went in and I knew there was a program on the old UNIVAC computer that had punch cards and there was a digitizing tablet, a very small digitizing tablet in the department. So I talked to a couple of people and said, "I know that this digitizing tablet

puts out X, Y, but it's not in any format that anybody can use." So with the help of a friend of mine, we wrote a little program that took the output from the digitized tablet and reformatted it. They had a modem there where you take the handset from a telephone and pushed it into the modem, I think it was like 200 baud, or 300 baud modem that then I connected to the UNIVAC computer. So I just had to tape the map down and go, *click, click, click, click, click, click, click, click, click, click, click, click,* in a certain order, and then just type in the temperature values, call up the UNIVAC computer, hit return on this little short program, and it would ship all the data to the computer for contouring. I was the TA in the class the next year. [BBL laughs]

RLB: That was a fun class. I enjoyed that. But, you know, I wouldn't call it lazy because it probably took me longer to write the program and get everything set up by measuring things multiple times on a map when there was a digitizing table, not a table, just a small tablet. Just didn't make sense to me, so I did it a different way.

In that class was a guy who tried to learn computer mapping because the USGS had just gotten into computer mapping. He said, "You're coming to work for us." That was my first introduction into the USGS.

BBL: So you ended up getting a Master's degree in geography?

RLB: Geography, actually, yes. And remote sensing and geographic information systems.

BBL: So as soon as you finished your degree you had a job with the USGS?

RLB: Before I finished my degree. They hired me as a student. I worked there part-time. Then once I started with the USGS I decided to get my Master's degree in geography from the University of Utah.

BBL: You must have helped the USGS implement their computerized mapping program and remote sensing.

RLB: Yes, here in this office—well, it wasn't located here—but here in this office they had a digitizing table, so I started working on their geographic…computer mapping eventually became geographic information systems, or GIS. So I was one of the first, if not the first—I was the first—heavy user of GIS in the center in Utah, and just went from there and it's grown ever since.

BBL: So what are some of your memories of those early days, or some of the projects you worked on?

RLB: My first project was trying to figure out water use, agricultural water use in Tooele Valley, and the best method of collecting that data. So we looked at satellite imagery, we looked at driving along with a truck going, "Okay, what's that?" "Oh, that's corn and it's flood irrigated in these fields," and do the comparison between the time and the cost of acquiring all of that data. And the resolution of the data. Was it good enough to discriminate crop types and application methods? So we did that project and it turned out that low altitude 35mm slides from aircraft were the best method to determine what water was being distributed and what crops were on a particular plot of land. We did this research for the State, so the State then developed a program where they went around every five years. They did a repeat survey with an aircraft and slides and collected data so they could see where water was being used for water rights applications, and also what crops were out there, who was planting what crops, how many acres of crops, what the water application methods were, etc. Then they would take, I'm not sure how they did it, whether they projected it on a digitizing tablet or whatever, and they would digitize each

parcel and give it the crop type, etc. I think they've gone to using some of the better satellite imagery techniques now because back then you had 30 meter or 90 meter resolution on a pixel and you used to look at crop type then.

BBL: Let me ask you a basic question. What does the USGS do? What is your job?

RLB: The USGS is the science agency for the federal government. We are a branch of the Department of the Interior and we do research, science. We don't regulate anything. BLM has lands that they have to regulate, administer, etc. Bureau of Reclamation does waterways, dams, but all we do is research. We're completely separated from any management issues, in part because that keeps us unbiased. It's just collect the data; what does the data say. We have a very intensive review process where it has to be, any of our reports or products have to be reviewed by someone both interior to the office that's familiar with the area without input from the author, and also outside of this office by someone that's familiar with the topic area that we're reporting on. We have to document that we agree with them or we don't agree with their comments, provide clarification to satisfy both of those reviewers. Then we create a product, a not so final product, based upon those two reviews that then goes to the director's office. The director has people that review all those reports after we've reconciled the reviewers' comments and looked to make sure that they're unbiased and they adhere to USGS policy and all the standard scientific quality assurance tests that need to go into a publication. Then we're allowed to publish the results of an investigation.

