ELMER WHITMORE BROOKER

Elmer Whitmore Brooker was born in Edmonton on May 27th, 1931and graduated with an MSc degree in Civil Engineering (soil and foundations) from the University of Alberta in 1955. He became a lecturer at the university. In 1960, he was the recipient of a Ford Foundation Grant, and entered a PhD program in foundation engineering at the University of Illinois. After completion, he returned to the University of Alberta as an Assistant Professor in the Civil Engineering Department. In 1966, Brooker's love of construction work led him to establish a consulting practice, Elmer Brooker & Associates, which later became EBA Engineering Consultants Ltd. Initially the company offered consulting services to the Western Canadian resource industry focusing on oil sands and permafrost. Brooker made key contributions during the formative years of the Syncrude project to the emerging technology of dragline mining of oil sands. EBA Engineering made significant contributions in arctic offshore petroleum exploration projects in both Canada and Alaska; through the 1970s and 1980s, the company completed numerous pipeline routing studies across the Northwest Territories. Brooker was a prolific contributor to technical publications. His technical paper 'Rational Design Treatment of Slides in Over-consolidated Clays and Clay Shales', coauthored with Ralph B. Peck, is one of the most frequently referenced articles in the Canadian Geotechnical Journal. Brooker also led the management committee for the book *Edmonton Beneath our Feet*, published by the Alberta Geological Survey. Additionally, Brooker was an active volunteer throughout his career. His areas of service included terms as President of the Alberta Chamber of Resources; President of the Edmonton Chamber of Commerce; Chair, Alberta Laser Institute; and Vice-Chair University of Alberta Board of Governors. The Geotechnical Society of Edmonton granted Brooker the Stan Thomson Award, in recognition of his contributions to the development and growth of the GSE and to geotechnical and geo-environmental engineering in the Edmonton area. He was also the recipient of the Frank Spragins Award, which honours members of APEGGA for their integrity, expertise and outstanding accomplishments. Brooker has been inducted as a Fellow of the Engineering.

Date and place of birth (if available): Edmonton, May 27th, 1931

Date and place of interview: Residence of Elmer Whitmore Brooker, April 9, 2013

Name of interviewer: Adriana A. Davies, CM, PhD

Name of videographer: Jimmy Bustos

Full names (spelled out) of all others present: N/A

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Initials of Interviewer: AD

Last name of subject: BROOKER

AD: My name is Adriana Davies and I am the Researcher/Interviewer on the Petroleum History Society Oil Sands Oral History Project. It is April 9th, 2013 and I am in the home of Elmer Whitmore Brooker. Elmer, thank you so much for agreeing to be interviewed.

BROOKER: It's a pleasure Adriana.

AD: Now, can we begin by you giving me about a 3-minute, summary, potted biography for the record and then we can explore your various involvements in the oil sands and geotechnical engineering.

BROOKER: I was born and raised in Edmonton, attended local schools, the University of Alberta, then wound up at graduate school at the University of Illinois. My father was a general entrepreneur but had been trained in England as an Architect Surveyor so that there was always construction around. From youth, I was involved in those activities as a helper then as a worker, and so on, and that's where the engineering influence came from. It was a good experience all the way around.

AD: You mentioned that your father got into building and even as a teenager you were involved in building some family properties in the University area, Old Strathcona. Do you want to talk about that?

BROKKER: Yes, my father began building in Edmonton at an early point and I think it would have been in the late 1920s. Some of the early homes in the Garneau area were built by my father. He was active in both homes and then apartment buildings throughout Garneau and King Edward areas. That came to an abrupt halt in the Depression.

AD: And so, you mentioned you went to high school with returning vets and, as a result of the demand, the university created a special high school class and program at Corbett Hall. What was that like?

BROOKER: It was great; one of the finest experiences you could have. That high school was called University High School, and initially it was in a former school that had been condemned but opened because of the need of high school education for returning Veterans. I was just at the tail end of that because I was not in the services. University High School was an experiment; it soon moved to Corbett Hall in the north side of the building, became well regarded, had excellent teachers and it had a pretty decent academic standing. But, in particular, there were some wonderful teachers there that were a pleasure to be with. Doris Sheppard, whose father had been a major person in education in Edmonton, was there as a Drama teacher, and that was always a lot of fun because she put on an annual play which became well regarded throughout the province.

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AD: So, basically the academic life drew you and why did you choose Engineering at the University of Alberta?

BROOKER: I think the major influence was that, as a young person, I was helping my father initially; it was just as a kid, 8 or 9 years old, cleaning up a site, getting small pieces of wood out of the way. That grew to helping put on siding as you grew up and stacking lumber and then working somewhat with cement making concrete, and then doing general things as the ground was excavated to put a building in. The sense of buildings happened through that. Finally, my older brother went to engineering. I think that had a major influence because I liked the people and I liked my brother and it seemed the right way to go for me. Looking back on it, I think it was.

AD: So you chose Civil Engineering, am I correct?

BROOKER: Yes. There weren't as many choices in disciplines in Engineering, in 1948, as there are today. Basically, it was basic Electrical, Mechanical or Civil, and the disciplines we know today were not yet available.

AD: Who was the Dean at that point and who influenced you?

BROOKER: The Dean was a gentleman named Robert M. Hardy. He was a great man, considered to be one or maybe the premier Canadian engineer. He came from Winnipeg and from fairly humble circumstances, and had been mentored a great deal by the Arctic Ice Company, through scholarships. He went to McGill and then came to Alberta, but he was a determined and an affirmative man, and he was just a great person to run a developing group of engineering professors.

AD: So you got your BSc and what did you do next?

BROOKER: I joined a local firm with the intent of being a bridge engineer, but was sent to Calgary and wound up on infrastructure works at Lincoln Air force Base in Calgary, and that went on to a point that I thought I wasn't progressing in my objective of bridges so I went to Vancouver and worked on some large bridge structures including the Second Narrows Bridge. But during that period I met experts in steel that had advanced education beyond the BSc degree and I thought to myself, I have to get to that level to really get into the technical details, do the depth that I wanted. So, I returned to the University of Alberta to take Geotechnical Engineering; they called it Soils at that time. That's the progress of how I got back to the University of Alberta.

From there, I was hired by Bob Hardy to work at the University; at the same time, Hardy left the University in the form of retirement, and George Govier became Dean, and through a long relationship he one-day called me in and said that you have to go and get a PhD, so here's a number of places that you can apply, and my wife and I went to the University of Illinois, but on a leave of absence. Returning, I went back to the staff job and soon became so involved in the developments, and the oil sands were one of them, that finally drew me out of the University into private practice.

AD: Was it rare for practising engineers to have PhDs at that time?

BROOKER: No, it wasn't [rare]; even many of the staff in the university did not have PhDs. I was the first person to my knowledge west of Toronto to have a PhD in my field at that time. It's quite common now, not just at universities but in Engineering firms to have PhD's. It has been a huge transition in education over the past 30 years.

AD: So what was the topic of your PhD?

BROOKER: That dealt with the design of underground structures to resist blasts, such as by atomic weapons.

AD: Wow! So of course this was the Cold War Era.

BROOKER: And I was sponsored in that by the United States Air force.

AD: Interesting.

BROOKER: Well, it was an era that the Cold War was on and there were great threats of atomic warfare. Even people in Edmonton were building shelters, the wealthier people, now probably wine cellars in larger homes, but little was known about the transmission of an air-created shock to underground structures.

AD: What was it like at the University of Illinois, the Faculty of Engineering there versus the Faculty of Engineering at the U of A?

