BOEM DEEPWATER GULF OF MEXICO HISTORY PROJECT

Interviewee: Lawrence Buck Curtis

Date: March 4, 2010

Place: Lake Conroe, Texas

Interviewer: Jason Theriot

Ethnographic preface: Lawrence B. "Buck" Curtis graduated from the Colorado School of Mines in 1949 and promptly went to work for Conoco in its Wyoming oil fields. Curtis soon wounds up leading a burgeoning engineering group for the company in its New York City office, overseeing international efforts. At the Fetah area in Dubai, Curtis helped to pioneer the use of underwater oil storage domes in the 1960s. In 1972, Curtis was transferred to Houston, Texas, to head up Conoco's Production Engineering Services (PES) group. Curtis, widely heralded as the "father" of the tension-leg platform, or TLP, recounts his efforts to pioneer the system at the North Sea Hutton field as well as at the Gulf of Mexico's Jolliet development.

[Begin File 2]

JT: This is a second interview with Mr. Buck Curtis, up here in Lake Conroe. Today is March 4, 2010. It's Jason Theriot for the MMS-Deepwater History Project.
We're talking about the 1970s and the research and development going into actual doing experiments that led up to the Hutton project. One of the things that Mr. Curtis is explaining to me is how this evolved in phases, and if you kind of look at it as an evolutionary process, you begin with trying to figure out what is the most cost-effective tool for getting at deepwater.

BC: Or what is technically possible.

JT: Or what is technically possible, and the route of some producers. Using a fixed platform was not an option for Conoco. Using underwater manned facilities to a great extent, Conoco decided that's not something that they wanted to pursue for various reasons. Certainly, I'm sure the human safety factor was one of them. But, again, if you're going to go in 1,000-, 2,000-, 3,000-foot water depth, a human can't really go down that deep, can they?

BC: Atmospheric.

JT: Using the atmospheric. So the available technologies that were out there really pointed to a combination of a floating platform attached to the floor.

BC: Some way to anchor it.

JT: And some way to anchor it and a sub-sea operation of some kind to be able to produce.

BC: Initially, yes. But then we discovered we could bring the wells up.

JT: Right, bringing the wells up from the floor up on top of a platform for long-term maintenance.

BC: Yes. Much cheaper operation.

JT: So it was all about, as you mentioned, trying to get out of this so-called box to make deepwater cost-effective, using a technology, choosing a technology to make it cost effective, and the TLP was that option.

BC: For Conoco.

JT: For Conoco. Then there was the test off of Catalina. I've got some data on that, some articles on that as well. But from Conoco's perspective, the experiment off of Catalina did not produce the type of experimentation and data that you guys were hoping to be able to base a big move on.

BC: Let's put it this way. The data that we received from Catalina was insufficient. It was okay, what we got, but it did not acquire data from high-enough sea states that gave us any kind of a comfort factor in analyzing the data and projecting it into more severe and deeper water environments.

JT: So in other words, the waters were much calmer than, let's say, in North Sea or Gulf of Mexico.

BC: Yes. They expected the sea states to be greater in the actual experiment, but they never were. So, consequently, we had to accept what nature provided.

JT: But you guys would at least take that data and run with it.

BC: We did, yes.

JT: You started a marine group, you had mentioned.

BC: We formed a marine group in PES, and the key man was a man named Scotty Burell, who was a marine engineer that we hired, who had extensive experience in offshore operations on the East Coast in the mining and had dealt in the kind of sea-state environments that we were considering in the Gulf of Mexico and elsewhere around the world. So he was the key man in our marine group, and from there we added each individual discipline as we needed it and the right person. We spent a lot of time finding and hiring the right people for this team, because this team was to pursue in greater depth the application of TLP technology in marine environments that were in much deeper water and also much more severe than we had encountered up to this point.

The big question was could we anchor a TLP in greater water depths in high-sea states and have it survive and still continue to produce. These were the objectives we sought to answer, and this is what we undertook to do. So the second iteration of the TLP technology was about to begin with the PES marine group being the interface, the primary technical interface to get this done, and we seconded folks from the other partner companies in the concession to assist in the engineering, and sometimes that was hard to do because they did not have people who were qualified to do that. But we managed to put together a good general team, including folks from the other companies, and they undertook this and spent several months going through.

