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DR. ORVILLE BUTLER: We're at the Kennedy Space Center Archives. I'm Dr. Orville Butler with Dr. Sally Middleton and we're chatting this afternoon with John Conway. I'd like us to start out by a little bit of background information, where you grew up, went to college and the events that led to your coming to Kennedy Space Center.

MR. JOHN CONWAY: Okay. I grew up in Florida. My family consisted of native Floridians. My father's family came here in 1930 and my mother's family came here from Georgia around the turn of the century, around 1900.

I grew up in Florida and I went to college at Florida State University in Tallahassee. As it was getting time to graduate from College, I wandered by the, I don't what we would call it, the recruitment center, whatever we called it in those days, and there were four (4) government agencies there, I guess interviewing people for jobs. One was NASA – NASA Langley Research Center. The other was the US Weather Service, and the National Security Agency and the Navy at, oh, I forget what the Navy place was.

I was planning on going on to graduate school, but NASA made me an offer I couldn't resist. They offered me the princely sum of $6,345.00 a year. They, at that time, were pulling people out of the Services to go work on – go to the mission

Moon and so they said, don't go in the military, just go straight to us. We'll defer you and we'll send you to graduate school and we'll pay all expenses. So I became a group of about 300 people in 1962 that went to work up at Langley Research Center to be a part of the, soon to be, Apollo Program.

The year before, they had hired another 300 people. Young engineers. All of us had to be accepted into graduate school, to be able to be hired. They were looking for people that were gonna help with their Moon program. So I worked at Langley from 1962 to '66 and while there, I went to graduate school at University of Virginia at William and Mary. I got my masters in math from William and Mary in 1966.

My plan at that point was to go to PTI and work on my doctorate degree and I was all accepted and planned to go, and some of the people I knew down at the Cape started calling and wanted me to transfer down here to work in the space program down here. Being a native Floridian and recognizing that people in Virginia worked all their lives so they could go to Florida and retire. I retired in 1966, and moved to the Cape.

So I came to work down here. Let me just say – at Langley, I worked on some of the earliest telemetry reduction from the ELV rockets on the Scout Program and on the Rambi (phonetic) II Program, where we were launching from Waltz (phonetic) Island. I wrote one (1) of the first programs to digitize the analog data coming off those rockets that would launch, and we would do that over at Langley.

They would launch a rocket and we would get line and sight coverage after about five (5) seconds. We would actually see the rocket above the horizon and they would call, and I would read out the pressures and temperatures to 'em over at the block house. So they could see what we were seeing over there on our telemetry.

We had maybe 24 measurements or something on a rocket. Small number of measurements. The Rambi (phonetic) II program studied radio blackout. You know, we were trying to understand the phenomenon of reentry and you lost your radio signal.

DR. SALLY MIDDLETON: Is Rambi an acronym?

MR. JOHN CONWAY: Radio Attenuation Measurement. Okay, and they were studying blackout, and basically, they launch this rocket and then they would fire it back to the earth and they would have a recorder with a delayed play back on it. So it would be sending you real time data and then you'd have this recorder that was playing you delayed data, so that you would see the actual data that occurred during the blackout period, along with your loss of data and so forth.

Ay any rate, I came to work down here and basically worked in the Central Instrumentation Facility – computer stuff. There were reduced for the, both the ELV rockets and for the Gemini and then later on the Apollo Saturn rocket series. So I worked there through Apollo and that's what I basically did in Apollo program was work over in the Central Instrumentation Facility and worked in computer systems. The last

place I would have chosen as I got out of college, that how I spent most of my career working computers, so, you know.

DR. SALLY MIDDLETON: What would you have?

MR. JOHN CONWAY: Do what?

DR. SALLY MIDDLETON: What would you have rather done?

MR. JOHN CONWAY: Well, I would have rather done – at Langley they offered you three (3) things and computers was my third choice. If you were a mathematician. One (1) was working with engineers and designing aero surfaces and so forth, and I thought that would be a lot of fun. Another was, gosh I don't remember what the other one was, but it had to do with some sort of engineering design work.

Then the third was computers and I didn't want anything to do with computers, and so ended up – I showed 30 days later for work then a lot of people did, and all of the choice jobs were gone, and I was stuck with computers. I ended up really working in computers until I went to payloads in 1985 - my primary area of work was with computers and computers systems.

DR. ORVILLE BUTLER: Your bio-sketch indicates that you became section chief when you came down here to KSC.

MR. JOHN CONWAY: Right.

DR. ORVILLE BUTLER: Responsible for computer system software for Launch Operations?

MR. JOHN CONWAY: That was for the – it wasn't in the blockhouse. Okay. It was the central computers that we had in the CIF building and what we did is – we were getting real-time telemetry data. We're requiring real-time data and landline data. We were reducing that data and displaying both for unmanned launches and for the Saturn–Apollo program.

DR. ORVILLE BUTLER: So this wasn't launch processing?

MR. JOHN CONWAY: It was processing the real time data leading up to and following the launch, but it wasn't the control room data where you made the launch decision. It was looking at all the pressures, temperatures, all of the engineering measurements that provided input to the launch management process. That's what we did in that building.

We ran the large computers and the large computers could reduce the large amounts of data whereas in the blockhouse and so forth, they'd be looking at some very specific things. We would provide them the rest of the data on CRT displays that they would evaluate.

We had, if you go back to Apollo-Saturn, we had really, three (3) computer systems down here at the Cape. We had the ACE computer system that was developed at.

DR. ORVILLE BUTLER: ACE?

MR. JOHN CONWAY: And don't ask me what that stands for. That was developed at Houston, and that was used for spacecraft check out and it

probably was Apollo Check out Equipment or something, I don't know. Then we had, what we call the LVDC. I believe it was called the LVDC computers and these were computers that were developed at Marshall and they were used to check out the Saturn vehicle.

These were small – fairly small machine. They were relatively small computers, and then we had large systems which were the old GE 635 computers. GE 235 computers built by General Electric that could process hundreds of measurements in parallel.

That's what I worked on over in the central building and we shipped our data out to the firing room and the control rooms, and so they had them in the blockhouse and all that stuff, but we weren't – I didn't want you to think I was in there, mashing the red buttons and all that good stuff.

DR. SALLY MIDDLETON: What does LVD stand for?

MR. JOHN CONWAY: Launch Vehicle something. They had some sort of check out computer systems. And Data System maybe - could have been, okay. In, let me see, about 19 – in the late 70's, early 70's, I guess we began, after the Apollo program, we began preparation for the Shuttle program. Okay – you tell me, when was the first Shuttle launch?

DR. ORVILLE BUTLER: First Shuttle launch was '81.

MR. JOHN CONWAY: '81, okay. So, in about, this would probably be in about 1973 or 4, we began work on, what was called, the launch processing system.

DR. ORVILLE BUTLER: You were chief of the launch processing project office in '73?

MR. JOHN CONWAY: Right, and we had another group that was developing the actual firing room, distributive computer systems and we were all one (1) project. I had a partner in crime whose name was Tom Walton, who was developing the small stuff, and I was doing the large computers and the interface between the two (2), and the simulation systems and that sort of stuff.

We developed – that was the first computer system that was really developed by the Kennedy Space Center. The first vehicle check out computer system developed here at Kennedy.

DR. ORVILLE BUTLER: What would be involved in – how would the launch processing system for the Shuttle, compare with the check out system, because it wasn't all computerized for Apollo, how would?

MR. JOHN CONWAY: Okay, for Apollo we had three (3) different check out – completely independent check out systems. We had, just like I said, we had the ACE that did all of the spacecraft measurements and spacecraft analysis. It was run out of the ONC building and that's where the spacecraft check out occurred.

The launch vehicle stuff, and I just don't know for sure, I think it was called the LVDC computer, but I didn't work on it. That was out here at 39 and that checked out the launch vehicle and at Marshall.

Then we had the Kennedy machines - were the large computers that could process the massive amount of data. In other words, all of the hundreds of measurements. We could look at in real time, convert them to engineering units and give them displays, in black and white of course. That said, here's all the pressures from the sub-systems. Here's all the temperatures from this sub-systems and so forth. In other words, system by system by system – we could display all of the data back to them.

We looked at data, not as much from the spacecraft, but some from the spacecraft and a lot from the launch vehicle and we provided that. These three (3) systems were not integrated. They didn't ship data back and to between. We drove our displays out to the firing room, and then the engineers would also be looking at displays from the ACE System and from the LVDC System.

DR. SALLY MIDDLETON: Where was the firing room, was it here?

MR. JOHN CONWAY: 39.

DR. SALLY MIDDLETON: Okay.

MR. JOHN CONWAY: Pad 39. Nothing changed. It just that Shuttle, Apollo – all the same.

DR. ORVILLE BUTLER: A lot of decisions with Apollo relied upon engineers using strip charts, as well.

MR. JOHN CONWAY: That's true. They had strip chart recorders out at 39, a ton of them. They still got some in Hager AE. Not as many as they used to have, but that was because you were looking at analog measurements. Two (2) reasons. One (1) you're looking at analog measurements and strip chart recorder gave you a continuous signal of data. So, you saw any little blip that occurred.

Initially, by the way, when I was at Langley, we would look at those analog records and we would - I had a ruler that I still have today - that we calibrated that thing. We did a cal sample at the front of the, for the instrumentation.

We would calibrate that instrument and then we could convert to engineering units and what we would do, we had big 'ol bulls eye readers that you would sit in front of, and you'd move that silo graph along, and you'd put that scope right on that line. If you wanted to sample every tenth of a second, or whatever, and you'd punch a button, and it would put out an IBM card that would have the coordinates of that one it and we would reduce the data from that on the computer.

That's how we had the first computerized engineering unit data was taking a silo graph record and that bulls eye thing.

Then back in '62, we bought our first analog to digital transcription equipment. A company down here – System Engineering Labs in Fort Lauderdale built that equipment.

DR. ORVILLE BUTLER: Is this for Langley?

MR. JOHN CONWAY: For Langley. My intern project was to write a computer program that would, first of all, determine the accuracy of that machine. We put in known voltage values. We knew what we should get out digitally and this thing would look at Kzillions of samples and see, you know, was it really performing like it should.

And then to actually – I wrote a program that would then take the actual data and convert it to engineering units and print the data out. So, we weren't doing it in real time, but we were making a tape in real time, recording it in real time, running it down to our machines. I mean, our machine was picking it up in real time.

Then we would take the tape from that, run over to the computer, lead it into the computer, run my software against it, and we'd punch out the engineering unit. Then we would call or they would call us. We could do it quickly – I mean – in a minute or two, you know, we would have the data for the first few seconds of a launch. Cause we had a computer stand there ready to go and we just took the tape off here, put the tape over there. Later of course, we shipped that data direct, and did a lot of wonderful things, but that's the way it was in the early days.

The launch processing system though was the first system that integrated all of Kennedy check, except for (inaudible), for Shuttle, it integrated all of the check outs into one (1) set of computers that we did out at 39.

So we took the capability plus some – the LSP was built on our knowledge of ACE, LVDC and what we did in the CIF because as an engineer you know, you can only build, based on something you understand how it works.

We understood those systems and how they worked and the team that was put together consisted of people from all of those elements, and together we pooled out knowledge and came up with this integrated design that would do everything that we felt need to be done. And amazingly enough it worked.

DR. ORVILLE BUTLER: How much more was that than what was done for Apollo?

MR. JOHN CONWAY: Oh, a hellava lot more. I mean, just for example, I mean the data rates we were looking at were significantly higher. We had 15 consoles in the firing room. We determined how many consoles in the firing room – still that same number today. People haven't been able to prove a thing. It's amazing.

We sat there in a room, and in three (3) weeks, six (6) of us came up with this approach and it held up. We built what we designed in those three (3) weeks and we didn't have to back off because something wouldn't work - and we made it work.