BROOKER: It is like going from a junior league to a major league. The competition is very high, at a very high level. There is little room for failure, so you have to maintain probably an A- average, and the professorial staff was to me, and I think pretty much acknowledged, as leaders in the world. Champagne, Urbana in Illinois, was well located in respect to Chicago, so virtually every visiting figure worldwide arrived in Chicago, and was persuaded to come to the University of Illinois for some period. It was amazing and, I think, the effort that you had to put in was tough, but it was a wonderful experience and, at the end of it all, you were advised, "Now, since you have achieved this degree from the University of Illinois, you were expected to go out and prove to the world that Illinois was a good place." They had expectations of you when you left as well.

AD: Did you ever toy with not coming back to Alberta?

BROOKER: A little; we had left a home here that I owned and all of our families are here, so that was a strong pull. The pay scale at the University of Alberta was good and the staff at universities was short at that time. There were offers from both the east coast and the west coast of the United States but, by that time, we had three children and I had to be sure that I could keep the table full and a roof over their heads. I did negotiate for a period with the University of Southern California, but we couldn't agree on what I needed to live, and wound up staying here which was no mistake because it is a fine place.

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AD: So, you went back to the U of A and I assume you were an assistant professor?

BROOKER: First an assistant and then an associate, then heading towards full professor but was really driven to leave through an experience in Fort McMurray at what was called Great Canadian Oil Sands at the time. They were starting to build their plant and placing a river water intake to feed water to the plant and, for a variety of reasons, I got asked to design the cofferdam, which was a large structure and deep. The secretary brought a note to the lecture class one day and gave it to me and left, and the note said the dam is failing. That's when I realized that consulting is not done on your schedule; it's done on the schedule of demands of work. It was a deep tear of conscience, because I had no complaints with the University, in fact, really enjoyed it, it was ideal for family but the pull to the field and actual construction was greater, so I finally left.

AD: And what year was that?

BROOKER: 1968, actually, I was fundamentally gone in 1966, but Bob Hardy, who by that time had returned as Dean, kept saying "Well, you've got to stay." Even on the very last day he came and said that they hadn't yet processed my resignation, but it was not easy leaving.

AD: Now, was it Dean Hardy that got you involved in the oil sands work?

BROOKER: It was in 1958 as a graduate student under his guidance.

AD: Oh, tell me a bit about that.

BROOKER: He was involved in Great Canadian and City Service Athabasca subsequently called Syncrude was also beginning to look at development of the sands. He had been asked to advise on the foundation requirements for the proposed plant and also tailings dams that were to be very extensive, and a variety of other things, and there were questions. So, as a young student and then professor under his direction, he asked me to look into a few of these things and that's where the association with oil sands began.

AD: So was the Tar Island Dyke/Dam, was that decision made at that early stage [1958] or was it later?

BROOKER: That was made after I got back from Illinois. The river-water intake was an earlier circumstance but the dam across Tar Island was still under debate. It was coming towards the point where operations would begin, and there is no need for a tailings dam to retain the waste materials until there is an operation that creates the waste. So, as soon as I got back from Illinois, I was asked to look into that by Bob Hardy and [what later became] the Suncor Organization.

We had some great experiences going over the land and, then, it was my view the Island was there because it was a little stronger than other materials and the Athabasca hadn't eroded it out and, through a few other technical concepts, we decided that you could build over it. It's there today, 300-feet high.

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AD: I will get you to talk about the construction but I am going to backtrack a moment because of the observation that you made [that], in 1958, it was the issue of water intake and I am going to connect that to Karl Clark and the water-based method of extraction. Did you ever meet Karl?

BROOKER: Yes, the University was a smaller place then, and the Alberta Research Council was virtually right on the campus, with not a large staff so that the staff of the University and of the Research council were always mixed at lunch or at coffee. So, you did meet and talk with these people sometimes over a coffee or over lunch or just casually on a street corner. He was an impressive person, very gently inclined, and had a vision of separating the bitumen from the oil sand and his vision worked. I met him; I wasn't deeply involved with him.

AD: Did you get a sense that this was a technology and an era in resource development that was really going to succeed? Did you have that sense that early on? [1958]

BROOKER: Yes. You heard about it and, then, particularly, in the very early time; you visited the area and saw the possibilities and looked at statistics of how much petroleum energy was available in Northern Alberta, simply because of the University and its closeness at that time to the Research Council and the Government. The Government was looking forward to the economic impact even earlier than that. I was impressed with it and it consumed a lot of my mind at that time.

AD: Did you actually read the Blair Report in terms of its forecasts for what would become the oil sands industry?

BROOKER: I am not sure that I can say that I have read that but I have read many documents and that may be one of them. I was familiar with the projections and the pace of that was projected in the development which didn't happen exactly that way.

AD: In 1950 when I think the report was released, of course it was intended to stimulate company and commercialization interest and, then, in 1951 you had the first Oil Sands Symposium. Now you were at the U of A at that time right?

BROOKER: I was a student at the U of A at that time.

AD: So, do you remember that at all because they had an excellent turnout from international companies?

BROOKER: Only vaguely. I was still trying to survive the academic process and didn't realize, in fact at that time that it would become such a major part of my life, or of the economy.

AD: So, then do you want to just talk a bit about that early work around water intake in 1958 and then move on to the whole Tar Island development after that?

BROOKER: Sure, the river-water intake was simply needed because you had to get water from the river for a variety of reasons, the primary reason being that it was going to be part of the water that

is to be part of the processing. You needed water to mix with the raw material in order to assist and facilitate this separation of bitumen from the sand. But, you also needed water for a variety of other reasons: domestic water for people working at the camp, or employed at the camp; water for making concrete or a variety of other reasons. But it was a large structure, made of sheet piling and driven into the river and the intake structure was to be constructed inside a sheet pile cofferdam.

The sheet pile cofferdam was an impressive structure. That ring of piles was driven – not exactly a ring but close to it – then braced inside and dewatered inside and workers were working inside with water to a depth of about 15-metres above them on the outside. What was impressive - where as it is called a dam - it is made of elements that some time get placed "out of lock" [as] they call it; where one sheet pile doesn't quite meet the other as intended and is forced by something in the ground to be out of lock so it gives a passage for water which is spurting in, and you have means of mitigating that. But, it's a great experience to be inside while this whole thing is being welded together with water coming in like fire hoses and workers around you; so you felt a deep sense of responsibility to the people because you had conceived this notion, and it was important that it stay together.

AD: So, you rushed up, and what did you do to fix the problem that was prejudicing your dam?

BROOKER: Well, we piled a lot of dirt around the outside a little bit upstream and it was eroded out and sort of flushed into a plug around the dam but it took – it's not like grabbing a band-aid from the drawer – it took days and days and days. So you were hoping the whole thing would stay together while you were putting fill in around the exterior to mitigate the problem, and plug the out-of-lock holes.

AD: Now, compare it to other dam-type structures in Alberta at that time to give us an idea of the scale and size, etc.

BROOKER: Well, to me it was very impressive, and it's hard to compare it to a dam on a river that's intended for different purposes. A cofferdam is a temporary structure, but this was one of the largest in North America for the purpose of cofferdams, but not by standards of the irrigation projects of Southern Alberta; it wasn't a big structure. As a cofferdam it was big and impressive.

AD: So, then in terms of the actual building of the Great Canadian Oil Sands plant, you were involved through Hardy and Associates, in terms of those structures, including the Tar Island Dyke; when did that work begin?

BROOKER: That work would have started in about 1964 or 1965.