Finally, we came to the point where we were almost certain we could do this job; we could put a TLP in place in deeper water and have it be on station permanently through the life of the production cycle in the reservoir, and we could do this economically. So then we went to management and we had to find a place where we could do this. We had to have an actual case where we could do this. Well, one case that existed which was kind of first order for us was Hutton in the North Sea, which was a reservoir that had been found that wasn't of huge size or production potential and was very marginal to develop on a conventional means. It was located in about 500 feet of water, which is not really deep water, and could be developed without a TLP or any deepwater concept, but it was deep enough that if we could do it here at a lower cost than what it took to do it conventionally, then that's what we were seeking to do. Our initial run through the project, through the design and the development of the TLP concept, showed that we could put it in, develop the Hutton field for less money than we could conventionally. But it had never been done, and having said that, it turned out to cost more than what a conventional project was, but it only cost more because we perceived a severe welding problem that probably could have been omitted.

JT: Let me back you up just a little bit. You had mentioned the consortium, which is the collection of all the partners in this operation. Was the consortium based around the marine group that you guys had put together at PES?

BC: Well, the team, the analytical team and the development team and design team was based around PES. The consortium, of course, were the operators who were in the concession, and they, of course, had a normal operating management system, and the technical people were a part of that. But it's the technical people that were seconded to the team to assist in the design development.

JT: They were from the individual partners?

BC: They were from the partnership. We also included folks in the certifying arena, which was Lloyds of London in our case, because we were going to do this in Britain.

JT: Inspectors and whatnot.

BC: Right. And we also incorporated the National Oil Company because they were a partner, and they provided quite a lot of seconded engineering help in our project.

JT: So PES, which is Production Engineering Services, is a division of Conoco that led this research and development.

BC: That's right.

JT: Had the actual field of Hutton been leased out yet? In other words, had there been a lease on Hutton, and is this what the consortium—

BC: Hutton was a Conoco concession block that we acquired in the North Sea, and it had a partnership, partners, and it had been discovered, the exploratory well and a couple of delineation wells which described to a certain degree the reservoir deposit or the oil deposit that we were dealing with, and also we had done enough testing on the wells drilled to determine what kind of productivity we might expect.

So in our analysis of using a TLP in 500 feet of water—in 500 feet of water, by the way, you're still not deep enough that you can't have manned intervention if you have problems. Since this is the first time around, that could be an important item, allowing us to have a little more confidence that we could deal with anything we raise that came up with a manned intervention using divers or what have you. So the case fit what we were trying to do very well, and it also fit because it had a number of major operators involved, along with us. Our aim was not to have some privately owned technology that we could use around the world, but it was to get the concept into an acceptable state as a means of developing in a worldwide scene and greatly expand the exploratory arena that existed.

JT: Because not just Conoco, but everybody was looking for a means to get out of that box.

BC: Right. Everybody, yes.

JT: At the time in the seventies, at least by the seventies, it was understood that this needed to be a joint partnership, not just the partners involved, but a worldwide industry partnership to figure out—

BC: It would have been easier if it had been a 100 percent Conoco project. We could have moved much faster. But by doing it this way, it opened a lot of doors for faster subsequent development as soon as it caught on. It took a while before it caught on, though. Shell, I believe, was the first one to use the technology after us.

JT: The PES, it had been around for some time? In other words, it wasn't specifically established for this means? It had been around?

BC: No, it was an operating group that interfaced with every operating sub worldwide, including the United States.

JT: Out of Conoco?

BC: To deal with the highly technical problems encountered in the upstream side of the business, and it was formed in the sixties because of what we were doing internationally. We needed a high-powered engineering group that we could apply for this six weeks or this six months and then let them move on to another thing. We didn't want a concentration for one thing in each country we were dealing with. This allowed us to pull these folks, highly experienced, highly technical group, in to help us and then move on.

JT: Did you use PES for the Dubai operation with the underwater tanker and the multiple sub-sea wells?

BC: We did.

JT: On a well platform?

