Steve Francois

Interview

By

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Dr. Butler: Ok I'm Dr. Orville Butler and we're here in the O&C building this afternoon, uh discussing space station and its developments in the 1990s with Steve Francois. And we may go back a little bit earlier than that I'm not sure.

Mr. Francois Start any place you want.

Dr. Butler: Ok, well I guess what I'd like you to do is to begin by a summary of the positions you held that dealt with space station.

Mr. Francois Ok Well like all things it was a progression, a transition of things. If you go back to the 1990, 1991 time period I transitioned from what was the old expendable launch group over to what was called Cargo Management or Payload Operations. And the way they had things set up at the Center the operational aspect of the space station, the planning part of the operations and the early ideas of how was we going to treat space station when it got to KSC was being worked in that Payload Operations since they had the experience of handling other payloads that flew in Shuttle, space station was viewed as just another payload, as a payload element that would be coming downstream. So I begin to get familiar with space station and how the folks were planning facilites, how they were planning the ground ops modes to handle the different pieces of space station, because at that time Dick Lyons headed up the space station project office and there was a design engineering group that was working on the actual design of the facilities and the GSE and this payload ops group that I was associated with was providing the operational requirements and and what we expected out of that GSE and facilities and providing budget imputs to the project. So it was a three, three pieces to the puzzle at KSC, the project, the design development agency and then the operations piece. So my focus was to be in the operations piece and while we were flying the current shuttle payloads in those days in 1991 we were doing the early planning for space station. So when I came on board about '90, '91;

about '91 or '92 they were having the final decisions about breaking ground on the SSPF. and so there was through out there there was continue are they going to redesign station; are they going to change it. The program office in Reston I think went through one iteration where they said ok we've changed the station one more time but here's what its going to look like. But in all them cases the SSPF was always built generic enough to handle whatever, if you changed a particular element it did not change the structure or the way you handled things over in the space station processing facility. It was capable of being tailored or being modified. I mean, it didn't take much, it could handle any flight hardware that came into it. That was a good part of the design. They really thought it through. So one of my early memories is headquarters wanted one more review to say if we were going to build the SSPF, because one of the choices was to put all the stuff through the O&C building. In that period of time all the Space Lab hardware was going through the O&C building high bay and clean room and had work stands and everything, so there was always one more question always well could you add on to the O&C to expand it, could you not modify the O&C and save the cost of a new facility and just process it in the O&C. And it sort of depended on the traffic models whether you thought you were launching five or six or eight a year and how fast you were assembling the station as to whether all that hardware could be at KSC at one time and housed in the facility. And how you were going to continue the existing shuttle missions. Space Lab was still flying, pallets were flying, modules were flying from the space lab. So I remember the group I was in put a presentation together to talk comparisons of the O&C versus the SSPF and how you could, what trades you could make. And so final decision as I recall, we went to Washington one day to Tom Utzman who was the head of code M or atleast high enough in code M to make the decision and he said I want to hear one more time before we break ground on the SSPF whether we have an alternative; should we be

looking at something else. And so Joanne Morgan and I and a couple of others went up there that day and we just went through what the guys back here put together and when we got out of that basically we got the go ahead to build the SSPF. And I can't remember, it was '91, '92 they broke ground on the SSPF, but you'd have to go back and look. I

Dr. Butler: hm, hm.

Mr. Francois So we had

Dr. Butler: It was March of '91.

Mr. Francois That's what I'm thinking. Because we had the ground breaking of the SSPF and so that was the final, we finally passed that milestone to make the decision and so construction started on the SSPF and things kept progressing but then again station was always up and down. Is it going to be redesigned or are we going to do something and the politics of that.

Dr. Butler: What were the politics of that?

Mr. Francois Well at that time I wasn't, I mean Dick Lyon can tell you better the politics of that era. He was dealing with with the Reston group and that. As the operations group we were hearing that, and we kept hearing oh, its changing this and that and the budgets were, you know, what are you going to do if you have a smaller budget? What are you going to do if we postpone it x number of years? Where I got involved in the politics that I can comment on was in March of '93. They suddenly decided with Golden and Congress that they needed a redesign of the Space Station. So they chartered this independent group to pull a bunch of people in that wasn't associated with space station and that was politics. I mean if you take people that know the system and ask them to go take another look at it or you go get people completely separate. So the basically got a lot of people separate from space station and they

brought one or two of the existing space station folk in but put a group into crystal city across the river from Washington there and said your job is to go figure out whats the options and whats the right design for space station and run a trade and make a recommendation to us. And they made it an effort that you had to start in March of '93 and the idea was to be done by the end of may. And so it was a three month effort to suddenly just take what people had done for years just decide overnight, you know, here's the right way to go do it. And so they had three three teams, they called them option A, B and C. And they chartered, one went to Langley to sort of be the host center for the look at this option, Marshall was the host center for one and JSC was a host center. Option C was the JSC one. That was what everybody called the big can. It was just one big, sort of ala sky lab. Go build one module that you put everything in and launch it and then basically. [interruption]

Dr. Butler: ok we're back.

Mr. Francois yeah, sorry about that. Uh

Dr. Butler: No problem

Mr. Francois They had JSC as sort of the big can, you had option A was the Marshall one, I think, which was figure out the minimum you need using existing space station hardware more and Option B was Langley and it was more or less take the current station and build it like it is and tell you why that was the right thing to do. So those three teams ran and operated out of the centers and I was assigned along with a core group to stay in crystal city and just sort of integrate and aggregate those three options together and make judgments about either the costs. And I was on the operations team. The operations team was to go write an ops concept and decide how you would operate this thing. So it was a real learning experience. I mean I'd had a flight background in station and this was sort of like an accelerated course in

catching up on the politics of station and the whole idea of Congress and going to selling this thing to Congress. And if you're a young engineer and you haven't seen that sort of thing its sort of neat when the administrator's coming over at seven o'clock at night and getting briefings and the next day he's bringing a congressmen with him and their getting briefings and there's iterations back and forth to the hill and you know, more than. [interruption]

Dr. Butler: Ok, we're back again.

