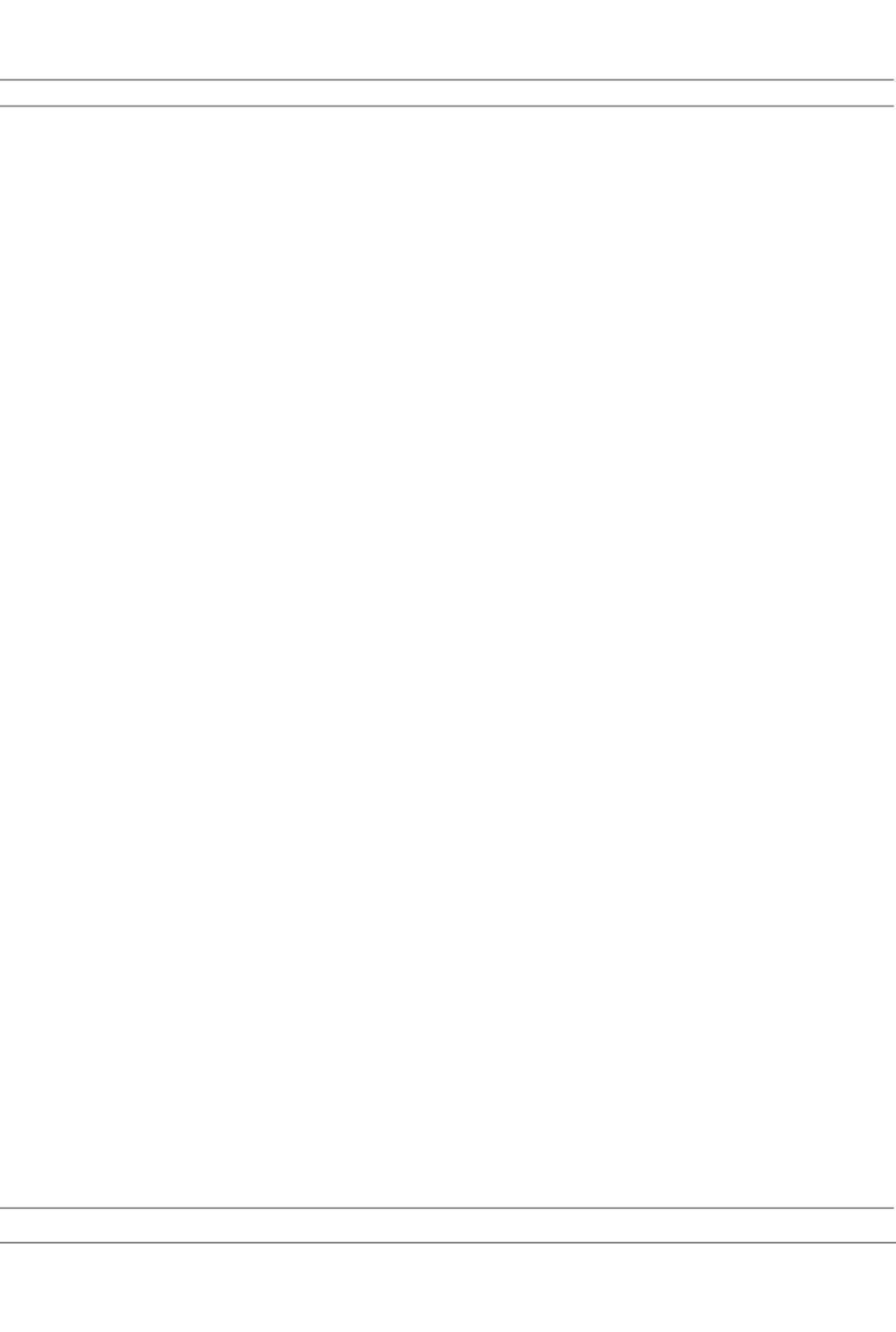


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*About an Element of Human  
Greatness—Homer Hickam*



What a grand day that was when Alan Shepard climbed into his Mercury capsule attached to a Redstone rocket—the rocket which would ultimately grow into the greatest rocket ever built, the Saturn V Moon rocket.

When I was a boy in Coalwood, WV, my greatest hero, besides my father and my mother, was Huntsville's Dr. Wernher von Braun. After Sputnik was launched in October 1957, the newspapers we received in our little coal camp were filled with stories of how American scientists and engineers were desperately working to catch up in the space race.