BC: As a matter of fact, the Dubai operation was one of the operations that provided the impetus that we needed to have a PES-like group to call on to help with technical and engineering problems in operations around the world. So, yes, we did use it. They were very, very helpful, as was PRD, Production Research Division. They had a lot of highly qualified folks in several areas that we used. But in the case of Dubai now, initially PES was being formed about this same time this was going on, and we were pulling experts out of Conoco's domestic operation in the Gulf of Mexico to assist us. Almost all these folks are deceased now. But they helped us a lot. We faced some big, big technical problems there, but the financial reward was overwhelming. If we've succeeded in doing what we were undertaking in Dubai, it was a whole new concept of development worldwide and could save huge sums of capital input, which is what we did and was accepted by the government of Dubai.

JT: So after you guys were able to put this team together and convince the managers of the various companies to go along with this, from that point to until the actual building of this Hutton TLP, walk me through maybe just one or two of the major technical or managerial problems that you guys confronted.

BC: Let me bring up the final iteration on the project. Once it was established that, yes, we were going to develop Hutton using the TLP, using the TLP concept, we took the information, developed it with the team PES, and we moved some of the people to London for the engineering of the TLP to be done in detail, construction-type engineering. That began the final iteration on TLP and took about eighteen months for us to do the engineering and construction.

JT: One of the articles mentions the partnering with Bechtel Corporation for engineering and design.

BC: Not to my knowledge. Bechtel?

JT: B-e-t-c-h-e-l [*sic*]. Was there an outside group that you guys brought in in addition?

BC: Brown & Root. Brown & Root was for the hull, and maybe it was Bechtel did the topsides, the production operation gear.

JT: Either Bechtel or McDermott?

BC: It was one of the two. I thought it was McDermott, though.

JT: You guys were working hand in hand with these contractors.

BC: Absolutely. We had people in the engineering offices all the time.

JT: Those people came from PES?

BC: A lot of them, yes. You had people that could deal with the electric side and the civil engineering side and the mechanical side.

JT: So just seeing that Hutton was the most perfect fit, it's got all the components that can test this system to the limits and make it possible.

BC: Yes. One, it was an undeveloped reserve in the North Sea. We were in need of developing it some way. It looked like we could do it economically with a TLP on the basis of the preliminary work that we did. We could do it cheaper than a conventional development, which was a real big plus. The technology looked like it could be done such that it would be a very viable way of going about it, and we could extend it into much deeper water at only slightly incremental cost grade, rather than [unclear].

JT: Adding tension cutters.

BC: We cut the material way down. The steel that went into the system was cut way down using the TLP system, and that's how we got there. We did develop it, but we ran into a welding problem during a process of construction that some folks deemed to be really severe. We went through an annealing process that was very costly. It ran the costs up.

JT: The heating of the steel?

BC: Annealing. It heated up and then [you] cool it down slowly so that it anneals and it doesn't develop cracks. That was very costly, and it really wasn't necessary.

JT: Let me ask you a question about—and this is from the *Crude Britannia* documentary. The disasters and the tragedy that had occurred in the North Sea prior to Hutton—

BC: The *Alexander Kielland*.

JT: The *Kielland*, the *Sea Gem*, there was a couple, two or three really big industry disasters that occurred prior to Hutton.

BC: Not *Sea Gem*.

JT: No?

BC: What was *Sea Gem*?

JT: *Sea Gem* was a BP platform, eight legs, and one of the legs broke, and the whole thing fell into the water and killed a few dozen people. That was in the 1970s [actually, 1965]. It was one of BP's first platforms.

But, nevertheless, from such a young industry in a country that so desperately needed oil and gas, an industry that had only been around for ten or fifteen years by the time Hutton came along, do you think that those disasters and the publicity that those disasters received in some way influenced the decision to make this Hutton, particularly the going back to the cracked wells and making sure that everything was absolutely perfect?

BC: Of course that was the motivation. But, you know, hardly any well occurs without having some cracking, and if you're trying to do away with all cracking, every single bit, it can be very costly and achieve very little for you in terms of strength or maintaining the strength over the production life. Hutton, it's safe to say that the platform never had a single crack in all of its operating years, and, of course, the field's now depleted and Hutton TLP is gone. It was salvaged. It's currently in the process of being salvaged in Scotland.

JT: For scrap?

BC: For scrap.

JT: I'll be. It appeared from the movie, at least, that the way that the management quickly adapted to that change in plans with the six-month delay in redoing the wells, how they decided to actually put the deck together, put the topsides together all in one place and barge it out instead of what they had originally designed.

