JOHNSON

RB

an in-flight logistics uh? I mean it won't be in your area? No, we hope that our plans are and I'll be talking to NASA Headquarters on this Thursday and we hope that we'll be given the job of doing all the logistics planning and executing for the shuttle and its ground operations now not in its flight operations Throughout NASA? Throughout NASA. Great. This is what we are aiming for. It would be terriffic. We have the people here that can do it. O.K. we thank you for your comments_____.

This is an interview with Dr. Johnson on the subject of the Pagosis Meteor Detection Satellite. O. K. I don't know if you've had a chance to read that paper over of not I have had a chance only to a briefly scan it. There were a couple of specific questions I had in mind if you don't mind maybe we can go through those O. K. good. The thing was the Meteor Detection Satellite was designed to protect not only space craft but lost vehicles is that correct? I can't say I don't want to use the term protect. Alright. The problem that probably existed at that particular time was a problem of attempting to design vehicles which would in fact survive for periods of several weeks in space and one of the hazards was the danger meteoretic impact you know this tied with the time that the Pagosis was initiated or that bit of research was initiated which ultimately lead to the Pagosis. The design concepts or the concepts of what is the Lunar landing was concerned was one of earth orbital rondavou, a somewhat smaller vehicle that the Saturn V, and the operation was

put together the what was acctually put together a vehicle to actually build it up in earth orbit and one of the provisons was put up tanks filled in fluids that a _____ a the a operations was to put together a vehicle

Back ground noises too loud to understand
what the speaker is saying

The problem that particular problem became rather clearical however, the less critical with desire for the changing concept of a Lunar rondevous. However the desire for the information remained relatively high, At the time that we went into it there was went to attempting to come up with a system to make some measurements there had been a large number of studies done sort of the background information consisting mainly of observations on surface we had the meteorites type observations both visual and with radar. And the uncertainty of what that particular data ment in terms of puncture capability of puncture hazards on a peice of metal flying space was sev. orders of magnitude that is rate of puncture as a function of its thickness. NASA had flown several experiments which were relavently small in size ranging in size from something of due of 12 in. up to at least one experiment with total exposure some 200 or something square inches._____ recording devices extremely sensitive microphones and also pressurized containers and the pressurized container uh once you got a puncture in it it leak down _____ it pulled a switch that said it had be punctured and then it was completely out

of business. Usually on the explorer theory? Usually on the explorer theory. We after analyzing the problem for a bit and recognizing that it was the problem of exposure circuits and length of time of exposure it was an area time type thing in order to get good statistics prosposed a anitially the we join forces with Langley An attempt between us to fly as the passenger payload on the Saturn vehicle a somewhat larger service than the one which Langley was then proposing in order to be flown on a smaller vehicle and I believe the vehicle that they were proposing then was the Delta . Excuse me were you at NASA Headquarters at that time? No, I was here at Marshall. O. K. alright. We proposed to join forces in an attempt to design a payload to be flown a saturn. As a consiquence of the meetings at Langley we ultimately elected to go our seperate ways. One of the reasons being that the Marshall approach was to be more purely engg than that the approach which Langley ~~Migh~~ then was considering adapting which would have made an attempt to determine both directivity and velocity. Neither of which had yet been successfully measured incidently. Our feeling was that since we had design information that or had information on the environment that particular environmental region which allowed us to give the designer no information at all as a matter of fact if apon span spand ten decades and this is obviously of very little value to him because in essence we're talking him into something that so far as the designing something something else

so far as we can determine is more critical Oh as a matter of fact that you don't know how critical the information that he is asking you is. To put it very bluntly _____ the limits we could to put on the on our ability to calculate the was such that the best thing we could do the best we could tell the designer was to take out worst case some that the bottom side of the spectrum is of the worst possible set of numbers that we can calculate uh is accurate. An in order to assure the type of situation you are proposing to put up in order to assure that all of those facts applied to two weeks. You would in fact have to make the wall so thick that it would be impossible to _____ _____ so that's obviously stupid that's obviously a stupid design. However, if our best case isn't correct then your problem is not going to be making the wall so thick it doesn't really make any difference as far as we are concerned it doesn't make any difference how thick or thin you make them _____ _____ so under those circumstances _____ any information you have the design for some other perameter. Which was a rather unsatisfactory answer. The mistory statred off as the carry on type of experiment carry on in the sense that your payload capability became a available or if a payload was required or if a Saturn vehicle in that test program became available _____ – task will be done. I've heard some comment from some place that one of the reasons for Pagosis too was to answer some criticism in the scientific community The Saturn really wasn't turning out scientific information