We had the capability that with the large computers now. We could drive the data to the firing room – simulated it – that would look just like it would look like it was coming from the vehicle. So they could check out all their software with a simulator. Didn't have that (inaudible).

We maintained all the library data. The historical data so we could do comparisons between what the data looked like before, and now, in a large machine.

DR. ORVILLE BUTLER: Before, would be earlier in the launch check out?

MR. JOHN CONWAY: Or from a previous test, which compared the data from a previous test. You know, we had large archive capability. We did all of the software bill for the little machines and the big machines, because it was a complex process of building your engineering software for your guidance and navigation stuff – let's say – because you were linking it to all this data and the appropriate data.

Different consoles were looking at the same data, and we had a guy who designed this thing called the common data bubber (phonetic), so that we put all the data in there just as fast as we got it and people just plucked out what they were approved to pluck out, and multiple people could pluck it out, and so forth. Still works.

There were those that didn't think Kennedy could do that. Particular JSC and it did work, and really, all of us who were a part of that program went on to have

nice careers with NASA because of that success. That's the hardest job I've ever done. I worked untold hours and days doing that. The biggest challenge I've ever faced.

It had never been done, no one had ever build anything quite like that. A lot of it was special design software that was not commercially available from industry. We were able to pool the commercial software of the day with what we had to develop, and build all these special interfaces and we made the damn thing work.

DR. ORVILLE BUTLER: You did that also, or the launch processing system was under continual development during the early Shuttle period?

MR. JOHN CONWAY: Well, not really. Not really. What we did for the first Shuttle launch was about the same thing that we did for the second one and the third one and the fourth one. Yeah, people evolve their program and added some measurements and the systems would be redesigned or changed on the Shuttle. They would modify things, but there was a never redesign of that system, to this day.

They've tried to rebuild that system twice, and spent Hundred of Millions of Dollars, not for reasons of inability to design, but for politics and serious things that occurred, they weren't able to do that, okay. That's another story. That's a long story in itself.

That had - what we had going for us, we were not launching anything to speak of at Kennedy Space Center, so we had the pick of the best and brightest people to put on this project. It was the premier job that was given Kennedy for Shuttle

program. We had a group of people that were gonna make this thing work, no matter what.

Up until the time of the first Shuttle launch, I'd never been able to keep - those 15 consoles in the firing room, I've never been able to keep more than about seven (7) or eight (8) of them running up without failure for more than seven (7) or eight (8) hours at a time. It really all came together on that first launch.

The first launch we ran for two (2) days and stayed up continuously and then we scrubbed, and I thought the world was over because there's no way in hell that that system's gonna perform another two (2) days like it did for these two (2) days, but it did.

Once we stopped making changes to the software and the hardware, and then we were able to stabilize it and it worked. So no, it didn't.

DR. ORVILLE BUTLER: Did it ever expanded to include data controls from the processing to the OPF and things like that?

MR. JOHN CONWAY: We were doing that in those days.

DR. ORVILLE BUTLER: Okay.

MR. JOHN CONWAY: We had systems that went to, over here where we check out the, what do you call it, the (inaudible) pods. We looked at data. We had front end processing at the OPF, so we could look at OPF data when we were testing the vehicle. I mean, after, let's put it this way – after we built and designed the thing - then I became Director of information Systems, and so all the ONM of the all of

that LPS was under me for the next, up until the time I went to payloads, which was in – from '79 to '85, all of the ONM of LPS was under me and we didn't – I mean.

You know, we did some modifications and changes and upgrades and stuff, but they were not significant. There was never a major retooling of that system. You know, some added capabilities and things. We did a front end processor upgraded, as I recall. Seems like, you know where we had more capability within the unit, but nothing that was a real challenge.

DR. ORVILLE BUTLER: Were there differences for the different Shuttles – new Shuttles that would be brought online with different capabilities?

MR. JOHN CONWAY: Well, the only difference in capability in a Shuttle was that after Discovery's, the other Shuttles didn't have as much instrumentation in 'em. So therefore, you just didn't' have as much data to look at. The data was data not that you – it was data like pressures and temperatures and so forth - that probably was more germane to in-flight problems, like was evidenced with Columbia, than it was with – I'm sorry, Columbia, that had the original extra stuff in it, and so some of that data was still working. A lot of it had been taken out, but some of it was still working on Columbia, and that's how they got a lot of data.

But see, that data was more applicable to, what do I want to call it, like wind temperatures and that sort of stuff, than it was to engine performance or computer performance or those kind of things.

The biggest upgrade to what you would get, if you get upgrades to the Shuttle, like an upgraded computer system, which would cause them to send us another data drop that would redefine interfaces and perimeters, but that was like - that didn't cause us to recode the basic system. It was like a new application almost, you know, that we would apply to the thing.

At any rate, so personally way back in the CIF, I worked with the ELV people and then when I have that information systems group, the ELV Hanger AE people, actually worked for me, or were in our organization, that didn't work for me, but they were in our organization.

Then we integrated all that into an ELV organization later on. In May of '85, was when I was promoted to do the payloads organization, which consisted of the ELV program, the Space Station Development effort here and the Shuttle payload. So had three (3) different types of work in it.

DR. ORVILLE BUTLER: I have one (1) more question before we move on. How was the launch processing system or the data processing for expendables different from the computer systems of the launch processing for the Shuttle?

MR. JOHN CONWAY: Okay, the launch processing systems – Okay, let me think about this for a minute. The systems for the ELV programs consisted of two (2) types of systems. One (1) was the Hanger AE – telemetry station. The Hanger AE telemetry station, well, I'm gonna say it differently – you think back to

Apollo. It's done like Apollo, okay. You have a central telemetry data reduction system – that's Hanger AE. Provides data display, provides all your launch perimeters – that's what the SIF was in Apollo. It's analogous to that.

The launch vehicle manufacture, Boeing or Lockheed Martin, they have their own vehicle check out computer system. Most of that equipment is in the actual blockhouse itself, I think now. Pretty sure that's the case. Hadn't been out there in a day or two, but pretty sure that's the case.

The spacecraft people bring their check out system to Kennedy with the Spacecraft. They bring a portable check out system here. It can either be installed just as in the case of a Shuttle payload, in Hanger AE, or it can be installed over in their payload check out facility.

You know, if they use one of the big payload facilities on this side of the river, then they'll normally install it right in there, and they'll RAF or land line it over to AE. So, on launch day, they're looking at that same data over there at AE.

DR. ORVILLE BUTLER: RAF means?

MR. JOHN CONWAY: RAF means Radio Frequency – land line.

So for ELV, there basically has always been three (3) computer systems. Those brought by the vehicle manufacturer out at the launch pad, as in the case today. Those that come with the spacecraft, check out the spacecraft. Then those that do all of the engineering data of pressures, temperatures, value opening and closures and so forth through the whole sequence. That's done in Hanger AE. Now Hanger AE has a group.

Always has had, a group of renegade engineers over there who were led for many, many years by a fellow named Skip Mackey (phonetic) and I hope you talk to Skip Mackey (phonetic).

DR. ORVILLE BUTLER: Haven't yet.

MR. JOHN CONWAY: Well, you should because he is an icon in the ELV world. He is –

DR. SALLY MIDDLETON: How do you spell Mackey?

MR. JOHN CONWAY: M A C K E Y and I can give you his phone number, I'll have to call home and get it, I didn't bring my address book with me. It may be in my cell phone.

Skip was the Lord and Master of Hanger AE, for as long as I can remember really. I don't remember – there was some people before him - (inaudible) Sheets, the old (inaudible) comes to mind, some people like that. Skip and his engineers developed their own systems and their own displays and even their own communication system.

Try as we might to get them to use common systems with the Shuttle program, they managed to squirm, wiggle and come up with rationale for why that was just impossible. What their concern was, in fairness, was they needed to change things very quickly to accommodate a new type vehicle or a new type payload or a new whatever, and they were very concerned about loosing the flexibility of being hung in there with a like configuration.

Now, the comp system was where we really – we didn't have a problem with the computer system – that made – but they were used to the their comp system and they were comfortable with it. Their customers were comfortable, and so basically we left them alone and they did a great job for many, many, many years.

Skip was the guy, if you ever watched TV back in those days, when we did a launch, Skip retired about the same time as I did. Maybe a little after me. The voice you'd hear on TV explaining, you know, what was happening to the rocket as it flew, that was Mr. Skip Mackey.

He was doing that by running around the room looking at strip chart recorders, and real time and telling you what was going on with that rocket and telling you anything that looked abnormal. He was probably the best strip chart recorder analyst that knew a rocket vehicle better, in terms of data, failure analysis than anybody that ever lived. I mean, he was that good. Still is, I guess.

I've worked with him since I retired, and he ran that world over there and when I got this payloads job I went over to Mackey to see how we were gonna get along, you know, a new situation and he said, well, I'm gonna make you the same deal that we made George Page.

George Page was another icon in the ELV world. I don't know if you got a chance to talk to him before he died or not, but he was.

DR. ORVILLE BUTLER: There's an interview on record, but he was already deteriorating.

MR. JOHN CONWAY: Well, George was probably the, of all the people that I worked with, through all the years, he was the greatest leader of men. Not necessarily the best manager, but leader. You would follow George through hell, you know, with a plastic umbrella. (laughter)

I mean, literally, George was just the greatest guy to work with and for, and I never really worked directly for George, but George didn't know that. And I certainly never drew any distinction. Yes, George - whatever you say George.

DR. ORVILLE BUTLER: You're not the first to mention that.

MR. JOHN CONWAY: So, absolutely a great guy. But at any rate, Skip said, I'll make you the same deal I made George Page, he said he'd come over here once a year, inspect this facility, chew us out for lack of cleanliness, junk parked everywhere, and he said, he'd then go back to the ONC and leave us alone. And he said, we will listen respectfully and promise to do better. (laughter) but don't do it once a month. We really can't stand that.

I said, well, it didn't seem like George couldn't get you to clean the damn place up, I said, I guess I'm not gonna have much luck, so maybe I'll just dispense with the lecture, just try to keep us out of trouble. They're a great group of people over at Hanger AE. And you should talk to Skip – he knows – and he knows the old timers, actually better than I do. So there's a good group of people.

Now Jim Womack (phonetic) – when I went over there Chuck Gay was the ELV director, second level director under me, and then, let's see, I went in May of '85

and then Challenger occurred in January of '86. After Challenger that's when Bart McCartney (phonetic) came down here after Challenger. After Challenger Forrest (phonetic) wanted to take Chuck Gay over and have him run operations for Shuttle because of his experience, and so he did that.

We promoted Jim Womack (phonetic) into that job and then Jim Womack (phonetic) was there almost, I guess until I retired, maybe until I retired. The one (1) that I remember working with through all the years was Jim Womack (phonetic). He's another guy that you really ought to talk to in the ELV if you haven't. Have you talked to him?

DR. SALLY MIDDLETON: No.

MR. JOHN CONWAY: That's the one you ought to talk to, cause Jim knows rockets like nobody knows rockets. He is also an icon in the ELV world. Now when I went to work, like I say I was over there – I wasn't there long before Chuck Gay left and went over to – and so then Womack (phonetic) took over, who was really kind of the second in command over there anyway. We were together for all those years. I guess from May of '85 to December of '96, when I retired. Jim, I just don't remember.

I guess Jim retired right after I did. So he was there pretty much the whole time, and he's just a super, super guy to work with. Just a couple of things that stand out in my mind was I guess looking at the records, it was hard for me to remember back that far, but apparently in May – after I went over there in May we had

a couple of Atlas launches in that year, in '85 and then in '86, January we lost Challenger. The very next launch after that was Delta 178, and of course, (inaudible) McCartney was here, and we were being ultra careful with the Delta 178 because of the Challenger accident was certainly fresh in our mind.