AD: And, what was the relationship between this Alberta engineering firm and Bechtel which were the over-arching contractors responsible?

BROOKER: Let's, if we can, define Suncor/Great Canadian Oil Sands and then Syncrude. Bechtel was involved with both. They were the major contractor with an enormous engineering capacity

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and a familiarity with processing petroleum products throughout the world and had more cumulative experience on major projects than virtually anybody in Alberta.

Well, that was a long time ago and these circumstances here were not as impressive as they are now. Bechtel had management systems and experience that was well trusted in the petroleum industry, but a lot of local engineering capacity was used in a variety of means. I think, on the actual refining plant, Bechtel was pretty covetous of their role in that but, when it came to peripheral infrastructure, a certain amount of engineering was released to local firms. On the geotechnical and soils part, they had only a couple of people that were of pretty great stature that would over-view what a local person would do because these men at Bechtel would have a good idea of what was needed, but they had no experience in the local geology. They turned to people like Bob Hardy, who collected guys like me for that advice; we were generally under the guidance of pretty senior and well-educated men, but only on a casual inspection basis.

AD: So who were some of those people from Bechtel that you were working with if you can remember?

BROOKER: I think I can't put a name on – the first name of a fellow was Karl [Taylor and he hired Casagrande and Hardy] but his last name escapes me right now.

AD: Not to worry, but I think what is interesting is that now everybody talks about the supply chain but it's very clear that there is a causal relationship between Bechtel using local engineering firms and the growth in engineering disciplines that we've seen at the University of Alberta and, later, at the University of Calgary, and so that whole technological expertise and then consulting firms and other firms that developed in Alberta. There was a whole diversification of the economy resulting from the beginning of Great Canadian Oil Sands, and then Syncrude.

BROOKER: That's correct; for example, the University of Calgary was evolved being in around 1957 or 1958, firstly using some staff from the University of Alberta but even the University of Alberta may have had 4,000-5,000 students at that time. Both Universities now are major, virtually world-scale places, with over 30,000 students at the University of Alberta and probably that at the University of Calgary. There has been an explosion of engineering capability and of virtually all capabilities since that era.

AD: So, can you talk to me about your work on GCOS [Great Canadian Oil Sands] and how it developed and then talk about other oil sands-related projects, chronologically?

BROOKER: The initial experience is where, at Great Canadian, under Bob Hardy; Syncrude was a little bit different because by that time I was no longer at the University, and a practising consultant and it was Syncrude, at that time City Service Athabasca, [that] hired me to assess the ground for the purpose of building the plant, and other needs. That would have been around 1966-67 and it was Frank Spragins, who was regarded as the Father of Syncrude, who hired me and put me with - not directly but as a consultant – they had a small staff and he had a mining engineer to determine the most effective means of recovering the resource, which was, for Syncrude, draglines. But, at an

earlier stage, Great Canadian had decided to use bucketwheels, where there were a lot of buckets along the perimeter of a huge wheel that dug it out of an embankment.

The whole geography of the lease at GCOS was quite different than Syncrude; GCOS came right off the river and you were faced with a bank of oil sand and, I think, the bucketwheel was a good choice at that time. Syncrude was more inland and we had to start from the surface down by removing the overburden to a depth of 180-feet before we could get at the bitumen, or the oil-bearing resource. The decision had been that - the economics had said that draglines were an ideal instrument for doing that. It was a thrilling process because draglines are used quite a bit in the mining industry throughout the world, and they were being used in Alberta on a smaller scale for coal mining but the size of the oil sands is enormous, and the proposed size of the equipment was enormous, and there was a great deal of concern about the stability of ground underneath these large machines.

On top of that, little was known about the engineering properties of the oil sands itself. So, it was a great opportunity to evolve knowledge on both the properties and the material, the nature of the geology of the material, and the viability of the large mining.

AD: Can you tell me what it was like; did you fly or drive up there when you began your survey, as it were, that then resulted in recommendations as to how to proceed?

BROOKER: Well, it's interesting because the first time I ever went, I flew and at that time they were using - I think it was Pacific Western Airlines - West Jet didn't exist. But Pacific Western ran up in aircraft that were, I think they were called a C-46, they had been used on the Boomer Run for transport. But the first time I went up was with a group of other people to find out specific information in one of these machines at a private strip and then was brought home after several days the same way. But in those days when you arrived, they inspected your baggage and removed all the cameras or if there was any liquor around, all that was taken away and given back when you left. There was a great deal of secrecy.

The next time I went up it was for the purpose of looking at Tar Island, and I went up in a commercial craft the same sort of thing – it may have been an old DC 3, instead, but it was one or the other of these pretty old airplanes. Then, there was little transportation around but I chartered a small pontoon aircraft at Fort McMurray, who flew me up and dropped me on one edge of Tar Island, with the agreement that he would pick me up at 5 o'clock that afternoon at the other end. Once, as a consultant, that I acquired work up there, we drove small pickups or vans. It would be an 8-9 hour trip to Syncrude; first to Fort McMurray and, then, from there along a roadway up to the site, and Syncrude had a small camp down by the river edge that was a delight to be in. You didn't get around with the ease you do today.

AD: So, how did you begin the scientific work that would result in recommendations as to positioning of drag lines - all of that technological stuff that was needed?

BROOKER: Well, the first approach was to – we pretty much walked over the ground of the site and around to get a feeling for the nature of the topography and put that together with, what you

could sense about the geology through a geologic discipline called geomorphology – so you could recognize things and postulate what the nature of the ground would be.

From there, dealing with what was going to be used on it, that is, large draglines, the chief of mining at Syncrude said that I had to be familiar with draglines so they took me all through North America to every large dragline site that they could arrange, and we spent a day or two at each site observing the draglines and becoming familiar with how they operated, because it was pretty new to everybody and certainly new to me, but not new to the world.

These were draglines that had a capacity of anywhere from 50-cubic-yards in one bite to the largest one – called Big Muskie – in Pennsylvania that took 200-cubic-yards but the scale intended for Syncrude was about 80-cubic-yards. To put it in perspective, draglines in Alberta that were mining coal were about 30, so we were moving into new ground, and people who weren't familiar with the equipment had pretty gloomy forecasts. So, once becoming familiar with the equipment and the ground that you put the two together, and say we know something about what's going to support it; through a series of borings, you defined the geology more carefully, then, you hypothesize a solution to holding the equipment and achieving the excavation. And from there, that goes under a lot of examination by the experts from Bechtel who, in turn, hired experts from Harvard and Bob Hardy was involved, and you went under a series of examinations where you attempted to consider every adverse thing that could happen; and your job was to provide or evolve a countermeasure. So, it was an intensive data-collection study and process that led to the final decision. The mining engineer at Syncrude who was – who had a lot of vision on the matter, with other people's help including me – finally pushed the dragline scheme into reality.

AD: Who was the head of mining at Syncrude?

BROOKER: It was a person by the name of Bob Hendry; he was about 6 foot 2 inches and had been all over the world mining, and he was a very determined and well-experienced man of considerable physical stature.

AD: Was he Canadian?

BROOKER: Yes, he was, a graduate of Queens University. Queens had the reputation and probably still does of creating the best Mining Engineers in the world. He was good.

AD: And who were the Harvard experts that were brought in?

BROOKER: Arthur Casagrande, who was a major leader, and his brother Leo, together with the expert from Bechtel.

AD: And who was that?

BROOKER: That was Karl; I'm not in touch with his last name...[Taylor]

AD: Good.

