Interview with

Enoch Moser

By

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At

Kennedy Space Center Archives

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Dr. Butler: Ok, I'm Dr. Orville Butler and we're at Kennedy Space Center headquarters' building right next to the Archives this afternoon talking with Enoch Moser. And I guess I'd like to start out by asking you to briefly summarize your background and upbringing and education, the events that brought you to Kennedy.

Mr. Moser: Ok. I was born in Chattanooga Tennessee in 1942; lived there until I went to Georgia Tech where I got my bachelors degree in 1964. My senior year we took a spring break trip to the Florida Keys from Atlanta. Two of my three friends that joined me on that trip happened to be Titusvillians and we took a tour of the Kennedy Space Center on the way to the keys and that, I didn't apply for a job but it resulted in the offer of a job which I subsequently accepted when my fellowship that I thought I was going to get fell through. I decided that I would accept the job offer for a year, save some money; go on to graduate school and here I am forty years later still in Kennedy Space Center. I came to work here in June of 1964 in the pre-Apollo; it was then the lot one Saturn launch vehicle program. If I remember right I cam in on the SA-7 vehicle, if I remember right. There were ten total. Got out of sequence a bit SA-7, 9, 8 and 10. I worked on those. Then the Saturn V program started and I over to work on the Saturn V launch vehicle. What in those days was called networks. Networks meant something different in those days than what it means now. Back then it was largely cables, power systems, patch distributors, electronics for ordinance and things like that. So that's how I got started here at the Space Center. I worked in the Apollo program until '73 and I got invited to join a group that was being put together to develop the launch processing system for the Space Shuttle. I moved over there and worked in that a couple of years until 1980 and that was a wonderful period of time working hands on designing, testing, building and implementing launch processing system elements. Then in 1980 I was fortunate to be invited to

join the Level IV, the new term at that time. Level IV was one of the phases of integration in Spacelab. And that phase was going to actually be at Marshall and NASA decided it didn't make much sense to integrate the elements of Spacelab at Huntsville and then ship them all the way to KSC. There would be a lot of potential damage in transit. So they decided to move that operation from Marshall Space Flight Center to Kennedy about the time I got involved and the Marshall folks were heart broken about it but very professional in their response. We spent a lot of time there learning about the systems. I spent about six weeks up there at Marshall participating in the test in, test and checkout in preparation for delivery to KSC of what was called the payload checkout and the hit system. I already interface test system (unintelligible). Another gentleman from Design Engineering was already up at Marshall participating in the development of the system. So I moved up there to join him in the final few weeks of testing. Then it all moved down to KSC and that was the beginnings of the Spacelab Level IV Experiment Integration Activities.

Dr. Butler: Very good. Let's go back briefly and talk about your work under Apollo. When you arrived and you were working on the Saturn's. What sort of work were you doing? You mentioned that you were doing networks and what all did that involve and and uh, to what extent was that hands on, to what extent did, how did you interact with contractors, things like that?

Mr. Moser: When I first came on it, the team was made up of NASA personnel and in my particular area Chrysler. Chrysler had the contract. And if you didn't look at the person's badge you couldn't tell who was who. We had NASA engineers, NASA technicians, Chrysler engineers, Chrysler technicians, one and the same. No difference whatever, we all did the exact same work. Not long after I came here this gentleman started showing up in the office

who was a Boeing person and that was the beginning. He was there to learn how we did things and that was the beginning of where NASA did hands on work to we had actually NASA technicians and, and we as engineers also were out there crawling around in the stages doing testing of cables, making connections, testing ordnance devices and everything ourselves personally. But this gentleman from Boeing, I only mention that because he was there representing what was to come which was Mission Contract where we had to back off and oversee, an entirely different role?

Dr. Butler: Do you remember who that was?

Mr. Moser: I remember the individual, yes.

Dr. Butler: The name?

Mr. Moser: Arnie Gilliard [Phonetic] was his name.

Dr. Butler: Ok. And he was here representing Boeing?

