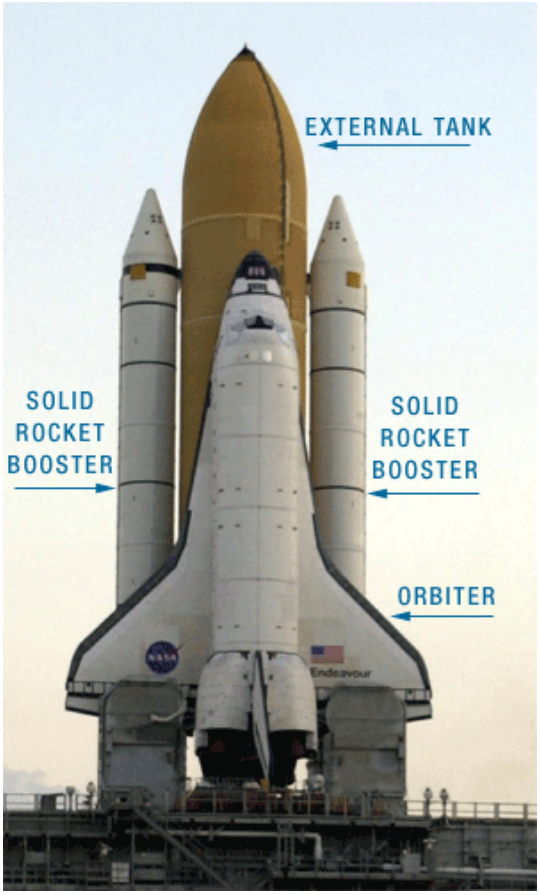
A Space Shuttle Story
Stephen Coester '63

I had several nice comments about my Apollo 11 story so I'm going to share one from thirty or so years later concerning an episode that ended up with my being the first individual recipient of the Manned Spaceflight Safety Award along with five other NASA and contractor engineers.

Every day the technicians, engineers and quality control personnel at Kennedy Space Center conduct tests, fix problems and make modifications. Every action is to provide the greatest margin of safety for the astronauts who will ride the Space Shuttle. This story is little different from hundreds of others performed by the dedicated personnel who worked on the Space Shuttle.