I'll never forget, I went over there and the McDonald people had the Delta erected on the pad. They had their logo and they'd had, it seems like they'd had almost, and again my memory may be wrong, but seemed like there was a large number of successful launches – I'm thinking 70 or something, you know, some big number and I asked, how do we know this rocket's gonna work. These guys said, listen, we know what we're doing with this thing.

We have launched, you know, a Gzillion of these things and we've had, you know, X number of successes, and I'm thinking it was like, although 70 seems like a very high number to me. It may not be correct, it may have been 20-something, but some large number of launches successfully.

DR. ORVILLE BUTLER: We can dig that out.

MR. JOHN CONWAY: But at any rate, we went in and we launched that rocket and it was – no real issues on the launch countdown and it was flying along in first stage, and the first stage motor just shut down and the rocket made two (2) or three (3) complete 360's before it came apart.

We're sitting there watching this on TV and it was just like, hey, it was almost as bad as the Challenger, because I just come from the firing room out here

watching the Challenger launch. Sitting in the firing room looking straight up at that, cause I was out there with the payloads guy and now I'm over here in the firing room and this rocket blows up, which is totally unexpected under the circumstances. I felt, you know, the end of the world had come, almost.

I called Admiral Truely (phonetic) who was the NASA Administrator and told him that we'd just lost a rocket. He said, well, John, he said, did you hurt anybody? And I said, no Sir, we didn't hurt anybody, but we sure put that rocket right in the water. And he said, well, if you didn't kill anybody and you didn't hurt anybody, it's not that bad. So figure out what went wrong, and we'll launch again. I said, thank you Sir.

It turned out, they had changed the wiring harness on the first stage some five (5) or six (6) vehicles before then. Several vehicles before then, to a Teflon coated wire, because Teflon had – the insulation on Teflon is a much harder, rougher insulation. What no-one realized was that another characterization of Teflon is it cannot stand – it erodes very easily.

If you rub it on something and in that tunnel cover that goes up the first stage on a Delta, there are little protrusions that go up through there and that wire rubbed on that and shorted out – and shut down the first stage motor and that was what went wrong with that rocket. So, I mean, and again that's something that had been changed a few flights before, got away with it for awhile and then it up and bit us.

You're looking at that recorder awful hard.

DR. ORVILLE BUTLER: We're getting close to the end of the tape.

MR. JOHN CONWAY: Probably wore me out. You're writing everything down?

DR. SALLY MIDDLETON: Yeah, cause I want to use it right away.

MR. JOHN CONWAY: Well, the other – let me say, the other, you only remember your failures in the launch business. Unfortunately, you don't really remember your successes. You only remember the things that go wrong because they are so – you work so hard to keep things from going wrong.

I mean, you worry about everything. You worry about what did we not look at enough. What did we not check enough. The other notable one was AC 67, when we were struck by (inaudible) lightning. That was probably, but let me back up a little bit. Let's talk a little bit about the history of the program and some things that changed. You want to change tapes?

DR. ORVILLE BUTLER: Yeah.

MR. JOHN CONWAY: Okay, why don't we change tapes.

DR. ORVILLE BUTLER: Okay, we're back. I think what I'd like us to do is, you were in charge of payload processing for both Shuttle and ELV when you came in '85, right?

MR. JOHN CONWAY: Right. Okay.

DR. ORVILLE BUTLER: Could you take us through the payload processing process for Shuttle prior to Challenger and I don't know, that probably means for you the Challenger payloads, and then how that changed afterwards and then do something similar for what happens over on the ELV's, in terms in what is the process for processing the payload?

MR. JOHN CONWAY: Well, first of all the payload process is very similar for Shuttle and the ELV. There's not a whole lot of difference between the two (2) basic processes. There are some differences, but not a whole lot of difference. When Challenger occurred, of course, we were flying a TDRS, and I'm not sure, TDRS F, was it maybe, TDRS, but one (1) of the TDRS'.

The only thing that I could think of when we saw the Challenger, and I'm sure everybody in that control room had similar thoughts was, what could we, in payloads, have done wrong that could have caused this. With a TDRS payload, you've got a cradle that, you know, TDRS got, and IUS motor strapped to it and you've got a big cradle that it sits in - that's bolted to the liner of the Shuttle payload bay.

DR. SALLY MIDDLETON: What is IUS?

MR. JOHN CONWAY: Interim Upper Stage. You see, the Shuttle can only go into lower earth orbit, and so with satellites, weather satellites, other GS stationary satellites, you have to have a third stage motor on an ELV. You have two (2) stages to get in lower earth orbit normally and then you have a third stage that then takes the payload to it's GS sinuous position.

Okay, you got to do the same thing in Shuttle. In fact, when we flew commercial satellites and weather satellites in Shuttle, we had to have a third stage motor that went up with the payload - was deployed. For Hughes 376 Payload, it was a McDonald Douglas motor, and it was called a PAM motor, I think.

DR. ORVILLE BUTLER: Payload Assist Module.

MR. JOHN CONWAY: Payload Assist Module and for a TDRS, it was a motor that was developed by the Air Force under contract and, I don't remember, Martin Marietta maybe, an IUS motor and it was called Interim Upper Stage. But any rate, these are third stage motors that essentially, after you deploy the payload and it's in lower earth orbit, it then fires it's motor, and takes it out to the GS sync position.

Of course, the payload itself has some onboard fuel and maneuvering capabilities, so that if the upper stage doesn't get it exactly where it wants to be, it kind of maneuvers itself around al little bit and has enough capability that it can finalize its orbit position. First of all, when we – the first reaction to the payload community and my reaction was, what could we have done wrong. What could we have overlooked. What could we have.

DR. ORVILLE BUTLER: This is at Challenger?

MR. JOHN CONWAY: This is at Challenger. And the only thing that I could think of, at the time, was maybe somehow that payload came loose in the payload bay and caused some problem or the cradle came loose. Course, as we

knew subsequently, nothing like that occurred. Basically what we did following Challenger, was go back through all of our payload processes to look and see how we could do things better, safer, eliminate risk.

The thing that stood out in my mind that we did different was the people thing. When we went back through all of the processing papers, and we looked at the processing papers not just for the Challenger, but we looked back at all the pervious rockets and we looked to see, okay, what kinds of errors had we shown in our paper. What kind of quality clause, what kinds of waivers and deviations, all those kinds of things.

What were we seeing, and what could we do to either eliminate that or do a better job of workmanship, safety, quality, all those kinds of things and the thing to me, that had the most pay off, was that we recognized that the quality people, the technicians, the so forth. We had all this paper down there that they were initialing off, that a certain process was done in a certain way, or whatever, but a lot of the workforce didn't understand the purpose of that paper.

When we would go back through that paper and try to determine things. Look historically at it - sometimes we had difficulty determining exactly who did what, when a little bit, that kind of stuff. So, we started having meetings with all the technicians and all the quality people and everybody and explaining our, not just what our process was for doing work, but the purpose for each of the steps.

The purpose of this paper and why it was important that they fill out the paper correctly, because this is how we use the paper down the road to determine the validity of the rocket ship – or the payload.

This made, in my mind, a step function improvement in our total quality - was the fact that people understood the Why, not just were told, this is the way we want you to fill out the paper. This is the process we want you to use. We tried to train people into how their job fit into the overall quality program, engineering program, whatever you want to call it. Why it was so important that they do their job right, and that made a tremendous change.

Now we also, and I don't know if it was because of Challenger, but the other thing we did is, we did a very aggressive lessons learned program, that every time we would do a test, routine or otherwise, we would have the technicians and the quality people and the engineers give us a briefing on not what went wrong, and what went right, so much. Paper covers that. But anything that occurred that troubled – anything that scared 'em. Any part of the process that was just a little hairy, a little scary, when they went through it.

We started translating that information and getting it – and have them meet with the other teams who did the same type of work, and go through things that just scared them a little bit or they were just a little uncertain what do at a certain place. Anything that came to mind like that that they felt uneasy about. We translated that into performance.

Now, I'm gonna also say that in the payloads world you had a lot easier job than the Shuttle world, because we had like, a thousand contractor employees. Thousand contractor employees, and maybe three or four hundred civil servants, counting, you know ELV and everything. You could get a thousand people to work as a team - their manageable. It's a manageable size organization. You can instill in people a sense of the importance of their job.

The importance of the overall team and a sense of responsibility for the total effort and that's a key thing. It's having people feel totally responsible for everything. Not just their little 'ol piece of the job, so that if anybody was on that floor, like when we were doing Spacelab, and we had all these different payloads gathered around the ONC building.

If they saw anything that they thought looked unusual, or they felt, they'd never seen before, or they saw a washer lying on the floor underneath the spacecraft, okay. It didn't matter who you were, it didn't matter who you were, or what your job was, we wanted it reported. We wanted you to tell us about it. We wanted you to worry about it. We wanted you to go out on that floor and we wanted you to worry about everything, not just the payload you were working on. We wanted you to worry about what your buddies were doing. We wanted you to watch your buddies. You see anything that looks different - let us know.

The ELV's the same way. One (1) of the things on ELV that saved a rocket - totally saved a rocket. It wasn't all this quality inspection and all this stuff. We

had a technician walk around the rocket one day, and he looked up at one of the SRB's that were hanging from that Delta. He said, that doesn't look right. They said, well, the paper said, and he said. It doesn't look right. Okay, let's go check it.

Took it down and that ball joint up there where it hung on the nose of that thing, had bent or broken, and if we had launched that rocket, the first thing that's gonna happen is that thing was gonna come to and go right through the flame trench and that rocket was going right over in the ocean.

What gets you the quality difference, is in peoples' minds. You can do 90% of it with paper, processes, procedures, rules, inspectors and so forth. That will get you 9 out of 10 launches successfully. That ain't very damn good. What makes is work is when everybody, from the top boss down to the lowest technician feel a sense of responsibility for the success of that mission and that vehicle and the payload and they worry about it.

They talk about their worries to you and let you know, and if those little things – it's the little things that make the difference that get you that last ten percent (10%), that get you. In my opinion, anything over 90 is caused by having people with the right mind set.

People who felt their part of a team, who feel their job is important. Who – this is a McCartney story, who don't walk down the hallway and they walk by your office, and they look in there and they see the copy machine on fire. They say, well,

copy machine's on fire, I guess whoever runs the –whoever is responsible for the copy machine's got a real problem, and they go out, get in their car and go home, okay.

That's the attitude we can't have in the rocket business. It is too exacting. It's too hard on your best day to make it work. It's just too hard, and so what gives you the edge is a set of people, a set of lessons learned, and a constant evaluation of everything you're doing. A constant reevaluation of everything you're doing that eliminates complacency to a high extent and makes everybody feel that when it works, it's a miracle and we all made this miracle happen.

And when it doesn't work, we all got to do better. This is on all of us. It's not that department and this guy and that. It's all of us. And that's how you make it work. I mean that's how we made LPS work back then. We worked as a damn team. We worked day, night, seven (7) days a week, and you know, I could get into a lot of things, but.

DR. ORVILLE BUTLER: Well, give us a couple real memorable lessons.

MR. JOHN CONROY: Yeah, you learn by failure. Somebody said, you don't learn a whole lot from success, and I think that's correct. I think what you learn from success is generally bad lessons, because you know, success seems to tell ya, all I gotta do is do it the same way again, and it's gonna work.

You know, I drive home drunk, seventy miles an hour, no seat belt on, I made it. All right. Now, what's that supposed to tell me. It's okay to do it again.

You know, that – success is a deceiving mistress. You can, you know - failure causes you to reexamine everything. Well, you have to re-examine everything even when their success is the point. You got to realize that every success is a miracle.

JR Thompson, you know, was a mogul and orbital scientist, used to be a number two guy in NASA, and used to run Marshall, and was head of the Internal Challenger Evaluation Board. He's a really good guy and he's a friend of mine and someone interviewed him and said, do you like to watch rocket launches, and he said, absolutely I do not. Said, I've been in this business all my life and I dread the launch. Three (3) things can happen and two (2) of them are bad. And that's really it.

