KENNEDY SPACE CENTER

INTERVIEW OF

JOSEPH A. BROWN

APRIL 15, 2003

DR. MIDDLETON: This is an interview with Joseph A. Brown on April 15, 2003.

MR. BROWN: I don't know whether you saw this or not. That's the article about the refurbishment of facilities.

DR. MIDDLETON: Oh great. And this was taken from what periodical? *Florida Today*? Okay.

MR. BROWN: I've got it referenced.

DR. MIDDLETON: Oh, *Florida Today.*

MR. BROWN: I got it dated on the back of the paper.

DR. MIDDLETON: Okay.

MR. BROWN: I made that as a special reference.

MR. BROWN: You asked for my name and so forth, let me repeat it. It's right up here at the top.

DR. MIDDLETON: Okay, that's fine.

MR. BROWN: You need my website? Okay, born in Washington D.C.

DR. MIDDLETON: And you grew up there?

MR. BROWN: I was raised in Washington and Tampa. Raised in Washington till I was about ten years old, around 1944, when we moved to Tampa, 1944-45. My mind's lost a year in memory because of some stress in the family and the War and everything. My Dad was overseas and we thought he was killed and my Mom, and so it was a year of, somewhere between '44 and '45 that we moved to Tampa after he got out of the service.

DR. MIDDLETON: Your Dad came back but he was Missing in Action?

MR. BROWN: Yes, they thought his ship was torpedoed.

DR. MIDDLETON: Oh, okay.

MR. BROWN: And that had my Mom stressed out quite a bit consequently, and that affected the family. My parents occupations. My father, Mr. Andrew Brown, was a master plumber in Washington, Maryland and Virginia. He had his own business and – when he was drafted into the Service for World War II and because of my Mom's illness we went to Tampa after the War. So like (inaudible) of us and he was a master plumber in Tampa and he then became… After that he became a chief plumbing inspector and starting the Plumbing Inspectors Association for the State of Florida. He was also a member of Sanitary Engineers, which was Merit Society Sanitary Engineers and became the International Vice-President. And my Mom was Constance Brown, was a homemaker, but during the war when he was called into Service she had a job working in the (inaudible), general accounting office, in Washington within walking distance from where we lived and so she was working in there from around 1942- 43 to 1944- 45.

Did I build model airplanes and rockets? Yes. I remember more specifically an erector set that I used to make a lot of different things including an electric motor that had an elevator view of some kind and also interested in space flight. Our high school annual in 1951 had Sputnik on the cover and it was quite controversial because our colors were red and black, that they chose because of space green and black.

DR. MIDDLETON: What was your high school?

MR. BROWN: Hillsborough High School.

DR. MIDDLETON: Hillsborough?

MR. BROWN: In Tampa.

DR. MIDDLETON: Okay, I know that high school.

MR. BROWN: It's one my Mom had gone to. She was born and raised in Tampa and my Dad was Italian, born in Sicily and his family moved to Tampa but he was, I guess. My grandfather died during World War I apparently, and then my Grandmother remarried someone here in America. And after she had married then he came over with my other uncle. So I guess we were immigrants.

The first launch of the Shuttle. After waiting twelve years another impossible dream comes true. I'm trying to. I guess the simple answer was a long wait because of (inaudible) and we had different problems with the (inaudible) The tile delays and some other things and started working in the 70s, right after the Apollo landing. We were starting to work on the shuttle at that time and we had the Sky Lab that was destroyed because it came down, because we didn't get up there in time to go ahead and save it like we had hoped we could do, because of funding delays.

DR. MIDDLETON: Oh, I see.

MR. BROWN: And that was frustrating.

DR. MIDDLETON: What do you think Sky Lab (inaudible)?

MR. BROWN: They use something. It was in the mid 70s, I believe, we were in the moon program from what 1969 to about 1973-74, and I'm still, my memory for some of those dates, but then we had. I think it was just one Sky Lab, but we had three missions to it or something like that. That we had to use the milk stool, as we

called it, to raise up, we didn't use the lower stage of the Saturn - Apollo, but we raised it up use that and we called it a milk stool. Later we found out that in Huntsville, they called it a bar stool. A three-legged stool. The different engineers that were working on it and.

DR. MIDDLETON: It had a platform?

MR. BROWN: It was like a structural steel stool that they set the vehicle on. There was a hole in the middle so that the exhaust could go through it, so we didn't have to change configurations and launch pads and everything.

DR. MIDDLETON: Okay.

MR. BROWN: So when you go on to the upper stages, not the lower stage, cause we weren't going to the moon, so we used that and that allowed us to go ahead and use the existing, basically the existing (inaudible).

DR. MIDDLETON: So, you didn't have to configure a whole new rocket?

MR. BROWN: We did for the Space Station. The Space Shuttle.

DR. MIDDLETON: Space Shuttle.

MR. BROWN: My title, develop. I got to read this one.

DR. MIDDLETON: So, when you first came to Kennedy Space Center. First of all, did you come before it was Kennedy Space Center?

MR. BROWN: Yes. Merritt Island Launch area, I think was the name of it.

DR. MIDDLETON: Merritt Island Launch area. You were working with the Corp.

MR. BROWN: I was working with a contractor in Jacksonville but we went through that fast. Building churches, schools warehouses and so forth. Okay, I built a house in Jacksonville right now the street from (inaudible) Cassidy (phonetic), our neighbor who worked for the Corp. of Engineers and then he saw whatever I was doing and we chatted construction and shared idea. He said, Joe, we have openings down in Merritt Island for the construction of the Space Program, the Apollo. And I was a little reluctant, but I went ahead and filled out the application and got graded on that as a structural engineer and because of that, they hired me as a structural engineer, even though I was cost estimating for the most part, but I had done design work (inaudible). And that's one of the reasons they gave me an upgrade as opposed to a civil engineer or a construction engineer and it meant a big difference later on. So, we came down to (Inaudible) around July of '62. When the Corp. office moved down here. It was either '62 or '63. I remember it was the July 4th weekend and we were down here for several months before our houses were built, and we came down and worked on the bidding. They had started design on some of this stuff up in Jacksonville, I believe and we came down here. We actually bid the VAB from down here at Kennedy, I mean on Merritt Island Launch area, the bids came in. And from that movie that you saw the big challenge here, covered a lot of the background in there. So, but I was working for four years with the Corp. of Engineers.