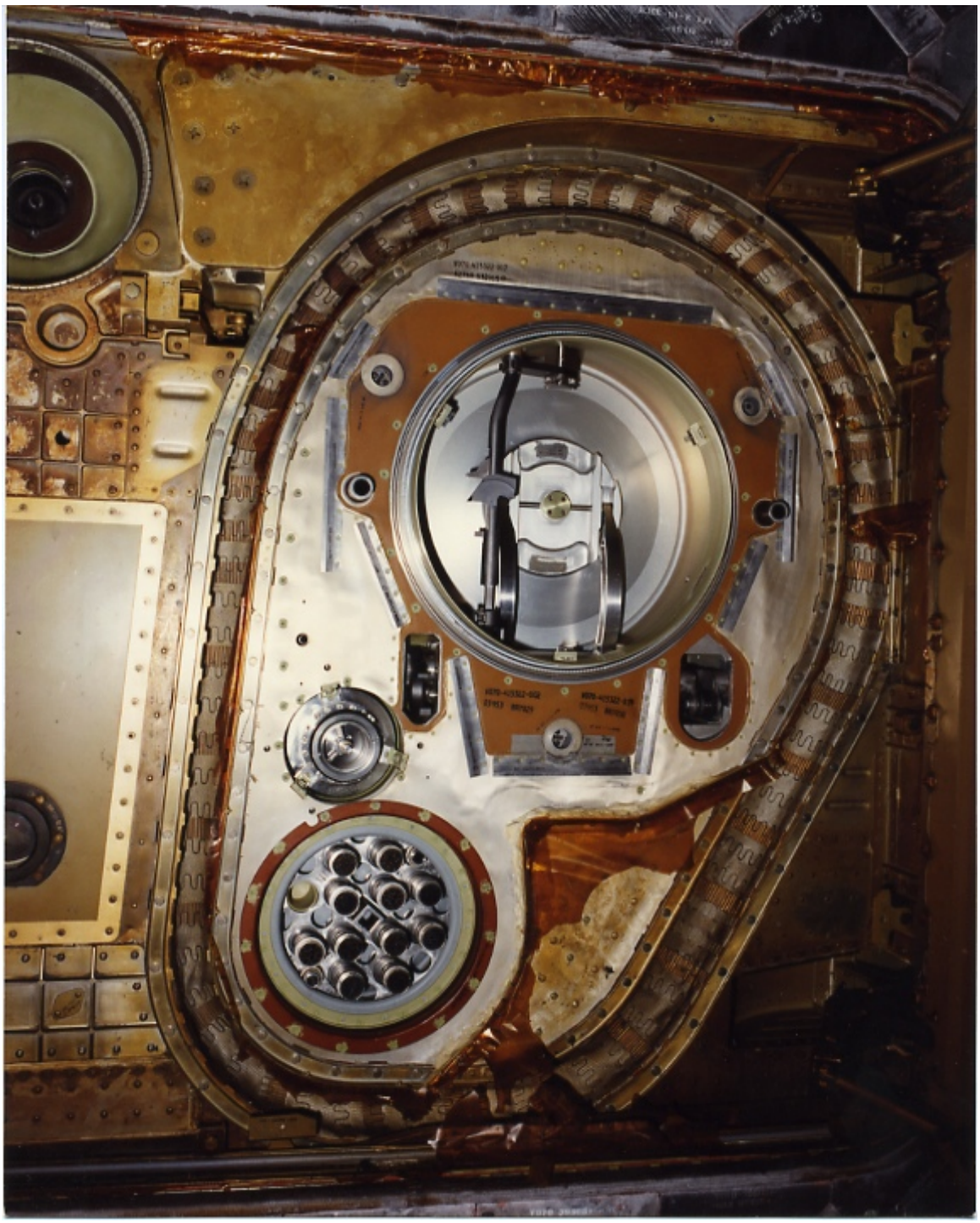
By this time I was a Rockwell System Specialist for the Main Propulsion System (MPS) after having been the MPS Engineering Supervisor since the first Shuttle flight in 1981.

I'm going to try to keep this from getting too technical, but that will be difficult. As most of you know, the Space Shuttle is assembled in pieces with first the two large solid rocket boosters being built up on the mobile launcher. Then the big orange external tank is lifted and mated to the boosters. Finally the orbiter is lifted and mated to the external tank and all connections between the orbiter and the tank are joined together. All this occurs in the Vertical Assembly Building (VAB) and system checks are performed prior to moving the whole stack the three miles to the launch pad.