To be honest with you, since Challenger I've never enjoyed a Shuttle launch. Never. It's like going to the damn dentist. I mean, I sit there, I dread it, I worry and when it was successful, I said, thank you God, we've had a miracle.

That's the real world. It's not a world for cowboys, and it's not a world for people that think it's easy. The systems are just (inaudible). Now the same is true in the event. We did the same thing in the ELV world following challenger that we did in the Shuttle world. We went back and we re-examined things. Not unlike what their doing right now in the ELV world, because I came out and worked with them a couple days, responding to the CABE (phonetic) report.

Looking at how could we apply the CABE recommendations and what they were doing subsequently in the Shuttle program. How could we use that to make a

stronger ELV program. So I came out and free labored the guys for a couple days to try and help them, you know, with their report.

In answer to your question, there wasn't – Challenger caused us to do a heightened sense of what we we're doing. We didn't, I don't think we made a C-change in what we were doing in payload processing. I think the last memorable change was a lesson I learned when – we really went to, found the documents – anyway, we went back to previous launches, and we looked at all the paper and what all this was trying to tell us.

What brought it home to me, was the remarkable difference that it made when we explained to people the purpose of what they were doing instead of telling them what to do. Answered their questions and took time for them to understand the importance of an inspection. How we use the quality paper. How that was then used to verify this step in the process. How, without that, we would lose the trail.

They didn't know that. Been doing it for years. It's obvious. It's the little stuff. It's not rocket science, it – at any rate.

DR. SALLY MIDDLETON: Can you relate that to, sort of, special training for any specific ELV launch? That's kind of a training issue or re-training issue. Is there a special launch that you had in mind that this new training really applied?

MR. JOHN CONROY: Well see, we were talking payloads, okay. In payload processing – let me kind of differentiate a little bit – there is kind of a little difference between Shuttle payloads and the LV payloads in the following.

If you talk about a commercial communication satellite, there was very little difference in the way it was processed. A commercial communication satellite either came here - and the commercial one – okay, let's talk the differences there.

After the Space Act of whenever it was, we were no longer allowed to process commercial satellites that fly on Shuttle in NASA facilities. So they did them over here in Astro-tech. Okay. ELV payloads that flew in ELV's were also done over here at Astro-tech. Those payloads, there was virtually no difference in the way their processed. Whether they fly on Shuttle, or they fly on ELV.

Then there's a category of payloads that fly in the Shuttle or ELV that are NASA payloads. Those are processes in NASA facilities on this side – you know, over here. Some across the river, but mostly over here. Their processed is the same facility – those are unique one (1) of a kind payloads. The engineering team comes from JPL – just like the Mars missions. They come here with their check-out gear for that spacecraft, and you know, 18 wheelers or whatever, and what Kennedy does, is Kennedy provides host support in the facility.

Kennedy provides commodities, anything you need in that facility, they give them a launch flight support manager who works with that payload team. Who is - they need propellants or gases or a conference table or crane operations or they need something moved, or whatever.

We provide host support. We don't get in there with our hands and mess with the spacecraft. It would be totally – it would be stupid to do that, because with a

one (1) of a kind spacecraft, you bring the people that build it here. They do the final check out. You show them how to go through the process. You lead them to the integration with the vehicle process. You help them with their procedures. You help them get through all the wickets. You help them with their safety review packages and their hazard reports, and all that stuff, but you're in a helper support role.

The spacecraft person in ELV is King. It's their mission. It's their thing. The rocket is a cost of a factor of maybe twenty percent (20%) or ten percent (10%) of the cost of the payload. So, it's a much nicer world. Payload people don't like flying on Shuttle. They like flying on ELV's because their King – it's their mission. They're in charge. They get to call all the shots. They tell you when it leaves. K?

So, from a process point of view, we changed some roles. We made things more stringent on terms of hazard processing. In terms of lifting and handling, which is the most hazardous thing you do with a payload, is lifting and handling. That's the biggest opportunity for failure, probably. Either in stacking a vehicle, or carrying a payload out or mating a vehicle to a rocket.

For Shuttle, Spacelab was built here at Kennedy and integrated at Kennedy and all experiments are integrated in it, cause that's where, so much of this, when I'm talking about the procedures and the technicians and understanding the quality paper, it came in with the Spacelab world. With the payload that we did, all the integration work and the build up work, was here at Kennedy.

TDRS, IUS for example was done in an Air Force facility across the river, because. No, yeah. Because IUS we got from the Air Force and so we integrated, I'm pretty sure we integrated TRDS with IUS across the river and then because we would install that in the pad in the vertical position, we would bring it over to the vertical processing facility and we would rotate it to the vertical and install it in the payload canister and take it out to the launch pad. Take it out to the launch pad and put it in the Shuttle in the vertical position.

DR. ORVILLE BUTLER: If you can clarify for me, does this canister go in the Shuttle?

MR. JOHN CONROY: No sir. What it does is, you got a payload change out rim out at the pad. What it does, in the payload change out room, it's just like the inside of a payload canister. It's got the same steel structures and stuff in there. So if I got a payload hung in the vertical, you know with the payload canister up, hung on these J-hooks, we call 'em – the attach points.

Then I've got the same configuration, same distance apart, same arms out there in that payload change out room, so I take a crane and I pull this canister up to the top and it's got doors on the canister that look just like payload bay doors – not just like – but they open in the same manner.

We swing the one (1) chamber, the payload change out room out, we bring this one (1) over. We open both sets of doors. We put them up to each other

and then we take – the payloads are hanging on these big arms with J-hooks, we call 'em, on the trunions (phonetic) that go into the Shuttle.

Okay. Where there's a big trunuon (phonetic) about this big that goes in – took from the Shuttle bay, along the seal, and so this thing is hung on the J-hooks. Then the J-hooks reach out from inside that payload change out room and go right along side the J-hooks and the canister. Pick it up. Once that goes up or one (1) goes down, okay, bring it in. Swing it right back over, and then it goes into the orbiter just like it went out of canister into the payload change out room. It goes right in there and sits right in that (inaudible).

DR. SALLY MIDDLETON: This is a clean room, right?

MR. JOHN CONROY: Yeah, right. You get everything clean and so forth. Now like Hubble telescope, Hubble telescope, of course, went in. Now let me think about that. I'm sure Hubble telescope went in, in the vertical. Yeah, because it was in the VPF.

DR. ORVILLE BUTLER: Why don't you use Hubble as an example, and take us through the payload processing for Hubble?

MR. JOHN CONROY: Okay, the Hubble came here – okay, the Hubble came here from Lockheed facility in California. It came here six (6) months before it was to launch because – or thereabouts – because it was costing so much to keep it out at the Lockheed facility. So it's a vertically installed payload on the pad.

So the Hubble was brought here, and I'm trying to think of the transport mechanism, I think it was Bart.

DR. SALLY MIDDLETON: No.

MR. JOHN CONROY: It wasn't?

DR. SALLY MIDDLETON: It was an airplane.

MR. JOHN CONROY: It was an airplane.

DR. SALLY MIDDLETON: Yeah.

MR. JOHN CONROY: Okay, okay, okay.

DR. SALLY MIDDLETON: Somebody - Robbie Robinson (phonetic) and he said that the Air Force brought it on a.

MR. JOHN CONROY: C-5

DR. SALLY MIDDLETON: Yeah. They built a special canister.

MR. JOHN CONROY: Yeah, okay. All right.

DR. SALLY MIDDLETON: And he said he wasn't sure whether it landed (inaudible) the Shuttle landing, but he said it came on an airplane.

MR. JOHN CONROY: Yeah, and I don't remember where it landed either, okay. Okay. It came and so it would be - . The way this would have worked – I'm just thinking how this had to work. Okay. If it came off that airplane, it came off that airplane in the horizontal position. We would then have taken that and put it in – I'm almost certain we would have put it in the canister, okay, off the airplane somehow.

Then we would have gone over to the canister rotation facility, which would have rotated the canister from the horizontal to the vertical. The we would have driven it around to the vertical processing facility, okay, and the vertical processing facility had a clean room, and we go through the clean room, you know, get all that stabilized and everything.

Then we would go into the VPF, and the VPF had, in it, it had two (2) structures, still does, I guess, that are just like a payload change out room, just like the orbiter bay, basically. Two (2) simulators, what do you want to call it, two (2) icons things, and we basically hung the telescope up there and then we did – first of all the telescope was in storage for about six (6) months, okay.

But that didn't mean they didn't still run tests and work on it. It was just down here instead of in the Lockheed facility. We didn't need it here as quick as we got it. They brought it here for financial and other reasons, okay. Cause a Shuttle flight wasn't available until down the road. We it had to wait on the Shuttle flight.

In the VPF, we have a Shuttle simulator and it's called – what is that thing called – it's called – at any rate it's got the Shuttle computers, Shuttle onboard computers. It's got – I can't think what the name of that thing is – but at any rate, it's a Shuttle simulator. Still got one over in the SSPF.

We do all the interface checks between the orbiter and the telescope, okay, prior to going out to the launch pad. Installing it in the orbiter and doing the actual validation checks out there. So, we checked now that we can flow data back

into, between the systems. We can power up the spacecraft from the orbiter. We can do all these sort of things using that simulator, okay. Now that's what we call an orbiter interface test with a spacecraft.

Now, the telescope people also had a whole bunch of tests that they ran the whole time it was here, with their own check out gear that they brought here and set up in the control room over there and cabled over to the telescope. So they ran test after test, after test.

The would run, you know, not only did we run, you know, deploy sequences and still like that for deploying a telescope, but they would, you know, everything on that thing that you could move or wiggle or rotate or whatever. They did all these tests. They go through whole sequences, and so forth, with their check out gear and that's the same as every other spacecraft.

Now, if you take Galileo and I'm just getting off Hubble a minute, and go to Galileo to show you another variation. Galileo was too big to transport in one (1) piece. Most of them are. That's why I was a little bit confused about Hubble, but I remember Hubble was all together, okay.

Galileo had to be brought here in pieces, because they shipped it by van, I'm pretty sure and the second problem they had, it had an RTG and you sure as hell can't ship that over the highway and they had these RHU heaters and that was a problem.

DR. ORVILLE BUTLER: RTG is?

MR. JOHN CONROY: Radio Active – that's a nuclear power plant. Okay. So what happened is the spacecraft is normally, partially assembled. It may be completely assembled at times in the factory and taken apart or it may be partially assembled, but most spacecraft are partially assembled, shipped to the launch site and then the antennas, the bigger structures and stuff are put on here.

The final set of check out – factory check out tests are run, as in the case of Galileo. As in the case of the Mars missions, with little rovers and stuff. All that finally put together here and a whole bunch of tests are run and then we'll so this orbiter interface test with it.

Now we don't have a simulator, per say for ELV's like that. We only did it for first time – like the first TDRS IUS'. The ones after that we didn't have to run that interface test, but for ELV's you do exactly the same thing. You check out the payload in a payload facility, final assembly, final attachment of the radiators, and antennas and all that stuff is done here.

You think delicate. Lot of times something will be late delivered from a vendor and they'll have to be installed here just because they didn't have time to get it on before they shipped it. Other times its because of the size, the complexity, the delicacy of something.

And then in the case of Shuttle, we take the telescope out in the canister again. We take it up to that payload change out room. We put it in the orbiter. In the

case of an ELV, we will, a lot of times, sometimes we'll encapsulate it in the faring and take the faring and the spacecraft out and put it on the ELV.

Other times we'll take just the spacecraft out, put it on the ELV, the whole pad upper clean room area of an ELV. It's a clean room also, and we'll mate the – we'll take it up with a crane. We mate the spacecraft. We put the firing around it at the end. We have doors, you know, we can run cables in and out and run tests and stuff out there. So there's not a whole lot of difference in payloads.

