

Stages to Saturn History Project
Interviewer- Dr. Roger Bilstein
Interviewee- William M. Allen

We began back in the first part of April 1966. The President of the division Harrison Storms asked me if I would go down to Mississippi and take a look at the facility. At that time we were experiencing difficulty with progress of the Saturn ST program was behind the S1C and the S4B. We probably have all those reasons why they were behind.

Bilstein- Go and try to see from a number of angles so you never feel you are getting the information over to him because even when you do I get a different dimension to it.

Allen- In essence what it amounted to was that the S1C and S4B had its design beginning by the government at MSFC. North American was after that and the S2 program here. Then had more complex problem type structure, in essence an eggshell type construction never before attempted. There were considerable difficulties getting that off the ground. The net result was an extremely light-weight, efficient stage. Being in this behind condition everybody hurries and when you hurry I don't think you do as well as a beginner. They admitted it. I don't think anybody knows where the line is but let's take enough time to do it right. And time to hustle up, when you take enough time to do it right. In my past experience if you take ample time everybody wants to reengineer it to get it there. So that's one end of the spectrum, the other end of the spectrum is hurrying a little too fast and the net result is shipping parts and pieces down to Mississippi. The parts and pieces meant- I'll give you an example- if you want to make a phone and you get the dial and the buttons first you can't do much with them. You've got to get the guts of the phone first then you can start putting it together. That's what they were getting in Mississippi. So in Mississippi they were in a behind schedule condition and with a lot of frustrations, and when you're running behind in this condition and the customer you're trying to satisfy is dissatisfied and it gets into a vicious circle – confusions, frustrations and disappointments, adversaries and everything else that was going on. So the condition had deteriorated and something had to be done.

The first thing that was done was that Ed Mimms who was known around here in North American circles and was pretty much a dynamic dynamo was sent down, he marched in and said I'm taking over. He started to realign and reorganize the place and do what dynamos do to get a sick organization moving. That was a temporary measure. Storms had asked me to go down and take over the operation. It wasn't because of my extensive knowledge of S2 because I was not in the program but it was because of knowledge of base operations and off site location type operations, I spent 23 years in the military of which about half the time was off site locations. Including command of Vandenberg Air Force Base which had 3000 people supporting the tenants of some 20,000. I understood support. So on the 16th of April I arrived at the Mississippi Test Facility. Mimms stayed there about a month. I concentrated on the overall management of the activities one of those things essential to an operation of this size and nature. With respect to overall management and relations with our customer really to establish an image of confidence which North American did not have at this time. These were manifested in many ways- the day-to-day attitude of the customer as well as anybody else around the base, Boeing

and GE people. All the way to expressions like when the customer says; "Why don't you go to Boeing and see how they do certain things." This had a degrading effect, you think you might be doing things right and they say go to Boeing. I concentrated on these overall kinds of things and Mimms concentrated on trying to get the first stage fired. The first stage was a test vehicle. Before he left we blew that stage. We did this not in the conventional sense of smoke and fire but by pumping it up too much like a balloon. There were some gross errors involved in our procedures and our personnel and these amounted to a lack of communication during the shift change. A technician during one shift deactivated the pressure sensing line of the S2T stage vehicle that was in the testing area. The next technician was supposed to reinstall these lines. Between the time the next gent had started to install them the test conductor had occasion to bring the stage up to low pressure like 5PSI which was put inside the stage with no problem. He activated the pressure valve he looked at the gage and the gauge didn't move. The reason it didn't move was the sensor on the device was not hooked up correctly. Actually he was going to an overpressure of some 18PSI as I recall, but the valves on the stage are automatic and if it starts to go over pressure it automatically opens, and that is what it was doing, automatically venting. The technician talked to the test conductor and said there must be a valve on the facility that's open and we can't close, I'll close that. So he goes and closes that valve and that prevented the relieving activity and it didn't relieve except by blowing. It ended up blowing a piece of the stage off. There was no fire associated with that and no injuries so we were fortunate.

I didn't get credit for that because technical operations were still being run by Ed Mimms, and he was there temporarily, so that came out nice in terms of face saving was concerned with North American. So I had a good base to start from, that was zero. We started applying some normal techniques. Over a period of time we reinstalled confidence. I'll mention a couple of these things.

