

H. Raiklen

The specific incident and you sometimes confuse incidents and I recall that there was a man assigned in the Saturn II Office for a period of time a few years ago who was starting to write such an effort and we put together some material in support of that. Now I don't recall his name. He is up here in the shuttle area and I can't remember his name either. No, this is a Onessa. Onessa. Man. Well then it was Christenson? Dave Christenson? Tall thin fellow? No. Was he stationed at Seleby? Well, he was out here for awhile. And I'm trying to recall, it seemed like he'd been to the Air Force and was an Air Force Officer who had been assigned to NASA. You mean Tom Ray, _____ man. Well, he is about my height, as I recall he was blounde. Ray, doesn't sound Tom Ray. I don't think Ray would be tugged in. Christian was out here. You don't mean Gene Immy? Big kind of fellow, bastic fellow. He's the Air Force type. He's the Maste Historian's He a As I recall maybe Ray Oliver worked with them. An I know Ray Oliver. And Ray Oliver may but we made a matrix of trying to distinguish the events and the major changes and commentary on each and it could serve, the point is that it was made up in a rather orderly way. And it could serve to highlight some important points. How recent was this? It was a couple of years ago. Withing the last few years. They are beginning to prepare a document called a Car Schedule and the, No, this was done some time ago. They've already done for the command module, I think. Yeah, but their starting _____. Are you aware that in item cost study that they are doing on the Saturn and the CSM. There was one other and it escapes me. I just cannot recall it. Maybe you can track that down for me

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Ralph. We've done some of these matrix like things and made time lines, to show where the engines have come from. And we've done, Now this was more in line of a -- cronologies too. First of all it was S-2, and it was an effort to try to track the changes that were made. That were of substance, you know in effecting the program. I do recall now the other effort. Cornell University had a series of interviews with both ourselves and other words the contractor and Huntsville and as I recall they also talked to Huston people. And it seemed like their goal was to access the management techniques that were used. By both centers, what they thought about it, what the centers thought about it, and what the contractors thought about it. There was a--and I recall reading one of the reports and that was over six months ago. ---Umm um yeah _____ further this kind of studies.----and ---we've ask some of your management wheather they've been interviewed by the anybody else--Yeah Cornell was the one that a----and I have got any kind of answers. I kind dropped that question there on my own. Gene Immys had some summer people working from universities and maybe that's part of that program. No, this is a NASA contract that the University of Cornell had---el leta---and---Cornell has a Management School there---And da Arlene? Yes. Two things, I ^{gonna} test your filing system University of Cornell wrote me a letter and it was sort of ^{thank} you for your corporation type of letter and there also may be a precursite we are going to visit you on a certain day for an interview and the third element may be they sent me one of the report volumes to read which we may have. The University of Cornell? Yeah. Cornell University. Yeah Cornell University. That one

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incidentally, there was some controversy about the contents of those reports. The other thing I wanted was do you have any cigeretts? I don't. Ralph does. She has a package. Thank you. O. K. well I thought I'd pass that on that might be useful the matrix I think would I think for instense Ray Oliver might help in you know, identifying from the matrix some information that would be valuable. It would act as at least a que for him to remember.. And this other one may serve to give you a management perspective. I don't know if that of significance--Yeah we do want to talk about management. And say something about what new techniques we've developed in management. And talk about the interfacing of various contractors, relationsships between the NSFC and the contractor and George Millers office, Sam Phillips' office. See how this is put together now this story is gonna be pretty perrocial its gonna be told from the Huntsville point of view. Largely because of time. Now I'm not gonna say that Huntsville is going to be the dominant element. I mean that is that they are paying for work. Early Arnold said that this would be Von Brauns monument, he said that they are concerned with how they fair in it and if you get into administrative history and talk about what came out of the man space flight you're not really doing what they'd like you to do. Now, do you want to help me by asking me questions or how do you want to proceed. Well, if you think I can help you very much by asking questions I'll try. But, what I'd like to talk to you about is, well from your earliest association with the Saturn vehicle. My association started in November, 1965. And, At that time I was on a survey team. An in December, 1965 I was appointed assistant Chief Engineer, Chief Program