DR. MIDDLETON: Okay, so you worked with the Corp. for three years?

MR. BROWN: Right, and then. First off, a year after I was there I got bumped because there was a lay off and a structural engineer was bumped and another structural engineer estimator and he bumped me, so I think after the first year I was about to leave and I interviewed. I could have gone up to Jacksonville, no, to Savannah, Georgia, except I would have been the eleventh GS11 Cost Engineer, or Cost Estimator, and that didn't seem too promising. But as luck would have it, Jim Rivere (phonetic) who was supposed to bump me, came to work for NASA in '63 or '64, in that same time frame, and because he came here, they didn't have to bump me, so they gave me a reason to stay, instead of going to Savannah. So that's, and then I stayed there for another three years with 9GS11 and that's when I got an offer to go here with NASA as a GS12. There was another guy, John Henry. I'll call him, we called him the Riverboat gambler and he taught me (inaudible) law, which is a very basic in cost engineering. Basically you got 20 percent of the continuance of a cost (inaudible) of many (inaudible) contained 80 percent of the cost items, or of the major items, so if you get that 20 percent right, and those are the biggest items, then you're gonna be a lot more accurate, so you concentrate on that twenty-percent. Continuance, it's a general term, but we use it in terms of costing, estimating and reviewing. Because he was already a twelve and they wanted to give a promotion rather than a lateral, then they brought me to NASA as a GS12.

DR. MIDDLETON: What year was that?

MR. BROWN: It was around April of 1967, but you can check the resume more specifically on some of that.

DR. MIDDLETON: I will.

MR. BROWN: When I came over, three or four mechanical engineers came over same time I did and there were several (inaudible) that come over.

DR. MIDDLETON: John Henry?

MR. BROWN: No, the other one. The structural engineer, Jim Reaves (phonetic).

DR. MIDDLETON: Jim Reaves (phonetic)?

MR. BROWN: Maybe. Jim Rivera, Jim Rivera (phonetic). He's the one who was the main estimator for the VAB and I worked with him when we were doing the VAB for the Corp., and then Bob Barnini (phonetic), who I was working with on the Big Challenge. I came over and there was hundred, twenty to a hundred or so, that came over from the Corp. The Corp. phased down and then left, as you know, and some of us stayed here. Went to Huntsville, back to Jacksonville, went to New Orleans and some other place. I'm not sure where we are now. But.

DR. MIDDLETON: You are on Number 6.

MR. BROWN: Okay, my duties. KSC cost engineering, ground support equipment. Preparing, reviewing and approving cost estimates for cost control, bidding and awards, responsible for KSC cost data. Thee specifications, estimating specs for construction for ground support equipment. Over three hundred monthly cost indexes. We were doing the cost indexes. I created this and developed this in 1974 and it was indexing the (inaudible) cost of twenty or so items of (inaudible). The (inaudible) payroll taxes, one of the unusual ones. None of the other ones had payroll taxes in 'em, and we had some productivity in some of them. And about twenty-four material cost items and

so, we starting pricing that so that we could escalate, because if one chart on their (**inaudible rest of sentence**). We, I think, we may have been a little bit ahead of time because construction went up first, and we were told that and said we needed to do something about construction cost escalation. And we formed different committees and different education processes and everything, and education is the main thing to be used in escalation. Escalation, education, computerization, productivity improvements, construction methods and so forth, we had this list and everything. I would have a seminar or whatever, we'd take a vote, and I recorded those votes through History. We kept on, and now we can go back and figure out we beat inflation because of all these things that we did. And it's hard to say whether education or computerization or which may have been the biggest factor, but that's also documented in some of the books, but the cost index was an outgrowth of that, in 1971 or 1970, when we started the data on escalation.

In 1974, Howard Gates (phonetic) who had worked on the Empire State Building, who was with NASA, he said, Joe you're one of the promoters around here, you're gonna have to have some kind of a cost data. Sort of a power play, or political aspect. Otherwise you're just gonna be one of the names, and estimators don't know me very far up in the line, when you consider the previews and critical designers and so forth. So, I created the KSC Cost Index in '74 and subsequent to that we also used that index as a communications tool and a price book - we started documenting the cost and then we ended up with the full price books from that Cost Index.

DR. MIDDLETON: And these were used in the whole aerospace industry?

MR. BROWN: Right. Mainly here at Kennedy because it wasn't any documents of cost data, and we mentioned the narrow. Some of those up here, but I've got them on CD's now, but APB is my volume 1, 2, 3, 4. In those aerospace price books Number One, was basic architectural structural and how to make conceptual estimate. Volume 2 is Mechanical and Electrical estimating. Volume 3 is the System Summaries of three hundred difference projects, which you saw a couple in the video, except now that we got a new system summary. Was right around here in the center of the small one, that we just did. We got the color. This is for the OPF. OSP Number 1, Number 2, that we're designing now - building.

DR. MIDDLETON: The OSP?

MR. BROWN: Operations Support Building.

DR. MIDDLETON: Okay. Where is that going to go?

MR. BROWN: Right there near OSP1, near where the old Saturn 5 used to be, and that's quite a controversial building and getting back to the budget, we budgeted it. We told them we could build it for about $45 million. They said, no we're gonna do it ourselves and do it our way and they went and they have a nice monument, and it's only four stories instead of just six that we proposed. And then they end up costly pretty much what we told them in the first place, but.

DR. MIDDLETON: Who did the construction?