Payloads that fly on ELV's can be just as expensive as payloads that fly in Shuttle. You know, Hubble obviously was a Billion Dollar payload. Galileo was a Billion Dollar payload. The ELV has some Billions Dollars payloads too. There's not – we use the same people. The same facilities. Basically, the same KSC processes for Shuttle and ELV payloads that are deployable payloads.

Now things like Spacelab, that you take up and go back and if you reassemble here at Kennedy every time, we build up those spacecraft here. That's were all this stuff about the technicians and the IUS TDRS doing things, came into play. Although some of it comes into play with just the host role, cause you're out there working as a team with the spacecraft builders.

DR. ORVILLE BUTLER: You told us the general outline for vertical processing.

MR. JOHN CONWAY: Okay.

DR. ORVILLE BUTLER: What about horizontal processing?

MR. JOHN CONWAY: Okay, horizontal processing in a Shuttle. A good example is, let's see now. Aren't all the Space Station elements put in horizontally? I believe they are, but we won't go there, cause I'm not sure. I believe they are, but Spacelab certainly was. I think their done the same as Spacelab.

For Spacelab you build it up in the ONC. You ran all of your – you ran mission integrated tests, cause Spacelab was pretty much a self contained thing. It had its own computers, on board computers, all that stuff. We loaded all the experiments into racks. Put the racks together in a floor train. Meantime we build up the structure. We slid the floor train with the racks in there. Then we ran tests.

First we did individual experiment tests and we did experiments to the rack test and we test individual racks. Then we test the racks as a total assembly, with all racks working together. Then we would get, even the flight crew when we could, and we would run mission sequence tests. Just like we're doing in orbit. We run all these tests. Then we take that – we button up that – we put in end cones on. Button up the Spacelab.

We come in and we drive the canister transporter into the ONC building. Pick it up with a big overhead crane. Bring the thing down and install it in the payload bay. Take it out to the OPF and pick it up with a crane again and put in right back in that orbiter and to the spacecraft, Spacelab – whatever.

The orbiter and the canister look exactly the same. The little attach points for the trunions (phonetic) and everything are configured exactly the same. So

we just pick it out of one (1) and set it right down in the other. It doesn't even know the difference. Except it gets a lot more cables hooked up to it and you know, pneumatic lines and things like that. When it's in the orbiter, that (inaudible) and that canister for transportation.

DR. SALLY MIDDLETON: Okay, when the horizontal canister is taken to the?

MR. JOHN CONWAY: It's the same canister.

DR. SALLY MIDDLETON: But it's sitting in a different way.

MR. JOHN CONWAY: Okay, one (1) is down flat like this. Like an airplane sitting on the ground, okay. The other time it's up vertical, like this. Now remember when the Shuttle's on the pad, it's vertical.

DR. SALLY MIDDLETON: Right.

MR. JOHN CONWAY: When a rocket is at the ELV pad, it's vertical, okay, so if we're gonna put a payload on a rocket or the Shuttle sitting on the pad, which would be a late access payload in Shuttle terminology. Okay, then we got to have the payload straight up and down too. Pointing to the stars. Okay.

So what you do, depending on how you work on your payload in one (1) of these facilities, you could work on it in the horizontal, and then you could rotate it up and then you put it on a trailer and you cover it with a environmental container and you go out to the pad. You leave it in that container. You take it up. You put it in the

clean room. You take off the environmental container. You pick it up, straight up, sit it right straight down on that rocket ship.

Okay, when you're in that canister, cause you're talking big payloads now. You're talking 50 feet tall and you know, whatever, 30 feet in diameter.

DR. SALLY MIDDLETON: That's the size of the canister?

MR. JOHN CONWAY: Same as the payload bay. Canister is exactly like a payload bay. It looks like it.

DR. SALLY MIDDLETON: Kind of, it's got the same kind of doors, right?

MR. JOHN CONWAY: Doors, fitting inside, attach points – everything. If you have pneumatic – if you had to keep cooling on that spacecraft all the way, it's got a – behind that cab, it's got cooling capability and everything. You hook up the same plumbing and all that, if you had that. Normally you don't, but if you do. So, think of it – putting it in the canister is identical, to putting it in the payload bay. I mean from a physical attachment, size, form, fit, function – it's exactly the same.

The payload, if it didn't have eyes, would never know the difference. You'd have the exact same attach points, exact same mechanical fittings and so forth.

DR. SALLY MIDDLETON: But for ELV, is there?

MR. JOHN CONWAY: Not ELV. The ELV what it does is after you get two (2) stages of a rocket up. It's got a bog enclosed clean room area. You

take a crane and you bring that payload right up to that clean room area and you open the door, and you put it in and set it on the floor, basically. And you then remove all of the protective covers and so forth. Environmental enclosure and the you pick it up again, and sit it down right on top of that rocket, and you bolt it to the rocket.

So I mean, it's not any. There are people that have and Tip – Russell Romenella (phonetic) can get you, over in Tip Colon's organization, you just tell him I said he could get it for you, okay. Ray Lugo (phonetic) over in Steve Franco's (phonetic) area can get for you. Don't bother with Franco (phonetic and Colon (phonetic), that's a waste of your damn time, but if you go to Romenella (phonetic) and you'll to – he can get you either a slide show or a maybe even something electronic on the computer that shows it step by step.

It just shows the whole sequence of how you move a payload through the whole thing, and we used to have how you used to do a horizontal payload. All the steps and the sequence with pictures at every stage of how this thing goes.

Horizontal and vertical, and Russell Romenella (phonetic) can get that for ya. You tell him I said to get it for ya. Lugo (phonetic) can get you a sequence of a payload flow for a Delta and an Atlas. Just shows pictures of the various – nothing to it. I mean, and it's the same. You use the same rigors, engineering discipline, quality, for one that you do the other.

DR. SALLY MIDDLETON: Do they still do the spin testing?

MR. JOHN CONWAY: The spin test was done to balance when you had a third stage motor in it. Balance a third stage motor with a spacecraft. You put it on there and you put like wheel weights on your car. That was to balance it so that after the third stage motor in the spacecraft are dumped out in space, and their now rotating going through there, that it's not going like – Kattywompers, you know. Like a tire out of balance.

They don't use that much anymore, I don't think. We still have one (1) of those here, and I think at Vandenberg, but they were used primarily for communications satellites when they had a third stage motor attached and they were balancing the two (2) of them. I don't know whether they developed – either we haven't developed anything new in a long time, that's different from the way we've done it before or whatever. We haven't used that spin test capability much lately, I don't think. Hello, I'm a little dated.

Oh no, you still do it if you had a new spacecraft, new motor configuration.

DR. ORVILLE BUTLER: There's not sending satellites out of the Shuttle anymore.

MR. JOHN CONWAY: No, we're not doing that.

DR. SALLY MIDDLETON: Well, this was just for Delta because of the way they were.

MR. JOHN CONWAY: Well, I think it was because of the way they were doing all those third stage motors, is what I think they were doing. It's just a balancing thing, so that it would, you know, when they started rotating a spacecraft like it's going through space, spinning it, it would spin properly.

Now, did we destroy that question you had?

DR. ORVILLE BUTLER: I got a couple of more.

MR. JOHN CONWAY: All right go ahead.

DR. ORVILLE BUTLER: We talked about payload processing going into space. What about payload processing returning?

MR. JOHN CONWAY: Okay, well, let's talk about payload processing in space.

DR. ORVILLE BUTLER: Oh, okay.

MR. JOHN CONWAY: Okay. When you launch a satellite, Hubble or one (1) of these communications jobs on a ELV, the you go through at least a 30 days period once you're deployed, you're on orbit,. Now you're in about the right place.

First Tape ended.

DR. ORVILLE BUTLER: We ran a little bit long here, and probably missed a little bit in terms of payload processing – where we talked about the

spin test and balancing the spacecraft, so that when it got up into orbit, it went through the spin, it would be balanced.

MR. JOHN CONWAY: Balanced just like a tire.

DR. ORVILLE BUTLER: And now you were talking with us a little bit about payload processing in space, where the customer does the check out of their spacecraft or the payload before it goes operation?

MR. JOHN CONWAY: Basically what one does, is after we launch, The Kennedy job on an ELV is essentially over once the spacecraft is successfully deployed and in orbit. That really includes once it's deployed with its third stage motor. If it's a GO synchronous satellite or just if it's in lower earth orbit once it's deployed.

In Shuttle, the Kennedy job is over when the Shuttle clears the tower and Houston directs the deployment of the payloads there. Once you deploy a payload, whether it's Shuttle or ELV, the spacecraft mission manager will go through an exhaustive check out before any spacecraft becomes operational. Or really starts shipping operational data and we talked about an example of Hubble, where it was several weeks, maybe even months before the first images were brought back from Hubble.

Then in a case of, we talked about the Mars Landers, where we go through the check out we just been watching, where it takes some period of time, because you want to make sure that your spacecraft is operating nominally. All your

systems are working. All of your protective systems are in place. All your software that will manage the process and keep you from fail safe modes, and all that sort of thing, is working properly before you start issuing operational commands, and get yourself in an operational dilemma that could have bad consequences.

Now the other thing you asked was, well, what happens when you return. What kind of processing do you do after you bring things back to earth. Well, that works in two (2) or three (3) different ways. First obviously, with an ELV, once you deployed a spacecraft, there isn't anything coming back, so you're not going to process anything.

Same with the Shuttle. If you deploy a spacecraft on orbit, like we do with Space Station elements, there isn't any processing to be done, although with the Shuttle, you're gonna come back. You're gonna de-configure the orbiter bay. You're gonna remove – they'll be structure that's left in there from virtually any kind of deployable satellite. They'll be cradles.

They'll be fixtures that encapsulate that spacecraft, from which the spacecraft springs out, or is lifted out by the Shuttle arm, or whatever. So, you'll bring back, and all that stuff will come back. Be picked up by the payload people and it will go back to whoever is the owner. If it's the mission manager or if it's – could be Kennedy equipment – whatever. Like the Shuttle arm is maintained down here at Kennedy.

Now, in the case of the days of Spacelab. We would land the Shuttle with the Spacelab. We would go out – the first thing we would do is go out and get the samples off the Spacelab. The scientific samples so they wouldn't be lost. We would keep power on the spacecraft after landing to keep the refrigerators running and all that stuff to protect the samples. And we got all that off.

We would power down the spacecraft and then we would de-integrate the spacecraft in the same manner that we integrated it. We would tow the orbiter over to the OPF. We take the crane, we lift out the Spacelab. We put it in the canister in the horizontal. We'd bring it back over to the ONC building. We would take it back out of the – in the ONC we would set it in a cradle in the ONC, and we would disassemble the Spacelab entirely and prepare it for it's next mission.

In one (1) case, we had a re-flight mission. Can't remember which Spacelab it was. In that case we didn't take a lot of stuff off. We basically left it pretty in tact. Depends on what the follow on mission would be as to how much de-integration you would do, and how much change you would make.

There isn't much, except in a case of non-deployable payloads, Spacelab, Spacelab, those type missions, there isn't, other than de-integrating the supporting structure, is still labeled after you've deployed your payload, there isn't much other activity to be done.

DR. ORVILLE BUTLER: There are a few occasions where they brought satellites back for repairs.

MR. JOHN CONWAY: Right.

DR. ORVILLE BUTLER: What was Kennedy's role in the?

MR. JOHN CONWAY: Okay, what they did, yeah I know of one (1) case that occurred. Basically, what we did, we had in the orbiter. We had, I'm gonna call it a cradle, it was really a support structure to set the spacecraft down in, okay, that was bolted in the payload bay. We, on orbit, took the arm and/or the flight crew, and we put it in that cradle and bolted it down and secured it. We flew it back to Kennedy.

And I'm trying to remember. I think, what we did is then we took that out and probably put it in the canister. Took it to a payload facility and then took that out of the canister in the payload facility and turned it over to the Spacecraft people, who then carried back to their factory and worked on it back at the factory.