BROOKER : ...and then Bob Hardy, so that everything as a consultant was under their scrutiny and Casagrande was a very fastidious reviewer who, if you had a 1,000 pieces of data, he would find the one that was out of line and demanded an explanation why it didn't fit all the rest of the data. He didn't stand for it being called "experimental error"; it said it may be real and, in the event that it's real, then, what are we going to do? But he was a very demanding man to work for.

AD: Norbert Morgenstern got involved at some point didn't he?

BROOKER: Yes Norrie Morgenstern did get involved – when I left the University of Alberta – Norrie came from the Imperial College in England to replace that opening.

AD: So, he took over your position then...

BROOKER: That's right.

AD: ... when you set up as a consultant.

BROOKER: And he and I had a good relationship and he is a bright individual so I asked him one day to review our work because I thought that would be helpful because Norrie seemed to have the ability to conceive some useful idea from each visit or meeting which was helpful to us, particularly in trying to get the answer to Casagrande's questions that were inevitably going to happen.

That's how he became involved with us and in the oil sands. He became more involved later as consulting directly to Syncrude on a long-term basis in respect to both the slopes for the mining excavation as well as the waste materials - the overburden waste. Once the plant was built, operating, and the mine was operating, as we hoped it would, our roles pretty well finished, but Norrie remained on for some time on a review board at Syncrude.

AD: From some information that you gave me, you had projected that - that you would lose one of these draglines every 10 years - there was a potential because you were assessing risk and looking at risk mitigation. Do you want to talk a bit about that, because that is pretty scary?

BROOKER: Well I'd be happy to talk a bit about that but, if I may, I'd like to rephrase the introduction a bit because by the time the operation began, it was not me who was projecting the possible loss – once in 10 years – that was a risk analysis group, which, whose task was helpful but not exactly the same as mine.

I never anticipated losing a dragline and that it had been because, I think, I'd become so firmly convinced through the training that Bob Hendry at Syncrude had put me through, that it wasn't going to happen. There is one statistic that became very clear in that discussion, [and that] was that there was no record of a major dragline loss in the world, it's just that the nature of the ground giving away – sort of lower the machine down towards the pit – but they don't tumble off the edge

or go crashing over sideways, and they just build their own road and walk out of it. So you might lose some production but the machine was never, in my mind, in threat that way. But the loss of production because it was displaced for a period could have been a problem; from the point of risk analysis and financial planning, it was probably a wise thing to do.

AD: Now, that is an important distinction. That the engineers, the team, did not see this as a risk, as you clarified as a sense of loss of equipment, rather as loss of production, but the insurance brokers and so on...they would.

BROOKER: They would and it's a wise thing to do because I think the consequences are severe if the machine was lost; the replacement time for a major dragline would be a year or maybe two years instead of digging itself out over a period of 4-5 days, you'd be looking at both a huge investment and a huge loss of production.

AD: Let's go back and get you to comment again on the scale of this in respect to current technological achievements at that point, you know mine workings and other stuff.

BROOKER: My impression is, and I'm not sure of the statistics today, that the Alberta oil sand constitutes one of the largest mining projects in the world, if not the largest. There may – the diamond mining of Northern Canada takes people deeper – but the total scale of the oil sands is large, but let me qualify that. Although it's very large, it's not large for a province the size of Alberta; its impressive in its own but Alberta is impressive, it's a big place.

AD: I want to go back a little bit - that you talked about when you went out to survey, that you were drawing on geomorphological and geological studies, and I'm wondering, of course, in terms of oil sands, you had Sidney Ells, who had done some work, John Allen, the professor of Geology at the University of Alberta at the time of its founding, what were you drawing on?

BROOKER: I drew largely on my training from the University of Illinois, where I was taught, at that time, in the field that I was in, to observe the ground because in geomorphology it's the origin and development of the landform that you are working with, and it is similar in my mind to a physician being well-grounded in anatomy when they look at you and, as an individual, they see, in their mind, your bone structure and your muscle structure, and it can be a little bit different in that case for different people. But when you look at a person as a physician, you must be envisioning what all is going on inside; you don't really have to open a guy up to know what should be there. So that gives you an initial – when you look at the ground, geomorphology and particularly through the evolution of air photography, you can see the landforms – and saying it must be sort of this way.

When you get to the point that you can drill holes in the ground and extract samples, it gives you a little more evidence to sustain a hypothesis, but it's not until you get to the digging and getting right into the ground that you see what is actually there. The better you are in your practice, the closer you would have come to, through your initial thinking process, but it's a scientific process of examining the ground from the point of view of how it got there to the direct evidence of borings, or even

exposures on river banks, are all pieces of evidence that support or refute your proposal or hypothesis.

AD: Everyone I have interviewed on the project talks about the nature of the oil sands: in summer it's a molten mass, in winter it's rock hard and, basically, you were looking at positioning structures – great expensive machines – and that you had to make an assessment as to whether they would hold this equipment, the non-experts would question it.

BROOKER: Well, I would agree with you, with a modification to the thought that, when you say it's soft and messy in the summer, the lumps on the ground that you step on are in at that time are that way. And, there are some areas of an open face where the bitumen may even run out in globs but that's sort of like a sore on your skin. Inside, beyond that, maybe 4-feet of depth, it's different again. You get a north face exposed to mid-summer sun, it is warm and the material behaves differently on the slope, but that's more or less a surface effect; inside is different. And the same goes for wintertime, that [the surface] freezes but the whole hundreds of square miles of the deposit are virtually the same as they were at any time. So, as to the surface effects being either sloppy or frozen, it has a big impact on equipment; in the summer months, a bulldozer running around will collect this on their tracks and in their wheels, and the abrasion on the equipment is enormous, because it's all mixed with sand and silt that - silicone particles that are nearly as hard as a diamond, and it is very tough on equipment. In the winter time, not only when you take a bucket and try to push it into the frozen material, not only is the frozen material virtually as hard as ice, but the steel in the bucket changes properties and becomes very brittle, so breakage – a brittle break – in the winter is a big threat, and a real one, that frequently happens, and these huge buckets for example will break.

AD: And, I think that it's interesting that you mentioned that initially you were interested in bridge engineering, and that you then moved into the geotechnical side; well there is a convergence of these two disciplines in your own life and interest, correct?

BROOKER: Yes, there is.

AD: Can you talk a bit about that?

BROOKER: Well, I am always thrilled with bridges, but I've always really enjoyed the soils of the geotechnical area because it just involves a number of disciplines that are a great deal of challenge, and a great deal of pleasure to deal with and put together. To me it has been very satisfying. I have never done any significant amount of bridge work outside of the first few years. I worked with Swan Wooster on the Second Narrows – [it] is a huge, huge bridge – and that was thrilling. How would that compare directly? In working on a major bridge, you are working with a team of engineers. As a Geotechnical Engineer, I found myself, at times, the major figure in conceiving the hypothesis and bringing together the parts. I think there is a lot more trained capacity around today than there was then. But, it is a fascinating process. Another comparison is when I was working on bridges in Vancouver, I was in a design office all day long, day after day, and occasionally out to look at the

bridge, but it was days of calculations and days of drawings in the geotechnical practice – you are looking at air photographs; you are in the field verifying things; you're digging the ground; and you see the structure evolving. There is a point at which you work at it and, then, if it's all working well, your job is done and you are gone, off to the next one.

AD: We are discussing, simply put, is that really engineering became multi-disciplinary didn't it and that the oil sands required all of those different disciplines to come together to design these huge structures, and adapt equipment to be able to accomplish what was required.