MR. BROWN: It ongoing right now. Another low bidder story, David Bowen (phonetic) is the low bidder – about $24 million. Low awarded bidder. The low bidder was $22 million but because he was in a HUD zone (inaudible). He had a small

business set aside. They gave it to him even though he… because they give a 10 percent premium if you're from a HUD zone. So you can be up to 10 percent over the low bidder and still get the job, and that's quite a controversial thing. So, for around $24 million for that, but then you got all the other stuff, so it's gonna be near $40-45 million when they finish with all the (inaudible), cause that's just the building and it doesn't include a lot of the activation and some other things that we're doing or the change order upon the activation (inaudible)

DR. MIDDLETON: All right.

MR. BROWN: I've gotten off here a little bit.

DR. MIDDLETON: You're on Number 7. Since I'm interested in your shuttle years, how would you compare the shuttle years to the Apollo?

MR. BROWN: Well, that's a little different. Let me read you the first answer first, and then I'll fill in.

DR. MIDDLETON: All right.

MR. BROWN: As I said, the shuttle years were challenging and depressing, and we lost a Sky Lab and also we had the Challenger accident. We were frustrated with the delays in funding in 1970 to 1975 when we started our… in 1974 we started the Shuttle Facility Construction, but we had great successes. It's a good transportation system, but I wish it could be cheaper for greater space exploration and eventually (inaudible rest of sentence). The first shuttle launch was a good birthday present to Mom (inaudible) who was here from Jacksonville to celebrate her birthday. It wasn't necessarily planned but that's one of the things I remember about the first shuttle

launch. Now comparing the shuttle launch to the Apollo - the Apollo was a fast paced program from the 1960s to the 70s and I was learning, youthful learning and everything. And everything was new and exciting. The shuttle years as opposed to that were frustrating with the delays in the (inaudible). Cause after we'd gone to the moon, what else were we gonna do, and why did we need a space (inaudible) So consequently, the funding aspects were bothersome.

The tile delay was actually frustrating but the construction was interesting in that we had budgeted in the '70 for the total Space Shuttle construction, at around a $150 million, but escalated to $250 million. In the meantime we budgeted for Vandenberg and we budgeted at around $750 million, because they did have the facilities that we had here. We were going to use existing. With escalation to about $1.5 billion. And I may be getting ahead of myself but the facilities at Vandenberg , (inaudible), Space Launch Complex Number 6 ended up costing $6.6 billion. As I said, it was budgeted and built for $225 or $250 million. I considered the difference from the budgets and to the actual, that we saved teamwork, cost control and cost engineering and I worked (inaudible) because we had more responsibility.

Whereas in the DOD Programs, they keep on changing people every year or two, and because of that loss of continuity and responsibility for the program, and the different changes and maybe some DOD special requirements. The $6.6 billion is maybe one of the secrets that has not been exposed to public information. That's the best information I've been able to get on the total cost of it, so when you compare the two differences I consider, in essence, instead of saving the millions that I had said, in the video, it might have been closer to $5.5 billion and that's what I'm (inaudible). Because we were so

busy working on it, and we were doing ours, we helped them whenever we could with the Shuttle Facilities there. We didn't have the responsibility - the management. When NASA had the budget limitation to see about budgeting process and everything and the cost control and any time you were out of budget or something you had to go back and rework it and we did in many cases. We worked designs to use in the existing, and to keep our costs within the budget that we had set up.

DR. MIDDLETON: (Inaudible question) The funding was not there, was it more difficult NASA to get funding than say the Department of Defense?

MR. BROWN: I think it's a lot more difficult for NASA to get funding than DOD. One of the answers to that may be the secrecy of the process. The other answer is the lack of cost control and responsibility. Although when they did switch to the EELV Program, which is now underway, with the Atlas 5 and Delta 4.

DR. MIDDLETON: ELV – Expendable?

MR. BROWN: Evolved Expendable Launch Vehicles.

DR. MIDDLETON: How long is that program going to?

MR. BROWN: When I came to work here, they flew me out to Denver to work on it from Martin Marietta, Lockheed Martin rather, in 1996. It was underway in July of '96 and I'm gonna say it could have been six months or more underway at that time. In the time when I was retired. After I retired from NASA in '95, then this program was revolving and I didn't get back into it until they flew me out there and then I got involved in the middle of it comparing and analyzing the estimates that they had for the Launch Complex 40. I believe it was 40 or 41 and 34 – 37 that the Delta's under.

And I was helping the DOD and Lockheed determine the cost of the facilities and reviewing the budget conceptuals and their estimates, and fine tune 'em, because they really have two different estimates. One was high and one was low and they wanted to know which one was right, and so in the quick analysis of two weeks, I was able to come up with analyzing and the factors we had a Kennedy, that they didn't consider, as well as the productivity and other things that we had as opposed to California because we were building that here, and in California. That was budgets and the conceptual to the launch pad at each range. (Both speakers talking at once)

DR. MIDDLETON: The EELV Program – Evolving Expendable Launch Vehicle – you think that's gonna be, sort of the wave of the future, or do you think it's a good idea to run a program like that concurrent with the Shuttle Program? Do the two programs compete for funding?

MR. BROWN: I think they are two differennt programs We call ours the Manned Space Program. Whereas the DOD, the EELV is unmanned, so that's the major difference in it. Although eventually the ELV – Expendable Launch Vehicles, back earlier than that, back when I made an estimate with them in the Air Force. Early on for a new launch pad and all new facilities, this has to be in the late 80s, and I wish I could remember better, but it was a (inaudible) secret that it was a whole new thing. It was something like $7 billion for facilities for a whole new program that would be launch out of Complex C and the vehicle was unknown at the time, but we were trying to budget estimate facilities as opposed to the EELV, which was a more limited DOD because I guess our great successes in minimizing the satellites and platforms and so forth. They didn't need the big weight that they had anticipated with the ELV and maybe the money

because also it would cost them a lot more. I'm gonna say that ELV may have been five to ten times more costly than what they are going now with the EELV Program.

