MICHAEL: Chris, can you give me some background information; tell me about the original testing process and how it's evolved over time.

CHRIS: Yes, early in the Shuttle program, there was a lot of testing on the LRU's, the black boxes, Line Replaceable Units that we have on the vehicle. The communications systems, (Communications and Tracking System) which I'm responsible for, we would test all those systems in the orbiter processing facility to make sure that before we went out to launch that the system was ready for flight.

MICHAEL: So the original process evolved over time for doing this testing, can you tell me about that, how it's evolved?

CHRIS: Yes the evolution of testing used to be - do a lot of system testing in the OPF, go to the pad, do some minimal testing at the pad, and then you were ready for launch. Over time our black boxes, our LRU's are on during landing, our system is the interface for bringing telemetry to the control rooms and knowing that our systems are on until the vehicle powers down the OPF, the philosophy was if it works on landing it should work the next time you power it up. So, the decision was made to reduce the requirement testing in the OPF and take a lot of that to the pad. We did that by limiting the things that had to be done in the OPF and then we moved, do some of the requirements out to the pad during terminal countdown demonstration test with the crew and then we've had failures with LRU's out there too, it's some of the boxes are like light bulbs, sometimes you turn them on they fail.

MICHAEL: So, what would you recommend for a new program based on what you've learned over using the RF testing for the shuttle process, what would a new vehicle need to do?

CHRIS: I think for a new vehicle that its testing should occur, should do as much testing as you could at the element location once you integrate with a rocket your launch vehicle that you should do that similar RF testing to make sure that there's not any incompatibilities between LRU'S, between the human rated vehicle or the launch vehicle and as the system matures you can probably reduce some of that integrated testing. The big thing is, you know to do some of this testing in the integrated you have access to the antennas you can do in testing with a controlled environment such as a communications and tracking station which will allow us to set our inputs and output levels at certain levels to meet requirements.

MICHAEL: So the facility that you use, it's unique, it helps out with the testing, how does that work?

CHRIS: Our facility what we call communications and tracking station, basically we have from the test vehicle we run antenna coupler coax, we run it to a communications and tracking station which is located for the shuttle program it's located in the OPF. In between the OPF highbays one and two and there's a second station just outside of OPF highbay three. The C&T station has the ability to test all RF

interfaces KU band, S band, UHF so it has a capability to do all that in a controlled environment, a repeatable environment which is good on a flow by flow basis.

MICHAEL: And the team that you have working together anything about how they're involved and how they are working to make this process a success?

CHRIS: The team that we have and had, have had is a pretty dedicated group of people it takes time for communications and tracking systems takes time to learn the systems to understand the idiosyncrasies of the systems and understand how to troubleshoot the systems indicate in the event of the failure of an LRU.

MICHAEL: And any specific LRU or component that really comes to mind that highlights the significance of doing this sort of testing?

CHRIS: In research back to STS-1 which was a little bit before my time there was a LRU in the network signal processor that had to be redesigned a couple times before its first flight and that was just due to learning the idiosyncrasies of the system and from what, how they thought it would operate and how it actually operated that one set system evolved for a couple of missions it became pretty stable, the LRU's that later on the program are the radio frequency boxes, the RF boxes, over time, you know age, affects the circuitry's in some of those boxes and those seems to be the boxes that ya-know are most susceptible and they're the most important boxes, a lot of testing occurs on the ground is done via umbilicals and the umbilicals don't fly with you when you launch. So it's very important that the RF systems are tested thoroughly before launch so that we can satisfy all the requirements and safety of a launch.

MICHAEL: Great, Chris it's been really good talking about the RF testing, is there anything significant about testing a specific element first, the integrated testing?

CHRIS: The element testing once again, we have in a very controlled environment integrated testing on the shuttle is, was done at the pad's so that those interfaces are not the same as a controlled test set those tests were performed via open air to a ground station such as MILA here at KSC or to our communications and tracking station and those would be all over radio frequency. There's drawbacks of that you get attenuation due to atmospheric conditions, you also have external emitters that are kinda out of our control in today's technology we have a lot of RF emitting devices such as blackberries and cell phones and things like that and that can cause problems to the RF devices so it's important to identify what emitters would cause you a problem coming out going through a launch countdown.

MICHAEL: Well thank you for your time, I really appreciate sharing you sharing your lessons.

CHRIS: Ok, thank you.