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Engineerist they called it on the Saturn Program. Subsequent to the, well I remained on the program through, let me back track. Let me work it backwards In October of 1970 I left the Saturn Program at the time I was the program manager and came to my current job. In August, 1969 I was appointed Program Manager. And prior to that I was the Chief Program Engineer. Now I don't recall exactly when I became Chief Program Engineer but it was at least a year earlier than August, 1969. So between December of 1965 and that last date I was Assistant Chief Program Engineer. And Harold Dale was the chief Program Engineer. So that sort of fills in my direct association on Saturn Program. Now of course at the time as I recall the S2T which was sort of an all systems test vehicle was going through an out-of seal beach at the time. That's as I recall it. In other words you were there from the beginnings of the manufacturing operations. I was there centrally through the delivery of S2I through 15 and shortly after the delivery of S2 15 from Seale Beach. That I left the program and came here. Of course I'm still associated with the program because they still have engineering on the program and as a consequence I am still involved with it. All the engineering down there reports through you now? Well, we have a technique, a current is that if there is a program of significant size we appointed Chief Program Engineer who reports to a manager and then that Chief Program Engineer comes out of research engineering and test with a group of people and these group of people are assigned to that program now the group of people that are assigned are I guess in two general categories those that are dedicated in essentially a 100 per cent of their time. When I say dedicated and then those

that are not on the program all of the time because there isn't that much effort so we'll share them with something else. Now within that latter category for instance we have a laboratory here and it's difficult to dedicate a laboratory effort to a program especially at this phase of the program. So we have a laboratory function and test function which supports the Saturn, the CSM, the Shuttle or whoever else is doing testing. So there are some services of that nature which we provide as a and that and now when we started on the program we had a work content of the program was such that everybody was dedicated but even at that point in time this was back say through 66, 67, 68 and 69 about half way through 69 and then the work load started to bare down and that resulted in more people being moved back to central or laid off. What I'd like to talk to you about is some of the Manufacturing problems and techniques you used in the Saturn because Roger and I destroying some technology and in addition to all the normal historical things you'd expect us to go into why, ---Well we-- the scheduling, and we'd also like to talk about the technology of the operation We, well one of our of course we had a very large vehicle about 33 feet in diameter which had to be welded and getting the circumferential welds near perfect was a significant effort. And not that any advanced technology is simply a matter of finding the right process and control technique required to achieve this near welding that was required. That was a major effort. This is a tig welding? That this was done on? Tugston and _____. Yeah, I may recall now I think that's right Tonston Electrode with Enart Gas. Another area of significance was the these are not necessarily in chronological order cryogenic proof

welding

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testing. I think we were the first that ever did anything of this scale this size in fact that was a major accomplishment technically. this means that for the first time the tanks were actually loaded with crygenics of the t ____ material. And then tested to proof load .which is above the operating load. What is proof load? How much of an operating load, do you pressurize the tanks in addition to putting marks in higher chamber? Yes, and then we pressurize the allogenous volume, the volume of the liquid to a load such that its lower than yield we didn't want to yield anything but as I recall it may have been 10 to 15 per cent above the normal flight operating load but with centercubes I mean Syracuse University its in the state just down the road. Still founded. Thank you very much Now I know about Syracuse Dave. You're aware of that? Yeah, in fact NASA sends management people up. I think one of the people from talking to SFC organization is going up _____ techniques its kind of a mutual backstretching mode that they've fallen into. We're aware of their reports and all. O. K. fine. That was in September of 69. Yeah. Did they call it history or did they use that. Management. It was the Appolo Project Management Contractor Interphase. Thats the title of the report. And they apparently visited Gramin Rocket Dine McDonald Douglas as well as ourselves. You know its good to have that called to attention you should look it over _____
_____. Where did the scientist get into this alarm? On the decision to go to the moon on Herbert Bagose is doing one on the Technology Base for the Saturn Decision plus the institute in Washington , a number of different disciplines interested in what you've done. So primarily I thought

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another major effort on our part in as you know there liquid Hydrogen and liquid Oxygen fed to the engines and one of the requirements that the liquid Oxygen have a certain condition. By contition I mean the relationship between the amount of gas entraped in the liquid and the amount of liquid. And one of the conditions was that we had to have that subcool as we call it a certain amount so that it would be properly conditioned when we started the entrance. So that ment that at a certain time while it was still on the ground we had to identify a temperature such that during the warm or during the boost phase while S1C was we could predict that the temperature at engine start of S2 would be proper so that the engines would start efficiently. And it was imparically determined which by that I mean we had to run test at Santa Susanna and at Mississippi as a part of the static firing testing and then some test at the Cape in order to get enough inparical data under the different conditions to be able to predict that that temperature at that time something like three minutes prior to engine start which ment while it was still on the ground would be adequate. And it turned out that we were sufficiently conservative and it did work well. We did have some margin. We didn't have a pump fed system on the oxygen side we had a what we call a recirculation system where we are just taking advantage of the differences in temperature that existed to cause flow of the liquid and the flow of the liquid was important to keep it cool. On the Hydrogen side we had a pump so we could turn the pump on and actually control the amount of circulation and therefore have greater confidence in what the temperature would actually be at the time the engine start. I thought that was a significant accomplishment that