NASA wanted us to give a briefing on our management readiness before we fired the S2-1 stage. They also required a technical readiness briefing before we fired the stage. Then again, on the second stage they wanted the same briefings the management readiness. Management readiness is the procedural, crew training and things like that. The technical briefing just has to do with the technical status of the stage. We worked on weekends and nit picked ourselves to an extreme degree to make sure the briefings were flawless. As a matter of fact Dr. Rudolf was pretty critical about briefings. After he heard this briefing he said that's the finest briefing I've ever heard North American give. So it's a matter of how much you put into something is what you get out. We put a lot into it and we were very happy with that comment. There were a lot of others who mentioned how good it was but coming from him it meant so much more. What this briefing did was cover a whole series of things and showed we can do professional leadership, professional management and professional technical job. So we were successful the rest of the way up. It was a lot of little things that added up.

Another kind of thing was in- say you were building a product like an airplane and you have an engineering test pilot. He is a qualified test pilot. From the stand point of having graduated from a flying school and probably gone to a military test pilot school before he got a degree in aeronautical engineering and has ample evidence and lots of qualifications so he gets to fly the test airplane. There was a very definite trend in ballistic missiles I noticed back at Vandenberg and now with the space program that the technician was an

electrician or a mechanical man, whatever he was we took it for granted and made him a member of the crew. We would put him on tasks during ready for countdown where he had to perform an operation. If he got a glitch he would have to go out to the test stand and do something, or he might be a member of a team that was reading instrumentation and announce to the test conductor when he saw certain things, anomalies and so on. Taken for granted was not adequate. Because a lot of these people if they were engineers or whoever they were- their resume was not enough. They had not demonstrated to me they really knew the S2 stage and that was a critical part. So we established what we called a Testing Qualification Crew Operation and we select a person because what his paper said he was supposed to be good in whatever category you want. We would associate him with somebody we knew was experienced. This gent was supposed to be category one only, he could look at things but not touch things or we'd chop your hand off. Category two was that he could react to things if the man told him "Go turn that valve" or whatever the case might be. These were a graduated series of things and then category three he would do everything and his instructor would stand and watch him as he did things. For each of these categories we had a senior board. I was the chairman of the board and my management staff were members of the board so we kept it at a very high level and looked very close at people. We would talk with them with respect to emotional problems or whatever might affect people operating in a very critical or hazardous environment. Dealing with hydrogen is a hazardous environment particularly during static lines.

12.30- HE ASKS HOW MUCH TIME IS LEFT

The point is it was a detailed, professional approach to crew qualification. We updated our routine by several orders of magnitude. This technique got known to our corporate operation and they wanted to introduce this throughout the rest of the division. NASA became aware of this began to change in the later part of '66 they were saying to Boeing, "Why don't you go over to North American and see how they do things." We enjoyed the reestablishment of NASA confidence. One thing a little bit off the record was Jack Balch who was running the place at the time and still does had a meeting with the head of North American, GE and Boeing. He would be extremely upset with something- to the point when he banged the wall you thought the side of the building was going to go down. He would leap on the Boeing guy, he would leap on the GE guy and go back to the Boeing guy, and I sat there fearful he was going to leap on me, but he didn't do it. One of the GE guys said "What the hell have you been doing to keep him off your back?" It was only the establishment of confidence.

Another kind of element involved here was that when people seemed to be down and out there is a tendency to throw rocks at the guy who is down and out. I don't know why this is but I've noticed this in our American family. And one of the early meetings Sam Phillips and a bunch of the people were there, and Sam Phillips was a very good friend of mine and a contemporary back in the military, we were associates and peers. After the meeting it became an informal session, so everybody gave comments about the operation down here in Mississippi. Ge was there, Boeing was there and North American. I said "Yes, one thing bothers me and that's the castigation that seems to go on. I hear Boeing people in high positions and low positions making snide remarks about Ge or NASA or

North American. I hear my own troops castigating other elements within themselves or other companies. And one of the severest of all I hear NASA people, when they come visit me will say that the Boeing people are completely out of line or out of joint or other words. Very much more descriptive in the language industry or it was GE or something else. I said "As long as we keep degrading one another's character we have an unsettled family, we don't have a team spirit and don't instill trust and confidence in the people that you work with every day. I think this is a serious castigation we should eliminate and eradicate. About two days later I got a call from Dr. Reets (who) asked if I would be available on the following Saturday., if I could come up to MSFC and talk to him. So we sat down which I thought was indicative of what he thought about my comments. I had a very pleasant day with him and partially with Von Braun because he was with us part of the time. And we went over these accusations and they said nobody brought this up to them and as they think back that was right and it destroys the team and it takes a team to put this Saturn stage together. What technique they used then about shutting peoples mouths up was to say that if you have something good to say about somebody say it, if you don't keep your mouth shut. There was the beginning of the change throughout the house of NASA and throughout the industry that we stopped castigating one another. This was not a marked, immediate change, like some rule just came out but pressures were brought to bear here and there and conversations were had here and there I'm sure, and it was a significant change in the working relationship.