So costing was a factor in that, and when they started out with the EELV and the first meeting I went to, it was, we do not want another $6.6 billion, and that was sort of setting the tone for cost engineering and cost control was gonna be more than (inaudible) the DOD program and apparently they did, and by having complications which is another big thing in cost (inaudible), the competition at that time, it was McDonnell Douglas and Lockheed Martin, which the McDonnell Douglas is now Boeing. So that competition also allowed them to build two different launch systems, but again their goals were, I think a $1,000 a pound to orbit. And I don't know that their there yet, but that was their goal, because presently we're still talking in the $5-10 thousand a pound payload to orbit. And the futuristic goal is a $100 a pound, but (inaudible) and quite a bit that has changed from that and the other aspect.

I think DOD is now relying on the commercial programs to provide more of the R and D effort and then just tag along, in some respect. Such as some of the satellite we're now using for communication their going ahead to use for the military purposes. Except that then they may take them and modify them in such a way to make them less venerable to interferences and so forth. They are two different programs, although I do recall back when we had the MOL program – the Manned Orbital Lab, which was a DOD program for Space Station and the Dinosaur Program, and this was back in the 60s. So they had the ideas of the (inaudible) before the Sky Lab and the Space Station, but there again, there were finding limitations. So, the funding has been an important part and still the internal battle between, the ELV - between the ELV and how important space was gonna

be and of course, the conventional man C&L operations of the past and still there's some talk every so often about changing the name of the Air Force to space agency or space force or something, as opposed to I forgot the exact names, but some space agency, space force, so there's still that intercal battle going on sometimes, and that may be a political thing. However it may evolve. I've gotten a little bit off from where we were.

DR. MIDDLETON: That's all right, I'm on Question 8. What were some of the modifications to the VAB from Apollo to Shuttle? Go ahead.

MR.BROWN: Okay, we changed the platform configuration from the big single Saturn hole to the solid boosters, the external tank and the orbiter. So, in order for the platform to wrap around you had a different configuration. We did use many of the platforms from the Apollo, but with major modifications the configuration modification changes, but we did use some new platforms required and some of them went to the graveyards.

DR. MIDDLETON: Where are the graveyards?

MR.BROWN: As I recall the graveyard was at LC 39, industrial area. Behind the LETF area, as I call it. I haven't been through that area recently to know whether they are there, rusting away or not, but they took I think, some of that from the graveyard. One of the pieces they took and put it in the Saturn 5 Museum, but that many have been part of the big service structure, as opposed to a platform. I'm not sure what happened to the platforms that we had taken to the graveyard, but their rusting away wherever they are and to me, that may be back to your later-on question, that would be an idea enclosed and kept. There are near the - at the Apollo Pride Museum.

DR. MIDDLETON: Right.

MR.BROWN: Apollo Saturn 5 Museum. Let's see, how much of the history material was utilized, and I'd say most of the platforms were utilized.

DR. MIDDLETON: Okay. And then I have a question here, I guess, related to cost and materials.

MR.BROWN: My record in Volume 5, page 74, with (inaudible) shows the VAB (inaudible) with $23.8 million. That was platform mods but it also included some external tank in the other bays. Testing and checking out of the external tanks.

DR. MIDDLETON: Go ahead.

MR.BROWN: I'm trying to remember how recently we've been in one of the bays we have a stand-by the stack, (inaudible) taking some of that capability so that we can have a place to put it, and the orbiter - if we had to bring it back from the launch pad, and have an enclosed place for a hurricane. And this was done since the hurricane, was it Floyd - that may have come through here. Just about came through here, and they realized the vulnerability through that and that's why we've been outfitted (inaudible) as stand by the stack.

DR. MIDDLETON: So Hurricane Floyd sort of influenced the refitting or, one of the projects?

MR.BROWN: But that was more current than (inaudible).

DR. MIDDLETON: Were there accidents during modifications?

MR.BROWN: There were some. I don't remember any details. But somebody reminded me recently that, one of the guys on one of the launch pad platforms

was welding and something moved in the wind and he fell down and killed himself, so that was a major one that I had forgotten about it. And that's one in particular that someone else reminded me of.

MR.BROWN: Is that why they have the high wind alert all the time out at Kennedy Space Center?

DR. MIDDLETON: Well, not just that (inaudible) but for foreign objects debris that we might have blowing around and could damage an orbiter or a shuttle. So we want to make sure we don't have any two-by-fours flying around, because anything like that poking into the insulation, as an example, or one of the tanks, it could be a critical thing and stop a mission. So, we are under constant alert to keep the (inaudible) down and not have anything possible flying around. Even a nail or something sometimes can make damage. So, the wind as well as the people, especially working in those high towers would be another reasons for those alerts.

DR. MIDDLETON: Was mostly (inaudible) involved, or you talk about the closed and the open shops in the video.

MR.BROWN: Right.

DR. MIDDLETON: And you made some modifications where they done by closed or open shop?

MR.BROWN: Each contractor had his own set-up. Some were closed shop and some were open shop. And I'd have to analyze each one of them and then I did in that video in the case of the open shop bidding for the High Bay two. I think it was

and they did say that was one of those (inaudible). I think it was something like 10 percent lower than the lowest bidder.

DR. MIDDLETON: Was the crawler modified?

MR.BROWN: No. I don't believe it was necessary. However, we are now doing about $20 million of upgrades in 2000 and one to 2010, to upgrade the crawler.

DR. MIDDLETON: What are you doing to the crawler?

MR.BROWN: We found recently that the (inaudible) cylinders at level the crawler on the way up and down. The critical state that keep the platform level has cracked bearings, so we're having to go in and replace. We're going back in inspection. We're going back and modifying the control room. New window, and sound reduction because sound is quite bad on that, and in today's efforts we're realizing the importance of sound reduction. And there's a list of some of the Shuttle upgrades that somebody recently gave me and I'm trying to remember. There's just a one page list of them and if I can pull it out. An example would be conditioning monitoring system, driver's cads, motor control center, exhaust ventilation radiators, rebuild pumps and motors, servo valve mods., light exhaust manifolds, HPAC system fire protection. New PLC's, replace air compressors, DC propellants systems controls, cab instrumentation upgrades, walls, vestibules and doors, control room displays, (inaudible) and temperature measurements, R&R the (inaudible) as I mentioned, and refurbish the shoes, the 3,000 pound or so, shoes that you see there.