It was as if the science fiction I had read all my life was coming true. Gradually, I became fascinated by the whole thing. I read every article I could find about the men who built rockets and launched them, and kept myself pinned to the television set for the latest on what they were doing. Dr. von Braun's name was mentioned often.

At night before I went to sleep, I thought about what he might be doing at that very moment and imagined that he was down at Huntsville or Cape Canaveral high on a gantry, lying on his back like Michelangelo, working with a wrench on the fuel lines of one of his rockets.

I started to think about what an adventure it would be to work for him, helping him to build rockets and launching them into space. For all I knew, a man with that much conviction might even form an expedition into space, like Lewis and Clark. Either way, I wanted to be part of his team.

To do that, I knew I would have to prepare myself in some way, get some special knowledge about something. I was kind of

vague on what it would be, but I could at least see I would need to be like the heroes in my science-fiction books—brave and knowing more than the next man. I started, in fact, to see myself out of Coalwood, to see a different future than might have been supposed for a coal mine superintendent's son.

To get an early start, five other coal miner's sons and I began to build our own rockets. The people of Coalwood called us, with some derision, the Rocket Boys. Years later, I would write a book<sup>1</sup> about those days, and later that book would get turned into a major motion picture called *October Sky*. And who would have guessed such a thing would happen because we coal miner's sons wanted to build rockets?

In the manner of Dr. von Braun, we Rocket Boys persevered until we were flying our rockets miles into the sky. Eventually, we boys of Coalwood won a gold medal at the National Science Fair, bringing unexpected honor to our little town and our high school. A lot of people said we were lucky. But it wasn't luck that allowed us to reach our goals. It was because we were prepared to take advantage of our successes, just as our heroes in Huntsville.

In the fall of 1957, Huntsville's Army Ballistic Missile Agency had just completed a flurry of advances in the field of rocket science. Under Dr. von Braun's guidance, it had solved most of the difficult problems associated with climbing out of

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1. Homer Hickam, *Rocket Boys: A Memoir* (Doubleday Dell: 1998).

the gravity well into space. Everything was ready for a great leap forward, not because there had been a well-funded program for that purpose, but because the stubborn von Braun team had done everything they could legally, and sometimes a bit across the line, to prepare us for space.

When Sputnik hit this country like a flying sledge hammer, President Eisenhower turned to Huntsville to recapture a little American glory. Von Braun and his team launched our first satellite in sixty days of the go-ahead, and, less than a year later, they were cutting metal on another project even though it hadn't been officially approved—the Saturn family of rockets that eventually took the United States to the Moon.

This, I think, is history worth savoring and emulating. In many ways, the situation in space development is similar now to what it was in the years prior to 1957. There is confusion on what should be done in space and who should do it. Still, just as the Redstone was there to allow us to build the giant chemical rocket engines that made the Saturn rockets, the tools are available to us today, if only we have the courage to pick them up and use them for what we need to do. I want to give you a couple of things to think about. The first thing is that NASA is essentially a subversive organization. Anything else you hear is a public relations lie.

Some people, of course, will argue that there has never been a more conservative bureaucracy on this planet. NASA even takes polls to see what it should do next. It lets politicians decide technical matters.

I grant you NASA as a bureaucracy is timid. But what I mean is its charter. NASA is supposed to develop the means to

allow American citizens to leave the planet. Leave! What could be more seditious than that?

I believe, in fact, that most NASA engineers and scientists are essentially subversives. It's in their psychological makeup. We strive for something greater than ourselves, something that is considered by most of the population of the rest of the world as being outlandish. What we want is to build machines that will literally allow people to leave this planet, and its governments, and its philosophies, and its religions behind to find a new world, new ways of governing themselves, new religions.

Back when I was a Rocket Boy in Coalwood, and in some trouble, as I almost always was, a preacher whom I adored—his name was the Reverend Little Richard of the Mudhole Church of Distinct Christianity—came to me and told me he had had a dream. He had seen men on the Moon, and I was one of them. When he woke, he had opened his Bible, and his eyes had fallen on the testament of Peter. “Nevertheless we, according to His promise, look for new heavens and a new Earth, wherein dwelleth righteousness,” he quoted.<sup>2</sup>

It took me awhile to figure out what the old preacher was getting at, but then I understood it. I was a born subversive like St. Peter. My life was going to be dedicated to fulfilling His promise, the opportunity for mankind to look for those new heavens and new Earths, and all that would follow.