Mr. Moser: He was a lead or a advance person

Dr. Butler: OK

Mr. Moser: Put in place in their operation to learn what we did, how we did it and convey that operation back to Boeing who had won the contract. For the Saturn V they had the contract for the first stage. North American had the contract for the second stage and McDonnell Douglas had the contract for the third stage. And they were all mission type contracts. So out of the block one Saturn days there was a major transition in NASA's role from one of being there actually doing work to overseeing contractors.

Dr. Butler: Ok and then you went on from that and got involved in Shuttle Launch Processing System. What

Mr. Moser: The design, designing

Dr. Butler: Ok, in the design of that. What, what would be involved in that and what were the major concerns that you were addressing?

Mr. Moser: In the design of the Shuttle Processing System?

Dr. Butler: Yes.

Mr. Moser: Um, what was involved in it? We, actually a gentleman, a very brilliant man named Frank Burns conceived the concept of the Launch Processing system. It had a central memory bank called the Common Data Buffer and all the other computers interfaced with that to do their communications and issued their commands and read their measurements and a lot of what the team had to do was to design and develop this brand new thing that had never been built before. So not personally, I wasn't personally involved in the common data buffer, but I think that was one of the major challenges of that system. We had to (unintelligible) and test bid and we put together a functional system and the challenges associated with that was just designing, testing, making sure it actually worked and then we actually moved that prototype system to the Marshall Space Flight Center which they used for several years after that to checkout the solid rocket boosters up there before they came down to the Space Center. So the major challenge was there was some new concepts, new technology involved and everything had to be remodeled. We built the first prototype system that had to be functional. And then we went through a phase of source evaluation boards to pick the contractors to actually build the flight systems which went into the firing rooms and the.

Dr. Butler: What component did you work on?

Mr. Moser: the display system. Um, I was in the group that, display technology was brand new back then and it was a real challenge finding displays that would be bright enough, fast enough, vivid enough to the job it had to do in the launch processing systems. We

looked into those technologies, we did a lot of ergonomic studies, we hired contractors to do ergonomic studies as to how things should be positioned, how you avoid glare from the lights in the ceilings, things like that. I personally designed a thing called the safing panel. It be, because computers fail we had a hardwire system for emergency use for certain critical things and we came up with a modular way of doing that, so each systems safing panel wouldn't require a unique design but had plug in modules. Those hard wire companions actually went out to the launch pad and operated things directly in the event a computer system should fail. I also designed and fabricated an electronic computer version of strip chart recorders. Strip Chart recorders are a big important thing throughout the history of the space program because they record the measurements that are being made of all of the systems. And we thought it would be a good way, good idea to get away from the old standard strip chart recorders and replace them with a new digital version of it and especially because with this new Common Data Buffer concept there was an opportunity to go in and read measurements directly. So we came up with a little microprocessor based system that would go out and with inputs from the operator using thumbwheel switches download the particular location in the common data buffer and then that location would be writ and displayed and that was a pretty useful thing and the folks at Marshall for the solid rocket booster system wrote back to us that it was one of their most useful tools. Unfortunately, I mean from my perspective it was unfortunate, but I guess the folks at KSC that launched the Shuttles didn't think so; it didn't make it to the final version. It was not used in the (unintelligible) So those are two major things I was involved with and also just in general the overall structure and shape and ergonomics of the LPS Consoles, which I think are still used today out there. I personally evolved out there and it's been quite a while but to my knowledge those systems are still used.

Dr. Butler: Very good. And then after, after the development of the Launch Processing System, after your involvement in that you became involved in Level IV Experiment Integration.

Mr. Moser: Right.

Dr. Butler: Tell us a little bit first about what you know about how Level IV Experiment Integration got started and what its purpose was.