BROOKER: That's right; it's been a great process in evolution of practice of the disciplines coming together, everything from – we now know quite a bit about the geology of the oils sand, which we didn't know at the beginning, it was a pretty simplistic point of view; we know a lot more about the steel, can make better steel; we know more about the chemistry of changing, of extraction of processing the oil sands. I think the next major challenge is learning how to effectively remove the bitumen from the ground that is now not just a hundred or a couple hundred feet deep, but a thousand or three or four thousand feet deep. There is more of that up there than there is surface mineable material.

AD: So, when you finished your work for Syncrude, what did you go on to do?

BROOKER: Well there is always the odd thing in oil sands that continued but not on the scale that that plant took. At the same time, the Arctic was evolving and oil and gas resources of Arctic Canada were coming into interest, and the means of extracting them in the Arctic and transporting either oil or gas to the south was of great interest.

As a matter of fact, one of the hold backs to Syncrude's easy entrance was the discovery of Atlantic Richfield by Atlantic Richfield at Prudhoe Bay, in Alaska, where during the very course of the hearings in Calgary, it was announced that Arco had this enormous oil resource that changed the balance of crude oil availability all over the place, and, as soon as that discovery was made, it changed the economic viability of moving into oil sands, which was a relatively unknown process.

The Arctic really began to change the direction of things and, as an engineering corporation, we had to refocus and get with the next wave of work, which turned out to be Arctic pipelining of both oil and gas. We went through extensive studies much like Syncrude, questioning how anything from how you can effectively put an offshore exploration structure on the Beaufort Sea to, if you do get oil or gas, how do you pipeline it. There are a lot of environmental sensitivities in the Arctic probably that exceed the concerns that people have about oil sands. And, then, you need to pipeline this production of crude or gas to the south through major pipelines that still don't exist, but you have to answer billions of questions about the impact of hot oil. Oil comes out of the ground at anywhere up to 300 degrees centigrade, so an oil line in permafrost can be an extremely destructive structure. On the other hand, a gas pipeline is refrigerating things, and the hazard there is that you can build underground ice dams. So that is where we went, into the Arctic.

AD: What year was that and what were the projects specifically?

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BROOKER: It all started with the Alberta Gas Trunk Line and, wanting to build pipelines. Alberta Gas Trunk Lines then formed a division that Bob Blair called the Maple Leaf Project. It changed names again to Gas Arctic and there was an evolution of name changes, but to me it was always Alberta Gas Trunk Line. That's the way I thought about the people because the guys that I was dealing with stayed the same but the name changed. But, then, the question was that if you get production, then, what do you do with it, and one of the misbegotten ventures was a project called "The Manhattan Project." That's not the atomic bomb but it was a huge tanker that was reinforced as an icebreaker with the thought of taking it through the Northwest Passage to places like Prudhoe Bay, and filling it and bringing it back. Well, the boat got built but it couldn't penetrate the Arctic. It's amazing when you think of, over a span of about 50 years, it's not long until the Northwest Passage is navigable but it sure wasn't then. The question arises, once you have a product or production, how do you get it out? So, that's where we were and that's kind of where we stayed, that kept us busy; between that and gas plants, petroleum plants, refineries.

AD: So, what years where you doing this work in the Northwest Territories and Arctic?

BROOKER: We are still there as a company, EBA Engineering - big time on the diamond mines - but I'm not involved. I would say, 1978, we were well into the Arctic work. It was roaring because the major impacts we had, we were involved; I can put it nearly exactly, in the early 1980's, in developing an offshore exploration island in the Beaufort Sea for Chevron. When it was shut down, on account of OPEC [Organization of the Petroleum Exporting Countries], price dropped from $32 a barrel to $10 virtually overnight, and the book was closed on the Arctic. We were given a month to clean everything up and [they] said that "The last bill you can send is a month from now, so fold up the stuff, and put it in the corner," and the island was half built. We said, "We don't care, we are moving out."

AD: What is intriguing is that this little Alberta firm that you started as a result of this oil sands work began to do international work.

BROOKER: Yes, we did.

AD: Which, again is that...

BROOKER: We weren't very good at international work.

AD: But, still, you never would have had this opportunity or this capacity had it not been for the oil sands.

BROOKER: That is correct, but you could foresee, I used to be extremely concerned because nothing happens forever or stays forever; whatever is going well right now is not what is going to be well in two years from now, or maybe six months from now. And what is going to happen in six months or a year away depends on both national and international events, which are always unforeseen. So, I thought we had to have an element of foreign work to provide diversification but foreign work is a lot easier to say than do.

If you are going to do foreign work, you need a foreign legion. The type of individual that works on the foreign project is totally different than a guy that works in an office, or stays local. They are nomads; they love it. They are available; Montreal Engineering did it well. But we set out to get some foreign work and we did. One contract was to be in Spanish only, and I said that's no problem, I'll learn Spanish, and the other one was in French, which I didn't see as a barrier but it was; and neither contract worked very well.

AD: Because you would have to get native speakers to be able to function.

BROOKER: And you need people that are willing to go to remote places for extended periods of time. Virtually anyone that you hire will – we said we want to send you to Guatemala, they said that is great, but its great until they have been in the hinterlands of Guatemala for a week, then they want a Big Mac and their girlfriend, and that's just not available for the next year.

AD: Yes, the joys of "foreign work." So, again, in terms that your firm changed, you had added muskeg and permafrost engineering to your portfolio but I also want to talk about pipelines again. Were you involved at all in terms of the MacKenzie Pipeline?

BROOKER: Yes, in a major way.

AD: Can you talk about that?

BROOKER: Well, one of our fellows was on, in, the hearings. I never went to the hearings, but we did a lot of work on that, on heat transfer and the impact of hot or cold fluids in permafrost. All of this aimed primarily at the environmental concerns of these heat-sensitive materials. My regret was that, after we worked on that for 10 years … but nothing has ever been built. There has been delay after delay; either it's been a setback fired by environmental concerns and procrastination on the part of government bureaucracies or – then it got into the popular era of Native or Aboriginal claims and there has been one delay after another. And, through those delays, the total demand of the end product varies, so there is a time that's right and, if it isn't exploited at that time, it may take a good deal of waiting.

AD: So 30 years later.

BROOKER: Sure, because the supply and demand balance of the world, the whole political circumstances of the world, is continuously in flux, and the corporations that pretty patiently work at evolving are impacted by this; particularly, I think in the petroleum industry. I think that that's at the top of the risk.

Here you have – which is surprising – diamonds in the middle of the Northwest Territories, environmentally there hasn't been nearly as much fuss about that as Syncrude, and yet you could argue that, if you went and looked, the environmental issue may be a bigger one but its tucked away innocuously to the point where most of the people in the world don't even know it's going on.

The oil and gas profile is a very big profile and a very risky one, and I've always found it a thrill to work with the people because they are of a different nature; they are big risk takers. Imperial Oil was in our Arctic by about 1930 or so, exploring and exploring until they found some oil at Norman Wells, but it takes a lot of patience, a lot of dedication and it sometimes perplexes me that after all of this effort they are the subject of nasty publicity.

AD: It's interesting the parallels, and I'll go back to one, the coming in of Leduc Number One and the Redwater fields delayed the development of the oil sands because the government, Premier Manning, the Minister of Mines and Resources – they were gung-ho on the oil sands.

BROOKER: Yes.

AD: But, of course, then, with the coming in of these major conventional wells, then it delayed it into the 1960s when it started, and then you have talked about the oil in Alaska and how that also impacted on oil sands further development. Then, in 1980, the worldwide recession, the drop in the price of oil, those are certain parallels. But the pipelines, it looks like the whole – we're into a period of questioning pipelines parallel to that of the McKenzie Pipeline. Do you want to talk about that?