BBL: So who are your—and you probably don't call them this—but who are your clients? Sure, it's taxpayers, but I mean…

RLB: Of course, in the end, we have to answer to the taxpayers, of course. We work with other federal agencies, a lot of other federal agencies, because many of them don't have their own science branch. Science is very expensive. It takes a lot of time. Just the quality assurance to make sure our meters are correctly calibrated before we take a measurement. Every time. This isn't like calibrate once a month; this is you go out in the field and you do it in the morning when you get to a site, you take your measurements, you pack it up, you move to the next site, you do it again, to make sure that we have the best data possible. So a lot of federal agencies use us because they either aren't big enough or can't afford it, or they want to use USGS just because of the quality of our standard methods. We work with state government. The USGS and the state work cooperatively to answer questions that they have and that are federally related and we provide science to states and counties and municipalities.

BBL: So basically, other government entities?

RLB: Yes, other government…we're very careful not to compete with private industry.

BBL: Okay. So no company would hire you to do a survey of something?

RLB: No.

BBL: Though they may use the information that you produce in the end.

RLB: That happens very frequently. Consultants, private industry, use our data in many of their analyses. We run the stream network program. We run most of the stream gauges that measure stream flow in the state. We have a well network, water wells, where we look at water levels and water level changes over time, and that's done in cooperation with the State of Utah. We have projects throughout the state and there's some international work that goes on, depending on the researcher and their qualifications. The

USGS headquarters office has an international branch where someone could be in Cyprus working or in Pago Pago doing some work.

BBL: So those international projects would be something with international, but also with US implications, too?

RLB: Yes.

BBL: Or are you on loan and you're helping this country?

RLB: Yes. It would be generally through the State Department.

BBL: I see. Okay.

RLB: And they would need some scientific expertise in a particular area, that the USGS can supply in many cases, that scientific expertise.

BBL: So you've been here working for the USGS since you graduated with your Master's degree, which is in the mid to late '80s.

RLB: Yes.

BBL: So going on thirty years.

RLB: Yeah, I'm not sure exactly, twenty-seven, twenty-eight years. Because I was part-time for a while as a student.

BBL: Right. I have a couple of questions as you were talking. Is this the only USGS office in Utah?

RLB: We have two satellite offices, one in Cedar City and one in Moab.

BBL: Okay, but they're satellites from here.

RLB: Yeah, this is the main Utah office.

BBL: Does every state have its own USGS office?

RLB: Most states do. There are some states, the smaller states generally back east, the

northeast, I'm not sure of the combination of states, like Connecticut, New Hampshire, Maine, perhaps, there's groups of states that have a main office and then kind of a satellite office, because we do have to be careful, we don't want to spend too much taxpayer money…we want to spend money on science. We don't want to spend money on administrative costs or things like that. So where it's possible, we try to consolidate offices and minimize the cost to the taxpayers by just not having extra staff. It doesn't make any sense to have someone sitting there, fifty percent of their time is busy because they're working on one project. Put them on two projects and have 100 percent of the their time busy and funded, and then spend the money you save there, either just don't use it and don't require it from the taxpayers, or spend it on science, spend it on finding the answers, spend it on quality control to do a better job, to do the best job you can on the data and the interpretation of that data.

BBL: All right. Then here in Utah, what areas are you studying? You said you're studying streams and water wells, what else do you study here in Utah?

RLB: Myself or the USGS?

BBL: Let's talk about you first…is there a lot? Is there an exhaustive list?

RLB: It's a lot.

BBL: Pretty big. So tell me what you study.

RLB: Okay, in Utah, I've studied irrigation methods and determining water use. I've done a lot of work on the Great Salt Lake. I've done a lot of work on Utah Lake.

BBL: Mostly water issues?

RLB: Yes, this is the USGS water resources office for Utah. So just about everything you do here is related to water in some fashion. I've assisted in a project in Pago Pago.

BBL: So you weren't just making that up. [laughs].

RLB: I just was not making that up. I've assisted on a project in Cyprus. In Florida. So there is some travel involved, although we try to keep that to a minimum. But depending on a person's expertise, you can get called in to help or assist or training someone else in other parts of the state or nation or the world.