DR. MIDDLETON: The shoes are on the bottom of it that turn around?

MR.BROWN: So, that's going up through 2010, over $20 million.

DR. MIDDLETON: This (inaudible) platform modified?

MR.BROWN: Yes as you recall, the three holes was part of it. It was something else (inaudible) We took the tower off of the mobile launcher of the platform and we put it on to the pad.

DR. MIDDLETON: Right.

MR.BROWN: The big service, the big towers. So, and the galaxy printing was part of that and I believe a piece of that tower, or a small part of it, may be there in the Saturn 5 Museum.

DR. MIDDLETON: Right. I think I've seen a picture of that.

MR.BROWN: Right and if you don't have it I may have another one here.

DR. MIDDLETON: I've got it on my email – your file. Were additional buildings required for the shuttle.

MR.BROWN: Yes, several new OPFs. Well, two OPFs were done during the first budget – they were built together at the same time, but they were two different bays and the third one was later built as, not a space refurbishing facility, but that was after, the other flows, when we had the four orbiters.

DR. MIDDLETON: Okay.

MR.BROWN: One and two cost $27.4 million and there was some miscellaneous facilities, shuttle landing (inaudible) not a building, but De -mate was an

important thing and again some of those could be seen in the OPF's, could be seen in the little bit of video.

DR. MIDDLETON: Did you deal with the contract administrator?

MR.BROWN: Yes, several times, on the government estimate, on the construction project. Mr. Bill Lowsey (phonetic) was a NASA (inaudible) manager in general and we had different contracting officers on many of the construction projects. As part of the government estimate, there was like several many, many on the spot awards, that were for excellent government estimates that were within five percent of the low bid. I have a list of some of them and I could give you an example. The importance of rewarding, even though it was a letter only, no money, to the engineers, the team work effort that we had in preparing the government estimates between the NASA engineers and the A&E engineers and the other engineers and construction managers that worked on the projects. The interesting side effect of those letters, it seemed like most people that I've written letters for eventually got awards and promotions, monetary awards and promotions, so they were doing a good job and it worked out even though – it was one of the small things I could do. But just writing a letter would make a big difference.

DR. MIDDLETON: Oh, yeah.

MR.BROWN: In a person's career.

DR. MIDDLETON: Did you think?

MR.BROWN: Let's go back a minute.

DR. MIDDLETON: Okay.

MR.BROWN: What was that like, I don't remember. Details, we had near one thousand bidding projects and we did a great many congratulations on our successful projects.

DR. MIDDLETON: Did things come in on schedule or were costs higher than anticipated?

MR.BROWN: The shuttle facilities were ahead of schedule and about two percent under budget and as I said, saved about $5.5 billion when compared to $6.6 billion for the West Coast facilities. We were ahead of schedule. One reason was because the Orbiter was late because of the tile probleDR. This delayed the first Shuttle, Columbia, and eased the construction schedule, but we had to. We did a great job of getting the facilities projects in, on or ahead of schedule. In fact, I remember one in particular. They wanted the impossible. They had a job that had to be done in thirty days and that's impossible for the government to award a contract and get it finished within the thirty day time frame, and with incentive that we had and the need for it the priority for it, we were able to get it awarded and the contract finished ahead of schedule.

DR. MIDDLETON: That's great.

MR.BROWN: So incentive (inaudible) construction and projects is one of the keys to successful construction if you want money and (inaudible schedule, are critical.

DR. MIDDLETON: The Officer of the Inspector General reports say that costing cannot be done, what are your thoughts?

MR.BROWN: I'd like to see that report.

DR. MIDDLETON: Okay.

MR.BROWN: But maybe we have done the impossible.

DR. MIDDLETON: I'll put a note to myself to find the report.

MR.BROWN: Maybe we've done the impossible since the VAB budget was $100 million and was completed for nearly $150 million. The shuttle budgeted for $250 million and was completed within 2 percent of the budget, saving the $5.5 billion. The Space Station processing was budgeted at $380 million and last information I had it was $355 million, and that's with a couple million dollars of being completed. And those were in to change orders, I believe were one of the reasons that's still hasn't been completed. The project was completed ahead of schedule in '94. We're still doing the (inaudible)

DR. MIDDLETON: Now the Space Station that's up there now.

MR.BROWN: I'm talking about the Space Station Processing Facility.

DR. MIDDLETON: Oh, the Processing Facility?

MR.BROWN: Because I need to differentiate. I'm construction and ground support equipment, but not the hardware and software and the launches aspect of it.

DR. MIDDLETON: Could I ask you a related question that I just have written down here. It regards the design engineering.

MR.BROWN: Okay.

DR. MIDDLETON: What kind of a relationship did you have with design engineers of the facility?

MR.BROWN: Well, we were the design engineers of the facilities. We called it Design Engineering.

DR. MIDDLETON: Okay, so it's called the same thing.

MR.BROWN: But you're talking different, construction, brick and mortar concrete and steel as opposed to the satellites or the payloads and the vehicles, which is a different engineering. Even though they are engineers that. When ever they needed facilities, yes, if they didn't need facilities, no.

DR. MIDDLETON: All right.

MR.BROWN: If they didn't need a cost estimate for the facilities, more specifically is when I got involved in it. Just like now we did get in one program for the DOD. We had to, they asked for our support. They knew configuration to put on piggy back of the 747, with special DOD payload, that was bigger than the orbiter and we got into a computer program price, I believe was the name of it, with them and try and come up with an estimate for designing testing the configuration, to be carried from one place to another on the back of a 747 , if we had that background with our orbiter, but it would still require testing and everything. It was a multi-billion dollar program just to put a figure, configuration on the back of a 747. So on occasion, we did get into it and it was the conceptual estimating part of it.