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 compare
 recirculation of
 about 1000*

recirculation

the recirculation system did work. How do you get on the research system?
Do you start with certain parameter and rocket design and what's needed for
Yeah the engine rocket design told us what the conditions of the fluid would be
required. And, then of course the general requirements came from the customer.
It was agreed that we would use a recirculation system. What's the
alternative? A pump. Well we could have dumped it overboard that was
another technique we could have used to keep it cool. And that was one of the
things that was considered. A pump was another option these were contingency
options that we considered. But with the testing that we did and with the conservatism
that we put in there it turned out that we had ample margin and worthwhile
and consistent. Where did you use conservatism? It's a word that I
should be using in some of our interviews. Do you think that the designing for
the operation is at all conservative? Well, you would have to give me a definition,
but with my opinion and reference that I came from; which was airplane, I thought
we were being conservative. And I thought justly so. Was this because per man
rating? Well yes, but in a larger sense it was not only to make sure that we didn't
have a catastrophic event but also, it was a very costly program in terms of
people and time. And we had no option but to be right each time. And that makes
you take each decision and see what the options are and what the contingencies
are and choose the most prudent path to proceed. So I would say it was conservative
in that sense that all decisions were thoroughly reviewed more than once, several
times and the contingencies and alternates were developed so that we had a very
high degree of confidence as we worked the first time. Speaking of paralleling
development I know that MSFC was a little bit

9.
Rocket design

conservative

decisions reviewed

9.

scheptical of the common bulk head design. And they ask you to _____
_____ a separate part of the contract. Well now the reason I didn't
bring that up is that all of the--essentially that was all decided by the time I
came on the program and our business at the time was simply to complete the
testing and so when I came on the program it was that engineering required to
insure that the manufacturing was supported properly and the test was supported
properly. O. K. Why don't you start with those two questions? How do you
see that the engineering supports the manufacturing if its already in manu-
factory. You mean how do you do it? Well. How did the engineers in this
time of enterprise support the manufacturing effort? Well, by being on site.
We had engineers on site to support them in the critical areas full time. In
less critical at designated times depending on the manufacturing activity and
then on call. And this was true when I say support manufacturing I mean
also to quality insurance functions. And this would be in the structural areas
like welding. In manufacturing, processing of large panels, in the systems
area. For instance we had safety people in engineering assigned. Going
through how we could have a safer operation. And I use safety to include not
only people but also the safety of the hardware. Sort of a damage control to
minimize the damage of hardware. Of course as the program get older this
becomes more and more significant. Because you have got to banance the
number of spares you have versus what you have in the system and you don't
want to wind at the end having too many spares. So it becomes inportant
to keep the damage control of hardware safety visible. Then

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Do you run this on a kind of a manflight awareness program or something where you have people going around lecturing to people like don't drop the wrinch on the..Yes, yes, we have safety meetings and workmanship meetings we have a pride program. We have another cause identification program, and removal. Do you find people fairly good? the workers on various levels of supervision fairly good to fessing up when their coming out of the tool room and drop something? Yes fairly food is Yes we encrouage it we try as hard to keep people aware of the fact that identification is more important than penalizing the indivisual. Unless it was deliborate or something of that nature. We have a constant motivation program to try to encourage people to do that and they do in general. Its just kinda building up an awareness in the work course. We have fines of course and a these meeting identify the impact of not identifying the problems; the impact of having the problems we encourage for instance we identify how do you solve as a part of this so they wouldn't be too concerned when the problem did occur. That there was an orderly technique available. Well on the other side of the house then you say you also had a test function to support the manufacturer. Yes. How did the test cange the designer manufactur- ing as you went along? Obviously each vehicle is a little different than the one that preceded it. Would you agree with that? Well, due to changes, yes. And I think I'll aidntify the more significant changes. And I got some information from rocketdine that show how some of the engine parts were changed. And colors and the pumps were changed and then they were put back record base on some of the other engines. Wnd we want to do the same thing for the S2 to show