BC: That was part of the original plan before we had a welding problem show up. The original plan was to do this. That's one of the huge advantages of the system. You can have the topsides being built the same time you're doing everything else. You can be drilling the wells, you can be building the topsides, and you can be building the platform, the hull, all simultaneously. When it gets ready to go together, you do it in quiet water and then you tow the whole thing out and you anchor it in place, takes just a few days, and the wells are already drilled. So you bring the wells up and you're in production very quickly. And this happened on Hutton.

JT: It says that ten wells were predrilled. So I'm assuming that with twenty-four wells total, that after production came on line from those ten, that Hutton commenced to drilling the additional fourteen?

BC: Right. That's correct.

JT: So I'm imagining that, I guess, Brown & Root had to lay a pipeline extension from Hutton to the Brent main pipeline to get the crude ashore. Is that what they did?

BC: Oh, boy, my memory's—we laid a pipeline. I think it was Brown & Root.

JT: Well, somebody had to lay an extension—

BC: That's right. We had to lay a pipeline.

JT: —from a riser out to the main—

BC: [unclear] pipeline to bring the oil ashore.

JT: What about the gas? Did it come ashore? Was it re-injected?

BC: The gas was re-injected.

JT: Was any of it used to run the facility?

BC: I'm sure it was, yes, absolutely. We always used produced fuel.

[Begin File 3]

JT: This is one of the questions that I have. If we're looking at the transition from a big fixed platform like a Shell Cognac, going to something different, one of the things that I noticed, as you just mentioned, Mr. Curtis, is the roughly twenty-five days it took from load-out to first production for the Hutton TLP versus nearly two years for installing Cognac in its three pieces over two different hurricane seasons in the late 1970s. So just kind of, if you wouldn't mind, elaborating on the real cost benefits of getting a system in place so quickly, to get that first oil out in time, as opposed to waiting significantly longer, a year or even two years.

BC: Every single operator that I'm acquainted with evaluates every project on how much time it's going to take. Your capital input starts going in and accumulates. How much does it accumulate before you start receiving anything back? And in the case of bottom-founded platforms, as just mentioned by you, it takes up to several years to get production going from them. You can have a huge sum of capital invested with nothing coming back. Well, you do have a huge sum of capital invested in the TLP concept also, but you start getting it back very quickly, because you can pre-drill the wells and bring it up quickly and go on production rapidly, which then gives you an income stream that plays against the capital cost that you've just incurred.

JT: In reading that article about the air drone, did at least that concept in any way influence some of the decisions that you guys made in the seventies when you were thinking about a TLP-type floating option?

BC: Yes, it influenced the decision because it had been patented and the patent had expired, so we knew we were in safe ground using the concept. But we didn't really know very much about it. All we knew was that he [inventor of the proto-TLP, "seadrome" idea] had the patents on this concept, the general concept. I was unaware at that time that he actually had gone to the oil companies trying to sell this to them. I did not know that till this article appeared and they mentioned the technology. But he was a very innovative gentleman for sure, and he was bold also. To put in air drones in the middle of the Atlantic Ocean takes a lot of boldness. I was accused of that by folks in Great Britain, of being pretty bold to put in a TLP in the North Sea, and they were right; it was bold. I wouldn't have done it without really carefully considering everything. We did carefully look at everything, and we executed. We knew we could do it, and we executed beautifully.

JT: Was there a moment in maybe that ten-year period of time when you guys were thinking about getting out of the box? Was there a moment that you recall, even to today, Mr. Curtis, sort of a eureka moment when you were able to place in your mind from your experience that this TLP was going to work? Is there something that takes you back to those days that you remember something like that?

BC: I really didn't reach the point that the TLP would work until the late seventies. I was sure that we could do it in a permanent installation. You can do a lot of things on a temporary installation, like drilling semi-submersibles, but you can't do something permanent unless they can withstand every single sea state that comes along.

Once we started the Hutton project, I was confident we could do it. If we executed properly, we could do it. Now, I was very, very confident that the team we put together in London and Britain would do the job well, so I felt confident. People called me crazy from time to time, but, nevertheless, the cat was out of the bag and we had to go. But I did, I came to the conclusion on my own, pretty much, and directed the thought processes of others that we were going to have to get away from this business of manned intervention on the seafloor and trying to maintain an atmospheric pressure environment in which people could work. It just was not going to do it. There was no way we were going to get people to go down there every day or even every week. So I quickly got that out. I just discarded it very quickly in my own mind, which put us back to the air-water interface, so I didn't waste any time exploring other things. I said, "Let's put our energy there," and that's what we did.