Well, we went ahead with our operations and we probably talked to Jerry Wilson. I remember talking to him, he was my test operations manager. I said "I want to take a gamble. I'm acquainted with history. Years back the industry working was working people 16 hours a day 7 days a week and productivity went up when they worked 8 hours a day or 10 or 12 actually there was a whole series of things related to productivity. There are many examples, even in modern day industry. As you cut back on peoples time and overtime productivity goes up. We are so far behind we obviously need to work 7 days a week with 12 hour shifts. Let's take a gamble and do the same schedule by stretching it out, but we'll do it on six days a week. This was an agonizing appraisal of ourselves. From the standpoint of it's impossible to get the work done in six days a week. Furthermore if you cut out Sunday you cut out triple time or double time for technicians. They obviously wouldn't like that. Some of these technicians were making fantastic rates of pay, much more than the salary of the supervision. But we decided to do it. With a little arm twisting on my part, and there wasn't a change in the schedule position. There wasn't a change and we started to get better. I cut down another half a day after they tightened their belt. Within about six months I'd cut down to five days a week and normal shifts. We reduced overtime rates, I think it was around 40-50% down to about 12%. People get tired out and the wives are bitching and a guy who his home part of the time, his whole life becomes happier. And that's one side of the coin, the other thing is to establish some motivational techniques. I find group motivational techniques are better than individual motivational techniques. So many people for individual motivational techniques say "Well hell I can't run the 100 yard dash fast so I won't even enter the contest." But if you make it a group that our team against your team can win, and then don't give a prize that's a plaque you hang on the wall because an individual don't participate in a single prize, if you give each individual a prize then you really have sparks start come flying out of their butts. As an example I pitted the Instrumentation

group against the Mechanical Electrical and Facility Group. For these groups I would get the whole site involved, not just the technicians. Because all the rest say I don't get any part in the prize. So I made my whole operation down there into four groups. I split up the technicians and the quality control people into these four groups. I even designated the support people, planners and warehouse people and put them on some of the teams. The net result was that everyone in the operation except my top management staff was a member of one of these four groups. We established criteria like making or beating your schedule, starting an activity when you're supposed to and completing an activity when you're supposed to. Numbers of squawks you might have had to be a minimum, all these patterns were measured, so everybody knew what they were against. As a team the lowest guy on the totem pole said I don't have a chance so I'm going to run instead of walk wherever I've got to go. They did this mentally and sometimes figuratively. The reward was a jacket, a nice satin jacket with a patch. You never saw people jump so much in all your life. Particularly if the first team won. It was fantastic! As a matter of fact some people from back here, management, and technicians that used to be there all wanted to get a part of the jacket and so on. That really put sparks in their butt so we started cutting down the people. We used to have what we called equivalent personnel of about 1100 or 1200, then we got back down to about 700. We had 633 people when I was there and we got this down to somewhere around 500. Doing the same job, except on schedule, as a matter of fact ahead of schedule. We never missed a day, never missed a shipment and that was only a miscommunication. We were told by the NASA guy who was really not fully in authority. He was our guy that we liasoned with but he was not the contracts man. When you talk about milestones you talk with the contracts guy. But this guy said; "Don't ship the stage on the day you're supposed to because that means you'll have to work a little overtime., about a day of overtime" I said; "Hell, that's no problem, we can make our contract schedule." He said; "I won't have the barge for you so forget it." So we didn't work the overtime and slipped the one day to meet the barge he had for us. But the contract said that's a one day slip. That's always burned my fanny, but that's what's in the document. But other than that, and I say there was a reason, not an excuse but a reason we made all our scheduled dates shipping the stage.