was there any consideration of this _____

At the very outset of the program I had been _____

_____ to be very early Saturn I flights were of course loaded with water _____ the next Saturn flights were loaded with the upper stages which were not related with water. And on two of those flights we did an experiment called project High water wich was not too well planned, because of the first effort had begun in the planning in which that water was released and one looked where the water went well sorta what happened to it basically. With the with the idea that if indeed that if that water caused on its release during the flight simply by erupting the stage to cause some some severe change in the upper atmosphere or in the ionosphere and particularly one of the things that was being postulated by at that time at least one group was that it would disturb the ozone layer, and as a consiquence the intensification of sunlight in the area in and around the Florida. That if in fact this happened one would have to be awfully careful about using hydrogen oxygen motor through that region because of that factor your product from that is of course is uh water dissociation product and so this I guess is really the first where the vehicle was put to some use. Because of a point from a scientific community. "Is there any one scientist who can recall now who is. . ." No as a matter of fact it was a just a little bit a (end tape) Therefore don't associate me with it any more that you have to even though I was associate with it. Because it was not a well planned experiment. There simply wasn't time. It was done on a crash basis there simply was not time

however, the normal design philosophy in Marshall was if fact the design philosophy at Marshall brought into NASA with them was one of step by step testing you do first the first and you get that to the point that you comfortably confident that you have something then you do your next stage, then you do your next stage, putting more and more requirements on the vehicle. This is as opposed to the all up concept. Now this immediately forces you into a situation in which you end up with hardware that is going up; essentially. Since you end up with hardware up in favor of w/ payload capabilities but you're not utilizing. Payload inert stage with - - just stage with lead in it and there was a little bit of the feeling in the atterum after Pagosis as a carry on type of experiment. Secondary purely secondary type of experiment got under way there was a great deal of pressure. Yet, the decision was made to go to a one B S IVB so there was a great deal of pressure to terminate the ~~one~~ SI testing and however as a part of justification for continuing the one Sat I testing, and here one has a chicken and egg situation whether in fact the, one testing would have been continued without Pagosis or not but certainly as a part of the justification for continuning that testing. Pagosis became a primary payload, it became a mission for which the vehicle was presumably being used in order to perform the mission. As a matter of fact, I think that uh had we totally failed on the way up nobody would have been hardly upset about it except we look bad we'd look bad to have failed. The Pagosis thing finally became a

pacing item for the flight didn't it? Yes it did. Uh, the can you tell me a little bit about the problems that you had there what the difficulties were? Uh, I guess _____ way to get there is to go back and read the most simply is to read the correspondence and the records as _____ in the documentation file. _____. There were a whole series of problems one of them was that once we became a primary mission then thre requirements that they be qualified began to increase. The risk with it, ummuh, in other words with it. The risk that you could afford to take with it uh. Where initially the contractor _____ in some cases had planned in some cases work had been around in some cases would have been allowed to use _____ practice. It became necessary that he use uh somewhat more stringently controled design practices. The confidence program the it began to take in more and more features. Can you give a spacific example of that? Yeah in uh probably electronics. But one would have taken a risk with it as a purely secondary payload in other words the fate of the program doesn't hinge on it. The design philosophy was if you loose a century bank one your centry banks than you are not totally out of business and of consiquence what is the value of that centrued bank versus the if its got eight chances in ten of surviving what is its value versus the cost of trying to get it up to point nine nine changes or not even a hundred that it will survive. O. K. and if its purely secondary mission then your tradeoff comes somewhat lowered in fact you want to garantee that point nine nine then there is a great deal more intensive testing program

that you have to go through as a totally different parts of the program that you have to go through. The qualification program becomes the point. _____ _____ electronics program became pacing items too. _____ _____ however the principle that that became a pacing item was the capacities of the centrys themselves. And this one is an extremely hairy problem that I'm not at all sure I can discuss without getting into some sour ggrapes O. K.? O.K. thats excellent go right ahead. It the time we proposed the experiment and at the time OAIT decided to pick it up to sponsor it and it was strictly an OART sponsored experiment incidently. At the time OART decided to sponsor it Marshall agreed that they would go with it it was they were assuming the responsibility for sponsorship on it the proposal there were then two proposals for _____. For two capacity designs and one of them was the Langley design and the other was the Lulick design. At one there were actually three of us who were three centers who were in the game Langley and Lewis competing for the Delta vehicle and the Marshall making this other proposal for a much more increased statistics. A much larger vehicle you see. An the decision was ultimately to go with Marshall. But then the question came up whose censor do you use. Do you use the Lanley capacity or do you use the Lewis capacity? The Lewis capacity was a much more complex device. It was actually a multi sanwich type device. Both several sanwiches had to go becore you could assume you had a hit. And they were relatively thin but in a meeting on a Saturday morning Lewis and Langley and headquarters and Marshall got together