JT: One of the things that I'd picked out from some of the published materials was the idea of building a system that made it easier to do inspections. Talk a little bit about putting that into the design concept when you build a system like this that's designed to last twenty or thirty years in a harsh environment like the North Sea, and having the ability to inspect it and maintain it every year to make sure the quality control is keeping up. Talk a little bit about that. That sounded like something that was very innovative.

BC: Well, going in, there was a major problem. When you talk about a real high sea state where the waves are fifty to a hundred feet from trough to peak and it goes on for lots of hours, you can see that you're dealing with a fatigue system. It's a natural fatigue system, because if you have a platform that's floating on the top and it's moving back and forth with a wave system, and it's being restrained by tethers, in our case, the tethers are being subjected to stresses and strains, oscillating stresses and strains of high magnitude. So we quickly decided we had to do something to compensate for that both in the risers that were for the wells and in the tethers that were to hold the platform in place on station during all sea states. We did a lot of investigating about what existed that could really take this SN curve out of the system.

JT: SN?

BC: That's a metallurgical term for fatigue. We hunted around and we found this little place up in Alaska where they had a dock up there that they were using elastomeric joints in the dock, and they were made by a company back in the Midwest. We called them elastomeric joints because they were steel-rubber layers that could move. If we put these elastomeric joints on the bottom and the top of the columns that we were fixing to the bottom, they would take the motion without extending it to the piece that's holding it in.

JT: So it's flex joints on the top and on the bottom.

BC: That's what we were looking at, yes. We didn't end up doing that. We ended up with the flex joints on the bottom, but not always on the top. But we did provide for a means of letting the wellheads move with a Vetco system, motion compensation. But that's how we dealt with this problem.

JT: That was more of hydraulics, correct, the Vetco system?

BC: Well, it was hydraulics and the mechanical system allowing the motions without fatiguing the casing or the production part. So this worked pretty good.

We ran tests. Vetco helped us run tests, and Well States ran tests on the elastomeric joints, and with these in place we had essentially accomplished that. We took the SN curve out of stationkeeping and allowed the motion to take place, and in the highest sea state, which was a hundred-year-period event with waves reaching as high as a hundred feet in height, we could have an excursion of several meters. I can't even remember now, but it was over a hundred meters of excursion. Of course, that excursion forced us to realize another problem we had to account for, and that was what we called the air gap for a wave to pass underneath the deck of the platform, and that kind of is a limiting factor nowadays on where you can do it. If we had more air gap, we could take this to much deeper water.

JT: In reading all of this stuff and viewing the movies and talking with you previously, it sounds to me like that the key factor in making a TLP in the North Sea successful is controlling movement.

BC: That was the base problem. It's called stationkeeping, keeping the station for thirty years, allowing people to be aboard during the worst storms possible, which is not even done in the Gulf of Mexico. They still evacuate people. But in the North Sea we could not do that. We had to let people stay on there through the worst of all storms, and we had to be assured that it would be okay and that life would be sustained; there wouldn't be any great catastrophic events occur. We also had a worry that was investigated about the motion of the TLP. It's a unique motion. It's lateral, but does not have any heave, and man was not used to that motion. So we had to run tests on that also.

JT: From what I remember, as long as the buoyancy of the facility was not greater than the weight of the facility in addition to the actual mechanical tethers, that kept the platform from wanting to go up and down, is that correct?

BC: You had to have an excess of buoyancy. It's an excess of buoyancy that's a basic principle that you operate on in a TLP. For whatever the sea-state design is, you've got to make sure that you have enough buoyancy to go the full swing and still retain tension in the tethers, which is not too hard to do. You build the hull bigger, bigger diameter on the columns, and more buoyancy. So if you need more buoyancy, you just have to build it in. It does make the cost rise, however.

JT: So the drawstrings, the drill collars, were screwed in together, but yet the flexibility of the system is in its anchored base and the hydraulic systems on the actual hull that allows it to move around.