Mr. Moser: It kind of got started here at KSC as I mentioned already, the Spacelab process was decided to be a set of phases of integration. There was level IV, level III, Level II and Level I. Level IV was the experiments got functionally checked themselves and their interfaces to the Spacelab subsystem were tested. Level III was, and I don't know the distinction between III and II because throughout my involvement they were one and the same, you just called them level three/two, buts that where the experiments were actually physically installed in the Spacelab and tested with the Spacelab systems. Level I Integration is where the Spacelab was actually interfaced, installed and interfaced with the Orbiter. So there was actually a simulated level I test in CITE in the O&C building there was a system called CITE, Cargo Integration Test Equipment. So Level I tested, testing consisted both in the activities that were done in testing with CITE as well as the real actual Level I activities when it was physically installed, when the Spacelab module or pallet was installed in the Orbiter and the the business of that happening at Marshall and then transitioning to KSC, that all was taking place about the time I got invited to by Mr. Bill Jule to come over from Design Engineering LPS world in May 1980 (unintelligible) was very essential in setting up the philosophy and concept of how things would happen here at Level IV as a hands on NASA thing at Kennedy. He was the father of that and everybody kind of worships him as being the creator of the concept of Level IV hands on

operation. He was forced to do that simply because there were not resources available to engage a contractor full force to do it. Obviously it was a very valuable thing for those of us who got involved. How I got started, NASA decided to move it from Marshall to here and Bill was involved in figuring out how to do it. I guess you

Dr. Butler: Did they, did they have different teams involved in level I, level II/III and Level IV?

Mr. Moser: Level IV was largely a NASA engineering hands on activity and we had technicians. Once again you couldn't tell who was who unless you looked at their badge. The NASA engineers were out there crawling around on the flight hardware out there in the O&C high bay doing essentially the same stuff the technicians did; holding volt meters, looking at oscilloscopes. Level III/II was right down the hall in the O&C building. The flight hardware would move from our test stands over to the Level III/II test stands. There were two of those. And there it was a contractor operation. It was the NASA engineers overseeing the contractor. Quite a different set up than what we had. Then Level I similarly was a contractor operation with NASA oversight.

Dr. Butler: Let's take a project that comes through that's going to go into Spacelab. Describe what the process is going to be once it arrives here at Kennedy.

Mr. Moser: Well long before it arrived here at Kennedy, the team would develop the requirements, the test and checkout requirements for that experiment, hardware, flight Spacelab experiment hardware. So it wasn't started just when the hardware got here. When the hardware got here we'd already identified the requirements for testing and written the procedures for testing. And so these experiments would arrive and they would get installed, if they were a rack mounted experiment, a Spacelab rack mounted experiment, the mechanical

folks would install them in their, and then once they were all in their racks, the racks would be put up on their Level IV test stand which simulated the structure of the Spacelab. So then you had the real flight racks with the real flight experiments in them on simulated Spacelab subsystems. We would then run the procedures. We called them TAPs, Test and Assembly Procedures, which exercised all the functionality of those experiments. And did some limit testing, the things have to function within a certain range of power input and certain range of conditions and we did testing to make sure they could endure the specified ranges of things that they were designed to meet. Um. It involved a lot of people, a lot of communications, a lot of organizations. The testing was done from the third floor of the O&C building using a system called the Payload Checkout Unit or PCU and the HIT system, the High-resolution Duplexer Input-output Test System which decommutated the telemetry off the High retinal duplexer and displayed that up on the fourth floor. The test scenario was we'd have engineers, our engineers in the PCU control room issuing commands and the responses would come back through the HID system and be displayed upstairs for the actual principal investigator team who were the folks associated with those experiments. They would fly here; they would be here during the testing and watch their experiments respond to our commands. And that's pretty much the scenario that we had. There was, down on the first floor of the O&C building was the systems, the measurement systems, I forget what we called that, that area, but all of the feedbacks from the on board systems that we simulated came through there and then got distributed up through the O&C building to the HID system in the user rooms. So we had folks all over the place on the first floor, the third floor, the forth floor and then out in the high bay of the O&C building.

Dr. Butler: And then once, once it makes to Level IV, what happens?