Mr. Francois So it's a very interesting environment for just coming from a center and seeing all that interaction. Its very interesting to watch the dynamics of congress, administrator and engineering and options and costs all play together and Ryan O'conner wound up leading that team. I mean he became the focus of that team in Crystal City. And it pulled in JSC, Marshall, KSC folks, there's all kinds there. And uh one of the things we debated up there was you know, this whole concept of ship and shoot.

Dr. Butler: Hm, hm.

Mr. Francois I mean station was built and there was a preset mind that said it was going to be ship and shoot. I mean, your going to take this thing out of the factory, your only going to need about a week or ten days at the launch site and we're going to launch these things so we really don't need much at the launch site, you know, barely get us an unloading dock and, you know, a truck to haul us to the pad and we're there. And its like weelll

Dr. Butler: That had been apart of the design philosophy that had been announced in 1987 even.

Mr. Francois It was a constant design philosophy throughout space station. Even, you know, there was always a minimalistic approach as to what you do at the launch site and and and in this business that's always been a concept that you can drive costs down if you

just don't have to go develop capability at the launch site, you don't have to transport people and your manpower and everything at the launch site if you just cut the time. And so yeah, station was really locked onto that. They were going to keep everything to a minimum at the launch site that they can. And even in the redesign as much as we're evaluating new concepts and operations, I could go in KSC and say look I haven't seen a payload that's done this yet, and that was basically the theme we would carry to the table and say look, I'm not saying that's not a good goal but we haven't met that payload yet and nobody's been able to achieve that and are you guys being realistic about this and that is what would enter into the conversations about the SSPF. It was always it is too big its too expensive, it was about half built at that time and there was always a discussion of well should we just shut that down, save the money go, you know, only spend a portion of that money on the O&C and that's all we'll need to, you know, we'll save money. That's one area they wanted to go and investigate and say could we save money by just cutting it off, you know, just don't finish it. Well you did have it about half built and if you look at good news bad news, the good news was it was half built. And its very difficult to make a very good cost trade that says its worth shutting it down and leaving a hole in the ground over there versus finishing it. And so, the other thing is, I felt we could bring to the case is that SSPF has enough versatility in it that it wasn't dedicated just station. Cause a lot of folks old facilities we built around, their only built for one program. If that program ever ceases to exist you can't use it for anything else it just without rebuilding the facility. I mean if you spent $70 million to build it the first time you'll spend $50 million to convert it. The beauty of the SSPF was that it was built with versatility from the outset, you didn't care what came in it. It didn't care if it was a lab, it didn't care if it was a truss, it didn't care if it was and ELV payload can go in there. It really didn't care because it could handle almost anything. And so I always think one of the convincing

points was its versatility so that they couldn't say well we don't need it for station so quit. We said No, if you think we've got station and you've got anything following on after station, I mean this is the, this is your facility for the next thirty years. This thing is good, its versatile, its capable of transitioning without having to spend a lot of money on it. I think a combination of that and the fact that it was half built. The practical side says you aren't going to throw half the money away, I mean its cheaper to finish it. Because you'd pay termination on the contracts and terminations to figure out how to safe it. So it got to the point where it was.

Dr. Butler: Now when you started to build, or when they started to build it in 1991 Congress cut space station budget significantly and there was a few months where where before they originally scheduled to let the contracts in August of 1990 and they ended up not doing things or had ground breaking in March of '91 and the newspaper reports indicated that until the resolved this budget cut, which was several million dollars, that they weren't going to build the the space station processing facility and that when they did it would be much smaller than originally planned. Do you know if they downsized the construction of the facility?

Mr. Francois From the time I seriously got involved in it in '92-'93 it was pretty much whats over there. It always, like any design around here, they'll build it and then they'll always show you that if the traffic model grows you can add additional and the SSPF is built in the concept of foot prints, a foot print being the dimensions within the building to process one shuttle complement of hardware. In other words sixty feet long, fifteen feet wide and the thing it could flex on is how many of those footprints or how many shuttle payloads do you ever anticipate having here at one time. I remember in the early days, there were concepts that says that you could have eight footprints over there or what. Well if you go over there today there's uh, heck I knew, there is eight. But there was capabilities to have ten. It was in multiples of two,

because all you had to do was take the east half of the building and you could just keep adding on to it. And go out in the parking lot and just keep adding footprints and extend the high bay. So I think the only trade I was familiar with was just settling on the number. Was it going to be six, was it going to be eight, was it going to be ten and so they finally had to say this is it and if it comes along later and they just locked in on the number that's over there now. We didn't ever reduce the size of the building. When they broke ground, we built the building that was over there.

Dr. Butler: The news reports said they were planning on cutting it from eight to four.

Mr. Francois That was always the question was do you really need eight, could you reduce the size of the building and do it with four, but as far as I know, the day they broke ground they had eight intended and that was the architect and the drawings were set for whats over there, we never shortened it or changed it after that. It was argued before though.

Dr. Butler: Who was doing the arguing for a smaller size?

Mr. Francois It's a continuation. Dick Lyon may have more of that story, but I know we kept supporting trade studies about you know, what if you only launch four elements a year. Well if you only launch four then you only need three or four footprints a year. And it just depends on how long, especially if your in this ship and shoot mode where you say they're only here for two weeks. Well you say well Gee, if I'm launching four elements this year and their only here for two weeks, well gee, I can do it in one footprint. I just put one in there today and it launches and two weeks later I stick another one in there. So I can have a building with just one footprint. And so there was an extreme group who said yeah if we really believe we're going to do that then do this. But then another guy would come along and say well no, you may say that,