BROOKER: Well, I don't know if I'm well equipped to get into a discussion about that. I know about the McKenzie line because we were working on it. But there is nothing wrong with pipelines; I think we have the technology to do it. I thought it would have been a wonderful thing to take little minor pipelines from the larger off to the Arctic communities and give them some heat. I think there is a lot of benefit to pipelines; personally, I'm all for it. I think we have the means and the intelligence and the nature of care to do all of that responsibly.

AD: A pipeline in the Northwest Territories, now the topic is being discussed with some Aboriginal groups interested because of the potential for economic development and jobs. But, whether the time will be opportune, one doesn't know.

BROOKER: No, my crystal ball isn't clear enough to look at that. It's a little disturbing in many ways because, in my view, which everybody doesn't hold, it's such a naturally useful thing that it perplexes me why people aren't thankful that we are at the stage where we can technologically do it.

AD: You mentioned these hearings, the ERCB [Energy Resources Conservation Board], I guess, with respect to Syncrude, because GCOS [Great Canadian Oil Sands/City Service Athabasca] they were there at the beginning of the race but, of course, GCOS was able to proceed. What became Syncrude, was not and there were various hearings. Now, I gather that your firm were interveners or something, do you want to talk a bit about that?

BROOKER: Well, I was early in my consulting career when the hearings, the Energy Resource Board hearings for Syncrude, were underway. I sponsored myself to that as a matter of business promotion. I stayed at the best hotel where all the big wheels were staying because I wanted to be seen personally and I wanted us to get work. It was a great way to have an opportunity to meet people so they've seen my face and heard my name so that, when we were out on the commercial

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track, it made things a little easier. It was business development that drove that one, but I was interested and wanted work on it, but the question was how I get to know these guys.

AD: So how long did those hearings go on for?

BROOKER: It was a week or 10 days; it was George Cuvier who presided over those hearings at the time, and there were about 30 interveners. It was the first time that I had been given a great insight into, what's called the Life Index of Oil, which continuously changes - that is the period of time at present consumption rates that we have left with the resources that we presently know about. You just divide your consumption into the reservoir capacities that we know about. But both of these consumption and availability of product are variables. At that time, the impressive thing was that the life index of conventional crude for the United States was something like five years but, for Canada, about eight years, that is at the present rate of consumption. Given the reservoirs we know about we would be out and there was no disagreement on that, but that was some time ago and we still have the product around because we – I recall speaking to an oilman in Edmonton, and said, "I've just really realized what this Life Index [is]." He said, "Well, how much oil you got depends on how much you are willing to pay for" because, at that time, oil was about $5 a barrel and it's been up since then; at one point a couple years ago, to $150 a barrel; its settle back now to about $92-$95; but it's going up.

AD: Its intriguing, and you have answered my question because I was going to say to you, "Well in terms of reserves, they got their science wrong," but what you said is that it wasn't the science that was wrong in terms of basins and reserves, it was the economics that their science wrong," but what you said is that it wasn't the science that was wrong in terms of the basins and reserves, it was the economics that determined.

BROOKER: Well, boy I think that's right. If the economics works, we will find a way.

AD: Yes, and with respect to Syncrude, talking to other people who were interveners there, they had to not only demonstrate that there was the market so you have to do some pretty fancy economics to say that it would sell, to justify the size of the plant to make it economical.

BROOKER: Well, that is correct; they also have to demonstrate and prove that their production, that is Syncrude's production, would not interfere in any way with conventional production in the Province of Alberta. That is – they basically said – that you have to get whatever you are getting from oil sands and take it out of the province. And they did have an agreement with a refinery (I think it was Louisiana) that, given the nature of the material, they could refine it with an existing refinery, and that the markets and the consumption would be in Louisiana or even offshore, sent away in boats, but it wasn't destined for Alberta or Canada. And it was – when you look back on it – it was just about impossible to believe. Syncrude found an answer to all those hurdles.

But, in the meantime, supply and demand has changed a great deal. It even depends on what the … during the OPEC [Organization of Petroleum Exporting Countries] crisis, it's what OPEC decided to do – flood the market. It was a supply and demand, but it's a real global/political issue. It's always

amazed me that you do all your business plans, and do your up and down analysis and try to work with all this, but, then, even the brightest people, all the Canadian Banks, never conceived that OPEC was going to drop its price. I am not really an economist but all the major banks employ PhDs in Economics and they didn't figure it out either. And, there we were, stuck with it, and it's still happening in various forms.

AD: Well, you know, it's your firm that is providing services to big projects; you have to be able to scan the environment and determine need and supply because you are on the supply side; I mean your projects right?

BROOKER: Well it's been a – I've always enjoyed the industry a great deal and we're a major beneficiary of the oil and gas industry one way or another.

AD: Now, what other … you mentioned some other oil sands work; do you want to talk about that?

BROOKER: Could you help me with that a little?

AD: Well, the two big projects that you were involved in from the earliest days were both GCOS/ Suncor and Syncrude, and then you moved into other areas.

BROOKER: Well, we helped and worked for other leases and other lease development for Shell and what was nominally called lease 13. And I've done quite a bit of work for some of the ensuing leases but not nearly to the extent that it was at Syncrude. Actually, the work at Shell was going on nearly simultaneously with Syncrude - lease 13 which developed later.

And that was the discovery, not really the discovery but the realization, that gas at the base of the oil sands was at a significant pressure and you couldn't get rid of it; and it creates a hazard of just lifting the whole bottom of the mine out. But that's where I realized through observations that it was a major force. Even at Syncrude, when we were opening the mine and digging the trail areas in the base, where we had drilled test holes, we could, in the middle of winter in the bottom of the mine, you could light these holes and they would give little flames, here and there. So there was gas there but in a very erratic pattern.

That's one thing about geology - it's not a homogeneous circumstance; it's pretty erratic. So that's where geomorphology gets into it because you have to envision how a deltaic lake area was formed and the materials got there. They were odd, as you can imagine, from one borehole where it said it's grabbing down from here, and oil sands from here on down. It's far from that simple, but it is thrilling.

AD: So, what was unique about the Shell work that you did?

BROOKER: For me at that time, there were two unique things. The territory was extremely difficult; it has what is called kettle topography where the last retreated glaciers left chunks of ice buried that subsequently melted and the ground above collapsed, which makes an extremely

tortuous topography at the surface. The second was that, although Syncrude's commercial resource was something like 180-feet deep – of overburden that you have to get rid of – before you got to the exploitable resource, Shell was 300-feet. I said, "At what rate, at what point does the cost of overburden removal get so high that the resource - as important as it is - can't be exploited that way?" So that's when you get into the "in place" processes that are being studied now. That was the second realization. The third was the gas, which gave an explanation to certain features of potential instability that weren't realized prior to that. So, those are the three major surprises, or new pieces of knowledge. Apart from that, as far as processing, to me the plants looked the same.

AD: Now, you mentioned the Shell project and you said there was another oil-sands related lease.

BROOKER: I can't remember the name clearly but the...

AD: Don't worry,

BROOKER: I have no significant … only a peripheral involvement. Actually, on that one, because I was involved in other things, I turned down work, which was unusual for me, but I had no more personal capacity.

AD: To take that on. Now, you mentioned, you didn't name it, but you mentioned the whole SAG-D technology and has your firm had any dealings with any of the SAG-D projects?