Mr. Moser: The, the rack, just talking about the Spacelab module, those racks that we've just finished testing in Level IV, physically got moved down the high bay to the next test stand, number II that it could go into one of the two and then it was actually put in the actual Spacelab module itself and the end cones were put on. And now the folks over there, contractor folks with NASA oversight ran tests to make sure that everything was tested right, everything was functioning right, the subsystems were working, some limited testing of the experiments that they were still working. And then if it was the first configuration of a particular major assembly of Spacelab hardware it would go in the CITE testing for Level I testing. There was a high fidelity simulator of the orbiter. It has actual flight, very close to flight subsystems and so a test was done there. If it was not the first flight of a major new configuration it went directly from Level III out to complex 39 where the Spacelab module was installed in the orbiter, and they did some testing there in preparation for launch and then for a couple of weeks and it would be brought back and deintegrated and returned back to the folks who supplied the hardware in the first place.

Dr. Butler: Ok and who did the deintegration?

Mr. Moser: Um, the handling of the orbiter, taking the module out of the orbiter and bringing it back to the O&C building was done by a contractor team and then the racks were taken out brought back to Level IV and then the Level IV team would do the deintegration of the experiments from the racks. So it was kind of a reverse process of the original processing

Dr. Butler: OK. Any experiments that were particularly unique or or that you had particular problems with that might illustrate the process. We had, we had several Spacelab flights in the 1980s, uh how many experiments would go up on a Spacelab?

Mr. Moser: It was a surprisingly large number. Don't hold me to this but I think I remember like forty to fifty experiments on one mission. They weren't all major experiments so (unintelligible) glove box type things. Others were major highly complex type experiments that would mount on the instrument pointing system, that that was a system that could very accurately aim an experiment at some celestial object to observe it. That system itself was highly complex and the experiments that flew on it were typically complex. So, I, I don't know what the average number was, but my gut feeling is somewhere around forty or fifty experiments on a mission.

Dr. Butler: And when you did Level IV did did you integrate all of those together or was each experiment integrated separately?

Mr. Moser: (unintelligible) didn't interact with one another, but they did interact with the Spacelab systems. So in Level IV the integration we did was making sure that the experiments were integrated with the Spacelab systems, energies, you know Level IV simulated Spacelab systems. So it was an integrated process of getting those things to work with the Spacelab systems not, except in very rare occasions, with each other. So it wasn't integration of experiments with each other. There were multiple experiments in a particular Spacelab rack. They had to physically conform to the rack and have their cables mated to the subsystems. I'm not sure about your question but.

Dr. Butler: Yeah, you're giving me some insights. In some cases confirming what I already know from some other sources in fact. It's always; it's always good to have, have that backed up. Uh, Spacelab was one of our, or one of Kennedy's early international projects. To what extent did Level IV Experiment Integration interact with international teams? Uh and if you can, give me, give me an example.

Mr. Moser: Well there was a lot of interaction with international teams, principle investigators with a lot of these experiments were internationals and our engineers worked sometimes, before the mission, getting to know those experiments and sometimes the people, the engineers involved they became fast friends for life. Spacelab itself, you know, was a European developed thing. That piece of, and we had a lot of folks that went over to Europe for quite a long period in the final years of the development of Spacelab to participate in the testing, to learn about it so that information could be brought back over here, used to develop the things that we were going to have to do with it. Anyway from the subsystems standpoint it was a European thing, major involvements, major interactions, and then many times our experiments were uh developed over there and brought over here and then on top of that there were often astronauts that were payload specialists that were from a European country and our engineers got to be very close, closely allied and friends with those people. A lot of respect back and forth between them (cough) indeed a lot of time in the Missions, most of the time the norm was we would, our engineers would become perhaps the foremost expert in that experiment through their involvement with it here, so during the actual mission our engineers would be on line, on station up in the fourth floor user room participating in the flight just as thought they were the, the end person if that was a European experiment. And if something went a rye, our engineers were often the ones that knew, or the first ones to come up with a solution, or to understand the problem and initiate a solution. So there's been a lot of involvement with Europeans in a very positive positive way.