but if your going to bunch these up you may want to ship them early from the factory and stage them all down there and get them ready to go so their ready to pop right out one after the other. So he could argue for four footprints. So the ops guys and the designers could argue and the assembly people deciding how your going to assemble this thing on orbit says you've got to have these guys ready to go at one time so that when we start launching, you know, we know we're ready to launch the first one, the second one, the third one, because we can't stop. We don't have a stable on orbit configuration until we get to the fourth one. Well as soon as he makes that requirement on you that'll drive the size of the building because now you've got to have all four of them at the launch site to be able to go do something. It's a push and take and, you know, that was the general theme of the conversation. Well if you say you need this many elements to have a stable and we've got to have them all ready then that means the building needs to be this big. Other guys would say no if I redesign the sequence I can get fewer people and we'll reduce the building. As in all things what you see over there is a compromise. And probably at the time they picked the eight footprints they didn't have a very good traffic model. There was still arguments about are we going to launch them this fast, you know, or not, but you had to go and build something and they built eight and then what we did after that is is we tailored the assembly sequence and kept the system in balance. We kept the facility in balance with the assembly sequence, with how fast they're coming out of the factory and how fast we could launch them. We never, you know there was a time when we said if we can ever prove we don't need it we'll add on to the building [sic] but when we finally settled on the redesign after '93 and played the games with the new assembly sequence it turns out the building did fit and when I did the initial layouts and had the guys do the first ones we had that building full. I mean people kept saying we'll never fill this building up. It will be an empty shell, its going to be echoing in

here because this is just so huge. If you go back and look at the first pictures after we opened that thing in 94 and started bringing the hardware down, by the time the node launched, the first one, we were stacking hardware in the corners and all over that building trying to fit it in there just to pack it in. And people then come down and take a tour and said well, I just never believed you could fill this up. And I said well just take a look at it. I mean, take a look at the pictures sometime. The node 2A was in there all the way up through 5A and the first, you know, the lab was in there and everything at one time. Today you go over there and its still packed. It turned out to be a great repository because they go build the stuff in the factory and if your running a program and trying to get the costs off, you get the stuff built in the factory and get the factory off your payroll, centralize your operations. And so what they've done is centralized their operations in the launch site in the SSPF. So they just get down to the crew they need to check it out for launch and maintain it. But instead of having four or five factories scattered around the country you've just got one sitting over in the SSPF holding all the flight hardware that station has yet to fly, so it turned out to be a really great trade. And I think in the program, you know, as it matured it really saw it as you know, that was probably the wisest thing that they did was keep the SSPF in the system and keep it as flexible as it is. I mean in the era of Dick Lyons and the design engineers at KSC and the ops guys, the old ops guys, I say old, the ones that preceded me, that came up with that concept to keep the floors clean, to keep the platforms moveable, keep them to where you could reconfigure it from a long payload to a short one, tailor it. Man that was, that's one time when the ops guys one out and actually got to build what they said they needed and and for the time I spent over there that was the greatest concept and the fact we were able to keep it in there and not lose it. Cause typically when they want to cut your budget, they start saying well you don't need all them platforms, why don't you just anchor them

to the floor and save that money and quit worrying about moving them around, just go drill holes in the floor and bolt it and be done with it. And the answer is nooo, lets don't do that. And fortunately we had enough people that began to appreciate what its capable of and that's why its as good as it is today, in my opinion. It's still one of the best facilities around.

Dr. Butler: Now, in all these meetings that you were involved with up in Crystal city, did Kennedy bring to the table a unique perspective or were these debates uh, debates that were going on in other centers as well.

Mr. Francois Well crystal city was was essentially an assembly of all the centers.

Dr. Butler: Uh, huh.

Mr. Francois JSC was there and Marshall was there, KSC. So it was a centralized mini debate if you will. I mean, before that they were sort disseminated. JSC would call KSC and we'd go have meetings once in a while. We were sitting in the same damn building on the same floor with everybody and my ops team had a JSC guy and a Marshall and us and we all set in one room. And so

Dr. Butler: Was there a different perspective?

Mr. Francois Oh yeah.

Dr. Butler: What was Kennedy's contribution?

Mr. Francois Kennedy's contribution was saying, you know, and you had to be a little tactful because the Kennedy perspective says ship and shoot is dumb as dirt. It will never work. But if you want to be politically acceptable you can't go and tell the other guy his idea doesn't make sense when he's saying but for the money, and looking forward and we got to more futuristically looking. So what you had to do was come in and say look, it's a good goal, ship and shoot was a great goal but what KSC I thought could bring was lets temper that, lets put a

little realism with that, what's the practicality of it, lets plan if it don't happen the contingencies we can execute. I mean, you bring a payload to KSC and you say your gonna launch it in two weeks and you get a survey that says, you know, you need to go unfold your solar panels and look at them. Are you going to ship it back to the factory or are you going to do it at the launch site? Most payloads from our historical perspective says they're going to want to work on it at the launch site. Well maybe we should have some capabilities so you guys go ahead and some GSE stands and go ahead and have some capability to support us with a crane and some other things. And we said, Ok, we'll take that role, that's good enough to start with. We'll build you GSE stands, we'll get you a good crane. We'll have gasses and electric and power so that if you need to bring some factory equipment to power it up to retest, you'll have the capability in the building. So by interacting that's what KSC brought was lets keep at least some capability there for you to do your, to help you do your job. Now the compromise for KSC and what was new about that was KSC used to tell them you bring it and we'll do the job for you. You just go home and we'll take care of it. Well nobody wants to build a hardware turn it over to you and say, you know, I'll give it to you. So the new compromise was we'll give you the basic outlet at the wall, we'll give you the basic support stuff and you bring your equipment and we'll work with you if you need us, but we'll. So at that point we had a good charter. We could build a facility, build all the air bearing pallets, put all the GSE in the thing, all the work stands that we built. We built some power carts, just saying everybody needs power, don't care, its like your laptop when you get to the office you'd like to be able to plug it in, we'll have a place for you to plug it in. They'd say, yeah, that's ok, You can have, I'll take one of those. We'd say ok. If you need another one we can build you ten copies or five. You tell us, send money, we'll build more. Well they'd let us build five and the next month they'd run their scenario for assembly sequence and they'd say,

you know we might need two more of them. We'd say that's fine, we'll go get them for you too. So we just basically just built up an inventory of capability that says if you need it, we're here to help you. It turned out to be a good way to quit, you know, arguing about we do it for you or whether ship and shoot works or not. We just said if you can prove it works and only stay here two weeks, that's wonderful. On the other hand if you happen to get here and your stuck for six months, that's ok too. We'll try to help you get through the six months. And it turned out they came and stayed for a year and a half.

