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NEWSLETTER

Project Apollo: In the Rear View Mirror

A rocketeer-turned-engineer looks back on the Apollo space program.

Question and Answer Corner

How to set up electronic staging in RockSim

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Project Apollo - In the Rear View Mirror

By Tim Van Milligan

Since the new school year is starting up, I thought I'd share this inspiring story with you. It shows the effect that model rocketry education played in the space program and the race to the moon. I think it would be great if you sent this to any teachers you might come across in the next few months. They need some more proof that model rocketry is the "first step into space," as rocketry gets students interested in science and careers in technology.

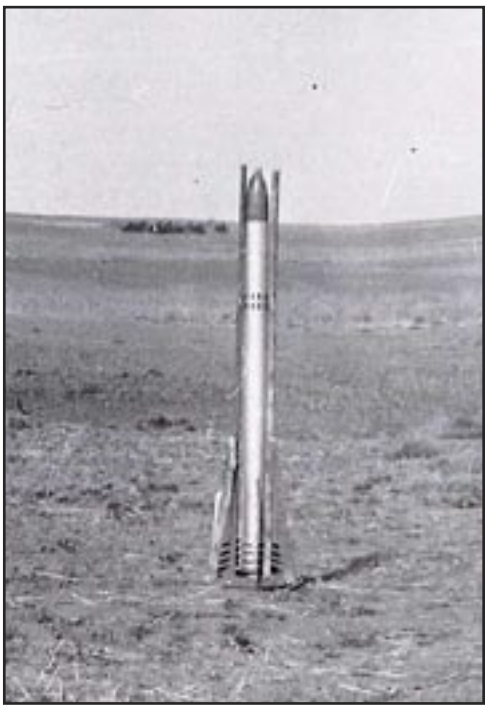
By now, all of us rocketeers know the story of Homer Hickam and his "rocketboy" friends from Coalwood, West Virgina. Earlier this year, I found out about a similar story from one of our customers, Brian Schneider. Seems that Brian's father, Dan Schneider, was also a rocketboy that was doing the same kinds of things, and at the same time as Homer Hickam, but in a different part of the country.

My conversation with Brian began when he wrote me this letter:

"We're really pleased with your inputs and your staff's help. My dad is having fun in his retirement playing with the RockSim (www.ApogeeRockets.com/rocksim.asp) program. He's an Ex-NASA engineer from Northrop University and worked on Apollo 4 through 11 as a guidance engineer in the control room. And me… well I'm just having fun watching my dad have fun as I build it to his specs..."

Photo 1: On the prairies of Northern Oklahoma in February, 1958. Dan Schneider (third from right) with other members of his high school physics class prior to launching the FRS-1 rocket.

I asked Brian for some more information about his dad. This is what he sent me.



"He sure has some good stories. He was advisor to Werner Von Braun at one point, working for TRW as a consultant. One of the best stories was when the Apollo 11 mission was nearly aborted at the last minute due to a guidance malfunction and Steve Bales asked him if they should allow it to go based on whether they should trust the computer data or their own manual calculations. My dad advised him to let it go ahead and fly on more than one occasion until it was finally clear that indeed the onboard computer was throwing bad data and they were fine. On one hand he played a pivotal role in the success, on the other, he was just another mission controller with input.

I guess what motivated me to build the Apogee Saturn V kit (www.ApogeeRockets.com/saturn5.asp) was our (my Dad and I) visit to Kennedy Space Center. He had never been to the launch site before as we lived in Houston when I was a kid. He walked that Saturn V display like it was a monument of high honor and respect. When he got to the capsule end he leaned forward against the railing and stared at it for what seemed like an eternity. I didn't want to interrupt him as you could tell that the span of a whole

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career around rockets flashed before him.

Attached is a photo of my dad in high school in the 1950's (in the letterman's jacket marked "F") with his friends who built a solid fuel rocket out of metal! Homemade.... I suppose it's about the same size as the Saturn V kit but was mostly fuel. He said it flew so far and so high they were never able to get a fix on its position and the launch was spectacular, albeit dangerous. He could tell you what the fuel and specs were but one thing is for sure...Anything like that these days would be found under the wing of a fighter jet!"

This is the story from the Northwest Oklahoman Newspaper that accompanied the photos.

"Fargo Physics Class Launches, Loses Rocket"

By MRS. EDGAR TERREL, NWO Fargo Correspondent

The FRS-1, a rocket built by the Physics class of the Fargo High School was launched on Monday, February 17. (1958)

After a morning of frustration during which the firing mechanism of the rocket failed to function properly, it was successfully launched at approximately 1:45 pm.