Dr. Butler: It seems that in this period in general, and as you've mentioned with Level II/III and Level I, those are mostly contractor run operations. Was there any

particular reason why Level IV appears to be reserved for NASA civil service with only contractor technicians?

Mr. Moser: Well it's my understanding, and it's only hear say that it was driven that way because there was not money to pay for the contractor work. The way that, back then, it's a bit different now, because of something called full cost accounting, the NASA engineers were in one sense free in that it was an infrastructure thing and we were funded out of a different fund source. So you didn't have to come up with special budget money to pay for a contractor. We were there, we were infrastructure and when the experiment integration function moved down here and the managers were faced with a challenge of trying to find money for doing that job, I don't know who had the idea, I suspect Bill Jule had a lot to do with it, let's use Civil servants, we've got them, they're paid for, don't have to find new money and furthermore it's a wonderful opportunity to develop expertise in our engineering force. So I think it was a resource driven thing, there was not money to pay for contractors.

Dr. Butler: (tape malfunction) and did level IV work only with the the Spacelab or did they work with other Shuttle projects as well

Mr. Moser: There were other Shuttle projects. There were what were called partial payloads that were not on Spacelab but they flew in the orbiter cargo bay. Thy were called partial payloads because they just took up a small portion of the payload pay. And we had a special checkout system here called PPCU or Partial Payload Checkout Unit that we developed just for those. And this was a simul, since they interfaced a direct, interfaced directly with the orbiter, we needed a simulator of those orbiter systems and that's what we did. The PCU simulated the Spacelab systems but the PPCU simulated the orbiter systems and we used that to do functional testing and interface testing for those partial payload things that we needed to

prepare. Using the term level IV for those was probably not accurate, but that's what we called it. Level IV was one of the phases of the Spacelab process, not necessarily the partial payload function (tape sticks). What we did was fundamentally the same but it was just a different checkout system we used to do it.

Dr. Butler: Ok so when you did partial payloads uh would it still go through an equivalent of a level II/III or a level I or it go

Mr. Moser: No

Dr. Butler: from here out to the Shuttle.

Mr. Moser: It would go from us, or if it would, it would go directly to the Orbiter unless it was the first flight of a major new configuration in which case it would go to CITE. There was a big decision made on each payload. Will it go through CITE or not. And and the folks would consider whether it's a brand new configuration or is it critical enough to pay for the CITE expenses thing called CITE testing. So sometimes they would go through CITE and sometimes they wouldn't.

Dr. Butler: How about some of the Satellites and interplanetary missions? Was level IV involved with any of those?

Mr. Moser: Certainly not, I can't think of any (tape sticks) I guess if it were involved in those.

Dr. Butler: When did Level IV come to an end?

Mr. Moser: Well the Spacelab program ended in (tape sticks) in a major loss to the agency and (tape sticks) vised was largely influenced by some private competition from Spacehab. And the Spacehab, a private corporation could do some of the things that a Spacelab could do and I think there was a privatization move a foot and so NASA made the decision to

phase out the Spacelab program. Wonderful program and it was a shame that it did but I think it was driven by the need to support commercialization and that was 1998, the very end of the program. We went through a large down moding, where we, there was an immense amount of property associated with the Spacelab program and we went through a formal process of dispensing of all of that in a proper legal manner. Some of it went to museums, some of it was sold. It was just a big operation. So anyway, 1998 was the very end of the Spacelab program

Dr. Butler: And where did, where did you go after that, or were you still with Spacelab?