to try to make a selection on the sensor. And Lewis took the position that they could not say that their sensor was really qualified and that it was a workable sensor and that they still had some _____ to do with and Laneley basically took the position that their sensor was qualified and it simply was a matter of having it fabricated. An so we chose the Langley sensor. It turned out indeed this was true it was a problem figuring out how in the hell to fabricate it. And that was a much more severe problem than anybody realized on that particular day. We had some very small samples they had done some which were less that _____. We were talking about samples that were detector papanels that were 20 inches by 40 inches after we got into the well there were all sorts of materials problems the probability that the _____ would have be breaked down _____ Then we got into the problem in which Langley indicated that in some of testing on smaller samples they had picked up voltagespikes and this is what you are depending on the voltage spike appearing in a cercuit once that capacitor is broken once it begins to discharge that they had picked up voltage spikes s imply because the milor was capturing electrons they had done this in a test device there was no way to unsramble these two so we went into an extensive testing program in that area. We came up with some methods for unscrambling them we had in fact observed functional discharges in fact we were able to duplicate some of their discharges in a machine up in Massechusetts thatturned out that they were

out that they were functioning a machine that was not in function with the test sample that also turned out at Langley that a large part of what we were observing was functioning machine that they were using and had nothing at all to do with the test. At Langley? At Langley, we went back and run the test at Langley. I got some people up there and _____ week and a half before I came up and my most critical design _____ _____ radiation facility Langley trying to figure out what we had. _____. _____? I don't think one can point to anyone as a matter of fact we had originally indicated that we could do the job in thirteen months it took us I believe ninteen months from the day they confermed go ahead to the date of the first flight. I'd have to go look that one up. It wasn't that much of a lost time_____ cost much _____because we'd have gotten into more problems and the thing became Marshall became a primary mission_____ tha cost went up on it. You remember the cost figures at all? The only one I remember is thirty million dollars and I've forgotten where that was. In the beginning of the program I guess. No, this was the ending of the program. Oh, O. K. The _____yeah I can tell you what that cost figures are the initial bids by the contractor which was Fairchild it was their first job k the first of the Stratis division the initial bid uh six seven 6.4 6.7 million 6.4 million. The bids ranged from there up to about 13 million as I remember

it our estimate of the cost in the job as was then scaled; which was for no left out it was development model one fairly simple qualification model and one flight model. It was around thirteen million and a final _____ which included develop model prototype three flight units and a great deal more qualification testing was 29.3 million and that included almost a million dollars worth of post flights. Where there five Pagosis models basically altogether? There was an EDM a prototype which is a I believe on this thing over here. And the three flight units and then there was a one it was only partially it was only partially riged and it was done for structural analysis and this type of thing one of their shake rattle row test you just had a lot of dummy capacitors and dommy electronics and this type of thing I don't know exactly what you would call it a shop cleaning type model I guess_____.

When you finally got down to figuring on how many volts would _____ you talking about so you had some discriminator cirtutry in there the final voltage was set at something around four volts do I remember that correctly? Four volts to indicate a hit. Now anything below that in the discriminator panels was charged off to modelack. No it is lost you basically just lost it. Its the same old problem that you find on any of things like typical radar typically the radar problem I could d escribe it in that sense. You make your radar if you want to make it sensitive enough so that you are sure that you don't miss an appreciable number of your target s but at the same time you don't make it so

sensitive that you've got so much information that you can't unscramble your target. So basically this is the problem we're trying this is the problem that we're trying to beat. We're trying to get a balance between number of misses _____ occured that it was really an invent that you've missed it and the number of false alarms. And we ran a large number of test with the actually with hyper velocity guns. This was after we had gotten the descrimenator set so far as the radiation noise is concerned. Just to a because this was really a matter of filter more than as it turned out. Yes, there were discharges electron intravelment they were generally pretty low and they were also generally pretty high frequency once you started so you could actually cut them out and then get rid of them. O. K. so they were high frequency you can do that. And you found out that the other problem too was that it would be a sperious charges where functions of the test machines, actually. Some of the extremely big things that a people were most concerned about was really a matter of the machine. I think we came pretty close to