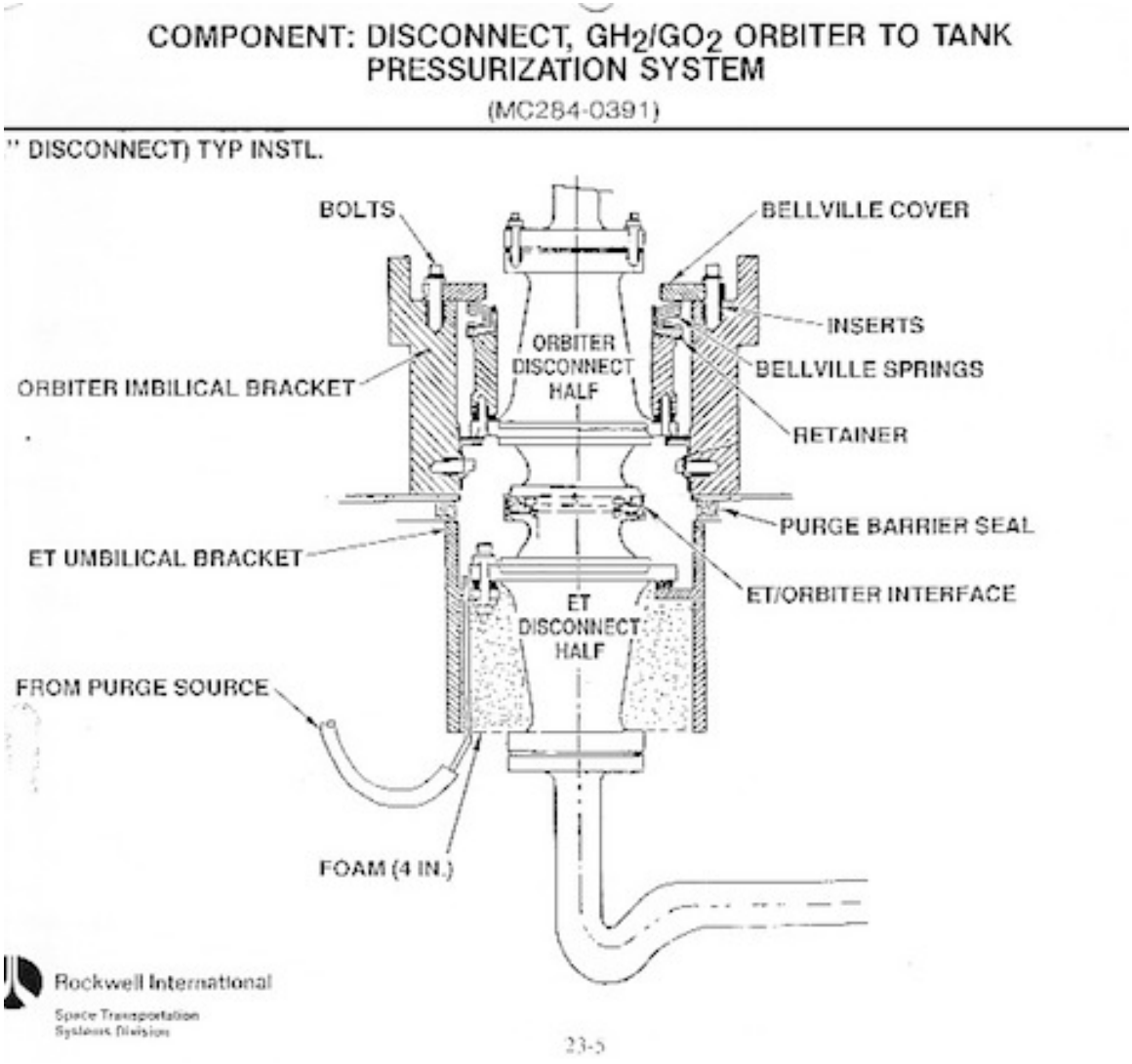


For the Main Propulsion System these checks leak check the connections between the orbiter and the external tank which are located on two large umbilical plates one for liquid oxygen and one for

liquid hydrogen. The LOX plate on the orbiter is shown and mates to a similar plate on the external tank. The umbilicals are held together by three explosive bolts that go through the three holes around the large valve in the brown area shown in the photo.



This story concerns the smaller valve to the left in the photo. It is known as the Gaseous Oxygen two inch disconnect and its purpose is to direct high temperature, high pressure gas at 400 psig from the Space Shuttle Main Engines (SSME) to the top of the Liquid Oxygen tank to pressurize the LOX tank during flight. Here's a schematic of the two inch disconnect.



Okay now you are a Space Shuttle expert. The pre-rollout test for this assembly consists of a simple leak check of the interface between the two disconnect halves at the joint indicated as ET/Orbiter Interface on the photo. Because of external tank pressure limitations it is conducted at only 20 psig instead of its operating pressure of 400 psig. The allowable leak rate is a miniscule .29 scims, which won't mean much to you but picture perhaps a pea sized chunk of gas leaking per minute.