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how the design progressed. I imagine this comes out of the test functions. in part or does it come of a... Well the test function that I'm referring to is the post manufacturing test in other words after you've a completely assembled a stage and installed all of the systems we run test on a system basis and in a integrated test in the end to assure that all the systems work together. And then subsiquent to that at Mississippi they were static fired, close to fired to validate that under firing conditions the systems all worked satisfactorily. And then based on that they were judged to be ready for flight. And then were shipped to the Cape to prepare it for launch. The firing test was you see in a program like this I think there are two things you have to achieve, and identify. One is when the design is mature. Second when your quality assurance techniques are mature. The first to show that you have achieved the performance re- quired and the second to show that you can sonsistantly achieve that performance. And of course the static firing was the final test to assure that the vehivle was performing as designed. As required really. And did achieve that at both points. And our technique for determining that is through assesing the reli- ability achieved and through the change rate that was being accomplished and the design assurance assesment was made based on detecting all of those con- ditions may have caused problems in flight of different catagories. And when that deminished to a point to design and we were finding other things which say to the way the system was put together to assure that things like contamination control, workmanship and so on were correct. We had a stage that was ready and by ready I mean the design assurance or the quality assurance techniques

that were being used were mature and could find these defects. Now this whole maturance techniques would you say these had existed in industry before and it was up to the aerospace industry particularly Saturn Development Program which would bond these techniques of testing of manufacturing under clean room conditions. Well all of these things existed but I think you better talk about two things. One is the degree in which they were applied and then the integration of all these techniques into one structure. By one structure I don't mean the structure of the vehicle I mean the structure of the management. And I think those two things would I think the integration of all of these things into one flow and then the attention to detail and the attention to providing alternates and contingency plans where techniques I think became more pronounced and more consistantly applied than I'd previously experienced. Well I keep saying that I'm previously experienced because I'm not in a position to make a current comparison. Not having been say with the Air Force or Commercial recently. That's been kind of my feeling in talking to people and what I've been seeing of other industries. Well I also think that one of the major factors in success is the people. And we had people that were dedicated. That were willing to work to all kinds of hours and were willing to devote a substantial portion of their own time to assuring their success and even with all these techniques it was the people that applied these techniques really made it work and so the question becomes one of getting the people to apply the detail, the attention and so on. Were you at all in on building up the ... I didn't get in on the buildup of personnel or the buildup of a we moved it I guess Seal beach

17.

was just nearing completion when we moved in down there. As far as people
Now that you mention it I think that was another significant event I think that
when we moved the total S2 family together at Seal Beach. Some of us were
down here and some of us were at Seal Beach. When was that 66? I think
that right but I ...we don't you know... I'm not sure. I thought that was an
important event because it made a closer net team. O. K. I'm trying to
think of some new clue to motivate my memory. I had something just a
minute ago it escaped. Some of the personalities I thought that some of the
basic concepts and feasibility determination prior to my coming onto the
program was it became evident that a lot of very good solid work had been
done early. Particularly when we got to the light weight stage. This was S2-
4 through S2-10 apparently they'd been asked to reduce the weight of the
stage in order to enhance the ability to carry higher weight payloads, higher
weight payloads and . How was this weight reduction achieved? In other words
the first three vehicles plus T were heavier? That's right. And I don't re-
call the weight. We also made another significant weight reduction when we
changed from a honeycomb helium purged insulation on the outside of the
LH-2 tank to a spray foam technique. It provided us with a better insulation
and a substantial weight reduction. So there was the structure weight and then
the insulation weight reduction. What percentage of the reduction could you
attribute to these two parts? Half of it was insulation? Well it was done in
see it was actually three or two steps I guess. One was the weight which was
predominately a weight reduction in the structure. It did include some weight

move to
Seal Beach

Weight

weight
structure
insulation

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reduction in other systems like the instrumentation was reduced from the R&D instrumentation to the a operational type instrumentation. And the insulation came in increments and I don't recall a spacefic stage it might have been S2-8 when we finally achieved a complete change on the insulation so the light weight insulation. Percentage wise I could give you some numbers but I'm afraid they're way off. I just as soon not. I check this out later.