The rocket, which was 3-inches in diameter and approximately 5 feet in length, used a mixture of zinc and sulphur for its fuel. The rocket remained in sight for about five seconds after its firing before it disappeared in the high clouds.

The only difficulty arising in the launching of the rocket was the fact that no one was able to follow the full ascent and descent of the rocket … therefore, the class has not been able to find the rocket to exam-

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ine it.

Dan Schneider wrote these notes about that launch:

"The firing mechanism that caused the launch delay consisted of a 6 Volt battery connected to a Model T Ford coil. A telegraph key was used for the "launch button". A stack of hay bales comprised the launch bunker. The mechanism worked superbly when we tested it in the school gymnasium. Some still remember the school having to be evacuated because of the terrible smoke and stench produced when the propellant sample, the size of a golf ball, was ignited.

This rocket launch gained a little unintended notoriety because it vastly outperformed all expectations. Calculations made later by the physics instructor indicated that apogee occurred well into the upper airline corridors of the day, and went downrange far enough to endanger the Panhandle of Oklahoma. That sort of explained why we couldn't find it. It also explained why Civil Aviation officials appeared in town asking questions about the press release. Unofficially, this venture had something to do with lawmakers placing restrictions on building and launching rockets of this size. None quite like it has been legally built ever since.

The launch of this rocket resulted in two of the launch team members (including myself) being invited to meet Werner Von Braun in Oklahoma City at a Science Fair held that same year. That was my first meeting with him. My last meeting with him was in Huntsville, Alabama at the Marshall Space Flight Center 10 years later. It was there that I briefed the Operational Mission Plan and Trajectory Profile for the first launch of the Saturn V. It was here that I felt like I'd truly sat at the feet of the master, and his concluding words ***"We Fly"*** *still ring in my ears. This mission is known in the history books as Apollo 4 (the Program Number) …. But also known as AS-501… the flight article designation. It was the first Apollo mission after the fire, and the first to capture a picture of the entire earth orb during its flight. I still think our ignition scheme was far more elegant than the one NASA uses."*

It is so interesting that it was a model rocket that seems to have been the turning point in Mr. Schneider's life, and put him on a career in the space program.

Mr. Schnieder wrote some additional memories of his days with the Apollo program. His perspective is interesting and riveting reading, because this was written by someone that was involved in the space program and got our astronauts to the moon. The rest of this article is from Mr. Dan Schneider in his own words.

Project Apollo - In the Rear View Mirror

By Dan M. Schneider

The Story of Apollo began in October of 1957, the day the Russians put Sputnik into orbit. I remember it well, and how that event scared the socks off all of America. The State Department and the military establishment were in far greater panic than they care to admit, even today. Rightfully so, since that event occurred on the heels of the infamous event in the UN when Nikita Kruschchev pounded his shoe on the table and shouted "We will Bury You". We could only respond with failure ...Multiple disasters were occurring with every launch vehicle.

Werner Von Braun was to become our savior. He was a German rocket scientist who led the R&D effort and production of the V2 rocket at Peenemuende in N. Germany. After being forced into rocket science work by the Nazi Regime, his work during the war was actually done against his will. In that position, he reluctantly "Rendered unto Caesar…." That reluctance caused him to be arrested by the SS more than once, and he nearly lost his life over it. At the end of the war, he evaded the Soviet advance and

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found his way to the US Army. After coming to America, he became the central figure in America's Space Program. He obviously had more than his fair share of genius and vision to be the designer of the now famous Saturn V rocket.

What remains of the Saturn V is becoming more and more legendary every day, since it is still unequaled by anything ever built. By comparison, the space shuttle is a mere shadow, and there seems to be nothing in NASA plans that will live up to it in the future. Unfortunately.... America chose to forget their gratitude, and to relegate Von Braun's contribution into historical footnotes. Some politicians wouldn't forget his high position in the Nazi technical world, even though he actually impeded their progress in using the V2 as a weapon. Besides that, Von Braun didn't need any adult supervision from them, which was an even bigger problem. I personally think it is a national travesty that no Space Center holds his name today.

The Apollo Program was not for the timid, those with weak resolve, those who couldn't take chances, nor those who couldn't thrive under pressure. When I arrived in Houston in October 1965, I stepped into another world, a one-of-a-kind situation. I sincerely doubt that the environment could ever be recreated again. When President Kennedy committed us to go to the moon and back within the decade, he couldn't have picked a worse time. It wasn't possible to even attempt it until the late sixties. At that time, the Sun would be at its very worst in its eleven-year cycle for generating solar flares – radiation bursts. Besides having the daunting problem of building a launch vehicle and spacecraft that would work, a worldwide tracking network was also required. Solar observatories had to be set up to warn of solar activity, and the space capsules had to be wrapped in gold to shield against the solar radiation.