BC: These were joints of kind of like drill collars that we put together and fastened to the seafloor in a latch joint with an elastomeric joint to take the motion and fasten them in the columns. That way we could do down the columns and do this. This was interior.

JT: You could actually go and inspect all the way down, correct, through the column?

BC: We could inspect everything in the column internally. We had to use cameras to inspect the tethers to the seafloor, or send a diver down. We could, in Hutton's case, send a diver, but we did not. To my knowledge, we never had any event take place that required any unusual intervention. We did have a tether that had to be replaced. One tether had to be replaced.

JT: That's an article on that.

BC: Other than that, in the entire life that it was in place, there wasn't anything that happened.

JT: Amazing.

BC: We went through a lot of big storms.

JT: Yes, there were a couple articles that mentioned that. I want to go back to the actual areas where this facility was built and constructed. It was built in two parts, as we know. This is from the *Britannia* movie. Tell me a little bit about your own experience and observations about what the documentary *Brittania, Crude Brittania*, describes as the invasion of the cowboys from Texas and the coonasses from Louisiana. Talk a little bit about how the experience of the Texans and the Louisianans in the Gulf of Mexico, how they were able to bring not only that work ethic, but the actual experience of working for fifty years offshore in the Gulf of Mexico and bring that to a newly developing offshore region like the North Sea, and how the managers and the foremen and the tool pushers and the designers and the engineers were able to interact with the local workers and the people who weren't, let's say, as experienced in the operations.

BC: As the documentary on British oil points out, they viewed the American as flamboyant and cavalier in many respects. But the thing that they brought to the system was the know-how and the confidence. They were confident we could do things. The British weren't that confident, or they didn't seem to be at the time, but their confidence grew steadily as we were able to execute on various jobs in the North Sea. That passed on to a segment of the British population that now lives there, and they know these things can be done, too, now. So we brought to the table know-how and confidence.

JT: That confidence, is that a pattern that built up in the Gulf of Mexico as the companies were able to gradually move further into deeper water over a fifty-year period? Would you peg it at that as maybe a main factor for the confidence?

BC: Well, I think seeing us do things or helping them do things in that early period was a big motivator for them. There was a transplantation that took place, I think, in this process that really helped them. Of course, the British are not new to oil development around the world. British Petroleum is a big producer in the Middle East, huge quantities of oil and great big reservoirs over there that they found and develop. So they were not inexperienced at all at this. In dealing with the North Sea, everybody thought that that's the worst possible weather environment you could ever get yourself into, was in the North Sea. Trying to find something that would withstand this environmental system, in the British eyes, this was not even maybe possible to begin with.

JT: But the Americans and the Texans and the Louisianans, they had worked in the Gulf of Mexico for two generations.

BC: All you had to do was get enough steel beef and you could do it. That's kind of the base thought. It was a lot more complicated than that, but we did it.

[Begin File 4]

JT: That was what I was trying to get at with that question, is, yes, many of these companies, even the Brits, had long been experienced in oil and gas development, but most of it had been on land.

BC: That's true.

JT: The North Sea had only just recently opened up in the late sixties, some of the big gas finds, the forties development, as you mentioned.

BC: It was the Americans that had the basic experience from the Gulf of Mexico.

JT: I don't know how much you were involved with this, but I ran across this in one of the articles, and I thought I'd mentioned this or at least have you elaborate on it. One of the articles mentions about the contracting scheme that was used with the Murchison project and that this was the template that, I'm assuming, Conoco and the consortium used to build the Hutton or to have Brown & Root and McDermott build the actual project. Do you recall maybe some of how the contracting worked with some of those companies?

BC: We never turnkeyed. Conoco did not turnkey to the engineering companies. We had people in the engineering offices all the way through the design process, and it was a two-way street, input from both the contractor and from the producer in the design if you run into problems. Conoco was very good at this and we interfaced with them. Every place where a technical discipline intermeshed with another, we assisted to make sure that that process went smoothly and there were no gaps. There were no balls dropped in that sense. This was a little bit different than had been done up to this point, but it was necessary from Conoco's point of view. Since we were the ones that were going to be responsible when it all ended, we felt the need to be sure that everything fit. So, therefore, we entered the engineering process by having our own people on site.

JT: That had also been used at this Murchison project?

BC: Yes.

JT: Where was that?

BC: It was real close to Hutton, five hundred feet of water.