Mr. Moser: Well no, after it ended we basically had to find new jobs and I ended up being a technical assistant for the director of engineering and launch processing services directorate in the ELV payload carriers' program office. To back up, I was the, let me fill in a blank that I haven't told you about. In May of 1980 when Bill Jule invited me to come over from Design Engineering, I became the lead payload checkout unit electrical engineer. And I was in that capacity for two or three years and then they decided to make formal supervisory functions and I became the chief of the experiment checkout section in 19(tape sticks) and I served in that capacity. Space lab was still going strong and I personally chose to go find a new job and I was fortunate to have an option to go move to the Program Office. So I did that in 1998, I was there in 1998, I was there until 1998. Still in those intervening years serving in a capacity associated with Spacelab. I was what they called a project manager for Spacelab experiments and for a while the Space Station utilization were responsible for resources and program management issues and planning and things like that. But when the Spacelab program ended we basically got told we had to find a new job and I ended up in a position as the technical assistant to the director of Engineering and Processing Services in the ELV's Payload Program

Office. Pam Biegert was the Director. I basically got changed a couple of years later and I became the technical assistant for Mike Benning (phonetic), the director of ELV (tape stuck) Services Project and that was the result of a reorganization and then a couple of years after that another reorganization and I became the technical assistant for the chief of the Program Planning Office in the ELV directorate. And I'm still in that role today.

Dr. Butler: Ok, You mentioned that for a time period people who were doing Spacelab were also working on Space Station Utilization. Uh, can you tell us a little bit more about that?

Mr. Moser: Well I don't know how many were, I was only referring to myself in that role, but

Dr. Butler: Well what was your role in Space Station Utilization then?

Mr. Moser: It was looking ahead to the era of the Space Station and doing the planning. There were four or five times a year a large gathering of the folks involved with Space Station, what was it called?

Dr. Butler: Freedom?

Mr. Moser: The group was Called SSUS, Space Station Utilization; I forget what the acronym was. But my role was advanced planning for how we were going to do experiment integration in the Space Station here similar to what we'd done for Spacelab. My role was very similar to what I'd had in the early days of the Spacelab Experiment Integration but it was a looking forward, how are we going to do it, what equipment do we need, where are we going to do it, what procedures will we need. I was in that role for a short period of time and then another person became involved.

Dr. Butler: What, what were the concerns? Had the decision been made to build the Space Station Processing Facility yet?

Mr. Moser: Um yeah, it was prior to that, but, I mean, it was prior to the existence of that, the decision was made, it was going to happen, it was probably in construction at the time.

Dr. Butler: Ground breaking there was in '91 and it opened in '94 (tape catches)

Mr. Moser: My involvement with the Space station was in the first part of that period you talked about,

Dr. Butler: Ok

Mr. Moser: so I guess it was under construction in that time frame. I do remember being involved in some meetings talking about how things should be laid out, how many off line labs do we need, what should be in them and that kind of thing. I guess in my role was since I moved into that program office function in 1990, it was that era of 90 to '92 or '93 that I had that role

Dr. Butler: Looking back on it, on, uh, Level IV Experiment Integration being a unique program in the sense that you have civil service hands on as opposed to having civil service supervising contractor hands on, what were the benefits and the disadvantages of of the way it was set up.

Mr. Moser: Well the benefits were immense in that it brought to us the best of the new hires out of college because they wanted to be here they wanted to be involved doing things themselves that was a lot of excitement for them. So it brought us really the best, the cream of the crop. And once they were here it was a major advantage in that there were

absolutely no morale problems. You had to send them home as a supervisor, the greatest challenge was making folks go home to get some rest because they wanted to be here, they wanted to do that work. My program (tape sticks) that in my four years I haven't seen anywhere else. Disadvantages? I can't remember any per se but there were some challenges with it because friends and NASA people in other jobs maybe were envious and that led to some problems. There were some perception problems, there enthusiastic folks got to be through this supervisory and management challenges associated with this trying to preserve relationships between us and other groups. That was a byproduct problem but so far as any direct disadvantages of hands on thing everything was positive. Except for the envy of other folks

Dr. Butler: And why would they be so envious?

Mr. Moser: Overseeing a contractor is not a great deal of fun in most peoples' minds. Somebody goes does the work and then you say yes that was good or no that wasn't and hands on work is a highly desirable thing in most engineers' minds.