I'm going to say a little more about these motivational techniques. One of these was we had 8 flags, four reds and four greens. These were on polls on the test stand labeled mechanical, instrumentation, facility and electrical. I said; "What is your schooled position today, ahead or behind?" If you were on schedule or ahead you got a green flag, if you were behind you got a red flag. Creating amongst the troops then the idea you are behind schedule and that friendly antagonism amongst and between the groups. I shouldn't say antagonism, rivalry. That was going along pretty good until I started to see more red. I asked one of the technicians; "What the hell's the deal?" He said; "If you're red you're behind and you get ahead and it's more money in your pocket." So I said "We've got to stop that."

We did have individual awards, a top technician award and a top inspector award. I worked out a deal with the Vice President and General Manager down on the Cape of North American to bandit in in top guys, my top tech and my top technician every time there would be a firing. Normally with the pride program North American has there are a few people that can go to the Cape at company expense and see the launching. I think it's a fine morale booster, people really enjoy it. Because our people, our technicians and

quality control people were dealing intimately with the hardware they thought we were a bit closer than some guy in publicans and accounting. Everybody contributes, even the janitor don't misunderstand me. But this seemed to be a step closer and I needed the motivation. Because the guy in publications wasn't as critical as some guy who would make a mistake and we would lose it in flight or on the test stand. So he agreed and in the back door I slipped in two people. This is probably the first time this has come out. But these guys were given the royal welcome. They were treated on the side went to a coctale pary and got the tour and all the rest of it. That charged people up so much that even the guy who didn't think he could win humped his butt. Sometimes we would pick not the sharpest brilliant guy but the guy who worked his ass off. A guy who works through his efforts and spirit rather than his superior brainsmanship. We would not only send them to the Cape for the firing but we would put up a plaque with his picture and a resume of what he did to earn that award. As we took his picture down and his award we would put his name on a little brass clip. We also provided him a parking place at the test stand. My place used to be the first but I said; "No move mine back and put his there." We had the top tech parking place, the top inspector parking place and the director of the facility parking place. And these guys jumped through their butts. These are just a few of the things you can take to motivate people. Because you get the job done down there or any place not through fancy machinery or the stage itself but through the people. If you work with the people and get them educated on what they have to do and motivated through some of these techniques I've told you about with good leadership there's nothing you can't do. That's my motus aparendi for doing the job down there and I think we were successful.

I'll talk a little bit more on some of this leadership business. One of the top people down there, a very smart man, technically capable was in a management position but he tried to do all of the details himself. The net result was that the operation would fall apart and he was reduced and sent to another area, Mississippi. When I arrived and started working with the top management group I could tell there was a brilliant young man. So I took it upon myself to be an educator of him for how to manage. He didn't have an opporunity or class on how to do that before. So each week we would pick up a new subject and once a month he would go to school for how ot manage, how to delegate. If you have a list of 18 important things to do today you can't get to all 18 do the first 10, don't worry about the other 8 today. He was worrying about all 18 but he couldn't get to them and he was lining them up and working on the last 8 rather than the first 10. After a series of these powwows a position opened up to become head of the Test Operations Group. This gentleman in my estimation was the man for the job. I talked to the program manager, Bob Greer, he sai; "No you can't do that, this gent doesn't have the confidence of NASA and he doesn't have my confidence because he had a position like that before and flunked the course. I said; "That's because he wasn't ready from a management standpoint, he's ready now, take my word for it." So after considerable thought he made a few calls to NASA and they were willing to gamble this on my judgment. So we put this gent in the management position, it was very critical to manage test operations and he did an outstanding job, completely different than he did before. He was eventually selected to come in and take over a very important activity in a program and is now a very prominent man in our total operation you probably know him very well. But it's that sort of dealing with people. I just picked that one he was the most outstanding case but there

were many others- I shouldn't say many others. The whole staff I dealt with. Let's learn how to manage an operation.

So I've told you about the individual motivation, now the management staff and my philosophy of management. I think those are the winning factors of success and it got to me that we couldn't hardly do anything wrong even when we made a mistake we would expect the wrath of NASA on top of us they would say "Well hell, those are good people, anyone can make a mistake." It used to be that when you were down and out and made a mistake you'd get chewed on.

Well, if you've got more questions I'll just tell you about our overall philosophy of management of the operation. I haven't gotten any details

Bilstein- We've never gotten material like this before, it's very helpful Mr. Allen. 2.24
COULD ONLY UNDERSTAND PART OF WHAT HE SAID

In the very early days we didn't have proper detection material, detection techniques for detecting hydrogen. Hydrogen is odorless and even when it burns you can't see it. At first you would go along with a broom and go along the lines that had hydrogen in them including around the stage and stick the broom in and see if the ends were charred.