DR. MIDDLETON: Did you know Don Buchanan?

MR.BROWN: Buck Buchanan, as we called him.

DR. MIDDLETON: Okay, Buck Buchanan.

MR.BROWN: Yes, in fact I just saw him recently at a NASA Alumni League meeting and he was one of the main engineers, I believe for the crawler transporter and many of the other facilities in the budgeting and he was involved with the VAB budgeting too, I believe.

DR. MIDDLETON: Okay. That was a question that Ken had, he talked to him, and he wanted to know because he did a different kind of, I guess in his mind, it was just a facilities?

MR.BROWN: Well, he interfaced more with the engineers and designers for the launch vehicles. Then he would sort of come down and tell our managers what we needed and we'd come up with the design and the budgeting and more details of the facilities and he would then turn around and say, no, what are the assumptions and what configurations. I had, somewhere there's a, it goes back, when we budgeted for the (inaudible) facilities, we didn't have the detailed shuttle design. There was several different configurations and we had to make some assumptions on that. I'm just gonna give you here, cause I was just going through it just recently and I don't where – it's not here.

DR. MIDDLETON: Can I turn my tape over?

(THEREUPON THE TAPE WAS TURNED OVER)

MR.BROWN: As you can see here there's about seventeen different configurations for the shuttle.

DR. MIDDLETON: Um-hum

MR.BROWN: From eight-nine feet wide up to two hundred and eighteen feet high, and comparing it with the Saturn of three-hundred and sixty feet high, and it doesn't give the width of it, but a different configuration from what we were budgeting for facilities.

DR. MIDDLETON: Okay.

MR.BROWN: So that was one of the things that we had to make some assumptions of which one was the most likely candidate and budget our facilities and not recognizing the change and this was one of the difficulty factors and why we were lucky to come in with as accurate an estimate as we did. Remembering there were so many configurations we had to budget to.

DR. MIDDLETON: Did you deal with the accounting department?

MR.BROWN: I don't remember dealing with the accounting department.

DR. MIDDLETON: Okay.

MR.BROWN: And did they have automation at the time? I can remember our paychecks were made with direct deposit as far back as I can remember, so I assume they were.

DR. MIDDLETON: Implied automation. Okay.

MR.BROWN: And computerization.

DR. MIDDLETON: Okay, so as far as you know, so you're not familiar with the challenges in accounting and I'm not sure and I'll ask somebody in the accounting.

MR.BROWN: No, because I wasn't in that interface and that was more the project managers that were assigned to those responsibilities. Interfacing with the accounting and well as the budgeting and some of the others.

DR. MIDDLETON: What do you think of a single contractor working the Shuttle processing?

MR.BROWN: I think USA is saving NASA, KSC millions of dollars. As I wrote in January 31, 2003 in our cost data report, congratulations to the USA team effort, employee incentive program, VIP Report of (inaudible) shows costs and performance score of 1.4 percent, or we were 1.4 percent under budget. A good score for our five year contract. We had a score of ninety-six for safety and quality. For education, using our safety, quality and cost performance as a performance measuring tool. For our incentive bonus can make a big difference. This is more good news for our cost engineering effort. Incentive cost sharing, bonus performance, measuring system safety, delayed cost of living pay raises (inaudible) up to seven months to three years, lay-off's and consolidation and cost performance have been an important part of the USA contract and the savings of millions of dollars for USA, per Kennedy Space Center.

DR. MIDDLETON: Why haven't shuttle facilities been upgraded in all these years?

MR.BROWN: We have been upgrading shuttle facilities for $10-60 million a year.

DR. MIDDLETON: WOW!

MR.BROWN: You can see come of my abstract to bid reports for specific details and examples and that was done on our O&M, Operation & Maintenance contracts of USA, SGS and EG&G, but we have not been doing enough and as I said today's' section showing $600 million needed to repair buildings. Remember, currently pace and values of KSC facilities is $4.6 billion, plus ten top 90 percent for design escalation, contingencies and activation. Business is usually spent 2 to 10 percent per year for replacement value on O& M, so.

DR. MIDDLETON: Operations and Maintenance?

MR.BROWN: Right. And that's some of it – that's part of the difficulty – which of it is operations and maintenance and what is new projects and (inaudible), which is a different pot of money.

DR. MIDDLETON: Could some of the money needed go to another program?

MR.BROWN: Possibly.

DR. MIDDLETON: What other program would?

MR.BROWN: I'm not sure. I'm just saying in the budgeting process there's a fight for money in appropriations and that's more of a congressional, as well as DOD, and the secret aspects of what's spending on what - and what shared and so forth.

DR. MIDDLETON: What do you think of saving the Apollo launch tower?

MR.BROWN: I think saving the Apollo launch tower would be great, but who's going to pay for it. Tourists, like the Saturn 5 Museum, which cost $35 million?

DR. MIDDLETON: What's the Saturn 5 Museum? Is that - I haven't been through it.

MR.BROWN: You need to take a visitors tour. It's the best thing we've got and it's about twenty years behind time when we need it. It's north of the VAB, about a mile and it's a nice exhibit, including several animated type exhibits like Disney, because it goes through a launch demonstration and a landing. And from there it takes you through stages and it's a very exciting. And it has the Saturn 5 thrown in, inside. So, we did have an Apollo Saturn 5. It used to be outside. We had to refurbish it and put it over there as part of the $35 million project.

DR. MIDDLETON: Is that why they are starting charging for the tours?

MR.BROWN: That's one of the reasons their charging the price they are charging. They were always charging for the bus ride. It's used to be about $3.50 and I assume, it's now $20 or $30.

DR. MIDDLETON: I took a bus ride and I think it was only a couple of bucks, when I came.