Dr. Butler: You mentioned that level IV was able to obtain the best and the brightest because of its hands on work. Where are the best and the brightest going today?

Mr. Moser: Um, I'm not in the position to answer that, I don't know. I haven't been a supervisor in a long time so I'm not involved in that process but in ELV, where I've been working now for a few years we've recently gone through a hiring expansion and I can't personally vouch for this but its my understanding that being in ELV is kind of a hands on thing too and its able to bring in some of the best, not just of fresh outs but from private industry, the more experienced people are finding it attractive to come here. And what we do in ELV, NASA's policy congr, congressional policy, congress mandated that NASA not own its own launch vehicles but will hire launch services and so we have major contractors, Boeing,

Lockheed, and Orbital Sciences Corporation who actually provide services for air NASA payloads. But what we in ELV do is in parallel to what the contractor's doing, we do all the technical analysis to make sure that what they've done is right. So its hands on its just parallel it's different. We do the trajectory analyses, the loads analyses and all of those kinds of things, so it is hands on work and that's used to validate that the contractor's work is good. And it's, so far as I know been one hundred percent successful so far. We've not lost a payload as a result of failure and I credit that to the fact that we're off doing the same thing that the contractor service providers' are doing and I and they're very thankful that we're there doing it, cause as I understand it we don't buy insurance on payloads that fly on ELV's, the NASA payloads. Instead we spend the money on this effort to in parallel validate what the contractors do. And that's the only place that I can think of that I'm personally aware of that is puller inner of the best and brightest people.

Dr. Butler: And I guess and since you're not in a position to determine this but I would speculate that if hands on stuff is being done by the contractor that many of them might be going to the contractor

Mr. Moser: I think you're probably absolutely right about that.

Dr. Butler: Let me see here. How do I ask this? With the end of Spacelab, did you get a sense of where most of the people who had been in Level IV went? Or did they, did there tend to be areas that were open to them or were they pretty well spread out?

Mr. Moser: I think most of them went to the Space Station Utilization group. A few went to the ELV group and a very small number that actually left NASA and went into private industry, started their own business. The preponderance of them went to the Space Station Utilization.

Dr. Butler: Is there any particular reason why they might move in that direction?

Mr. Moser: I think it was a natural evolution of the things we did in Spacelab Level IV or very analogous to the things that have to happen in the space station. All of these experiments have to be tested they have to be gotten up to their flight configuration and they've got to work when they get there. So it was a very analogous thing and so the migration there was just a natural thing.

Dr. Butler: Any other issues that are significant in your career that you identify with Kennedy Space Center and make Kennedy Space Center unique.

Mr. Moser: obviously the space center will always be here because anything that goes to the other Centers are leading to things that we are going to launch, a preponderance of those come through here, so we're unique in that regard. I'm drawing a blank on how to answer your question

Dr. Butler: Ok, uh, I'll ask a slightly different question then. You mentioned that in many respects that Level IV Integration people were involved in the projects long before they arrived here within Kennedy Space Center tradition with the rockets with the spacecraft with the Shuttle, people from Kennedy have always gone out to the factories to bring the product here. Do you see something analogous to what, to what the Level IV Integration people were doing in terms of interacting with the experimenters in the development of the experiments to operate on the Shuttle? When the Space Shuttle first came, in fact for very Space Shuttle that has come to Kennedy and for every rocket that has come to Kennedy and for every spacecraft that has come to Kennedy, they have come unfinished and there reached a point where people from Kennedy would have to go out to the factory and say "Ok, It's time for it to come." and they

would work out what still needed to be done, how, how to finish it and and things like that. It would then be brought here. I guess some of the early space craft were actually brought here in baskets and final assembly was done down here. Is there a similar role in what Level IV integration people were doing with the experiments in terms of bringing experiments that?