2. 2 Peter, 3:13.

Recalling the Reverend Richard's Bible verse, I believe it is the manifest destiny of this country to make all of us on the planet into a two-world species; our second world being our Moon. But I don't believe we will use chemical rockets to do it. It is time to put those old things in the museums where they belong. Let me explain.

It seems to me there are two ends of the rocket the American people love. The front end where the astronauts sit and the tail end where the rocket engines are bolted. It is time the working back end of the rocket got more emphasis than the front end. It is time that the old chemical rockets that have gotten us to this point be set aside and a new breed of big, bad rockets be constructed. If we don't do this, we are forever going to be stuck in low-Earth orbit—not doing any better than struggling to bolt together another Mir or Alpha or whatever you want to call it, a bunch of small modules like wieners in a string where astronauts can stay cooped-up for days, taking their blood pressures and peering at e-mail from home.

The Bush administration here in Washington is even now trying to figure out what to do with NASA. It's a problem. President George W. Bush knows, as all of us know when we are honest, that we are essentially spinning our wheels as far as spaceflight is concerned. And so it will always be until we start building advanced propulsion systems. Without them, we simply do not have enough lifting capacity or the acceleration to truly explore space. The one thing we don't need the ISS to teach us—we've already learned this—is that space is essentially bad for people. Zero-G is debilitating to our bones and muscles, and

radiation from the solar wind and cosmic rays is likely to give us cancer if we're exposed to it over a period of time. To conquer space, we're going to need to get through it in a hurry inside spacecraft made of aluminum and steel and lead shielding. To go back to the Moon and definitely Mars with chemical rocket systems is asking for trouble, and that's trouble I don't think this Administration or the next or the next is ever going to take. So propulsion engineers, the good folks of Marshall Space Flight Center who head up propulsion for NASA, must take the lead, or we're never going anywhere.

Here's what my admittedly cloudy crystal ball says is coming: I believe we won't send humans back to the Moon or to Mars the way we did it in the Apollo program. Apollo pushed our technology to the outer edge of the envelope, and it took a brave corps of professional astronauts to go. That won't happen again.

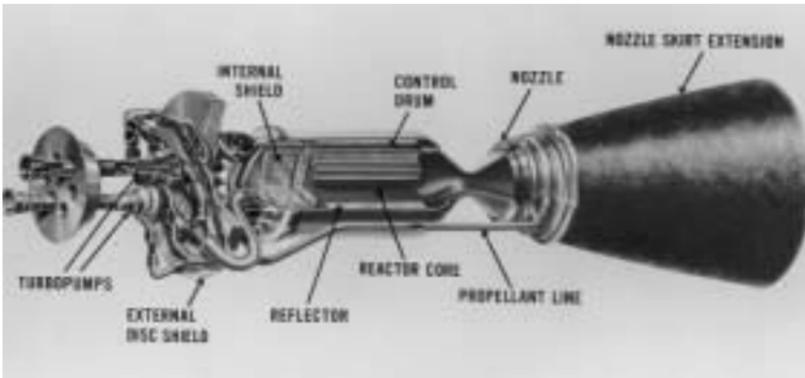
I think spaceflight is going to evolve very much the same as the exploration of Antarctica. The first expeditions to the South Pole in the late nineteenth and early twentieth century were essentially sprints and publicity stunts, primarily accomplished for national prestige and personal glory, although often wrapped in the dubious veneer of science. These sprints were accomplished with the technology of the day—steamships to the ice shelf followed by the use of dogs and manpower to make a torturous journey to the pole and return. Many men died and many more suffered from frostbite, hunger, and exhaustion.

Roald Amundsen, a Norwegian, reached the Pole first on 14 December 1911, followed within days by his competitor, Britisher Robert Scott (who died with his entire team on the way

back). After these highly adventurous and publicity-conscious expeditions, interest waned in duplicating their feats. It was far too expensive in money and blood to do something that had already been done. Amundsen and Scott's forays might be seen as roughly equivalent to the Apollo program.