This is the things I'm looking for in a trip like this, to get some _____ at what is important. And I want to develop maybe the insulation story. Insulation uh... If you kind of build up as a case history so maybe I'll say half a dozen technical things about this ... That's why I think this matrix that I referred to earlier you deffinately ought to get your hands on it. Because that would have all these things on it. Maybe it would be wise to talk about the two failures the one at Sealé Beach and the other down at Mississippi. That's a good idea Roger. To give another little aspect several people mentioned You will find that the nauzzle. No I'm talking about the structure Newmatic test failure. You know when they had the water in it at Seale Beach. Well prior to my time. I went over to look at the pile of what was left but that's all I can tell you about. Anyway we are aware that the weren't up to the requirements. Now that test qualified the so called heavy weight structure. We had another series of major test articles that we called the mini stages, and they were called mini stages A, B, and C. And C was essentially the thrust structure, that supported the engines. And B was essentially the Hydrogen tank. And A was the liquid Oxygen tank. Now the A and C structure were

mini stages

tested at Huntsville, and the B structure was tested at Sana Suzanna. Now the Be structure was demolished during testing. And that was just prior to the launch of one our stages. And I recall I was out of town and the action was we had to prove the failure that occurred there either did or didn't have an impact on the stage to be launched. Because we launch it if did have that implication. And we cleared in stage that was on the pad as not being related to that failure and worried about proceeding with the launch on schedule. It was a rather hectic few days. You remember what mission it was? My recollection it was late in year like in December. 69? Probably. 69. I think that's right. So that would have been I'm mixed up to. Now when did when was the Lunar landing? That was July, 69. Twelve then was November. Apollo 12? Yeah. What other comment? Did you say something about your relationships with Von Braun and some of the people in Huntsville Lab directors and things on the project. Well, lets see the... Vonbraun came out for his inspection trips and other dealings you had when you went to Huntsville. Well my primary relationship with Von Braun was when I presented briefings for what we call the flight readiness sequence. In other briefings in which we had show ourselves as well as the management council of Huntsville and the stage managers that we were indeed ready. And we'd go through a sequence at Huntsville and finally for us the contractor would at the Cape were presentation would be made there and that was to develop the data, testing, logic ractiontics that we were ready and usually we would say we're ready with a few exceptions and identify that we did have these plans to

and that whole thing would be excessed by a large room of experts and they either agree or disagree and if they disagree if they disagreed the challenged had to be met if not you had to go back to the showers. And then there would be a that was the sequence then here at in Southern California we would present briefings to Von Braun on special either program status in some instances special briefings. That reminded me another subject called "Pogo" we identified that we had a pogo problem once we I thought that was a rather significant and interesting series of events. Apparently we had pogo but because of our instrumentation limitations weren't able to identify it after the first flight. But we decided to use some special techniques on the data and then we did indeed have a pogo problem. Then subsequent to that we had to develop a what were the physical laws, hypothesis permitting us to explain why it happened. Then permitted us to identify the physical elements the hardware in the system that was involved. And then we were able to make analysis and test to validate and support the analysis and tellus that the theory as applied was valid. And having establish that we were then able to proceed to identify how to fix it. Which we then validated with testing. And having done that we then installed it on the flight vehicle and it flew this last flight very successfully. eliminating the pogo. Now that had quite a history. It came out of the pogo working group. Did you establish for the Saturn S1 C stage first or did the desk I wouldn't say that it came out of the pogo working group. The pogo working group was used as a consulting function. Do you do most of the pogo problems internally? I would say

pogo

This idea you said that after the first three flights you didn't see the problem. But you felt you had one so you put special instrumentation and sure enough you had it just was dormant pogo or something. Well, on I think it was the third flight it became quite large...502?...so that it wasn't, no 503, and so with the instrumentation we had the signature was there very vividly. *pogo*

But in going back and looking and the 501 and 502 data with new data analysis or assessment techniques also found that it was there. And prior to that we hadn't recognized it because of our instrumentation limitation or our ability to interpret it whichever way you want to look at it. And then frankly I think the pogo working acted as a sanction and a consulting body. By sanction I mean that you could or some group of people that were expert in the field whom you could use to challenge whatever approach you had to see that you were really being objective. not objective but also putting the proper weight on the importance of various parts of your analysis. But my personal opinion was that we did most of the work and some of the experts in the labs at NASA made significant contributions and the pogo working group itself I think acted as a say a consulting function. Where there were experts from many companies and other centers that we could use to keep ourselves in balance in what we were doing. And I think they performed that function well. See that a Now I deliberately avoided using any names of anybody. Well you should have done, well you know. Because I didn't know whether you wanted to get names of people in it or not so I just left out names of people.