The USA was well behind the Russians. Their rocket boosters were far better than ours, and they were having one success after another. Although our Gemini Program was going along OK, the Russians were outdoing us on every mission. It looked like we had little chance of getting to the moon first, much less within the decade. The Manned Spacecraft Center (now Johnson Space Center) had sprung up almost overnight. Companies were coming in at a rapid pace, new communities were forming everywhere, and people from all over the country were migrating there. MSC had taken over as the focal point for space operations, and it resonated with a vibrant, hectic, almost desperate, atmosphere.

The Apollo Working Environment

The Working Environment was unlike anything that came before, but it had to have similar overtones to the Manhattan Project. I worked for a company called TRW Space Technology Laboratories. They were responsible for developing the operational mission plans and trajectory profiles for both Gemini and Apollo. TRW assigned me to Project Apollo from the very beginning.

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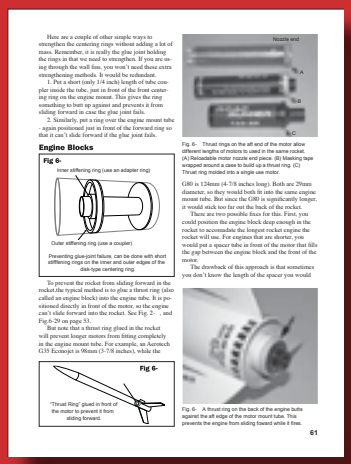
Model Rocket Design And Construction


Here are a couple of other simple ways to strengthen the centering rings without adding a lot of mass. Remember, it is really the glue joint holding the rings in that we need to strengthen. If you are seeing through the wall fins, you won't need these extra strengthening methods. It would be redundant.

1. Put a short (only 1/4 inch) length of tube coupler inside the tube, just in front of the front centering ring on the engine mount. This gives the ring something to butt up against and prevents it from sliding forward in case the glue joint fails.

2. Similarly, put a ring over the engine mount tube - again positioned just in front of the forward ring so that it can't slide forward if the glue joint fails.

Engine Blocks

Fig 6-

inner stiffening ring (use an adapter ring)

Outer stiffening ring (use a coupler)

Preventing glue-joint failure, can be done with short stiffening rings on the inner and outer edges of the disk-type centering ring.

To prevent the rocket from sliding forward in the rocket the typical method is to glue a thrust ring (also called an engine block) into the engine tube. It is positioned directly in front of the motor, so the engine can't slide forward into the rocket. See Fig. 2- , and Fig.6-29 on page 53.

But note that a thrust ring glued in the rocket will prevent longer motors from fitting completely in the engine mount tube. For example, an Aerotech G38 Econojet is 96mm (3-7/8 inches), while the G80 is 124mm (4-7/8 inches long). Both are 29mm diameter, so they would both fit into the same engine mount tube. But since the G80 is significantly longer, it would stick too far out the back of the rocket.

There are two possible fixes for this. First, you could position the engine block deep enough in the rocket to accomodate the longest rocket engine the rocket will use. For engines that are shorter, you would put a spacer tube in front of the motor that fills the gap between the engine block and the front of the motor.

The drawback of this approach is that sometimes you don't know the length of the spacer you would

Fig 6-

"Thrust Ring" glued in front of the motor to prevent it from sliding forward.

Nozzle end

Fig. 6- Thrust rings on the aft end of the motor allow different lengths of motors to used in the same rocket. (A) Reloadable motor nozzle end piece. (B) Masking tape wrapped around a case to build up a thrust ring. (C) Thrust ring molded into a single use motor

Fig. 6- A thrust ring on the back of the engine butts against the aft edge of the motor mount tube. This prevents the engine from sliding toward while it fires.

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Project Apollo - In the Rear View Mirror

The key to the Apollo Program was the Saturn V rocket, a magnificent beast and art form at the same time. It was a four-stage behemoth which would tower 39 stories above the launch pad, and would produce 7.5 million pounds of thrust at lift-off. It would be the one which was destined to overtake the Russians and take us to the moon within the next five years. When all five engines lit up, the sound and/or shock blast could kill you within several hundred yards of the launch pad. It still holds the record for having produced the loudest man-made sound on the planet. Our whole success was riding on this thing. I instantly developed a runaway romantic interest in working with it. My job was to do the mission analysis, targeting, and generation of the Operational Mission Trajectory for the first two Saturn V launches. After that I transitioned to develop the Mission Control Procedures and Flight Limits for controlling the Lunar Module descent to landing for Apollo 11 and 12.