Dr. Butler: Yeah, ultimately KSC develops Multi-Element Integration. How does that come about?

Mr. Francois That had been there even when I had, and I'll say inherited the program, because when came out of Crystal City on the redesign, not to digress but to set the stage for that. When we came out of Crystal City on the redesign, one of the things on the redesign was not only the hardware configuration, but they wanted a whole new approach to management and the ways the teams interacted and the way the program was structured.

Dr. Butler: Ok, lets look at that a little bit first. Ah, what was the change in management philosophy that came out of redesign.

Mr. Francois Redesign came out and said key points--we want fewer people on the program, they actually had a management team at Crystal City that I wasn't a part of but that I interfaced with. The management team wound up coming back saying, and you can look it up, I think they wanted 1100 people in the program. At the time the program had almost, I don't know, 2000 people or something, 2200. So they had a grand goal that says we're going to cut it to like 1000 people. And these were like, these were NASA people now. They were still going to go get a contractor but we're going to do a thousand nasa people, which was earth shaking

because all the centers had their headcount and they said my god we add it all up and we don't know what we're going to do. The other management thing is we're going to go get one contractor. You know up until then they had this whole thing distributed. They had all the little, you know, the power guy that built the photo arrays was one guy, the guy that built the trusses was one , the modules the pressurized modules and the labs was another guy and, you know, they had an integrating contractor in the old management style. Well they said we're going to let a new contract, we're going to wipe all them out, we're going to let one contract and that contract go put it together for us and he'll contract with all the different elements. Well that's fairly monumental. That's putting all your eggs in one basket, but that was a big change coming out of redesign. And the other thing that affected me when I came home was they said, there's a new management style out there that we've heard about-this management team fit--and we're going to run the program with it and part of the basis was Boeing in their 777 program supposedly and some other things they've done called and they employed a technique called IPTs, Integrated product teams. And this whole idea that you empower a team to have a budget and a schedule and a defined product and they go work it at their level and so you have these IPTs working on different pieces. And that was a completely different idea for anything NASA or you know, the Space Station, had previously thought of. And so basically when they rolled out of Crystal City they said Ok, fewer people, gonna have one contract and by the way everybodies going to operate with IPTs and their going to get along with each other and that's how we're going to break this barrier between the Centers is the program will run them and the IPTs will be where we need them to be but we'll manage with those. So, when I came home Dick Lyons was still ahead of the project but it became apparent that they really wanted to see a transition. They wanted to go away from the project office and they wanted to go to this IPT structure. And so

basically they disbanded the project offices, the ones at Marshall, the ones at KSC, the ones at JSC, they just disbanded them. At KSC we went so far as to take the project office and yeah it folded, but we created this, I think I was first called the launch site Integration Group, if you went back and looked on an old org chart. The Center help, between Dick Lyon's history and helping us and I still credit him with helping make the transition cause even though here's a guy their telling they don't want a project format anymore and they don't need your office, he knew enough about what work needed to be done at KSC facilities, the GSE, the checkout systems and so we sat down and they helped, the center helped me structure and we came up with I think its 7 IPTs. And that encompassed the total work content at KSC and so we basically and basically instead of having a DE and an OPS group and a project office now, we basically created one group we called the Launch Site Integration and we created these IPTs. The IPTs within them had the people matrixed to them so that you had the designer and the OPS guy and the budget guy all in this IPT. And you basically told them you guys are in charge, you got the schedule, you own it, you make it work. And the only thing that set on top of them was an Integration group. I would lead the integration group that looked across the seven of them and basically said, I'm doing the arithmetic. I'll had up your budgets and I'll add up your schedules and I'll produce the master one and I'll go the program office and tell them KSC is on schedule or not. But I need you guys to work it at your level. In some ways it was considered a bit naïve to go do that because most people said it won't work. Some of the other centers did it by name only but didn't really implement it, you know empower them to go do anything. I often said because we didn't know any better at KSC, we empowered them and we actually tried to make them work. And basically they worked pretty good because the nature of our job fit em perfectly and it fit KSC to work in that style. So we set up and that's how we managed and that was a big

management change and it was a change for the center. Instead of having project offices and design engineering saying ship me so much money and I'll go spend the money for you and the OPS guys saying well send us our part of the money and we'll do this for you, we put it all together and told the designers and the ops guys its all one pot of money, we're all in it together. We sink or swim together. And you guys got to make it work. And that's how we finished the SSPF cause we came home and made that transition in the end of '93. And so January, February '94 I called the first meeting of that group of seven IPTs and said this is what we're, here's what we're starting and so we got to figure it out, no bodies done it this way before so if we got an issue with it lets sort it out among ourselves and lets figure out what we're doing. And we didn't in the SSPF until what, mid '94 or something, late '94 or ninety-

Dr. Butler: I think it was August or something like that.

Mr. Francois It's the summer time. First six months we lived in the O&C building and then we moved to the, in the summer we moved to the SSPF and moved into it, and started to do activation of it. I mean at that point your activating it. So to go back to your question about Multi-element Integrated Test. Cause Dick Lyons group had always proposed that. That was always the answer to this Ship and Shoot. You can ship and shoot but your going to really want all these elements in one place somewhere and your going to want to plug some of them together because you really don't want to get them on orbit together for the first time and plug them together on orbit because, you know, what if they don't work. Well the designers "no no no, with Cad K drawings and, you know, all the maturity we've got in these things, I mean we can design this thing to the interface and you know digitally prove they fit together and we'll never need to fit check them. We'll just, they'll all fit together and software's perfect and we got this all checked out and we don't need it. But we said, your going to need that thing sometime