Otherwise you could walk into a hydrogen fire and it would just crisp you. You just can't see a hydrogen fire. You can see it at night because there's pollutants or other dust in the air and you can see these as they sparkle at night. In the day you can't see it. So in operating this hydrogen everybody was very cautious because they were afraid, and that's the way I wanted them to be. When you are afraid you are cautious as opposed to being too bold. As a result we didn't have any incidents with respect to operating with hydrogen, as far as personnel problems were concerned. But there were things that I suspect if we sat down we were very very thorough and all wisdom you can analyze ahead of time and then do something about it to prevent it.

One of the other techniques I didn't mention to you was that after we got through planning an operation; planning a check out of this or planning a check out of that – by the way the test operation is a series of going through step by step checking out things to see if they operate before they operate. If you get a stage down there you hook it up- I'll back up. The process, you receive a stage install it in the stand and second check up that all those hook-ups are right, the right wires go to the right terminals, the right pressures there are indicated. And that they're supposed to be. If it's supposed to be a 600PSI system you check through and make sure it runs at 600 and the relief valve is not popping on you and the regulator is not running at 400 and 900. So all that's check out, then you go through the the study fire operation. Loading it with pellets and firing. The third is the post fire check up to see that the fire that's out didn't disturb anything on the stage. And the stage still is functioning operationally, then you take it off the stand. So the program is one of static fired and acceptance tests. Acceptance tests, that's when the stage is bought. You proof it out as to its firing capabilities and its post firing soundness. Then the government signs I think a DD-250, the stage is bought and the contractor gets his money. So it's a critical operation to prove that every function and aspect of that stage is all right.

Bilstein- Normally how long would that take, from arrival to completion?

Well when we first got there was about 6 or 8 months, when we got finished we could do it in about a 3 month period. It didn't mean every stage we got there left 3 months later. There were some schedule changes so we just put them in storage, but we always met our schedules from the standpoint of 3 b months because the rest is just waiting.

Getting back to each step in the process, each step on the way, getting ready, the firing. We would sit down in sessions and ask what if. What would happen if this didn't go? If we flip a valve or switch and some valve was supposed to open and allow some gas or fluids. What would happen if we flipped the switch and it didn't happen just then? If it hung up for a microsecond would that affect something else. That's a very difficult analytical thing to do. The interactions of all these are in microseconds when things are supposed to happen. It's a very difficult analysis to perform, but you have to perform and when you get through you still feel unsatisfied because you can't get all operations all indications. You can't think in that great a detail.

As an example- the way this hydrogen vent system is involved, I'll draw you a picture. Here's what you call, well I'll start with the test stand. Sitting way up in the test stand is a stage. It has fail lines and vent lines, I'll talk about the vent lines. Coming out the top of the stage and going all the way down the side and going a great distance across country to a ball. When I say vent it's also it's also the emergency dump. When you want to dump your propellant it goes down through here to the ball. From the ball it goes to what you call a burn off stack. It has igniters on the top so if you're dumping liquids, the liquids would go to gas in the ball and then you have a pipe, so the burn off is quite dramatic. Another technique your people at KSE would talk about is a burn off pond. Instead of a stack it would go to a pond of water with lines underneath it and there would be fire on top of the pond. We used the burn off stack.

After we would run an operation these lines have hydrogen in them. Gaseous hydrogen, so we would purge them with nitrogen. We had done the purging, but here and there you would trap some hydrogen. As light as it is it hides under nooks and crannies and bends in pipes and so on. We had a task of changing a valve. So when you change the valve you take it off and it really created a beautiful smoke stack effect. So we created a draft here. This draft sucked air in through the burn stack, picked up some hydrogen gasses here and there, started back for this pipe. Hydrogen gas is extremely ignitable – as a matter of fact if you create enough friction rubbing a paper bag together it'll ignite. As it started to flow back to this line, the line as you look straight down it had a series of bends in it. Just going around the corner enough friction and heat was generated and the thing blew. It also had some air associated with it- some oxygen and hydrogen. Normally it can flow through here pretty fast but it's all hydrogen you don't have the oxygen content, but this time we were sucking air so we blew the line up.

You asked about difficulties. We precluded most of our difficulties by the analytical process or potential failure analysis we'd do. But you can't get them all, and we had that one. The other one I told you about, communication between shifts. We blew the stage because of the miscommunication or lack of communication.