JT: Using a fixed platform?

BC: Fixed platform. But it was a real nice reservoir. I mean, we had a lot more oil in place and we were able to just use a conventional system. It was first. It was developed first. Hutton's second.

JT: So the contracting there, again, you're talking about working interdisciplinary with the contractors and the engineer from the operating companies to kind of like, as you mentioned, form—

BC: Yes. Remember, we, Conoco, had done the preliminary engineering work. The concept work had been done by us before it ever got to Brown & Root or J Ray McDermott over there. We brought into the shop how to do it.

JT: You guys were the experts.

BC: Well, there wasn't any experts because it'd never been done, but we had done the investigative work and put together a concept and all of its interfacing pieces that would work, and we knew this. The rest of them could not have known that; they had never done this. So that became the template of pursuit on the detailed engineering, and we sent people out of that team that we had here and developing this to that team.

JT: Did y'all guys use that same strategy for Jolliet later on in the Gulf?

BC: Pretty much.

JT: Because in the article it says it was successful and cost-effective in using that kind of strategy.

BC: Well, it wasn't one of the nice big reservoirs like Shell found. It was limited resource space again, and we had to cut the cost down. We felt that the big job going forth from Hutton was to cut the cost down.

JT: Which meant cutting the steel.

BC: We had successfully done the steel, but we'd put so much into quality that the costs weren't as low as we thought they ought to be. We figured that the TLP concept could be, certainly on water depths going 2,000 feet and beyond, or 1,500 feet and beyond, would be way more economic than anything else that they could—

JT: So aside from the cracked welding issue that caused some delay and some cost overruns, was that the only—

BC: That was the only major problem we had, which is a shame, because it was during a time when inflation was running wild. I don't know if you remember this or not, but late seventies, early eighties, inflation was double digit, so it was tough.

JT: Let's move on to the Jolliet. You had mentioned a couple of names. One is Andrew Hunter. We'll see if we can track him down. But just to give me your general impression, because you were there, Mr. Curtis, tell me about applying

Hutton technology to the Gulf of Mexico, first of all, before we actually get into the details of Jolliet.

BC: Well, it's the same technology. It's the same technology that we used at Hutton, except we made a couple major changes. One, we decided it was unnecessary to go inside the columns and anchor the tethers. We could anchor them to the base of the columns and fix them, fix them on the sides, which is what we did. We also decided we could weld the tethers. Instead of having joints, we would weld one piece and just pull it out and then sink them and put them upright and tether them in. We did know that we needed the flex joints at the bottom, which we carried forth with, but we fixed the anchor point on the columns in Jolliet.

Jolliet was really just a well platform, because the reserve would not support the kind of investment needed to have a full-fledged platform. So we had a test system and a small rig on the platform and minimum process, and some pump and compression so we could send the well flowing on to a platform in shallow water.

JT: So Hutton was a full process.

BC: Full process, everything.

JT: Separate oil and gas.

BC: Yes, drilling, everything.

JT: Treated, everything, and sent almost a finished crude product.

BC: Yes.

JT: Whereas Jolliet was simply get the product out of the ground and just serve as kind of a conduit.

BC: Just initial processing and just move it over to a shallower platform for final processing.

JT: But, again, it was an experiment.

BC: You could put a big rig on there, but it was a workover rig. We could do any workover, and you could do a little drilling, but it was minimal. But it was a rig that could interface with all the wells.

JT: How many wells at Jolliet?

BC: We drilled them all.

JT: Do you remember how many it was?

BC: No, I don't. It was several wells, though.

JT: A few dozen, maybe?

BC: I don't remember how many wells. I wasn't directly—you know, my interest had waned because I knew we could do it, and it didn't bother me. There were a couple things that I followed, one of which was this business of welding the tethers and pulling them out, which was a neat idea and is done subsequently by about everybody.

JT: Welding them onshore and then—

BC: Yes, and just pulling them up.

JT: A thousand foot or 2,000-foot sections? Just like they used to do with the old pipelines back in the fifties.

BC: That's right.

JT: Weld them on the beach and use a tugboat to pull them out.

BC: That's what we did. And we lost one. [laughs]

JT: Oh, it sunk?

BC: But we recovered it.

JT: So if you look at the legs of the hull for Jolliet, it only had four legs instead of six like Hutton, correct?