The People

The people who worked on the Apollo Program worked for a different nature of company than you see today. In mathematical terms, we had more unknowns than we had equations, so we had to make a lot of uneducated guesses. That was against the grain for a lot of engineers, and many could not cope with that. It was somewhere between a ballet and a goat rope as we searched for answers. Because of the tremendous pressures involved, companies like TRW never questioned anyone's ability to accomplish something, and would allow whatever amount of responsibility one wanted, or could possibly support. They would enable you to do something, then send you away to go do it. From the very outset, I was pushed really hard, driven more from within than outwardly. I kept getting things to do that I didn't know anything about, but that didn't seem to matter to the management. You had to be smart enough on your own to find help somewhere if you needed it, or to dig it out by yourself. That's how I found out what it was like to work long hours, to learn on your own, to work complete weekends and holidays without going home, and to never miss a schedule deadline.

All of us had an equal chance to be a hero or to fail! It was baptism by fire. There was no in-between. There was no room for mediocrity. I personally had access to some really good people who knew what they were doing and they were always available to me as long as I was trying to hold up my end of the deal. Like most everybody else, I found that long work days were the only way to keep abreast of things, to make up for inherent deficiencies,

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and to make sure I didn't fail. We risked our reputations with the chances we took, we worked excessively hard, and the splashdown parties were equally extreme. Those who could not work in that environment disappeared very quickly, and nobody missed them.

Fate chose Apollo 11 as the first landing mission. I firmly believe that the selection of its commander had God's hand in it. We could have flown with any one of the other astronauts. They were all capable, but some were also problematic. There were some with egos too large to fit in the capsule. Some were too prone to wisecracks and performing stunts during the missions. Others got themselves into trouble with alcohol and scandals. Some were not quite the "right stuff", but they were all like everyday men….Brave, Patriotic, Willing. But one was definitely a cut above.

I truly think it was by divine providence that we got Neil Armstrong. He stood above them all. He was respected within the corps as a no-nonsense commander with brilliant execution. He had the kind of stuff we saw in Werner Von Braun. Neil produced the best set of photos and documentation ever sent back. But more importantly, he provided the dignity we needed for the occasion… and that was becoming a rare commodity. It was he that did not want the Astronaut names or USA to appear on the Mission Patch. That was more than just a little bit unique... and extremely astute. He is one of the few who refused to seek personal credit for what was accomplished on a mission, especially Apollo 11. He overtly avoided placing his personal stamp on anything like the others before, and like those since. He gently but firmly declined every opportunity for interviews and public blaze. He never sought any financial windfall from it. He never rode his destiny into the political arena or high visibility appointments. He had a spiritual experience on Apollo 11, and clearly saw his role in the right perspective. He seemed to know things the rest of us didn't. As we used to say in the industry, his guidance platform was aligned perfectly. In his 2hrs 22 minutes on the surface of the moon, Neil left the right kind of legacy befitting the accomplishment. I like what Gene Cernan said: "No one else in the Astronaut Corps could have done it"

The Great Legacy of Apollo

The Great Legacy of Apollo is that it brought the nation together, and brought out the very best in us. It even brought the world together for a few shining moments as the world's first extraterrestrial event occurred. It was probably the greatest technological achievement in the history of our planet. It is mind boggling to think that we accom-

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plished the lunar landing using a computer no more powerful than the processor you find in a digital watch today. For me, it was a superbly exhausting, pioneering, rewarding, and adventuresome experience. It leaves me with very bittersweet memories. After Apollo, the word “impossible” would never have quite the same meaning as before. It transcended its origins of failure, and raised the bar for human performance. It was a colossal adventure, born out of an arms race, and driven out of fear & rivalry. It was one of the fiercest Cold War battles. We fought our way out of the trenches. We like to say we emerged as victors, but in this great technological achievement, we had some moments of surprising humility that deserve honorable mention.... especially since they were unscripted.

Frank Borman…. Read from Book of Genesis while in lunar orbit during Apollo 8. He shared the marvelous work of creation with the entire world as he saw the “earthrise” for the very first time. His words were broadcast as they emerged from behind the moon on Christmas Eve. The photo taken still appears on a postage stamp.