MR.BROWN: Then you haven't seen the Saturn 5 Museum?

DR. MIDDLETON: No.

MR.BROWN: It's too bad because also they were taking them through the Space Station facility and we have built a complex over there that's -should be going and watch the Space Station processing, but since 9-11, that's changed. We also built a launch tower between, on the way to Pad A, at the junction road between A & B and it's about, I'm gonna say about, fifty feet high and you can go up there. You used to be able to go up there and take pictures. Now I was very unfortunate, my God-daughter was here with her husband, now a school teacher in Virginia, and we were able to go to the Saturn

5 Museum, go to the Space Station and do the other, before 9-11 and they were very, very fortunate. And at the same time, I had given them a Columbia t-shirt, and they reminded me just recently, after the mishap that they were fortunate to have a Columbia t-shirt, with Columbia on it. It was special significance that they were here and were able to see the facilities before the change in the 9-11 security situation we have now.

DR. MIDDLETON: Okay. Also, the housing of historic landmarks at Launch Pad 39.

MR.BROWN: Housing at 39 may be dangerous, expensive and hard to see. Why not store at the Saturn 5 Museum north of the VAB.

DR. MIDDLETON: How long will the shuttle facilities supposed to last.

MR.BROWN: The shuttle facilities were supposed to last twenty to forty years, with proper maintenance, refurbishment and upgrades.

DR. MIDDLETON: Did you think they would still be in use?

MR.BROWN: Yes.

DR. MIDDLETON: Yes.

MR.BROWN: As good permanent construction designed to last twenty to forty years. However, launch facilities are high maintenance facilities, such as launch pads, mobile launcher platforms, the VAB and the OPF's. Example – the $600 million needed to repair the VAB. A new estimated VAB replacement cost would be about, almost $2 billion, and that's not including some of the other little things like the activation or special environmental concerns that we didn't have at the time. I have made several estimates to enlarge the VAB, and, or little VAB's, as an example.

The Five Segment booster facility with a high bay of two hundred seventy-five feet, with a high estimate of $340 million for an idea estimate, or an economy estimate of $160 million dollars for this, plus escalation, which was for a five segment booster and we estimated at the time it would go between the VAB and the launch pads. With our history now, that would be a little better because of the solid boosters in the VAB had caused a QD relationship, a quality distance relationship, and the man power and a lot of the people who were working in the VAB had to be moved out for the shuttle configuration, when we started putting solids in the VAB.

DR. MIDDLETON: Okay.

MR.BROWN: And that's another reason for our Operation Support buildings. For some of the people that were in the VAB, are now in the support buildings, Operation Support Building. Number one and soon to be Number two.

DR. MIDDLETON: Okay. So fewer people work in the, actually work in VAB?

MR.BROWN: It's hazardous. Right.

DR. MIDDLETON: Because of the solid rocket boosters.

MR.BROWN: Before the vehicle was not fueled until it was at the launch pad. There was no fuel, it was just the tanks for the Apollo, but now with the solid rockets being installed in the VAB and some of the maneuvering engines and so forth, those are hazardous. Solid materials and there are a lot greater safety concerns.

DR. MIDDLETON: What are those materials made out of? Do you know?

MR.BROWN: What materials the.

DR. MIDDLETON: The solid fuel.

MR.BROWN: I would think it's an aluminum chloride type of an explosive material that burns up rather fast.

DR. MIDDLETON: How did they fuel the Apollo? Did they have a big gas truck?

MR.BROWN: No, they had those big tanks on the pad.

DR. MIDDLETON: Oh, okay.

MR.BROWN: And it took them a lot longer to fuel the Apollo. One of the things for the shuttle was the faster turn around.

DR. MIDDLETON: Right.

MR.BROWN: And the solids give a faster lift, but there not controlled, whereas the liquid had a more controlled burn. You could cut 'em off and on easier, and so forth. That's why the shuttle is a combination of liquid and solid fuels.

DR. MIDDLETON: Okay. So, the solid is what you see going up, right?

MR.BROWN: Well, they are all working at the same time. They start the solids first and then they turn the liquids on, when they get enough power from the solids to go ahead a push it on up further, and I'm speaking as a non-rocket scientist, so to speak, as opposed to the NASA design engineers that work on the launch vehicles, the propulsion systems and. Marshall Space Flight Center has more in that specially area, as opposed to the facilities here at Kennedy.

DR. MIDDLETON: Did you ever design anything for facilities for Huntsville or Houston?

MR.BROWN: We designed facilities for the program, whichever they needed.

DR. MIDDLETON: Oh, okay.

MR.BROWN: But I'm referring to the different fuel between the vehicles, the launch vehicles and engines and the satellites and payloads and so forth. We were more facilities – the brick and mortar concrete and steel and platform.

DR. MIDDLETON: Okay. One more question from my boss. He asked if you knew Rocco Petrone?

MR.BROWN: Yes, I recall Rocco Petrone. I hadn't worked with him very much, but I knew of him and worked somewhat with him. Not personally, but I knew of him and I recall some things about Rocco that were discussed and nothing more specific than that.

DR. MIDDLETON: Okay, okay. (laughter)

MR.BROWN: We did, one of our Chief's, was Albert Zeiler. One of the German's that came over from Germany, and he was one of our managers for our facilities design.

DR. MIDDLETON: How did they bring over Germans to do that sort of work? Do you know? Or was it just a..?

MR.BROWN: They had an extra piece in the rocket program that we apparently didn't have or was great supplemental to what we had, and it gave us a big

boost and our learning and developing program. It was a tremendous concept there and between the Apollo concept, was different. Bringing it in on the crawler. You wing it in the building and then rolling it to the pad, and then on the pad it was newly different than the earlier vehicles that we had. The launch vehicles, everything was done on the pad, exposed to the weather. And most of those were the unmanned, so when we went to the manned aspect of it, then we called for new and bigger concepts, and we were ahead of schedule in that respect because we skipped some of those Apollo missions, as I recall.

