AN INTERVIEW WITH ROD STEWART

Question:

Let's begin by saying something about your personal involvement in the RL-10 Program from the beginning, where you got into.

Answer:

I was project manager on the RL-10 engine. I started on in 1963, approximately, I stayed on the program for three years. The engine was essentially under development at the time I took over the project. Previous project manager is still employed here at Marshall his name is William D. Brown. Bill Brown head of the engine office, he can probably tell you somethings that I can't, about the origin. The RL-10 engine was used for the S-Saturn S-4 stage. Six of those were used in the Saturn S-4 stage and two were used in the_____. The_____program preceded the Saturn. It was an Airforce program to start with before it was turned over to NASA. NASA took it over because NASA used the same engines for the S-4 stage. The two engine configuration for the _____, both engines gimbled and the six engine configuration for the S-4 they also gimbled. The S-4 is the predecessor to the S-4B which is the third stage of the Saturn V. The S-4B is really an uprated version of the S-4 which instead of the six RL-10 engines it had on J-2 engine. The RL-10 has fifteen thousand pounds of thrust. An honorable duration in this application for the Saturn was 470 seconds. The engine went_____. The weight was 295 pounds and the propellers were liquid oxygen and liquid hydrogen. Contractor was Pratt and Whitney and the Saturn S-4 had six of them and _____ had two. The engine is a turbal pump fed. It's a _____ cool engine, the hydrogen and oxygen in rocket engines. There were troubles had to do with the _____themselves handling those, getting proper combustion, proper injector and ignition. Did you do much work at all on the injector as such? I didn/t myself but a lot of the engineers did. Most of the work on the injector was done later and later programmed as part of a _____engine program. Once we developed engine we determined that it could be_____back and forth, about down to ten percent and up to about one hundred percent thrust. Doing the_____ program various type of injectors were studied for allowing that_____mode. Can you tell us something about the original S-4 configuration, was for four engines, it was called the RL-117. I don't know much about that part of it, I am sure Bill Brown can help you better there, that decision was made after I got on the Project. There was another application for it being

considerate, it was called the Saturn IB_____which the_____was going to place up on top of the IB. One of the unique things about the RL-10 engine is that gears in the turbines are cooled with hydrogen and that was quite a fee. Could you give any details on that? Most the lubricants are like oil or something, they are based on producing friction. Hydrogen doesn't reduce the friction at all it keeps just as much friction, but it cools off the bearings and gears down below a point where they would wear. Based on the cooling aspect hydrogen is actually used as a lubricant. So the RL-10 was really the first liquid hydrogen engine. It was different from the J-2 engine. The J-2 didn't use what was called the _____cycle. In the RL-10 engine the gydrogen passed through the chamber and the heat created in the chamber caused the hydrogen to gasify and the gydrogen itself was used to turn the turbine. That was called the _____cycle, the J-2 engine didn't use that cycle, they used a gas generator which turned the turbine. Was the RL-10 the first one to use the_____ as the bearing cooler? Yes, as far as I know. The basis problem about the RL-10 was the test facilities, we had to build facilities that would assimulate a vacuum of space because the nozzle didn't flow full at sea level, the jet would break away from the enternal part of the nozzle and burn the nozzle when the engines were tested at sea level. In order to get this full flow inter fired into the vacuum chamber called an injector chamber, there were several of these facilities and there is one here at Marshall. Did you test the RL-10_____and their vacuum? I don't remember, but off hand I would say no. As far as historical significant I think that those are really the main points, the unique features of the engine, the fact that it can be modified for throttling, it can modified for running in what they call an idle mode that is without the pumps running just open the valves up and put pressure in the tanks forces the fuel down into the engine and then it runs a little thrust and that's a way of producing what you might call self_____. If you have a stage orbiting in space and you want to start it up just open the engine valves, ignite the propellant the_____come through and produces enough thrust in the bottom of the, to bring the propellers down to the bottom of the tanks and it can go into a normal mode of operation. It's a very flexible engine and it's a highly reliable engine after the first troubles were overcome then it became one of the most reliable rocket engines we have today.

Question:

Those troubles you said were basically in what then?

Answer:

As I recall there were troubles in bearings, there were some difficulties in the fabrication of the tubes, the proper brazing and the proper assemble techniques of the tubes. There were several incidents, there was on the S4-B itself, as I recall this was caused by the engine, but one vehicle vehicle that had six engines in it called the all systems vehicle.

Question:

Can you give us some detail maybe about the fabrication of tubes, the problem of holding the brazed tubes together, is that difficulty, tubes that hold up under the intense pressure from the heat.

Answer:

I am a little bit shaky on this point unless I really did some thinking, I am not sure that I can really find out what the problem was there.

Question:

What were you on before you got into the RL-10?

Answer:

I was on the M-1 engine which was a large hydrogen, oxygen engine that was suppose to be one and half million pound thrust. When we started that program it was suppose to be around a quarter of billion dollar program. It was suppose to be used for an upper stage engine for the nova vehicle which was one of the earlier concept. For nine months I was the program manager on that and because of the reduced funding, because of the decision not go with nova, that was reduced to a technology program and then the program was transferred to the Lewis Research Center. The program was continued as a technology effort for sometime then it was finally cancelled. That was a great huge engine. It was about the size of the F1 engine.

Question:

What kind of new technology were you looking at in the M-1?

Answer:

The size, great big size was the only thing. At the same time the M-1 engine that _____was working on, a liquid hydrogen and owygen high pressure engine, which has a higher chamber pressure and therefore is a higher technology and that I think was the basis for their proposal on the shell engine. They did do some work on high pressure engine using hydrogen and oxygen.

Question:

Did you run into any difficult with the Air Force in the RL-10 program in terms of getting into what they considered the secret and confidential work?

Answer:

For better clarification of this question you might ask Bill Brown. I can tell you that we had a lot of classified material because it was an Air Force program. As I see it there were no problems caused by that because a lot of NASA stuff was classified at that time anyway. There may have been some organization problems of getting the Air Force information to NASA, normal to the transfer of any project from one organization to another. The classification was there but it wasn't a serious problem.

Question:

Did most of the testing on the RL-10 take place in Florida?

Answer:

Yes

Question:

Did you have anything to do with the testing program down there?

Answer:

As program manager I had the whole program and all the testing. We continued to test other configurations the _____configuration, other configurations with the idle mode, other proposals, you may remember the multimission module was a program that NASA at one time thought about instituting now we are going to have two RL-10 engines. It was also called the L-2 stage, that never did bear fruit because it had no application.

Question:

What about your relationship with Douglas during this time? Can you make some comments about problems or lack of problems when you got around to mating the engine?

Answer:

I think the biggest coordination problem was effort in the whole RL-10 program was coordinating the configuration of the engine between Douglas and General Lewis Research center was managing the Satire.