BBL: Good. This is interesting. Your title, is this correct? You're a Supervisory Hydrologist.

RLB: Yes.

BBL: That's your official title?

RLB: Yes.

BBL: So you are the person who oversees all the water resource studies in Utah?

RLB: No, no, no. We have an investigations chief that takes care of most of the studies. We have a surveillance section chief that takes care of most of the stream flow measurements and standard well measurements. But we have specific people assigned to specific tasks. We have water quality specialists that deal with maintaining the water quality aspects of work that we do. We have surface water specialists that make sure that people are trained and the surface water is measured correctly and reported accurately and that we have information recorded as to the type of measurement it was. All that quality assurance thing. So we have people throughout the center that do very specific tasks to maintain the integrity and the quality of the data that we collect.

In the past I've done both fieldwork and supervision. I supervise the GIS section, the geographical information system section, and depending on the day it seems, the database quality. I used to do computer, monitor the computer section. I do most of the

public outreach. Utah Water Users Association has a meeting every year down in St. George and I'm on their planning committee. We put together presentations and things like that for the public, make sure the reports that we put out are getting through the process because sometimes they get bogged down. If we have someone that's really busy and they've agreed to review a report that sits on their desk or gets covered up the next day with another piece of paper, they forget about it for two weeks, then they get a phone call, "Hey, just wanted to make sure that you got that report." And prompt them to move that along. So we all do a wide variety of tasks here.

BBL: Okay. Let's get talking about Great Salt Lake. When was the first time you saw Great Salt Lake? When your family was coming out here to Yellowstone, did you ever swing by?

RLB: Yeah. We came by it and I remember that I was fairly young, probably ten or twelve, maybe even younger than that. I remember coming to the south part of the Lake and floating in the water, you know, lay on my back and floating up high on the water. But that's it, until I actually moved out here, I don't remember ever coming back again except for that one time and that was because on the way out to Yellowstone one summer, we took the southern route and went to Mesa Verde and did a whole bunch of stuff. It took like a week, rather than the normal three day straight drive through and saw a bunch of sites and came up and stayed in Salt Lake and did that. And then we went up past the Tetons and then into the Park.

BBL: Interesting. So you didn't see it again until you moved here and were going to the University of Utah.

RLB: Right.

BBL: Did you do any research or work or even recreation during your schooling years at the Lake.

RLB: I did my Master's degree on the Great Salt Lake.

BBL: Good. Tell us about that.

RLB: After I had started with the USGS, I was taking a bunch of classes and I had decided to get my Master's degree in the geography department. I had a friend who was a student with NASA that was in the geography department, doing thermal imaging of what is called Urban Heat Islands, the effects of pavement and buildings on heat flux. He was using this instrument called the thermal infrared multispectral scanner. It was an experimental instrument that was on a Lear jet and it basically collected temperature, nothing that anyone can see, but it collected heat signatures. I started talking with him and one of the issues that I was dealing with is, or the USGS was dealing with at that time, was how much ground water was entering the Great Salt Lake. The current center director back then said that all of the groundwater coming into the Lake likely was through diffusion, or very slow, just seeping through the sediments. We had some discussions on that and I said, "Well, I know that most lakes," because I'd done some research on it, "had very distinct springs coming into them." And he said, "Well, we don't know where they are." So I started talking to this friend of mine, who was this NASA student, and said, "This thermal imaging multispectral scanner, *hmmm*, collects temperatures. Why can't we use it when the Lake is cold in the wintertime and look for hot spots in the Lake." He said, "That might work," because this thing was being used for other than water based studies, geological studies, [something-cidity?]. So I scraped up enough money to have them fly specific areas of the Lake, including some areas of

springs along the shore, so I had some calibration data, and did that as my Master's degree, just a test to see if that was possible. Went through all the physics and emissivity issues and all that sort of stuff on how you could use remote sensing thermal imaging to locate groundwater inflow into a lake.

BBL: And you could, it turns out?

RLB: Oh, yeah.

BBL: So you found some sources of water that they didn't know about, some springs?

RLB: Yes.

BBL: And you were able to map that.