setting on the ground. Well all through Dick Lyons even though they initiated it and had what they called multiple interface tests they wouldn't accept it. And even when it transitioned to me I couldn't get it in there in the beginning either because they said look, you've got the facilities, you've got the GSE. The one thing we haven't convinced them of is we haven't convinced them of this multiple test. I said look, for now we just got to get them settled on building the facility and getting the capability here, we'll come back and talk about the test when they finally start seeing when the elements show up. And so after a year of getting the facility ready and then we started getting serious about when are the elements arriving and whats the latest schedule, how many are going to be here at once, we started looking at the schedule and said, you know, there is a period where your going to have the node and the other elements here and so here'a a block that you could put together and you could wire them together and run a test. But its going to cost you money and its going to be a setup time and we need to allow a week or two in the schedule to make that happen. And so we go selling that to the program. Well they go no no you guys are still harping that, we told you, you know, forget that years ago, we said just knock it off and forget it. The other change that came along is, and this is my story now. Mr. Abby, George Abby, came back from Washington, became the center director at JSC. The space station program

Dr. Butler: When does that happen?

Mr. Francois Well you got me there, it was like '95 I think. I mean go look it up but if we moved in in mid '94 it was like the next spring that Mr. Abby was back at JSC as the Center Director. And up till then we'd had these IPTs and basically we were finding schedules weren't being met, people were getting behind and even though Boeing was the over all contractor they weren't too accountable for what are they doing to fix this stuff. Well a couple of

things happened. Mr. Abbe came in and he said I want to start here and he started having Saturday meetings, the infamous Saturday morning. And it was like, the good news we was in Florida so he was having them like at 8 o'clock at JSC on Saturday morning so it was like 9 o'clock here. And they'd go on like for three or four hours on a Saturday Morning. And he made everybody come in. I mean the whole program manager and everybody in Boeing management at JSC and he made everybody at marshall and KSC. And he made them go down the list about, you know, where's the node at, where's the lab at, where's the truss? And of course as soon as they say well we miss drilled two holes and the cables didn't fit, he said, what are you doing to fix that. And it got down to the details of, you know, the guy scratched something, well what are you doing to make sure he don't scratch the next one? And it was like Oh, my gosh, it was painful. But that was his attitude, we're going to get serious about this and we're going to work this. But one of the other things, he came to KSC once and asked me to present to him about what we were doing to support the program in the SSPF. And I said, sir, we're building you work stands, we're here to help, we've got power, anything you need we're here to help you. And he said, but aren't you running the checkout? And I said, noo sir, their ship and shoot, their checking them out. And he said, what do you think of that. And I said, well if it works its good. We're here to help. And he went down a list of the whole things, well what about wiring these things together. Well we haven't got that. Well why not? Well its not in the program. So he turns around and says to the program manager why ain't that in the program? We wound up getting an action that says come back and propose. We offered to him, we'll propose some contingencies to you. We won't say its wrong, but we'll come tell you if you happen to get here, like I was telling you and got stuck and you needed something, well why don't we come tell you about this checkout system we've got and maybe we could adapt our checkout system as a

contingency to power this up and therefore you don't have to rip the checkout system out of the factory bring it down here and have all that time. Maybe we could have a minimal set for you, do some minimal functions and you could use that. Well ok, why don't you look at that. So that was a foot in the door. And now once we had that we said, well now lets go talk about this, you know if your going to have all of these elements, maybe you do want to plug them together? And and, his point was he pushed and told them you know you need to go look at that. You know, why aren't you guys doing something when you get to the launch site. He said, I've never seen anything get to the launch site that didn't get powered up and checked out. What makes you think your going to just bring it down there. So basically I credit him for being the stimulus to the program saying quit thinking your going to solve this by definition. Go tell me how your going to do it. So they got more serious about listenging to us and it started building. And about that time likewise with Abby he said, I'm accustom to having KSC, when we built the shuttle we had folks out in the factory. Where are your guys at in the factory. Well we don't go to the factory? You know, its ship and shoot, they're going to bring it. Well I don't understand it. We ought to have some people out in the factory. I like to see when your, when are we going to know where the problems are? So Jay Honeycut was the Center Director and he basically went to him and said I'd like to, why don't you get me a group like you did when the orbiter were out there and get me a group that goes out in the factory and looks at this stuff. Steve's over there doing the SSPF but he ain't in the factory. What, you know, whats wrong with that. So basically he created Tip Talone's early station, space station integration office, which their charter was to go meet the hardware out in the factory and find out what issues were being worked and head them off so that when it came to the launch site they wouldn't be transporting the problems to us here. They'd be worked ahead of time. So between us working here and Tip's guys in the factory

we got to know the hardware better and we started telling them about this idea well here's this Multi-element thing. We ought to be talking about this. So we started having these, oh what did they call them, Abby had a monthly, SDOM, Space Operations dev, development something Management Meeting. And he called everybody together and you had to stand up and say where you were. And if we had anything like this he'd give us an action. We finally put it on the agenda where we we started laying out the basics then Tip's guys picked up the ball and started pushing it through their points of contact and with us all pulling together we ended up defining this MEIT. And so that became the history of it. I mean we just, eventually we sold it and by that time we'd seen enough hardware built and seen enough problems with software and realism had started coming back into the world that they said yeah, your right, we need this test. MEIT had a life, I mean it took a couple of years before it was ever accepted but it gradually worked its way back in. And at the time, it was we'll do it for the fist one. We don't know if we want to do an MEIT II, and we sure don't know if we want III and IV. Well I think if you go over there and count now, four is about to happen or something probably by now. So and the credit it with finding all kinds of problems, I mean it found software problems and

Dr. Butler: Yeah, what were some of the problems that it found?