BROOKER: I can't say; I have been away from the engineering firm for some period of time, and the demand for what we generally do is quite different and I really don't know.

AD: So, when did you actually retire?

BROOKER: Well I like to think of myself partly as not being there yet but I left the engineering firm gradually as shares were transferred to others. The vision was an employee-owned engineering firm, not unlike the model that PCL has. That was my hope, that it would, first, be Canadian; it would be owned by employees because I have a belief that, if you are using an individual's brain as a production unit, then it should be rewarded. Fundamentally, I believe that people should be owners of the operation, which was the case when I left, but some circumstances came about where they – the people that got the firm – sold it to Americans.

AD: Which of course is what happens with a lot of these founder companies, as they change, and evolve. Now, you had mentioned to me that, based on the surveying work with Syncrude, you had developed, you had materials relating to the actual filming from the air, etc., and you created a presentation. Do you want to talk about that?

BROOKER: Well. sure, it is difficult to, and there were always arguments about the performance of the ground, as we've alluded to earlier in this conversation. But, I said, "I'd like to have an actual movie picture of what we can now see actually happening, rather than arguing with people that, well, it's going to be like this, or I say it's that way." Taking pictures on the plant site were strictly

prohibited. I had a particularly clever person that was a good photographer with movie cameras and, every morning when we entered the site, there were inspectors at the gate to make sure that there wasn't any camera on, but we packed the camera devices, such as the one that is filming this, into instrument cases that looked like the cases we used for other machines, and took them in and made a film ourselves. I believe I have shown you that little film at one time. It was ultimately shown at an oil sands conference but that was a lot of fun and it's a good film. It shows how the dragline worked. Today, it's not as relevant because everything has been converted to shovels, and so on.

AD: You also became the President of the Alberta Chamber of Resources in 1981; do you want to talk a bit about that?

BROOKER: Well, it was just a pleasure; these were industry people and it was volunteer work. You meet a lot of very fine people in the industry, but that is where I met Harold Page who was, at that time, Managing Director of the Alberta Chamber of Resources. Historically, that entity was called the Chamber of Mines and was aimed at the mining industry in the Territories and which was a major issue at the time and that, in turn, goes way back to the Klondike days and mining for gold. Yellowknife with its mines and – for gold – but, as time passed and circumstances of evolution changed, and the quotients of economic content of the province changed from mining - they claim that Syncrude is the largest mining operation around, which is true, but you almost don't think of it as mining compared to, for example, copper or nickel or gold. Displacing that was the exploitation of petroleum resources beginning in around 1947, which is now an extremely dominant economic unit of Alberta. The Chamber of Mines changed its name to the Chamber of Resources to include and concentrate on this industry, which is important, and they argue on behalf of the industry in respect to all sorts of issues, now, with the government. But, in particular, I met Harold Page who had been formerly President of Great Canadian [Oil Sands] and along with that went many key figures in the resource industry in Alberta. So, it was a good time of my life.

AD: What is intriguing is that, if the Chamber of Mines had not had that foresight and become the Chamber of Resources, with the focus on oil sands, because the growth was [there] – they were the miners – those were the new generation of mines, we wouldn't have had the Oil Sands Task Force and all of the … and its impact on its development. People like Don Currie, Eric Newell, Jim Carter and so on, so that was a very strategic move on the part of the Chamber of Mines. And you were at that transition point weren't you, when it became the Chamber of Resources?

Brooker: That is correct. Yes, it was a demanding period because I think Harold Page did an amazing job, almost an impossible job, at reformatting the organization. I think today it's deemed as essential to the industries.

AD: And this was at a time when no major developments were happening, in terms of … because of the drop of the price [of oil], so, again, you had visionary people who saw these recessions as hiccups and you had to recalibrate to anticipate growth, and you had to be an instrument of change as well, correct?

BROOKER: Well, they are a bunch of remarkable and determined people and I always felt personally like I spent my career "walking with the gods"; it's been a wonderful time.

AD: Now, you also continued to publish. Do you want to talk a bit about some of the key technical papers that relate to the oil sands?

BROOKER: I will only, briefly, because there were some. There is one, I think, that is extremely good that deals with the stability of ground. I can't remember the title of the paper, but it was...

AD: I actually have it – "Rational Design Treatment of Slides in Overconsolidated Clays and Clay Shales," with Ralph B Peck for the *Canadian Geotechnical Journal,* and, of course clays, etc., it has to do with oil sands.

BROOKER: Well, yes, that is a little broader; it's aimed around the performance of Cretaceous shale which – once upon a time, throughout North America a sea called the Cretaceous Sea that extended from the Gulf of Mexico to the Arctic Ocean and an inland basin. It is the erosion deposits from both sides of that that form all of North America today. But, it deals with the nature of Cretaceous shale and it's certainly applicable to oil sands. That is a good paper, I thought.

AD: It certainly is much talked about. You referred to Frank Spragins as the "Father of Syncrude" as it were, and you received the Frank Spragins award from APEGGA [Association of Professional Engineers, Geologists and Geophysicists of Alberta]. What does the award recognize and when did you get it?

BROOKER: I received it sometime in the … about the mid-1980s, as I recollect. It deals with the dedication and the ethics of engineers. Frank Spragins, at one time, was the President of the Association of Professional Engineers but he had a reputation for integrity and honesty, and that is what it deals with, apart from assuming you are technically competent.

AD: Now, just as the Chamber of Mines morphed into the Chamber of Resources, APEGGA of course has become a power-house professional association and, again, so much of it is to do with the oil industry, isn't it – both conventional and the oil sands. Is that a fair statement?

BROOKER: That is.

AD: So that, as a profession, engineering has evolved and – in the early days, with Bechtel, of course, the expertise had to come from outside, but in the last 40-50 years, we've had universities developing these competencies so that Canadian firms can compete, and even go and sell their services internationally.

BROOKER: Yes, I agree with that. We have a good supply of capable people now that didn't exist then.

AD: Industrial history interests me because I was the Science and Technology Editor of the *Canadian Encyclopedia* … many so-called experts and, certainly the media, talk about economic diversification and, in terms of Alberta in the early Klein era, the desire was to not be so dependent on our petroleum resources - from whatever source - or agriculture or even forestry but to move into IT. But, in fact, we have seen this diversification in terms of these service firms and construction companies, and others that have developed this range of services; and owner companies that have become multi-national as well. That isn't taken into account in terms of the diversification and, I guess, it would be part of the knowledge economy wouldn't it?

BROOKER: Yes, I think that you are right, that is a knowledge economy, and it's important. How, in the attempt to diversify your economy, I'm not sure that I know how to quantify some of these things. There have been many attempts, responsible attempts, by the Alberta government taking on partners, at times the University of Alberta, in attempts to diversify the economy, so that we don't have to rely on resource-based industries forever. But that is an overwhelmingly difficult task, because there are centres of knowledge; for example, in the computer industry in Palo Alto California, Silicon Valley, that are so dominant that it's only peripherally that we can compete and make a major industry.

I've seen examples of major diversifications of economics in action in the world. I will give you an example – in Germany, not far from Munich, there is a whole plastics industry that was evolved in a depressed area as a result of the Second World War and, when that was over, there was a massive part of Germany that was simply unemployed. There is a person there that conceived that new products were becoming available due to the evolution of plastics, and plastic components. He began to make hose connections. He figured out a new way of putting hoses together. You may have even used one of these locally - it's a clip-on fitting. But he supplies hose fittings, hoses and accessories for hoses to virtually the whole world today through this vision of using newly-evolving ability to put petrochemical products together to make a plastic. Just trying to put a name on the name of the firm, but I have those fittings out here on my own hose.