We had several Apollo vehicles designed and we had anticipated launching more than we did in our schedule. However, going back a minute to the VAB and the cost of Two Billion dollars, the building was designed for Four High Bays and we outfitted Two of the High Bays initially, under the initial configuration. Later outfitted Bay Number two for another Six and a Half Million dollars. And the Fourth Bay was never outfitted for the Apollo, so the building was not ever completely finished and it's only about 22 percent air conditioned. So, if you are going to replace it now, one of the things, would you replace it for the twenty-two percent of the air-conditioning or would you require it to be fully air-conditioned which would increase the cost considerably. DR. MIDDLETON: When you first moved down here to Florida, I mean, or moved over here to the Cape, where did you live? Did you live on Merritt Island or did you live on Cocoa Beach ?

MR.BROWN: Okay, going back to 1960, I believe it was '62, '63 when we first moved here, there was no (inaudible) homes. So, we ended up renting a boarding house. My boss and several of the workers over in Rockledge. Broderson (phoenetic) Estates over there. We called it the Broderson (phoenetic) Estates, it was old fashioned

three story home with three or four different kinds of water. Cistern water, hot water, portable and non-portable and so forth. And while they were building the homes on Merritt Island. The Corp. of Engineer – we should have known when they leased the building that they weren't going to be here permanently, but they leased a building to get it up in a hurry. They built that thing in something like three or four months. It had a dirt cheap base on it apparently and a very ouster construction, cause there were several things after we moved into it, we found we had to work out, such as air-conditioning and the windows, because the air-conditioning wasn't adequate. We ended up tinting the windows and doing some other things to help with the load on the air-conditioning system. And we were there for, I guess, three or four years, before they even moved up to the VAB area. I was able to move in to our home somewhere around three or four months after we moved here. Out home was not quite finished. We moved in before it was finished. It was legal back then to move into a house that just had temporary electrical power and refrigerator, but there was about twenty or thirty items on the punch list the contractor hadn't done yet. Including, there was no screens on the windows and with the big mosquitoes we had on Merritt Island, that was quite a thing. It was not air-conditioned because at the time, we couldn't. The pay that we were getting did not allow us the luxury of air-conditioning. So, but it was designed for air-conditioning to be added later.

DR. MIDDLETON: Oh, I see.

MR.BROWN: Which was one of the nice thing about the promotion and teaching at Brevard Community College in the evenings. It allowed me some extra

spending money to get our house air-conditioned and also the luxury of a color TV, to watch a black and white launch. Our moon landing of the Apollo.

DR. MIDDLETON: Because it was broadcast in black and white?

MR.BROWN: Right, but we had the color TV.

DR. MIDDLETON: So, you could watch it in color. (laughter) You worked over at the community college pretty early in the.

MR.BROWN: Yes. What's that?

DR. MIDDLETON: When did you begin working there? When did you begin working at the community college?

MR.BROWN: I think it was about six months after we moved here. They needed somebody to help them set up and teach, Building and Civil Technology Program and they had no-one at that time. This was such a small area and the Corp. of Engineers was being the most cooperative in the training, continuing education program. They had been (inaudible). We were contacted and my boss contacted me and said Joe, this would be a good opportunity to go over there and teach – blue print reading and estimating. So, I started teaching. In fact, I said, we need something to teach from, and all there was back then was a book called, Walkers, which had been published for twenty or thirty years, I think. However, Walkers was not an ideal textbook material. It was a hand book for estimators, but, based on what I had on the Building Construction at the University of Florida and my notes and that - and building houses and building - as I had done in Jacksonville. It gave me a good background, and the Corp. gave me a set of plans that they later didn't need, for a compelant (phonetic) system component lab, which made an

ideal teaching tool. They gave me the plans and specs and they had several copies and they said Joe, you can take these and so I took them and developed a course around them and that's how my whole program, my five seminars, and thirteen books had evolved, with that as a basic case study of estimating. We did it manually. We've done it computerized and we've done it automatic computerized. We've done it three difference ways in that respect and it been very successful in the teaching.

Interestingly enough it had walls - in one room it had an X-ray type facility and lead lined walls, similar to hospitals. And the cost of it and the cost of that lead, was a separate item in the cost and it made an important cost. It was one of the major costs, when you considered the cost per square foot for that lead. But it was a laboratory, and office building, a laboratory and a combination, had lots of plumbing, had three different water supplies system, a several different waste systems, and highly complex electrical power system with all kinds of GFE, Government Furnished Equipment, and stuff, so it was complex but yet it was a simple 4,100 square foot building and sometimes I wish I could have gone ahead and cost it or actually build that building as see what it did cost.

DR. MIDDLETON: All right.

MR.BROWN: In comparison, but we have the estimated cost down through the years. From the '64 time frame, when I first estimated it on through the '70s and though the '90s, when I estimated the estimated, computer estimated it.

DR. MIDDLETON: You kept the same building specifications?

MR.BROWN: Right. We had to change, we had to take out for the asbestos tile.

DR. MIDDLETON: Yes.

MR.BROWN: And we put vinyl tile in there, in place of the asbestos tile.

DR. MIDDLETON: Yes, I would think some things you would have to change.

MR.BROWN: Same way with the cost index, we had to evolve the cost index, and right now I'm suggesting that NASA and SGS change the regular windows. When I was there we went from regular windows to insulated windows and now it was a cost in our cost index, and now with the hurricane prevention, the new windows, the regular windows were a couple of dollars a square foot. The insulated windows were about $10 a square foot and now the new windows that we should be using, and we are putting in the crawler transporter, are the, I'm gonna call them, Hurricane windows. A hundred and thirty miles an hour with a two by four, without shattering, are more like $35 to $50 a square foot, and that's just in the design change because of the new codes. And that's how we've tried to keep on changing the index as the cost change and the design requirements change.

DR. MIDDLETON: I think that's all the questions that I have. I appreciate it.