Mr. Francois On the node it found a bunch of software incompatability thing. I know it was powering up some of the power supplies and every thing because they had Russian power supplies on the node and you just wound up finding incompatibilities saying hey this thing wouldn't have powered up like we thought it would and you could have been troubleshooting it for months on orbit. As it is we found it on the ground and fixed it. Uh, Tip and those guys kept a whole list. I've been away from it now for so long. I know when we first did it we kept a list of saves that says here's the things we found, and the other thing is because we were running that

test down here it forced the software guys to get their software done in time to support the tests. Because their tendency was well we don't need that software done until its on orbit so we can wait until then to finish it. Well at least this way they had to go test it in their software lab and run it down here early enough that you started finding the bugs in the software. And you know there was a whole bunch of things I know. The node they found with power, the lab I know they found a couple of things. The hooked up the Canadian Arm and found there was some communications issues with how the communications went through the lab and the laptop to get to the arm where it was, you know, it would go so far and then stop and so, uh, it did what we all, what all my, all the engineers told us that it it was going to do. It was going to find a bunch of stuff and it did. I mean they wrote a lot of lines of software got fixed and interface issues got defined. Some of them couldn't get fixed. That was one of the debates. They flew a lot of stuff as is, but at least you knew what it was and you could make a note in the book for the astronaut or JSC console operators that says when you get to step do this first do this second and your going to get an error and clear it and it'll be ok. They could put those notes in the book then and that's where you read today. They talk about fixing some of the software patches and going back and fixing some of those things because, you have this thing, is it worth fixing now or can we operationally work around it if you just put a note in the operators manual to say when it comes to this step, throw this switch first. Well if that works around it that's fine, but in the long run you'd like to fix it so you don't have to remember to throw that switch first, it just comes on when you say to. So.

Dr. Butler: What were some of the other issues that uh were say lessons that say Kennedy understood, but were not clearly understood by by the other centers. Or were differences in philosophy between Kennedy and Marshall and Johnson

Mr. Francois I think, well there is one out there, when they went to this concept of the one contract and we're going to build all this hardware, uh, one of the pluses was Boeing had its success with 777 and they said, hey, you know, they've got a good manage, management was great, you know, they've got this design they did all with the latest technology and they've assembled this airplane and space station is just an oversized airplane. You know we can do this. It's a factory and its just marginal, measuring out the work and one of the things we kept harping on is look building space hardware and building payloads or building an element like a space station is not like building an airplane. Well, its all engineering, that's all it is, all drawings and its all requirements and its just, you know, having a good tracking system and its no all those things. Its an engineering challenge. And we said no, there's certain things we've learned building space hardware that's different: cleanliness, tool control, you know, how you log stuff in and out, how you close your paper out, you know, I mean, the fact that your going to close out a panel and never get into it again for the rest of its life because its always going to be hidden and buried behind something. So you want to go in there and you know have some record of that. Bah, we can ticket. Well when Tip went out in the factory, I mean he's watching them build stuff in the factory and their out there drilling holes and then sweeping up shavings later. Well they don't pick them all up. We said wait a minute, you've got to get this stuff all cleaned up and whats your cleanliness control? Well we clean it at the end? No, our experience says you can't clean flight hardware at the end, you've got to do it as you go. You got to have discipline in the system and you've got to do it as you go. And then we'd get on Saturday phone call and they'd say well we were drilling the holes in the end of the flange and the guy misdrilled three holes. Well why is that? Well we found out his paper wasn't quite good and it got a little off and he mismeasured. And we said where's your verification process? Where's your procedures?

Well we don't have procedures. We had a work order and we just told him to go out there and do it per the drawing. And we said, no, when your doing space hardware and flight hardware you've got to have a procedure. You got a guy to give the guy instructions to talk about how he keeps the place clean, how he maintains his tools. You can't find out later that he's missing a drill bit and that its someplace in the hardware because you know, once your on orbit, it don't come home to where you can fix it like an airplane landing. We say, oh yeah, if you hear something clunk when you land check that out. It don't come back. And so it it is a real cultural indoctrination that went on and Tip's guys was at the forefront of that because they were out right at the front end where they could, you know, tell them. So we wound up bringing like the guys from the factory down to the SSPF and said come down and look at, come down and tour the O&C, tour the SSPF. We'll show you how you have an OPS desk on the floor and how you have all your work scheduled through the OPS desk and how they look after safety and look after cleanliness of the room and everything and the tools, you only put the tools in the room that you need. And there was just a lot of just things that KSC, we took for granted, that's just the way we do business, yet we found that it wasn't as natural as we thought it was to everybody else. And so I always thought that was one strength that we really took out to the program and indoctrinated cause all of a sudden we saw tremendous improvement. I mean, they aren't doing stupid things, you know, they regularly got paper. They didn't get things out of sequence. You know somebody says well we did this, well we should have found out we should have done that first. You said, how did you have your planning? Well, you know, so and so said he was ready and we just said if your ready go ahead. Well where's your planning? Where's your schedules? Where's your planning document that says, this has got to go first before that? And it was just an amazing learning curve, I thought, that KSC brought to the table. And again we joke about it

and I'm sure people still debat it with me today, but there's a difference to building space hardware to building airplanes or

END OF TAPE 1 SIDE A.

Dr. Butler: You've mentioned some of those differences. The importance of planning, uh, procedure controls,

Mr. Francois cleanliness

Dr. Butler: cleanliness

Mr. Francois yeah, contamination and everything was big, trying to indoctrinate that to where everybody thinks in terms of that

Dr. Butler: Why are those things so important for a space craft and perhaps not so important for an airplane.