Michael Collins… the Command Module Pilot of Apollo 11… referred to the CM as the “Cathedral”. He introspectively observed after Neil and Buzz departed for the lunar surface: “Not since Adam…. Has any human known such

Photo 3: Steely-eyed missile-man, Dan Schneider, at Kennedy Space Center in 2007.

Solitude”. He holds tight to the title of being “The last guy to view the moon walk”.

The Plaque on Apollo 11 ….“We Came in Peace for all

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Question and Answer Corner

How to Set Up Electronically Staged Rockets in RockSim

By Tim Van Milligan

Ashley Lightfoot writes: *"I am trying to stage a HPR with APCP motors (no ejection charges) but RockSim won't allow me to leave a "None" in the ejection delay blank. And the motors I'm using don't offer a zero ejection delay option. When I select 'None' for the motor delays, I receive the following message - 'You have no ejection delays specified for the booster engines, this will prevent staging during the flight simulation. Please specify ejection delays on the booster engines.' How do I make RocSim ignore the ejection delay (or default it to zero) for staged flights?*"

Great question. There are actually two things going on here that you have to recognize.

First, setting up "electronically staged" rockets in RockSim is different than what you are doing in real life when you use electronics. When we laid out the framework of RockSim, we assumed staging would be done like black-powder motors, with a booster stage that had a zero-second delay. Because of this, the "delay time" is what tells RockSim that it is a 2-stage rocket, and when to separate the two stages.

In other words, you can't use a "NONE" delay value in the bottom stages, because then RockSim won't know when to separate the stages apart. That's why you're getting the error. You must have a number in the "delay" field if you are going to do staging.

Second, you do have the option of typing a number in the delay field!

We did recognize a long time ago that most high-power motors are plugged (which is what a NONE delay value means - as in; "it has none" delay). So we allow the user to simply select the field and type in a number!

That is the simple answer to the original question. Just type in a number using your keyboard.

But there is one additional thing you must also do. After you type the number, hit the TAB key. This forces RockSim to accept the new value. Note, on the macintosh, use the ENTER key not the RETURN key.

So if you want the sustainer to ignite as the booster motor burns out, then you'd type in a "0" for the delay.

Electronic Staging Timers

If you are using an electronic timer to stage your rocket, and it triggers at the instant of lift-off, then you need to remember to set the delay time in RockSim a little different.

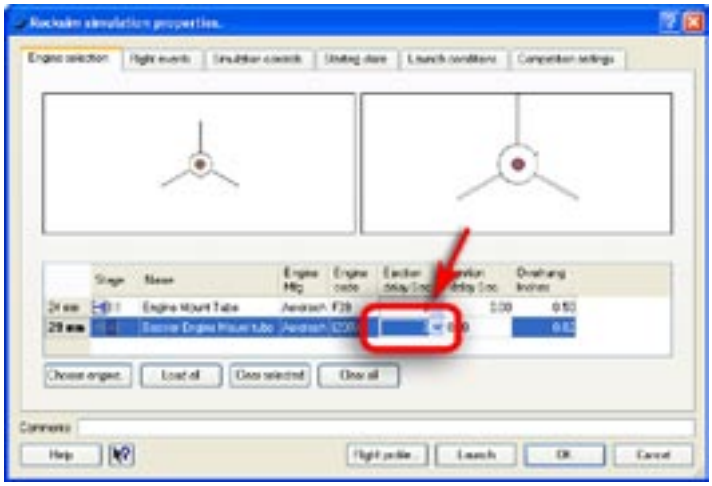

Figure 1: When you need a new delay value, just TYPE it in with your computer keyboard!

For example, if in REAL-life you want the rocket to stage 5 seconds into the flight, and the booster stage burns for three seconds, you would set the delay time in Rocksim to 2 seconds. It isn't hard to do. Just remember to subtract the motor's burn time from the time you're setting on your electronic timer.

To make it more intuitive, in the next version of RockSim, we'll probably have staging controlled as a "flight event." This will be similar to how parachute deployment is currently handled.

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Mankind " was utterly remarkable and brilliantly conceived. It didn't say who "we" were. There was no pride asserted by anybody, or for anybody. There was no victory proclaimed. There was no ownership claimed. There was no nationalism involved. It was as plain and simple as it could possibly be, unpretentious, and humble .... but with a superb and heartfelt message.

Gene Cernan ….who flew Apollo 17, the very last of the Apollo missions, perhaps made the most eloquent statement of all: … "We Leave Just as we Came… With peace and hope for all mankind"

Sputnik started the race with FEAR… Apollo ended it with HOPE.

Mr. Schneider welcomes correspondence on his rocketboy and Apollo experiences. Email him at: dbschneider@sbcglobal.net