So Kennedy was involved only in, if you will, disintegrating it from the orbiter and from any of the Kennedy handling equipment, like the canister and turning it over to the spacecraft owner, who then took it back to the factory where they work on it.

DR. ORVILLE BUTLER: Next big question.

MR. JOHN CONWAY: Okay.

DR. ORVILLE BUTLER: During the 1980's as part of the process of privatization, we have the development of three (3) what was called singles white

contract. The base operations contract came first, then came the Shuttle processing contract and then in '86, shortly after you came onboard, with payload processing.

MR. JOHN CONWAY: Payload ground operations.

DR. ORVILLE BUTLER: Payload ground operations contract. Can you tell me your role in the review for the payload ground operations contract? What was involved there into making process and how that developed?

MR. JOHN CONWAY: Well, when did that contract start? Do you remember?

DR. ORVILLE BUTLER: It was sometime in '86.

MR. JOHN CONWAY: Okay. Right that was on my shift. Okay.

DR. ORVILLE BUTLER: And how that changed Kennedy's role in payload processing?

MR. JOHN CONWAY: It didn't really change Kennedy's role in payload processing. Let's back up and talk about the three (3) contracts a minute and lead you down to the payload contracts. Okay. I mean I was involved, as many people at Kennedy were, in analysis that went on in the determination that said, let's go get these three (3) contracts. Part of the rationale behind the three (3) contracts was to focus responsibility on base (inaudible) and the Shuttle and the Space Station, I mean in the payload area.

Have a clear line of responsibility verses a large number of contracts, because if you take the Shuttle world, we had like four (4) or five (5) contracts that folded into the Shuttle arena. We had the SRB processing contract and then we had the tank processing contractor, and we had the orbiter processing contract and so forth.

It was felt that we could get some synergy within the Shuttle world by doing that by crossing your lightening technicians and things of that nature, which we did. It also would have added focus responsibility.

In the payloads arena, there were, and by the way, Kennedy studied that concept for two (2) years and had Booth Alan Hamilton (phonetic) come look at it and tried some independent assessment, and virtually everybody who was involved in a very long debate that led up to those contracts.

DR. ORVILLE BUTLER: When was Booth Alan?

MR. JOHN CONWAY: It was prior to the issuance of any of those contracts in that two (2) year period when we were studying what was the right approach, and what should go into each contract and how it should be structured.

Basically, you're dealing with a number of people who had their own individual little contracts and we're reluctant to lose control to the bigger contractors, so you're having to listen to a lot of that.

In the payloads world.

DR. ORVILLE BUTLER: There's was resistance here at Kennedy to the?

MR. JOHN CONWAY: There's always resistance to change.

DR. ORVILLE BUTLER: Sure.

MR. JOHN CONWAY: There's always resistance to change, and so people who had a little contract for 20 or 25 people that supported some function for which they were the sole owner of the contract. They were very concerned about loss of control and whatever, that goes with that.

Some of the arguments had merit. Some were basically parochial, okay. My personal view is that it was handling in a – coming up to those three (3) contracts. The way it was done over a long period of time with a great deal of opportunity for people to voice their concerns and to work through issues, was a constructive process, which I feel, led to a good conclusion.

There were compromises certainly. There were trade-offs between functions that should go in one (1) contract verses the other. You couldn't entirely have – you know the idea would be that the functions – there wasn't any overlap between functions between these three (3) contracts, but there were cases where the Shuttle contract would provide services to payloads – or payloads would provide services to Shuttle.

EMCFCA was an example of - that's the Frequency Control Analysis. Didn't make sense to have three (3) EMCFCA groups of people, so it ended being an

ELV type function. I say ELV. It went to the payloads arena because it supported the ELV's that the DOD's launched.

It supported the ELV's that Kennedy launched and it supported Shuttle analysis, as well. So most of the work, the bulk of the work was probably in the ELV arena, and so that's kind of the basis on which things we done.

It was like, if the majority of the work was done with support of Shuttle, most likely it would go to Shuttle and they would provide the ancillary support to the rest of the Center. Let me say, it was a well – it was probably worked to death – if you want to know what I really think. But it was done in a way to help sell change.

Making the change- the hardest part in making any change is convincing people that a change is good, and there are advantages in there for them, so they'll be supportive and not be resistant to change. I can give you an example of that, but that takes more time.

DR. ORVILLE BUTLER: That's okay.

MR. JOHN CONROY: An example of that - as the Space Station program was coming onboard within payloads - we had a payload processing group and we had a customer service group and we had an ELV group and the issue was, because the bulk of the payload work was kind of going to become the Space Station. Should we create a separate a separate Space Station organization or whatever and it was time to change with the Space Station near arriving.

So I did something that my Center Director, Bob Griffin, thought was a radical, radical approach, and he just shook his head. I said, I'm gonna let the employees determine what the organization looks like. What do you mean? I said, I'm going to set up two (2) teams of people - One, some of the young bright employees, and on the other hand, some of the more experienced, you know, more senior people and I'm gonna let them tell me how they think we should organize payloads for the future.

You know, I knew there were probably a couple of basic variations on how we could do that. I wasn't sure what was the best way was to do. So we did that. The two (2) teams pretty quickly joined forces and became one (1) team, on their own. I got no - Dave Flowercy (phonetic) went on to become the Chief Financial Officer here, which he was a staff guy that worked for me and he kind of headed up the effort.

They gave me no interim reports, other than to say things are going well. We're not ready to show it to ya. They worked and they spread out and, you know, the people were allowed to talk with their own organization about options and what they thought.

They came to me finally and they said, we're ready to give you a briefing on this organization and I'd already made up my mind. If I could live with it, I was gonna accept it as it was - period. Because it belonged to them. It wasn't something management levied on 'em, they thought it was the right way to do things, okay. So my selling change was a piece of cake - if I could live with it.

So, they briefed me on this thing. Took, I don't know, two (2) three (3) hours. They had all these charts. I mean right down to the lowest organizational level, you know, not with names now, but just the way the organization should be structured for the future. They had one (1) chart where they had a little group there, and I didn't quite understand what the group did.

So I asked them some questions about that and they explained. Okay, I understand. So they got all done and said, well, what do you think? And I said I'd like you to go back and change that chart where I asked you that question to clarify what that group does. I said, other than that, I'm fine with your charts and we're ready to go see the Center Director.

DR. ORVILLE BUTLER: Do you remember what the group was?

MR. JOHN CONROY: Naw. It was just some little group and the name wasn't clear. I didn't change a thing. I mean the name, I wasn't sure what the group did or something. I said, we'll change the name to - they said, well that group does so and so and I said, why didn't you call it that, then I'd understand it, you know.

So we went over and I said, I want you to give the same briefing to the Center Director, that you just gave me. Your not gonna change anything? No, not gonna change it. So we did and he said, is that what you want to do? And I said, yes, Sir, that's what I want to do. Okay.

Then the group came and they said, this has been one (1) of the most difficult things we have ever done and we really feel sorry for you manager guys. You're gonna have to go put names in these boxes, cause we know... (ringing phone) That's my wife. ...we know how difficult it's gonna be. <I'm still here talking>.

DR. ORVILLE BUTLER: We're back.

MR. JOHN CONROY: So anyhow, we then went back and so then we got the managers in there, and we struggled with who went in what box and everything and so forth. And we put it together with every name, every name in our entire organization. We must have 300, or some 350 people, in those days. Had ELV and all this stuff in there, who was gonna be in what box, where your name was, and so forth.

Said, okay, I went over and went through it with Bob Griffin and showed him and personnel what we were doing to make sure they weren't gonna have a.

DR. ORVILLE BUTLER: Do you remember the year this was going on?

MR. JOHN CONROY: You know I really don't, but it was probably - it was probably – we were starting Space Station up. When Space Station was really starting to get going good. I'd say it was around somewhere a little before 1990, I'd say, somewhere along in there. At any rate, we put all these names. So I came over and I visited with Bob Griffin and personnel and made sure we weren't screwing up the grade structure and all these good things.

So, we got all these people - the people in the training auditorium and brief these charts. For the first time, they were seeing where they were going and who their supervisor would be and so forth. And they all saw it at one time. And we handed out copies, so that everybody could have a copy, could find their name, knew where they fit, you know.

So I got all done with this and I said, are there any questions? One of them raised their hand and said, when can we start? And I said, you know, I didn't ask my boss when we could start and I didn't ask personnel. I said, you know, it will take a month or so to get all the paperwork changed. I said, when would you like to start? And unanimously they said, tomorrow. And I said well, today's Thursday, Thursday afternoon, why don't we make it Monday morning, and that will allow me time to go and explain to personnel that were gonna start operating this way, even though we don't have any paperwork (laughter).

So why don't take one (1) day of rest and Monday morning when you come to work, report to your new job. And I mean, I have never seen an organization so thrilled about. There weren't winners and losers. I mean, nobody felt like it was a group decision - it was done for the good of the whole. There wasn't a territorial war. Now, I could have done the same damn thing, but how many would it have taken me to convince them all that this was the right thing? So, I don't know how we got off on that, but.

DR. ORVILLE BUTLER: Let's move back to the processing contract.

MR. JOHN CONROY: Okay. So what I was gonna say is, back to the processing contract, there was enough debate that I think most people, ninety percent (90%) of the people, maybe seventy-five percent (75%), some number like that, were convinced that this was a reasonable contracting approach.

I had worked on the Shuttle side and worked in the Shuttle organization prior to coming over here, so. As a matter of fact, I was head of the management team on the source board when we selected the Shuttle Processing Contract, which turned out to be Lockheed, who won out over all the incumbent processors.

DR. ORVILLE BUTLER: Let's touch on that briefly. How come – what was it that Lockheed brought to the table that gave them, what newspaper reports said, was a hands-down advantage over Rockwell?

MR. JOHN CONWAY: Well, It wasn't what Lockheed brought to the table. What Lockheed brought to the table was a solid B paper. You've been in the University world – they brought a solid B paper across all areas. The incumbents brought a blackmail proposal to NASA. It wasn't that Lockheed won, it was that the incumbent self destructed.

They got together and they formed a team called the Great Alliance, or some such thing. They decided if they combined forces, NASA would not have the guts to select a non-incumbent. They wrote one (1) of the worst proposals in the history of

proposals. They did not reduce a single person from their workforce. They did not have any synergy, whatsoever.

They simply combined their forces. No-body gave up a single technician, and they said, if you give us the job, then you don't need NASA. We're so good, that you can get rid of a thousand NASA engineers. They said, we'll need a data center in Houston to do work control from, so that's another Twenty Million. That would ensure that no-one else could ever compete and that the contract away from them in the future.

The management committee of which I chaired, gave them eight (8) major weaknesses. By the way, the contract covered both the Air Force at Vandenberg and NASA here. They had different contractors doing the work at Vandenberg and at Kennedy, because Martin had a large presence out there, so they kept everything. Martin had almost no presence here, except for the ET, and so they kept ET here.

Now, I'm not an expert in this management stuff, but we went out and saw a fellow called Peter Drucker (phonetic). I don't know if you've ever met Peter Drucker (phonetic). I spent three (3) days with Peter Drucker (phonetic). A most remarkable man. Probably one (1) of the most wonderful two (2) days I ever spent as a manager.

Phil Culbertson, who was the number three (3) man in NASA chaired this board, and when we rolled in with these findings and said basically, the incumbents had

a poor proposal, and these are the same guys getting A's in award fees. And that this Lockheed bunch had a good proposal - not a very good - not an excellent.

We reevaluated finally and we moved the incumbents to, I think, one (1) point in the good range, and adjusted the Lockheed up the exact same amount so they were now very good. One (1) was good and one (1) was very good. We felt like, despite the proposals, they had done a good job and we should say they were a good contractor and so we did.