Mr. Francois And again, see that that's a fine line you get me in. They're important for an airplane. In other words you don't want shoddy work, you want good work. So your not implying that their doing anything wrong. Its like your taking it to a different level in my mind when you get to a space craft or a payload because one, you leave something in your garage when you drill a hole, its going to sit on the floor until the wind comes along and blows it or something. You do it in space, everything you do and you leave in there, you know in space there's zero gravity so its going to go anywhere it wants and you got a couple of elements. You've got a lot of connections and electronics and air systems and valves and components and all this stuff can insidiously get into crevices and if you think it can get there it will go there. Whereas on the ground, its not prone to. If you don't disturb it it'll just lay over there in the corner, its dust, but it ain't bothering you. Your not going to breathe it because it sitting over there quietly. In space it'll become airbourne and your either going to breathe it if you're an

astronaut your going to get it in your eye, your going to breathe it, it'll get into your electronics, sooner or later it'll be in your keyboard, somewhere its going to get into your fluid connection when you hook up your QDs and your going to say oh shoot, why in the world is it leaking? Well guess what, you've got a particle in there. Well where in the world would that come from. Well if you left it somewhere its going to show up sooner or later. So the systems, and you have no opportunity to say well when we get home we'll fix that. You know if you take your car out and you get a leaky line, you just say I'll take it down to the station tomorrow and get the guy to replace the hose on that because its leaking. Its not critical to you. If your in orbit once its up there your not going to bring that thing back and your either going to have the capability to fix it on orbit with one or two people. You certainly aren't going to take it to the repair shop, so you've just got to be a level of criticality. It wasn't as if aircrafts aren't built good. Its just that what you see in aircrafts you just take it to another whole different level of sensitivity and criticality for payloads. And we do it today. Hubble was built that way. Even the payloads I launch on the ELVs. It wasn't unique to station its something we've learned just processing space hardware period. You've got optics, mirrors, you just can stand dust and dirt. So its raised the whole awareness to a whole different level.

Dr. Butler: Ok. Another issue that you mentioned briefly and I'd like to go back and look at a little bit more carefully is this issue of uh, civil service contractor relations. There was a push and we see this over in Shuttle with the development of SFOC, A push to get Civil Service out of operations and keep them in management. What role did that play in uh space station and one of the debates that seems to have gone on is what I would describe as the air force contract model versus the Germans hands on engineering model. To what extent did that play a role in in issues in space station and how were they handled?

Mr. Francois It definitely played a role because I mentioned to you that when we come out of the redesign they said we were going to do it with a 1000 people or something, I mean that was the target. And so all the centers got new marks that says here's your civil servants Of course, I know at KSC I think at the time, we weren't even operational then, but if I remember the numbers right, Dick Lyons and the whole KSC, if I counted all the pieces of KSC there was like two hundred and fifty people, lets say, two hundred, yeah about two hundred and fifty people at KSC working on space station. And when I got my mark and the new IPT structure and the new management structure, the program sort of allocated I think it was like one hundred and thirty-five people and I found out there was one piece they'd missed so I wound up, I think getting up to like a hundred sixty people. So I went, KSC went two hundred and forty people to one hundred sixty with the idea just what your saying, their role is less, civil servant's role is less, we're going to have the contractor to it all. Uh, in time we kept working it and we kept justifying it, look, you know, this is what really our role as a civil servant is and this is what the real role of the contractor is. And our emphasis got to be inherently government, we're managing the contract. You know, approving the requirements. But to do that you've got to have people who are knowledgeable. So you want people actually down, you know, low enough to be able to see the engineering, see the documentation, be able to make a judgement of is this going to work, is this what we want? And so we really built our teams that way where we had the civil servants and the contractor all on these IPTs, but the civil servant had his role and the contractor had his. And basically I know in my case at KSC, I know we started with that low number and we said, ok, we're going to divide it up and start building work but we're going to build it against content. So as soon as you the program ask me to do something else, I'm going to come back and tell you that takes three more people, or it takes ten more, and the ten is made

up of two more civil servants and eight more contractor. And we'll tell you the split. So we said we'll always let the content drive our number, both the civil service and the contractor. And so basically the initial number was the starting point and from then on you just built, look that's added content and that content comes with this. And some of it could all be contractor. And, and it was a change for us, because up till then we basically thought, your right, there was a big thought that says civil servant ought to do it all. We said, we ought to make a value judgement and decide how much the contractor do and how much the civil servant would. But our value judgement was always based on the fact that the civil servant should be knowledgeable not to go to your model of the air force where they're not always, in my mind, not always technically engaged and everything as much as just managers or monitors. We said, no we want, we want to be more than that, we want to be technically engaged.

Dr. Butler: Part of the Air Force Model uh is that if your going to manage you can manage anything

Mr. Francois Yeah

Dr. Butler: That you don't need to have that technical knowledge.

Mr. Francois Right.

Dr. Butler: Uh, You argued or KSC argued that you need to be a knowledgeable consumer, that you need to have expertise.

Mr. Francois Right.

Dr. Butler: Where were the KSC engineers now to get their expertise?

Mr. Francois Well at the time we kicked this off we had the engineers coming of the space lab program [level iv engineering] that came with me and so they had that experience. They had grown in that environment so they had hands on, some of them had grown in what we

called, theres a term at KSC that meant, called Level IV, but what that was was an area set aside in the Payload Ops world where young engineers actually got hands on. Basically they were working with experimenters that brought their experiments in to fly in Space Lab. They could get an off line area and work with him and actually connect it up, run the tests with the guy to test out the experiment and then integrate it into the carrier or rack, whatever was going to haul it up. And so we had developed that cadre of folks and they came into station. So we had the core part built in to where we had the knowledge to follow the assembly elements. But even in station I had one of the IPTs was called utilization IPT and it was the equivalent of this old, we knew there was always a need that once you assembled space station you were going to be flying experiments and your going to be flying experiment racks and they come in all sizes and shapes and flavors and they come with all different principle investigators and developers who've built these experiments. But none of them have ever been to a launch site. Most of them had never flown the hardware before. So they needed somebody to hold their hand, be with them, be knowledgeable of how to run a test, how to interface with the space station and prove they're going to work. And so we carried that idea of making sure we had some engineers embedded in that and we always carved that out when we were challenged about well are you getting out of operations. Well I could say as the assembly is completed I'll get out of more of that operations, but I'm going to always remain focused on this utilization piece because that's the dynamic one when stations finally built, that's the dynamic that that's going to be where you interface with the customer that's a one of a kind customer and its not, you know, he doesn't come back every day and its not a repetitive task. Its going to be a unique one of a kind task. And so we need, and I held that out as as someplace, one, because I thought it was a proper role for NASA, but it was also a good training ground to be able to say there's where your engineers can keep their skills

current and go work. And so we always kept that carved out and acknowledged that once you launch a lab or once you launch a truss section there ain't another one coming, so that's fine, you know, we'll back out of that as you get the station built. We'll always focus then on this repetitive task of experiments and all going up. Tip did the same thing. Tip drew his guys a lot out of the Shuttle world. Because they had a lot of experience of overhauling and repairing Shuttles and getting them ready for return to flight and they had the same discipline flight hardware discipline that we did and it made them a natural and they had, most of them had some experience of orbiters in factories, either doing depo maintenance on orbiters or going out trying to get one to come back after a major mod period and so his guys were a natural for going out in the factory and again they brought their experience from the Shuttle and those maintenance cycles to bare in looking at the hardware and saying guys, hey this don't work, I've seen it tried, it don't happen that way you gotta put more time or effort into this area.