So we ran the test and while I don't remember the exact leakage, we flunked the test, although just barely. A problem report was written and analysis began. In the meantime management decided that the "stack" could be moved to the launch pad, which happened the next

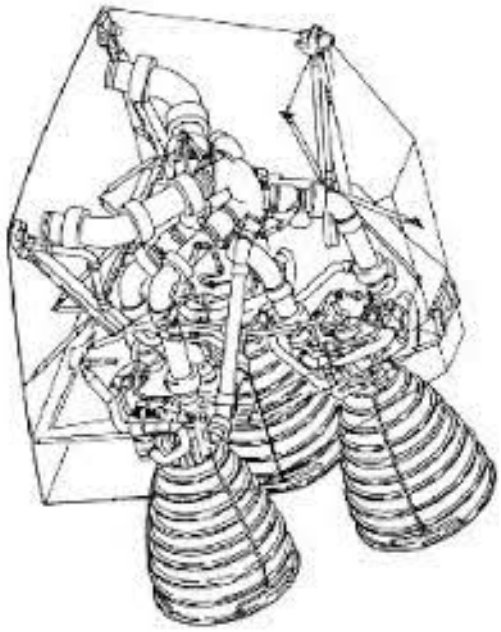
morning. I had recommended that we don't move to the pad because in all the previous Space Shuttle missions we had never experience any leakage at this joint, but I was overruled.

The design agency and NASA did their analysis and decided that the leakage we saw was acceptable for flight. I couldn't accept their reasoning because the test pressure was so far below the operating pressure and that we had never before seen any leakage. I wrote a letter to my management saying that I wouldn't sign off on acceptance of the leak.

By this time I had a pretty good reputation in the MPS community so management took a second look and decided we would have to look further into the problem. The big problem now was that the Shuttle was now on the launch pad and in order to disassemble the umbilical the Shuttle would have to be returned to the Vertical Assembly building and the orbiter removed from the external tank, which would cause a significant hit to the launch schedule.

I took a long look at the engineering drawings and proposed that it might be possible to do the disassembly in an unorthodox manner from inside the orbiter rather than externally. With help from my NASA and contractor engineers we developed a plan to try the removal while still connected to the external tank and still at the launch pad.

Here's a schematic of the orbiter aft fuselage.



The work area would be at that big pipe right at the top. What isn't shown is that area is a mass of pipes, tubing and wires where it is almost impossible to even get a hand or tool into the required area.

As a System Specialist my job was to be a design representative and advisor to the current launch contractor. But in this case everyone agreed this was my baby, so I prepared the troubleshooting plan and it was decided I would direct the removal operation.

I asked for and was assigned the world's best technician and I can't even remember his name. He should have received all the accolades after the job was done.

The technician and I crawled into the aft fuselage and wormed our way to the disconnect area. The tech reclined on a temporary work platform and reaching full arm length into the maze of tubing sequentially removed the bolts holding in the item called "bellville cover" on the schematic. I crouched beside him directing his actions and modifying the plan as we proceeded. Finally after hours of excruciating painstaking work by this dedicated technician we removed the cover.

What we found astonished us all. The bellville springs whose purpose was to provide 5000 pounds of pressure to seal the

disconnect halves were cracked in half. This meant their sealing force was completely compromised and that when subjected to flight temperatures and pressures might have failed completely spraying high pressure oxygen into the aft fuselage and possibly causing a destructive explosion.

This all resulted in a redesign of the springs before putting it all back together and thankfully a safe return to flight.

At a large gathering in Cocoa Beach I was presented with the Manned Spaceflight Safety Award by the NASA Administrator Dick Gregory and received several other awards and perks such as a trip to Johnson Space Center in Houston where Yvonne and I were feted. I also met this young lady who looked like a recent college grad named Eileen Collins. Turned out she was a new un-flown astronaut who would later become the first female Space Shuttle Commander! I was surprised at all the attention and just considered it part of the job and was thankful that management finally listened to my concerns.

A funny sequel to this story is that after receiving the award from Administrator Dick Gregory, as I turned to exit the stage, I fell off of it about three feet to a concrete floor. I was holding the spear pointed award as I fell and it passed between my arm and chest. I was hurt slightly from the fall but fortunately not speared. Nobody even noticed my fall as they were all returning to the bar. I could just picture the headline in the newspaper: " Space Scientist stabbed by Safety Award!".

Sorry for all the technical details.

Steve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