We went out to see Peter Drucker (phonetic). Phil Culbertson felt we had to test these findings because they were so strong. Went out to see Peter Drucker and we put together a very sterile presentation of what had been proposed. Carefully checked for no bias – just conclusions on our part. We had dinner with Dr. Drucker (phonetic) and his wife, we went over to his house, and we got out a bottle of brandy and we sat around – and he said, well, talk to me a little bit about this, cause I'll need to think about it overnight.

We talked about it and I pulled out these charts and I said, why don't we walk you through this pitch of what's been proposed and we would like your assessment of it. He said, well, okay. Said, first I'd like you to do one (1) thing for me. He said, tell me the companies involved in these proposals, and we did. They were all the incumbents, Rockwell and so on.

He said, now I want to go around the room now. There were three (3) of us, me, Andy Pickett and Phil Culbertson. He said, I want to go around the room. I

want each of you, in your own words, to tell me how you feel these companies are performing at Kennedy and at Vandenberg today. I would appreciate an honest input from the three (3) of you. We did that.

I mean, you know, it wasn't terrible, by any means. Like their doing a good job, by and large. Okay. So then we started through this chart. We probably had 30 charts that described how they had proposed to organize and which companies retained which functions, and the basic means by which they intended to operate.

On about the seventh or eighth chart, Peter Drucker (phonetic) said, I know what's behind it. I know what their proposing. I don't need to see anymore charts. I said, but Sir, I haven't even showed you. He said, and it was like a man saying, it's a 57 Chevy, you don't need to tell me about the transmission engine, I know this.

He proceeded to repeat almost verbatim, our eight (8) major weaknesses about this proposal, in his own words. I was writing them down like – you think she is taking notes – I was writing these down. When I left there I made – Andy and Phil sign that that's exactly what he said, because our team was the one (1) that was being challenged.

We also sent that proposal – Phil did – to what's his name, Welch, that ran GE, and to, what's the guy, the really respected guy, whose went to Wentzler (phonetic), Head of Wentzler Institute, George Lowe (phonetic). George Lowe, both of them said exactly the same thing about this proposal.

So what did Lockheed bring to the table? They brought to the table a solid proposal, not an outstanding proposal, a solid, well thought out proposal, at a time when the incumbent self-destructed. They didn't win, the other guy lost.

DR. ORVILLE BUTLER: That's a great story.

MR. JOHN CONWAY: I still have the notes from Peter Drucker.

DR. ORVILLE BUTLER: You think you could send me copies?

MR. JOHN CONWAY: I'll let you see them sometime. I mean exactly. So, Phil asked him one (1) other question. He said, well, Dr. Drucker (phonetic), I understand what you said about this proposal, but he said, they are historically, have there been any like arrangements that have succeeded. Peter Drucker (phonetic) says, well, I'll think about that and we'll talk about it in the morning.

So we came back in the morning. Well, we got – I mean, we were done the night before. In fact, I got up at 4:00 A.M. and called that management team back here at Kennedy and said, let me tell you what Peter Drucker (phonetic) said.

And I will make these guys sign these notes, before we leave, so they can't get back home and have memory lapse. But I said, and I repeated what he said. I mean, there was a sigh of relief, because you know, we were out on a limb. I mean, you know, we weren't management guru's or anything.

We go back the next morning and he said, I've given a lot of thought to what you said. He said, I can come up with two (2) instances. He said, there were two

(2) companies that teamed together and had an arrangement like this and they were very successful, and they were successful in spite of what they proposed. In fact, they had two (2) extremely strong managers who worked as a team, who liked each other and they worked as a team, and these two (2) guys made it work. He said after about two (2) years one (1) of them left and it fell apart. It was held together by these two (2) people.

He said the other example, that I can think of historically, was the American railroad system during the civil war. He said, it was so screwed up that you wouldn't even tell whether it was a confederate or a union train by the direction in which it was traveling. He said, those are the two (2) examples of a like proposal. Okay, did that answer your question to what Lockheed brought to the table?

It's happened, I help people today – I help people with proposals for NASA business, and sometimes you have a very strong proposal and you win on the basis of a very strong proposal. Other times you have a proposal that's a B paper and the competition does worse and you win. You have a solid B paper, and you win.

That's not the way you like to win cause that doesn't guarantee you're gonna win. That means, you know.

DR. ORVILLE BUTLER: It doesn't guarantee your renewal either.

MR. JOHN CONWAY: Well, no, but then again you have an opportunity to prove yourself as a contractor and so forth. I mean, there are two (2)

ways to win and that's the one (1) that's not guaranteed. Guaranteed, is if you write a better paper than anybody else.

DR. ORVILLE BUTLER: Originally there had been about eight (8) companies that had submitted proposals?

MR. JOHN CONWAY: May have been, but see, this collage of incumbents got together and teamed up on the world, and won. Now in (inaudible) case, there were only two (2) bidders. I wasn't on the source board. I think Joann Morgan ran the source board for me. Boeing and McDonald Douglas bid that job, and McDonald Douglas ended up being the winner - and McDonald Douglas. See, the reason that was not a C change in payloads is because there were seven (7) or eight (8) contracts that were there, but the two (2) biggest contracts were both held by McDonald Douglas.

One (1) was for payload processing, non- Spacelab, I don't know remember what it was called, ICKO or something, but it was the deployable payload processing contract. Then there was another Spacelab contract. Then there were just some small contracts in there for which I'm sure, like this EMCFCA stuff.

The ELV stuff. Naw, the ELV stuff really came over, it was part of the Shuttle contract. It was part of a CSC/ACA Shuttle Support Contract. Cause CSC/RCA did all of the LPS, the pad instrumentation and communications work, and I managed that. Then we also did the Hanger AE telemetry station and so actually McDonald

Douglas had CSC as a sub-contractor and retained that. So essentially, the incumbent contractor won.

Now the interesting story that goes with this is, is that George Fianza (phonetic) was the contractor base manager, and they were bidding that and of course, he had these two (2) big contracts that worked for me. He came to see me and I said, what are you doing? He said, well, I'm working hard on this proposal, you know. I said, why are you bothering? You can't possibly win. He just looked at me and said, what do you mean.

I said, George, I can write down a list of things that would be more efficient that you could do. I said, I you want to win this competition. I said, you've got one (1) choice. You go out to McDonald Douglas and you assemble the best team of managers you can find. You bring them in here. You show them how you're doing the work today and have them tell you how a competitor would beat your socks off.

I said, if you want to bid this job, and give me a good proposal, that's what you need to do. And by the way, if they tell you things that you need to be changing, you need to be changing them before you bid the thing to show some credibility. He did that, and he won.

But, business as usual, doesn't win. I mean, never has. I've been on a lot of these source boards, you know, and I was just giving him good fatherly advice, plus I want a good proposal. You know, (inaudible) man wants good proposals. He did that, and he won, so he did streamline, synergize, you know, made some

improvements, got some efficiencies, this, that and the other. We got two (2) very like proposals from the two (2) companies. I mean, you know they were both good proposals.

They didn't make a tremendous change in the way we did business, but in the payloads world, the civil service and the contractor have always worked more as a team than they did in the Shuttle world. Shuttle world it was more us, and them. And in the payload worlds it was – we, as a team.

When I was once asked by Bob Crippen, well, how do you separate the two (2), because I think Jay Honeycutt was struggling what the role was of civil service and contractor was in Shuttle. I said, it's real simple in my world. I said, I hold McDonald Douglas responsible for everything. And I hold NASA guys responsible for everything, and I said, when have a problem, I'm gonna come down equally hard on both sides.

If the contractor is screwing up, I expect the NASA guys to run in there, pick him up and carry him across the finish line. If NASA's screwing up, I expect the contractor to rush in there, pick him up, and carry him across the finish line. All I care is that we score points. That worked for me and they still do to a much greater extent.

Tip Colon would tell you that today, in payload processing, it's much more of a team situation, that they enjoy with the civil service and USA, for a variety of reasons.

DR. ORVILLE BUTLER: Now, how did USA, in '95, change things from the previous three (3) contracts?

MR. JOHN CONWAY: Well, from a Kennedy – when you say previous three (3) contracts, okay, all they did was, USA was a combination of the LSOT (phonetic) contract at Kennedy, run by Lockheed. In the Rockwell contract at Houston, that were run by Boeing – Rockwell, okay. So USA was nothing more than two (2) companies who got together, who combined their contract structure at Houston, that was all Boeing, with the Lockheed contract structure at Kennedy.

So, from a point of view of personnel, or that sort of thing, I guess you had a lot more synergy within the contract between Kennedy and JSC. You also had, in my humble opinion, you created a situation where the Kennedy civil service people felt disempowered to a larger extent, because now this contract was run out of Houston. The contractor tended to not be as responsive to concerns, maybe expressed by Kennedy, or at least that was the perception.

DR. ORVILLE BUTLER: Cause Kennedy wasn't (inaudible)?

MR. JOHN CONWAY: Right, right. If Kennedy complained about something, they could go to JSC. Now, I'm not an expert in that. I didn't work in that world. But a guy who does know about that, if you want to pursue that, is Tip Colon. He worked in that world. Knew a lot about it.

I understand there's a lot of good in the USA. There's also some things that, you know, from the CABE report and all, that troubled me about the way USA

operated. It certainly created a sense of confusion over who was in charge. NASA or the contractor, particularly at Kennedy. Perhaps broader than Kennedy throughout the Shuttle program.

That's not good because it's an unforgiving business, and just like I said before, you need everything working for you. You need everybody with their shoulder to the wheel in a high risk environment like that.

DR. ORVILLE BUTLER: Very good. Some smaller questions.

MR. JOHN CONWAY: Good Lord. Okay.

DR. ORVILLE BUTLER: In 1994, Vice-President Gore came here.

MR. JOHN CONWAY: Yes.

DR. ORVILLE BUTLER: And singled you out for reinventing government, particularly for payload operations – improvements in customer service. Can you talk about what was going on with customer service in the previous years and what you did to change it?

MR. JOHN CONWAY: I can tell you exactly what that was all about. When I got that job, I was called in by Dick Smith, who was the Center Director, and I was told that customer support – the payload customer disliked the Shuttle program tremendously, and they are very unhappy with Kennedy's performance and everyone else. Your Number One (1) job – Number One (1) priority is to fix this customer satisfaction. We want these people to be happy customers when they leave Kennedy. I sad, Okay, I understand that.

So, I went up to Washington, and I talked to the people up there - to Chetley, and others who worked in the customer services organization. I listened to their story, and the first thing out of Chet's mouth was, the first thing you can do is change the damn name of that organization. It's called "Cargo processing" and cargo is the same thing that Houston calls it, and that's like the bed of a damn pick up truck. That's the cargo bed of a truck.

In the ELV program, the customer is used to feeling they are the primary purpose for the mission, and they don't feel that with the Shuttle program. The first thing you can do is change the name of that organization. I said, what would you like it changed to? He said, well, I'd like you to call it Payload Processing. I said, okay, thank you.

I came right back home, went right back to Dick Smith and I said, I need to change the name of my organization. I'd been there two (2) weeks. He said, why? I explained – I said, you told me to work this customer satisfaction – customer doesn't like a name – we're changing it. Okay, fine. First thing we did, was change the name.

Second thing we did is, we got everybody in that organization in and said this is what we're about. This is our job, customer satisfaction. We don't have any other job. We don't build these payloads. We don't design these payloads. Our job is to help the payload customer get into space. We changed the culture. We started by changing the name.

I then made it a priority, when a customer came to this thing, first thing I did was have them come down to my office. I gave them my home number, my work number. I said, you call me 24 hours a day, seven (7) days a week, you got a problem. Let me know if you got a problem. Don't hesitate to call me. Don't hesitate to call me at 3:00 o'clock in the morning.

Well now, you know the people that work for me aren't gonna be happy if the boss gets called at 3:00 A.M. because they haven't taken care of something. So pretty soon, that customer had a whole list of numbers to call, before he called me. We basically, when I came over there, the payload people were going around with their head down because they felt like they were second class organization. The Shuttle people, you know, they flew the Shuttle. We just did the cargo stuff, you know.