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changing some ground planes you can change both the rate and the shape and size of that part_____. _____ through the Van Allen Belt Was that did you have I forget the question I had was that clamed to put the Pagosis diliberately through the Van Allen Belt to pick up whatever you could about the starfish things or or it just happened

that way? And also I guess the _____ I guess it was something else too that the a Well there were there were several pariferial experiments aboard periferial to the Pagosis which turned out to be periferal to the Pagosis that were actually included because we had some questions about the operation of the Pagosis. If in fact you had a real problem with respect to a a radiation the whole went insensitive because of radiation. during a certain portion of the orbit and one had a set of ____ so that you could determine the radiation blocks had gone above a certain level. Then you could still salvage usuable data during other portions of the during other portions of the orbit simply by being able to exclude that which for which you got simoltanelusly a real high meteoroid count and will have a nuclear particle count. Provided you had nuclear particles decetors on board. An so that was the reason for putting those things aboard. Well it turned out that their major use since that problem we did not encounter it turns out that their major use was to begin to get some gross cut data on a electron proton spectrum particularly in the south _____ Now, the other thing practically was the thermal behavior in the vehicle. And here we had instrumented because technizues we was using_____

_____

But then you are faced with the problem of how do you unscramble that data. What is the standard? And in order to provide a standard we went back and put on the box with the set of control basically controled samples on it one black and some of the white things that we thought had been used in these places

and daaa some gold fold type material and this type of thing. Well that box taken as a package comparing those behaviors or those samples back to the black one; that black body the black absorber in themselves constitute an experiment. And this is the thing that Bill Sniddy was interested in. but he needed that particular information if in fact we had gotten into a thermal problem on some other element of the spacecraft. Then in order to handle as that the behavior of the other element he would have needed information that he was gaining from here in order to determine what the actual behavior was Was alidine some thing that was around or was that something that was developed Aladine is one of these things that was basically around particular formulation of the alidine turned out to be a bit of a problem. And in fact Fairchild generally solved that particular one. He used aladine there which was done be a I guess Fairchild a group at Northfield No, _____ _____ jointly. Fairchild I guess did most of the _____ did the applications type of analysis. You said you had some sour with that thing you ran into some management problems because of the time scale was that between you and headquarters or between you and Fairchild or where did the Well no, I said sour grapes in the sense that I use to look back at that I remember sitting driving out here on a snowy Saturday morning Sitting through a entire day session to pick a capacitor a dector bank and then the problems that we ran into with that thing after having picked on the basis of the guy who really created a large number

of the guy who really created a large number of problems later on, _____ it was totally developed and all you had to do was figure out how to manufacture it. O.K.? Ummuh. And we had development problems all over the place. How do you ah _____ No, it was a matter of strictly development_____ What is the sensitivity of that type of product? How does it really work? So forth and so forth. Where there anything as far as the frequency of meteroid hit that really changed any design perameters of the spacecraft or launch vehicles? No there were not, as a matter of fact there were none. How do you evaluate then the a Pagosis satellite then in terms of what it was supposed to do and what it Oh it did it did exactly what it was supposed to do. Let me see if I can explane that to you. O.k. Frequency of occurance as the function or thickness of material this is frequency of _____ I've got set of numbers up here for very very fine material and this thing now is large scale so this_____ I've got a set of numbers like this and then way down here somewhere derived this on the basis of the size that is what size pipe line we have to have _____ _____ that is standing on the ground coming into the earths atmosphere. Down here somewhere I've got another set of numbers and then I've got some other random data scattered around and in here is the region that I'm interested in_____ and I start trying to draw some _____ _____ You with me? Ummuh. O. K.? NowBasically what this tells me is

that any one _____ is as good as any other _____

And that is the whole reason _____

This is the reason I have done measurement and I am quite a long way away from where I want to be with respect to the measurements we have only in a little closer that the design region that I was working for. But, instead of

_____

fee as a function of T as penetration is a function of thickness at it was equal to a number not plus of minus 10 orders of magnitude now but possible no more than half of that number. So now _____ for something long like this it becomes a _____ like that. I can now with some confidence project down to where my design is. I remember the Pagosis sort of gave it kind of a confidence that the designs were correct. That that that they were good now is all it also gave evasive data that the design the initial base data for designing the Skylab. The Skylab. Oh the Skylab? Yes. With the familiar bumper on it Sure thats right yeah . They went back and pulled the Pagosis data out Yeah that is where they studied from.

TOO MUCH NOISE.

All I can say is Thank God we do have a problem you see. That's what struck me as I was doing some experiments you know You think hole it baby you_____ _____ and you say here is the dramatic problem they had and they had to do a dramatic fix to do it. But if the kind of thing_____ may be interesting in another way you had to prove what you thought it was going to

maybe it was dramatic you didn't really find anything that was perhaps new but it was still significant in proving that the basic design was found incorrect. Yeah, this also you some confidence when you get in to something like Skylab and now you go into a much more complex type of design. It gives you some confidence that you really know how to design _____ That the environment you're designing into you understand. Well thats interesting to because you originally started out with EOR and here is the Skylab essentially in the same _____ environment. O.K. I know you have an appointment and I think I've