RLB: You know, it was an experimental instrument, so the data were very noisy, but it was successful. I went to those sites that looked like they were hot or warmer than the surrounding water and took the thermometers and meters and measured temperatures, etc., and it was verified that, yes, this worked. It's been used a number of times. And there's some classified applications, etc., that are being done right now.

BBL: Really?

RLB: You can find hot water and you can measure temperature differences. Now days they have these…what's the technical name? I don't want to use the commercial name for them. These infrared cameras that you can use to look at building temperatures, to see where heat is leaking out of your windows, and those are being used more and more. Those are basically the derivatives of this aircraft-mounted, multi-million dollar instrument that you had to use liquid nitrogen to keep cool, now you have a hand-held camera that you can measure temperatures with.

BBL: But you say some of the uses now are classified?

RLB: Well, I know that…I know nothing.

BBL: **[**laughs] Got it.

RLB: Strike that. The whole stuff.

BBL: So the information that you showed in your Master's thesis, was important to know, because why?

RLB: Because before that time, you couldn't find groundwater inflow into a lake, unless it happened to be a huge amount of water and you happened to be at that location. You could have a diver in there, and be walking along and feel, oh, it's warmer. Or if there's a big difference in density between the Great Salt Lake and the water that was coming in, fresh water, you can see some refraction of light at that point. But otherwise, there was no way to synoptically look at a large area very quickly and say, "Oh, there's one, there's one, there's one." If you don't know where they are, you can't measure them, you can't look at water quality, you can't look at volumes on how much is coming into that particular water body. And those things are important for refugia or places that rely upon that cold water. Trout, cold water species, if they need cold water, but the stream that they live in gets really warm in the summertime, they can move to that cold water inflow, that groundwater inflow, and survive, otherwise they may not. The same for, there's some endangered snails that are doing the same thing and there's also the issue of the quality of that water that's coming in. You can't measure it if it's been contaminated or if there's a problem unless you know where it is. This was a relatively quick way to locate groundwater inflow into rivers, streams. Now days it's done, again, with these new infrared cameras that are hand-held.

BBL: Not to make a pun, but that was probably pretty groundbreaking at the time, for you being able to use that method to find groundwater?

RLB: It was important. NASA liked the results. Other organizations liked the results. And it was used, the USGS picked it up and used it on some studies back East, not the same exact technique. And since that time, others have, once they recognized that could be done, they use these handheld cameras all the time now in Yellowstone National Park.

BBL: For the same reason?

RLB: Yes, to look at where the hot springs are coming in underneath the Lake, and also to look along walkways where people are walking in the geyser areas to look for hot spots in the walkways, knowing that there's a thermal spring or hot spring coming up underneath that and reroute it before there's a collapse or people get hurt.

BBL: So I'm guessing they still monitor that now out on the Lake, where groundwater's coming in?

RLB: Actually, no. They don't.

BBL: Great. So you finished the Master's degree. That was successful, that research. What other research have you done out there?

RLB: Oh, boy.

BBL: Or what did you want to talk about? What were you going to tell me today about the Great Salt Lake?

RLB: Just whatever you want to know. Well, after I got my Master's degree done, I wrote a proposal to look for springs in Utah Lake because a lot of them are saline and warm and Utah Lake is a freshwater supply for Salt Lake County and a lot of agriculture. Got that funded and did that research and located the springs and did a few other

investigations on other springs connected to wells, close to Lincoln Point on the Lake and what's the depth around Bird Island, which is located out in the Lake, and did some stuff there on Utah Lake.

Then in the early '90s, Dr. Doyle Stevens, who passed away in 2001, I believe, came to me with the idea of starting a project on the Great Salt Lake. There was a lot of interest in brine shrimp, brine shrimp cysts, on Great Salt Lake. Commercial companies wanted to harvest these brine shrimp cysts for sale. The State was interested in putting some sort of a monitoring program to monitor changes in the shrimp populations, sex ratios, the fecundity or reproductive aspects of the shrimp, salinity, water quality, all that stuff. So Doyle came to me because I had been doing a lot of boat work on Utah Lake, and I had a GIS background. He came to me and asked, "How do we do this?" He knew the limnology part of it, sampling and things like that. I knew the boat and the GIS part of it.

BBL: Who did Doyle work for at that time?