Dr. Butler: Great. Are there any other issues taken with space station that we really need to address when we when we discuss Kennedy's role in Space Station history?

Mr. Francois That's the major one. I think this was going out in the factory and getting the folks there and the successes of getting the SSPF built and then instilling that discipline in the program of how you treat flight hardware.

Dr. Butler: Very good. Well I thank you for your time.

Mr. Francois Ok.

Dr. Butler: You've provided some great help in filling out some stuff that we've already found and adding a few new items.

Mr. Francois Ok

Dr. Butler: So thank you very much.

End of Interview

Addendum

Mr. Francois You can just take notes here.

Dr. Butler: Af, after we turned off the tape you were talking to me a little bit about the roles that Space Lab played in influencing space station design

Mr. Francois Yeah

Dr. Butler: Let's go back first and have you tell us briefly what your role was in space lab and then have you iterate some of the the areas where space lab influenced space station.

Mr. Francois Ok, the connection is for my part when I came over the payloads in 1990, space lab was the biggest running thing. We had deployable payloads and all but space lab was was the first idea of having a reusable module, laboratory that went up stayed the duration of the shuttle and came back. But it came in modules, it came in pallets and all that drove a concept of how do you stage those things for launch, how do you check them out. And they took the O&C and they laid it out to where you had checkout stands. But what they did, they did more or less, the classic way at that time was bolt them to the floor, they were tailored for the space lab. In other words the stands was built exactly to hold a module, they were built exactly to hold a palette and they were wired and connected for the services that space lab needed. So if you will they were customized and built exclusively for Space Lab. And the ops guys that was running the place at that time that I come over, you could observe them and it was a very efficient operation, it was very tailored, but it was very limited. That's what it was built for. And what I learned quickly was when they took those folks and said go look at the SSPF on paper is were thinking about how we're going to build it, what would you do different? The striking thing that

these guys came out with is that they said was first, none of your space station elements is the same. Space lab is the same, its either a module, a palette, or fixed inventory. Space Station is going to be various, its going to be trusses, its going to be a lab, its going to be a node, some of themn are long, some of them are short, some of them have got trunions, some of them have got, you know, theres just a whole variety. So what I got was they took their experience on space lab and said you know, we need, we need, this is good, work stands, access, plumbing, gasses, power. We're going to need all those services because anything comes that way. But when they went to the SSPF they said we got to make this thing to where its reconfigurable. So they took what power, and plumbing, and gas and everything that they'd embedded in the work stands and fixed it in the O&C and they put it in the floor of the SSPF and said it'll be there if I need it. I can hook up to it with flex hoses and jumper it over. They took the work stands and said we're going to need work stands but instead of always knowing their exactly sixty feet long and fifteen feet wide, maybe we need to make them modular so that if we only need twenty feet we'll put two of them together or build them to where we can assemble some. So if you go to the SSPF they've got work stands that are ten feet long, fifteen feet long and if you want two you put three of them together but when your through with that payload you can break them down and reconfigure for the next one. And so I was always really neat about how the ops guys took their space lab experience and and basically what was fixed and the limitations they saw in space lab and when they went to the SSPF said we can over come them if we make the floor clean, move things on air bearing palettes, make everything configurable so that when this thing leaves we don't have to take it out the door and throw it away. All we have to do is unbolt it and reconfigure it and its ready for the next thing that comes in the door. And so it was, it was a real step from a operations processing to go from that idea of where we were on space lab and then translate it

into a space station. And so I credit the guys that, cause I came over and sort of saw that happening. They already had the concept and the idea was, hey that's valid so in all the struggles for money and schedules and what should we cut out, it was apparent, don't give that up. Give up a lot of things, I mean give up the carpet in the lobby, or give up windows or something, but don't give up the concept of flexibility and the words modular. Just never give that up. And the only mistake we made, if you dig in history was the SSPF was built in that big high bay to run with air bearing palettes and early on we made one cost savings and that was we put tile on the floor. We actually put one square foot tiles and put them down and and everybody swore at the time that the technology was such so that you could glue those tiles down absolute so that you could run an air bearing palette over them. When your running an air bearing palette your injecting air downward always, so if there's ever a crack or a seam in one of those tile air will get under it and you'll actually pop it off the floor. Well you got one foot square tiles, you've got a seam every foot square. And they said no no we can put this down perfect. We'll we put the floor down the first time and ran the air bearing palette over it and sounded like pop corn going off. It went bloop, bloop bloop bloop and we wound up out there with all the tile. It turned out the guy didn't get a good solid adhesion to the concrete floor and we wound up with, I don't know, forty or fifty percent of the tile popping off the floor. So the first thing we did, is we actually went out there one December and and went in there and scraped everyone of them, there's 65,000 square feet, (laughter) scraped everyone of them off and went in there and did a poured epoxy floor and that's what you see over there now. And that works perfect out there. That was the only thing that anybody, and they argued then whether you should put the poured floor or the tile and for cost they said no, we can do the tile and save money and it will be just as good. We said, well, you've convinced us we'll go with you, but as soon as we tested it it failed.

So that was the one, one change to the SSPF after it was built was to go change the tile out in the high bay, 65,000 square feet of it and put an epoxy floor in place of it.

Dr. Butler: Very good. Thank you very much.

Mr. Francois You bet.

END OF INTERVIEW