DR. SALLY MIDDLETON: Can I ask you – how many of those payload people came from ULO and ELV?

MR. JOHN CONWAY: The ULO program was basically maintained in tact.

DR. SALLY MIDDLETON: Because a lot of the payload people came from that?

MR. JOHN CONWAY: Not really.

DR. SALLY MIDDLETON: No?

MR. JOHN CONWAY: Not really. The payload people supported ULO and the Shuttle payloads. So they were – a lot of these people, yes, worked ULO, but all these customer service people – all these people that helped with a

payload processing were already in the payloads thing, but they had a ULO stamp on their forehead.

You know what I mean. They had a separate group kind of - that did that. So it was – now we kind of combined all those groups into one (1), so that we used the people. Some people, just because of personal preference and all, would be an LSSM for certain – we got a lady over here that just turned 80 the other day, you know, she was an LSSM for Hubble and – neat lady.

Then we put it, of course, in everybodys performance plan. We did, as a priority item, you do all the things you want when a culture changes. You start recognizing people in your organization that did something that helped the customer. Etcetera, on down the line. To this day, Kennedy has that reputation.

I was just one study team for NASA last year with Rita Wilcoxen and Russell Romanella (phonetic) that was looking at what we needed to do to change the way we handle payloads for Space Station. Course, this has happened before the exploration initiative, and so that's gonna impact all this to some degree.

They went out and took customer survey data for the last 10 years. People came back and said, Kennedy does it right. Kennedy understands customer satisfaction. Kennedy, if you're working on a spacecraft and lunch time comes, he said the Kennedy guys come in and say, can we go get you a hamburger so you don't have to stop work. He said, they'll buy you lunch out of their own pocket. They'll do anything – you can ask them for anything – and what we instill is - that 's your job.

Don't tell that customer, you know, that's not my area, you gotta call somebody else. No. You go call somebody else. You go take care of it. I don't give a damn what they ask for. That's your job. And we began to reward people and we began to celebrate success and it was easy and it was fun. I said, we've got the greatest job in the world.

We get to work with people from all over the world that come here. Goddamn Shuttle people - that's a garage job, you know. I said, all they do is put a greyhound bud on the road. They bring it in, They service it. They do it. They crank it up, they wash the windows. They send it out again. I said, same greyhound bus.

You guys get to see every unique payload. You get to work with every customer. You get to work with customers all over the world. You get to work with the best scientists. Tell me this ain't the best place in the world to work. This is it.

We began to attract people. And of course, the other thing you do is when you run an organization like this, is every time you get a chance to, as they do in football or baseball, every time you get a chance to hire an A performer, you hire 'em. You worry later about where you're gonna put him. Every time you get a chance to get rid of a C student - somebody wants him, you let him have him. You don't worry about whose gonna do that job.

Over time, you can build a team of first rate people and then you get out of their way and you let them do their job. One of my greatest sources of pride is that

if you look around this place and all these SES'r, a whole lot of them worked for me at one (1) time or another.

So, my heritage is people. It isn't rocket and rocket launches and stuff. It's these kids that grew up and became - and made something of themselves and people gave me opportunities, God knows, you know. Little 'ol country boy didn't know anything, and I had a wonderful time out here. I got the chance to pass it on to some more kids who rose to the occasion. That's the change we made. We made it a Number One priority.

You know, this Virginia Whitehead, who just turned 80 the other day, I don't know if you had occasion to go over there and see that film. You ought to see that film they made of her. Virginia is a little 'ol lady who wears tennis shoes. Single minded focus on customer satisfaction, and that's what you have to have.

In other words, she worried more about that customer than she did anything I said, or any rule I made. Now I knew that, and I knew that Virginia was gonna get – but you need an organization like that – you got to have people, that that's their priority in life.

And Virginia, if you stepped out my doorway in the afternoon to go home at 6:00 o'clock, you better look left or right, because Virginia was coming down that hall 70 miles an hour in those damn tennis shoes, and she'll run you over just like a linebacker, cause she is focusing on something that somebody has asked her to go get from one of these damn customers.

If she sees you she'll say, hey, John, just a minute, you know, you said we couldn't do so and so, but we gotta do it because this guy needs this and he needs that and here's what I'm gonna do, and Yes, Virginia - Yes, Virginia, thank you Virginia, thanks, yes, you're right, I didn't mean it that way, bye.

And it's fun. We had a fun, fun group. Group don't exist anymore., but we had some fun times. We laughed at each other. Made fun of each other. They made a lot of fun of me. We just, you know, once we got turned on to that customer thing, there was no stopping us. People would just come up with things we can do to help and do and so forth. I would too. I dropped everything to do that.

So when we had this process, what they said is - can't do it like Kennedy, Kennedy understands customers stuff, we don't need to change anything at Kennedy. They said Marshall used to understand customer support, but they lost it after Spacelab.

JSC has never understood customer satisfaction and working with the customer. Now that's what 10 years of customer data said. When we did our study team we didn't change anything at Kennedy.

DR. ORVILLE BUTLER: Is this report available?

MR. JOHN CONWAY: Yeah. Yeah, the whole survey. Everything. It's available. Rita Wilcoxen's has got it, and it called the SSUR report. There's an office up here on the second floor that's got 500 copies of it. Cause I come out and got my four (4) or five (5) about three (3) weeks ago.

DR. SALLY MIDDLETON: SSUR?

MR. JOHN CONWAY: SSUR report, and you want the appendix that's got the customer survey in it. It's got two (2) volumes. One (1) is the report of our team and you can get that from Rita Wilcoxen, and you don't know her, do you? Rita Wilcoxen is an SES'r, she works up there for SE and T, or some outfit like that. W I L – one L or two – C O X E N. If that doesn't work, call Russell Romenella (phonetic) and tell him that you talked to John Conway and you need that SURR report.

You need to understand that customer satisfaction stuff. It's a good report. A lot of fun working with those kids again. Boy, they were hell on me though. If I was a minute late – you know, grrrrrrr. What do you mean coming in here? Don't you remember what it was like working with you? (laughter)

DR. ORVILLE BUTLER: We kept you much longer than we ever we expected.

DR. SALLY MIDDLETON: I know, I gotta go. I have a long way to go.

DR. ORVILLE BUTLER: I'm sure we could come up with more questions, but I think we probably better leave those until maybe another time.

MR. JOHN CONWAY: Well, ok, glad to do it. All right.

DR. ORVILLE BUTLER: And I thank you very much. You provided.

MR. JOHN CONWAY: Well, okay.

(WRITER'S NOTE: Not sure the following was meant to be transcribed, but Mr. John Conway continued with the forthcoming conversation)

MR. JOHN CONWAY: We weren't gonna fly anything commercial on Shuttle, and then we were gonna turn over all of the launch ELV stuff to the Air Force, so that's what transitioned the launch pads at Kennedy. The Atlas and Delta pad to the Air Force. Now we did not transition the pad at Vandenberg and the reason for that is cause the Air Force didn't have any missions to fly. They wanted our pads, cause they had missions to fly on Atlas and Delta from the East Coast. They didn't want to take over the responsibility of the pad at the West Coast, cause they didn't have any missions to fly.

Then we went through a big debate over, if we turned over the pads to you, we still wanted to still maintain oversight for our missions. Now the way that would work is, our mission would fly, kind of like, commercial missions.

In other words, we'd go out and we'd but a launch service from a commercial provider and then we would do the integration, the Air Force would do the pad, and we wanted to have oversight out at the pad on our missions. We had a General Cromer, who was a space command guy, and he was determined.

DR. SALLY MIDDLETON: How do you spell his name?

MR. JOHN CONWAY: C R O M E R, and he was determined that we weren't gonna have that, but Charlie Gunn (phonetic) was running the ELV program up at Washington at that time, and I was running the thing down here.

We were negotiating the agreement for the transition of the pads and so I would write the language we wanted and Charlie would work it at the Pentagon and we ran circles around those Three Star Generals and managed to get language in there that said, we would have access to the pad to go provide oversight over the NASA missions and stuff, which we still have today. There was just a little bit of a power play, but it worked out fine and the right thing was done. And that pad still is NASA pad.

NASA still has the Delta launch pad. They have never transitioned and that's because the Air Force has never flown any missions. If the Air Force were going to fly missions they would have taken over that pad too. Which is fine, I mean it would have been better if they took them all over. We weren't trying to hold onto it. In fact, we were trying to get out from under the cost of maintaining the pad.

DR. SALLY MIDDLETON: I know you've always had a close relationship with the Air Force as far as.

MR. JOHN CONWAY: They are culturally, two (2) different worlds, but.

DR. SALLY MIDDLETON: I've heard that.

MR. JOHN CONWAY: They are. There culturally two (2) different worlds. Peter Drucker (phonetic) when we were doing that contract, he said you're not looking at the biggest issue of all. He said, NASA and the Air Force cannot do business together. They're two (2) entirely different cultures. Management style is entirely different.

DR. ORVILLE BUTLER: And (inaudible) under Debus, there was one (1) time when Debus made the argument that either the Air Force is gonna get out of Aegina (phonetic), or we are.

MR. JOHN CONWAY: We'll they're two (2) different cultures, course there are a lot of Air Force people in NASA today. And so that has led to somewhat of a situation, in my opinion, that NASA has somewhat of a confused culture today. NASA's culture is lacking in my opinion, in many things today. CABE report talked about some of it. Payload study we did, talked about some more of it, and it's because there hasn't been leadership.

We had a confused leadership at least since Dan (inaudible) been around. Where people of different cultures were brought in – never really assimilated into a common culture and if you, you know, if you got the people at the top who have a set of value systems, and their value systems is safety and quality, those kind of things and that system should permeate through the entire organization.

If you have mixes message at the top, you're gonna have a mixed culture at the bottom. And NASA has not had an integrated clear voice for some time. They still don't. You used to - we knew what it was about.

I give you one more story. George Lowe, when I was a child. I was about a GS12 or 13 down here at Kennedy, and George Lowe, when he would come down here to the Center, would go visit up and coming young people. He would take an afternoon. He was here for some meeting, and he would ask Kurt Debus and them to come up with six (6) names, and he'd go spend a half hour with up and coming people.

So I was selected for, probably through a mistake on somebodys part, for George Lowe to come call on – in my cubicle in the CIF. So, I'm pondering what profound thing that I could say to this man, you know, knowing I've got this one great shot that he would think I was a good guy.

So, he came and sure enough, we talked and sure enough, he said, finally, well, what do you think John, that we ought to do different in NASA, or we could do different in NASA or whatever, you know?

I said, well, I thought about this. Dr. Lowe and I said, you know if I look at the work force we got out here, about a third of people really excited about their work, go about doing their work. Then we got another third that does a good job, but doesn't have that same sense of excitement and we got a third of the people that rather be playing golf or fishing or whatever. Now I said, if we could find a way to

instill that sense of excitement in the bottom two-thirds that we have in the top third, what a great place NASA would be.

He looked at me and he said, Son, you don't understand NASA at all. I mean, I could have crawled under the carpet. He said, in NASA, ten percent (10%) of the people do all of the work, and the reason I'm down here talking to you today is to try to make the 10 become an 11, rather than nine (9). (laughter) Yes, Sir, I never forgot that.

Think about it. You know, that's the view of George Lowe. George Lowe was a God, in my eyes. Still is. You know, I'm not sure we have that ten percent (10%) today that we should have, but it's because we got the people. We got the talent, we haven't given people the opportunity, and turned them loose to show their talent.

DR. SALLY MIDDLETON: So you think the military does a better job of (inaudible) than?

MR. JOHN CONWAY: Surely you jest. (laughter)

DR. SALLY MIDDLETON: I'll take that as a No. (laughter)

Thereupon the interview ended.