RLB: He was with USGS. He's done a lot of research; just a brilliant guy. So what we decided to do is I randomly picked out a block northwest of the Great Salt Lake and then built a one-kilometer grid, east-west, north-south, that covered the entire lake, so I had a bunch of squares there and numbered them one, two, three, four, five, six, seven, till all the squares were numbered. Then I took a random number generator and generated a bunch of random numbers and picked out, in order, where those random numbers were and laid those numbers on top of the Great Salt Lake map, digitally. So we went through and depending on the order of those random numbers, we picked out fourteen sampling sites so they would be randomly distributed. Seven of them were above a certain

elevation—in depth, above a certain depth—and seven of them were below a certain depth. Those were our sampling sites and we started a program where we went in there and collected shrimp, water quality parameters, and algae, etc.

BBL: So you're the one who came up with the sampling sites that they still use today?

RLB: Yeah, I came up with the sampling sites that they use, in conjunction with Doyle, of course. He was the project chief and he designed the program; I just came up with the sites. That's why they're labeled 2233, or 2064, or 4610, because those were the numbers that were sequentially numbered on the base grid that I generated.

BBL: That's interesting.

RLB: So we did that until he passed away, then we continued it for, that whole routine, for about another year. Then we transferred the standard sampling and all of the various protocols that we had developed, the State took those over along with the brine shrimp cooperative and they're doing the shrimp counts and enumerations now, after we had tested a bunch of stuff and developed various methods and quality control issues. Went through all that stuff.

BBL: That's interesting. So the sites that you randomly picked, did those end up being good sites, or did you have to do some adjustments?

RLB: Well, what's good, what's bad? They were what they were. They were random sites. One of them, we quickly couldn't get to because the Lake dropped a little bit more and it was in a very, very shallow area, but most of them are still used today. We added two extra sites just to look at inflow from the Bear River system and inflow from Farmington Bay, not random sites, so we could capture primarily nutrient flux coming in from those two locations.

We started out with the same boat I used on Utah Lake, which is a seventeen-foot riveted ski boat with one engine; it's an eighteen-footer.

BBL: So you've spent a lot of time out actually on the Lake.

RLB: Oh, yes. So towards the end of that project, well, we used this eighteen-foot boat for three or four years. Then because of the high density of the Lake, it was just getting beat up. We broke the cross struts, the structural members in the boat that go across the boat. So you'd go through a wave and the boat would start to get thinner. It would start folding itself in half because of the density of the water. Once we noticed that happening, Doyle had some friends with the US Army Corps of Engineers, I believe it was, out of New Orleans, and he got a surplus, bigger boat, welded aluminum, with twin engines that we switched to. We actually used a chop saw and cut the other boat in half and gave it to the aluminum recycler so no one would use it because it was just too dangerous. We stripped off all the instrumentation, etc., literally cut the boat in half, put it on a trailer and took it over to the aluminum recyclers because we didn't want to go back out on that one and nobody else should either.

After Doyle died and transitioned the work to the State, we realized that in order to effectively model a lake, any lake or reservoir, you need to know the volume, how much water's in there and the shape of the Lake. Is it straight-edged? Is it flat? You need to build the bathymetry of the Lake. So up to that point, there was no good bathymetry of the Great Salt Lake. There were random points here and there; there were some shoreline contours where the Lake had gone down in the early '60s. People had mapped those, but no one had actually done a systematic survey of the depths of Great Salt Lake.

BBL: It's the depth you're trying to get?

RLB: Yes, bathymetric measurement of the bathy, or the bath tub…

BBL: The shape.

RLB: Yeah, the shape. The underwater topography of the Lake.

BBL: Tell me again why that's important to know.

RLB: In order to look at circulation or look at water quality and how water quality changes in a lake. If you took a cup of soap suds and dumped it into a gallon of water, that's going to be completely different than if you took a cup of soap suds and dumped it into Lake Powell. The dilution is going to be completely different and it's going to change the characteristics of the water, especially in the one gallon of water. So it's important to know the volume of water that's in a lake. How much is there? How does it circulate? Where does that water go?

BBL: I see. So what the bottom of it looks like will affect what the volume is.