Mr. Moser: weren't quite ready

Dr. Butler: weren't quite ready here and developing them to the point where, where they would actually work

Mr. Moser: Absolutely. I imagine every spacecraft, every payload, every rocket that was ever going to launch from here, the plan was to ship and shoot; bring it here and it'll be ready. And that rarely happens and you show them ship and shoot just doesn't work because things just aren't quite done when the schedule says you bring it here and so we send folks there a lot of times as you mentioned, to help finish the work

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Mr. Moser: In Level IV we had a lot of that because oft times the experiment didn't work ready, so they would come here and we would put final touches, final assemblies, final repairs things like that.

Dr. Butler: Can you recall and example of that?

Mr. Moser: Um, sorry I can't.

Dr. Butler: Ok. No problem. what were some of the (tape sticks) experiments (tape sticks)

Mr. Moser: Not me personally. As a supervisor I didn't personally work on these, the ones that were

Dr. Butler: Ok you were in a supervisory role,

Mr. Moser: Most of those years (both talking)

Dr. Butler: you weren't doing the hands on stuff yourself.

Mr. Moser: Right. Uh, never did I do hands on on the flight hardware, on the experiments themselves I did hands on work on the early years on the Payload Checkout Unit, cause I started out and spent two or three years as the lead engineer on that but (tape sticks). When I became a supervisory in what ever year was that. 1983 I guess, (tape sticks) my section was ranging from twenty-five to thirty engineers. And they were the ones out doing the hands on work. All I had time to do was all the administrative things associated with with that. But coming to mind as a more complex payload was the Astro. Astro I, Astro II payload. That was an ES instrument pointing system. Nickel stuff, highly technical interactions with the (unintelligible) system. Space science is things being particularly challenging, a lot of ways had to work right. When you do experiments its hard to think of which ones might be the bigger ones to talk about

Dr. Butler: Sure, sure. Another issue I'd like to probe a little bit more on and that is this tension that you hinted at between the Level IV people and some of the other areas of Kennedy where there may have been some jealousies. Uh, how did that manifest itself?

Mr. Moser: I remember complaints to our management from other organizations. Some of the complaints were why can't I do hands on in our area? There were complaints about perceived bad behavior from people with haughtiness or prima donna-ish actions. It got so strong that we became forbidden to use the term Level IV anymore. That was stricken from the books it was not used any more.

Dr. Butler: When was that removed?

Mr. Moser: That anyway, I don't remember exactly but it we got told we're now experiment integration; we're not Level IV anymore. When did that happen? I don't know exactly but it was probably in the '85 time frame. I don't remember exactly

Dr. Butler: Uh huh.

Mr. Moser: It was a major challenge to our management on how are we going to deal with this problem of Level IV and one of the solutions they had was we're not going to be Level IV anymore we're going to be Experiment Integration. I don't know if that actually contributed in a positive way to the solution or not but it happened. (tape sticks) I had many years of initially, initially I was a hands on person when I came here back in 1964, then I had many years of contract oversight type responsibilities and I can really appreciate those who were not doing hands one as we were but were in a position to observe what we were doing, because the enjoyment the motivation, the morale that springs from it, the enthusiasm, all of that is greater if your doing the work yourself and being personally held accountable for the results of it.

Dr. Butler: I certainly thank you for taking the time to talk with us. You've you've helped out a lot in terms of filling in some of the gaps and confirming some of the stuff from some of the other interviews that, where where we only had one source. It's been a great help.

Mr. Moser: Thank you, I'm glad I had an opportunity to be here

Dr. Butler: Thank you very much.

In his off the record commentary Mr. Moser indicated or talked about the difference between when the Germans were here and now. And he gave an example of once when he was up at Marshall in a meeting. And they were having troubles figuring out how to solve a valve timing

problem. And they couldn't figure it out. So they went to Von Braun. And he came in and he solved it. And he said, you know today would you even dream of going to the head of the Center to solve a technical problem? He said they're administrators, they're bureaucrats. But back then the heads were the best and the brightest technical people that they had. And I thought that was an interesting comment.