I even tried to make a deal with him once to produce those in Canada, but it's a massive operation. The offshoot is that his workers, as they have grown to retirement age, have purchased pieces of equipment and gone away and won subsidiary industry - making plastic model airplane kits that are sold all over the world, in almost every little hobby shop, as a garage industry, as an offshoot of the major one. But these take people that are maniacally driven with an idea and it was his idea – he might of got, for all I know, a little help from the Marshall Plan or something – but, if you meet these people, they are something else. And that is a big industry in and around Munich, and even model airplanes worldwide is big stuff. There are hundreds and hundreds of people making livings doing this thing. As he throws away his last model of injection plastic molds, they are picked up by his former employees, or somebody else, and off you go and do something like that.

But, I think, as mentioned by an individual instinct, maybe even just for economic survival, noticing the possibilities. I don't think, you can take classes at a university and be lectured at as to that as a case history but how to cause it to actually happen, seldom will people take the risk of doing that

because there are enormous risks. He has to lay everything aside, concentrate on this day and night, probably with five kids that need diaper changing and everyone is willing to starve while he puts his mind and all his efforts into that creation. I don't think that can be caused by an economic development department of any government. But, you can help provide the case histories and study of them, and records of this sort of thing. Finding that little golden drop is unbelievably rare.

AD: I'm going to pick up on something, you know, these maniacally-driven individuals. While you think of Karl Clark and his gentle way pursuing the science of separation, you think of J. Howard Pew and then others, Frank Spragins, and so on – we can go down the line. We've seen a generation and a half; we have gone from mega projects to actually achieving these economic gains, technological gains. We are at a period though where the current generation is questioning all of that.

BROOKER: Well, they aren't hungry enough. You know, you have to be hungry and want to survive. You have to have a vision of something ahead. It is interesting because I went through an era and I still fundamentally believe it, that … – you train people. The average person that I talk to says, "Well I am going to go to NAIT [Northern Alberta Institute of Technology]; I'm going to go to the U of A and get a job." But it presumes that someone has created jobs.

You have to change people's minds and say, "I'm going to create those jobs, and I'm going to create those jobs while making a new form and a better form of plastic hose fittings or something." To several people, I have said: "Why don't you think I'm going to create an operation …." But I have a real problem with some of this stuff because we've got a beautiful educational system, graduating [individuals with] the finest education that we can give them, to supply jobs, to go to jobs. At government cost, our cost, they have this and then they want a job which may be government subsidized and in little risk. But the risk is there anyhow, and the only assurance - I've said to quite a number of people is - "The only assurance you have of cradle to grave care is what you have above your shoulders." The culture in that sense needs to change, from saying that and, then, people get bitter and say, "Employment is 10%; the government has failed me." Well they failed themselves.

But I don't know exactly how … I was personally driven like crazy to – not to have an engineering firm, nor become wealthy, but there is just – boiling over [in me], because I wanted to use knowledge and the physics and the chemistry that I had been learning to some end. And I have enjoyed it enormously, but I don't know what people want or expect but the ride isn't that easy. The big demand is … somehow, you have to inculcate the mind of people today to say that "I am going to create and I'm going to suffer whatever I have to, to create and produce new things." But to diversify the economy, you can set up departments here, there and elsewhere and educational programs but, without these maniacal instincts of driving to a new frontier, I don't know how you do it.

AD: I'm going to ask you a difficult question, because you were involved in enabling the establishment of the oil sands industry, and here you have people saying, "Well they are devastating the environment"; they are trying to find faults with tailings points and, of course, these are all

structures that, as an engineer, you were involved with in some way; that they're questioning whether they should have been done, in the first instance. Whether additional developments beyond Suncor and Syncrude should have been done? All of this which is, again, challenging; out of ignorance, rather than any position of real knowledge.

BROOKER: And that makes me wonder about the evolution and the development of wealth - the wealth of nations or the wealth of the country. Obviously, things are very good here, throughout North America; so good that you can house and feed people that will object to the source of what's causing their wealth, their ability to live in an organized, safe society.

It's a conflict. But, as to doing damage, in my life, starting as a young guy working for Bob Hardy and going on foot in the oil sands, I mean, that's no nice country. It's tough; it was nothing but deadfall trees, black flies and mosquitoes. Now, what's better? And the rest of the province was half hungry all the time. But, today, everyone has good things to do; they have great cars; they live in nice houses, and go out lots to restaurants. I can't see a complaint. But, above all else, in observing, I've seen, because I was involved with the University on a number of things, they want to create a diversification but it's just – I guess, to do this, if you want to make plastic hose connections, you better start on the ground floor in the middle of Germany, sweeping it, getting to know the machine, what's it doing and then somehow get yourself a used machine and begin to do something and make a new little, better development. But that's going to mean giving up a comfortable circumstance.

At one time, the University wanted to commercialize their developments. They've got 2,000 clever staff. They wanted to develop the ideas of these wonderful minds but they aren't suited for the job, because … here we have a nice man on a steady paycheck, working in a facility provided by the Province of Alberta, all of the expendable things provided by the Province of Alberta. If he develops something, he wants the right to it, and it's a very difficult circumstance. That mind is not suitable to an industry that is fundamentally out there in the business world; it's Guerrilla Warfare. Apart from having to work hard, produce, invest and risk your wealth, your personal wealth, it would kill people, professors at the University.

AD: You have just described J. Howard Pew. I mean the company wasn't thrilled about the development of GCOS but, of course, it was his personal bailey wick, and he invested some of his personal wealth because he was obsessed, and he wanted it to work.

BROOKER: Well, I think that's how it comes about. If you read one of the great business writers Peter Drucker, he said that many of these developments are caused by a monomaniac with a mission. It's not easy; you can't just say we have to diversify the economy. We've tried electronics - the Province of Alberta gave the University a lot of money at one point about 20 years ago to develop computer systems. They went to Silicon Valley, a group of computer people from the University, and purchased the rights on some computer chip; came back – I was there when they came back - and not at the University but at an event - and they said "How clever they were." The very next morning, when they had cashed the Province of Alberta cheque, that company announced

the next evolution, Pentium or something, … making what these guys, these very clever people had just bought with our money, worthless. Are you really going to put this for public consumption?

AD: No. I think that the Oil Sands Oral History Project, of course, by interviewing people like yourself, is getting this information of the development of the industry out there on the public record at a time when there are huge public outcries, globally, about the industry. So, how do we create understanding of the industry? Well ,I think we all believe that we all do it through interviewing people like yourself. I'd like to thank you and ask you if there are any summative remarks, something that you forgot to mention, that you would like to?

BROOKER: Well, the only remark that I would have is my whole life has been transpired in a way that I never expected, and that I have some really wonderful mentors in my life like Bob Hardy or Frank Spragins, a number of others, even George Govier. You may not know that I was, at nine years old, janitor in an apartment building that George Govier lived in. Fifteen years later, when he was Dean, he helped me, but my life has been like a walk with the gods and I'm eternally grateful.

AD: Thank you. Now, I forgot to ask you at the onset where and when you were born so that's a part of the oral history.

BROOKER: I was born in Edmonton in 1931, at the Misericordia Hospital, which at that time was at the North – towards the north-end of the High Level Bridge and went to Garneau School, public school, University High School, University of Alberta, and then Illinois and that's the educational background.

AD: Thank you so much.

BROOKER: It's been a pleasure.

[INTERVIEW ENDS]

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