RLB: Right. Is it a deep bath tub or a shallow bath tub. If it's got really shallow edges, a small change in water volume or water elevation, or surface elevation, will expose a lot of land. If it's really steep-sided, a small change in water elevation will not expose a lot of land. And you need to know all those things in order to effectively understand how the Lake works. We didn't have a bathymetric map at that point. I think primarily because the salinity of the Lake was so high that the sound velocities, depth sounders, or fathometers, or fish finders, are based upon a set…when you see the depth, they're based upon a set sound velocity in the water and velocity varies with density. So if you get a sound velocity that's too high, you had a bad value for depth because the sounds faster than it can calculate. So instead of using a regular fish finder to measure a depth in the Great Salt Lake, you may get a reading of ten meters, but the true depth may actually be

fifteen, because the standard sonar can't correct to those higher velocities. So the sound went down and back faster because of the higher sound velocity, but the instrument was calibrated, so that was only ten feet; it's not the fifteen feet like it should be. There was just nothing out there to correct for sound velocities that high. So I was asked to do the project and try to figure out how can we correct for those sound velocities.

So I looked around and found a company that made a sound velocity meter or measurement instrument that measures the velocity of sound in sugar solutions, because then they can tell the concentration of the sugar solution if they know how quickly the sound moves; they can calculate density and they know how much sugar is dissolved in there. And it went to beyond the densities of the water in the Great Salt Lake. To me, sound velocity is sound velocity. It doesn't have to be an instrument designed for water; it just has to give me a good sound velocity. So we got this instrument to measure sound velocities in Great Salt Lake. Then you can take a fathometer or a sonar and measure the Lake and correct for those changes in sound velocity, by measuring how the sound velocity changes with depth.

BBL: Yes. So what was the sugar instrument called?

RLB: It's just a sound velocity meter.

BBL: So it doesn't have a special name.

RLB: No. So we got that, then we could measure sound velocity, how it changed in the Lake. There's oceanographic instrumentation or software that allows you to incorporate that, like at every meter, so we just measured sound velocity at every meter, a couple of times a day as we were surveying to make sure it remained constant. I took a real-time differential global positioning system, so corrections on the fly, and the fathometer, and

ported them into a single computer, fed both of those data streams in at once and recorded them to the file, and drove back and forth across the Lake. Took me about two and a half months to do the south part of the Lake and about one and a half months to do the north part of the Lake, back and forth, about four or five knots, maybe six, depending on how the weather was when the Lake was nice and calm. Then I used that information, cleaned it up, had to make all the sound velocity adjustments and generated the contour maps of the Great Salt Lake.

BBL: That's a lot of time on the Lake.

RLB: A lot of time on the Lake, yes.

BBL: So you would go out on a day and spend all day out there usually?

RLB: Yes. On the north end of the Lake we camped on the west side of Promontory Point because it was just too long of a drive, we were losing too much time driving back and forth, so we lived out there. Every three or four days we'd have to drive back and fill up the tank in the boat and I had a tank in the back of the pickup truck, a big fuel tank, and filled up both of them and came back and then we'd last for a few days before we'd have to come back and get more fuel.

BBL: Wow.

RLB: But at low RPMs, that really slow speed that I had to travel, we got pretty good gas mileage.

BBL: Well, yay! [laughs]

RLB: So we lost a few days, because we can burn up a tank at full speed in a day easily on the Lake. So we had a few days. We'd get food and water and everything, stock up, and come back and live in tents.

BBL: How many people were on those trips with you?

RLB: Two.

BBL: You and one other person?

RLB: For the most part. I had a couple of people that helped me a little bit in the south; that took a few days. Once everything was set up and operating, luckily, everything worked well. We didn't have much trouble on the data acquisition part of it.

BBL: That's incredible. That's impressive, I think.

RLB: It was fun. The north end was very scary, it wasn't easy because the environment's really harsh, and some of the storms that came through were just horrendous.

BBL: Now when was this, roughly? What years?

RLB: 2005-2006.

BBL: So the mid-2000s then.

RLB: Yeah, the mid-2000s.

BBL: Let me just stop here.

END OF INTERVIEW 1 OF 2