19.

That's typical North American you end up its all done by a bunch of faceless engineers and as a historian I always said we should try to _____. Well that's my problem too looked at the Marshall stuff and it was decided on the fourteenth _____. And it all committee, now people did have an impact on that it wasn't just built by a computer. It was built by people hammering out these decisions and these working panels and what have you. But a Von Braun doesn't even stand out in Marshall. As being a it comes out in conversation. It doesn't come out in reading the document. Well I think you can pick out some people but I think you also have to recognize that the methodology used of challenging and challenging again and challenging again and again involves many people because in order to make effective challenges you can't always have the same people making the challenge at each step. Because there's no formula for success yet. And if you consider that there is no formula and it's difficult to predict the future precisely. You have to admit that people have to ask questions and with enough questions you could and logical and rational approach you can minimize the probability of missing anything significant. And in that process many, many people get involved and it's difficult to keep of who asked the right question at which step of the way. Or who answered the questions properly at the right or who thought of the right idea. Now there are people that do stand out. In my mind Bill Parker, Bob Rear, Harold Dale, Billy Zele Dick Swartz, Bob Westrup, Stan Van Luvon, I feel ashamed of myself for not remembering more. Well that certainly the beginning Roy Heily, who passed away Chuck Allen, then there was the fellow named Cox who operated our Mississippi test site prior to Chuch Allen. Did you have any comments on

19.

You know I asked you this before, On what Von Brauns impact on the program as far as you're concerned? How he proceeded things from Huntsville ?

Well as I said my primary contact with him was through the presentations I would have to just speculate that his organization in Huntsville consisted of a program chane and a technical chane. I always had the distinct impres-
sion that that was deliberate in organization. To provide a check and balance. I associated that with Von Brauns method of operating. So I would say that thats an attribute of him. He's preserving the whole concept of check and balance of the chellenge and then another chellenge each step of the way. He's preserved that in his organization of the center. His people had a great deal of respect for him. Both as a technician and as a leader. Arthur Rudolph was another man probably had more impact on me than any other individual. Except possibly Bod Grier on me personally. Could you talk a little bit about the relationship with Dr. Rudolph. Well the thing that stands out in my mind is well two events. One we first he met Harold Dale and I and we were coming back from lunch I have to paraphase to quote it He said you have the whole program in your hands and in order for us to we were in engineering and the implication was you engineering and both of us being new. The success of the whole program is in your hands and apparently at that time we were a criticle element in the success at getting the launch off on time and so the national success of failure was is our hands. That sort of a paraphase of what he said and he said it with such sincerety that I'd have to admit that that would probably be the strongest single motivation

MSFC
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I got. It was essentially near the start of or just after the start of my efforts on the Saturn. The second time was I gave him a briefing here at Downey. We were still at Downey and after the briefing he came over to me and shuck my hand and he says thank you very much and I asked him what he specifically meant. It was rather unusual for someone to come over and shake my hands after I gave a briefing and his comment was Well, there are very few briefing I get that I feel are straight forward simply presented that I can understand without resservation. And this was one. So he congratulated me for it. And I thanked him very much. Bob Rear his impact on me was that he gave me essentially full wrane in doing what I thought was right. And I thought was a challenge for me and I tried to meet it. And Al Dale also had the same method of operation. That's pretty good, it's interesting to see how a submaster holds this together. Yeah. To get a monthly paycheck then going out there to see how this thing is build I mean that is what anybody would do. Its just very hard to describe. Well I can remember Sam Yarket I don't know if anybodies mentioned him. Sam Yarket and Roy Godfree, Bill LeHat, John Stone, we all had very food business relationships. Developed a confidence and repor in each other which I think is the keystone in any successful we had. I guess essence maybe I shouldn't tell you our secrets but you can't always have the paperwork at the right place at the right time so you have to know the people who dealing with and have confidence that they're going to deliver what they say they're going to do. And that's a two way street. And you make agreement to do the job and each party delivers the goods and you can really make the program tick. And you make the

paper come through as fast as possible. Supported. But you only use this
technique on exceptions not as a general rule. Cause the program is too
complex to go without some paperwork. And thought that was a very basic
need that was developed in mutual confidence and respect. That doesn't
mean we always agreed with each other. By any means. Thanks very much
Mr. Ragland especially the last twenty minutes of philosophy. Its really
what we're after. And I think we're going to talk to four or five around here
We're going to stage back in Huntsville

paperwork