CB: And Hutton didn't need six either.

JT: Right. You had kind of mentioned that. Instead of putting all the equipment to install the tethered legs inside of the cans, you guys had them attached to the outside of the hull in Jolliet.

BC: Yes, the base of the exterior column.

JT: So the tendons, the tethers, attached to each [unclear].

BC: We could have gone to a lower number of tethers, but we still stayed with three tethers per corner. This is redundancy.

JT: It seemed like everything went right with Hutton, except, of course, with the weld crack. What changes, in addition to the ones you just mentioned, in the actual physical design of the TLP? I know reducing the weight was one factor that—

BC: Cutting the cost. We cut the cost way back.

JT: What about the main components like the tensioners? Did that technology advance at all from Hutton to—

BC: We didn't have to deal with as high a sea state in the Gulf of Mexico as we did in the North Sea. So the environmental state, it was still a hundred-year-period design. As a matter of fact, it approached the thousand-year-period design. But the maximum sea state in the Gulf of Mexico is not as big as the North Sea.

JT: I had read an article that talks about permanently mooring a tanker on the side of Jolliet for worker quarters and for other equipment. Can you tell me how those two integrated?

BC: You mean during the construction?

JT: It was during the construction?

BC: They had something out there. I thought it was a semi-submersible, but maybe it wasn't.

JT: The article mentioned a tanker. That wasn't permanently? It says it was a permanently moored tanker.

BC: Yes, they were shuttled back and forth. They produced the oil into the tanker and shuttled it back and forth.

JT: So no pipeline?

BC: No pipeline.

JT: What about the gas?

BC: Well, wait a minute now. That's not right. We had pipelines from Jolliet to the shallower platform that took the oil and the gas and the water for processing, and from that shallower platform there was a gas pipeline and there was an oil pipeline sent to shore.

JT: I'll have to look into what they're talking about this tanker. They said a permanently moored tanker, that's what one of the articles mentioned, that housed additional equipment and accommodations.

BC: Well, maybe during construction they might have had something like that, but it wasn't permanent. It wasn't something we left out there.

JT: So it wasn't nothing else in addition to the Jolliet TLP?

BC: Not that I'm aware of, no.

JT: You had mentioned to me last time I was here, and if you feel uncomfortable about answering it, that's fine, but one of the questions that I have is how did Shell come into this TLP technology? In other words, was there any interaction between Conoco engineers, yourself included, or others? Was there any interaction of sharing data, sharing technology between those involved in Hutton and Jolliet with those involved in Auger and Mars?

BC: Of course, I'm not a Shell person and I don't know how they did it internally exactly, but I could see glimpse of interfaces when they were under way. We offered the technology, but we wanted money for it. We offered it to Shell and to Exxon, and both declined to do it. It was pretty reasonable, I thought. But what Shell did was they hired some of the same contractors we had and they hired some of Conoco's people.

JT: Right. Like McDermott.

BC: This gave them a way to it. We published papers on Hutton. It wasn't that we were trying to keep things secret. We wanted the industry to take this system and really apply it, because it opened the door to lots of areas in the world of deepwater, and a whole world industry could benefit from it. That was the way we felt, and I thought that was pretty benevolent on our part.

JT: That's a good place to stop. You had mentioned Andrew Hunter at Jolliet. Are there any other people?

BC: Jack Mercier. He was in this film.

JT: I have his name.

BC: He was a naval architect. He was a key guy. He was one of the first ones, and I used him for other things besides just the Hutton project. He went with the project.

JT: You're still in contact with him; is that right?

BC: Yes, I just had lunch with him or dinner with him not too long ago. I asked him if he'd be interested, and he said he didn't know. He said maybe so.

JT: He was a naval architect.

BC: Yes. I can give you his phone number if you want to call him.

JT: He was involved in the hull design, probably, for Hutton?

BC: Primarily Hutton, yes. Not the topsides.

JT: What about the hull? Do you think he was involved in the Jolliet hull?

BC: No, I don't think. No, he was—

JT: But he would probably know who was.

BC: There's a lot of these folks. I'm trying to think of the fellow we seconded from Gulf into the system. He runs a consulting company right now on TLPs. But my mind—oh, boy.

JT: I'm going to put a stop on this. It's a good place to stop.

[End of interview]