It would be four decades later before the next people arrived at the South Pole. They were Americans, and they simply flew there in an airplane. I believe it will be in the space equivalent of this airplane that will carry people back to the Moon and to Mars and beyond.

But what kind of engine am I talking about that will power this space equivalent of the South Pole airplane? I believe the first one, if we're to see it in our lifetimes, must be a nuclear-fission



*An explanatory drawing of the NERVA (Nuclear Engine for Rocket Vehicle Application) thermodynamic nuclear rocket engine. This program ran from 1960–1973 and was managed by NASA and the Atomic Energy Commission, but the nuclear engine was never actually deployed for a space mission. NASA Image NPO-70-15803.*

rocket. For three decades, nuclear fission has been a dirty term in this country, which is really a shame. Despite the fact that nuclear propulsion is the best and safest way to fly major missions beyond Earth orbit, we stopped its development back in 1972. That was a terrible decision. We had at that point successfully tested nuclear rockets in the open air in Nevada—engines that could be operated with high thrusts for long durations, the key to the solar system. I believe it is time to go back to the future, to revisit the successful development of the old nuclear rocket, and to go forward with other designs, including the SAFE engine (Safe, Affordable Fission Engine) now being developed in Huntsville at Marshall Space Flight Center. Other similar engines are on the drawing boards at Glenn and JPL. We need to get behind the Rocket Boys and Girls in Huntsville and Cleveland and Pasadena, and show the courage it will take to chase away the Chicken Littles who deride nuclear energy in all its manifestations as somehow inherently evil. Nuclear energy, in fact, is one of the cleanest forms of energy we've ever known, and it's time somebody stood up and made its case.

Need I remind one and all that right now there are hundreds of nuclear reactors tooling around in the world's oceans, propelling submarines and aircraft carriers? How many of our sailors glow in the dark? Not one of them. This is safe technology, and I am tired of the fools in our society who fear it and keep it from its potential.

I believe it's time to put chemical rockets on the backburner for NASA. We should go ahead and build the International Space Station for political reasons and then turn the whole dull business over to a contractor or the National Science Foundation

and get back to NASA's charter of truly exploring and utilizing space by constructing, testing, and flying some big, bad rockets. NASA should also be ordered to cooperate with the Department of Energy to provide energy from space to an energy-hungry world. This is the key. If we are to go into space in a big way, we have to have a big reason. That reason, I believe, will be the production of energy.

Right now, we're passing through a unique moment in time—a cheap energy bubble. This cheap energy bubble, actually available only in the Western world, is what allows us to transport ourselves, air condition ourselves, communicate with one another, run milling machines, make plastic, and do all the other things that make up our civilized, industrial, high-tech society. In this country, we can see that bubble just starting to burst in California. But it has actually already burst in most of the world.

The cheap energy bubble we enjoy is because of fossil fuel. When that goes away, and it will, if we have not taken the steps to prepare for alternative energy, our advanced society will collapse. Wind energy, ocean energy, land-based solar energy, all those can be added to the mix, but it will never supplant fossil fuel energy until we turn to space. In the meantime, however, while we work to come up with new forms of energy, we not only should be thinking about building nuclear plants for electrical power, but we also should start building nuclear engines needed to explore the solar system. Because those engines will bring us wealth, and energy, like we've never imagined. The solar system, if nothing else, is filled with energy, something we must have.

I am a boy of West Virginia, after all. I want to see a

Coalwood on the Moon or Mars. I want to read a memoir written by a boy whose father spends too much time mining helium-3 on the Moon or in the deep water mines of Mars. I want the solar system to become another place, a place of industry as Coalwood once was, a place where men and women can raise their families, and where a rough frontier—the roughest ever encountered by mankind—can be shoved back. And I want this country to lead the way.

One of the things Dr. von Braun instinctively knew was that it was as nearly important to explain why we should go into space as to build the machines to take us there. He wrote books and magazine articles, spoke to everyone he could formally and informally, and spent his life to his dying day seeking to educate everyone on the importance of and need for spaceflight.

I think all of us in this room need to continue that tradition, to get out into the public eye and explain why we should go and why we need to build the machines to go there.

Why should we go? I think there are actually two principle reasons:

1) Because the solar system is filled with cheap, clean energy, and we need to go get it, and, 2) this one may well be even more important, because we need a purpose for ourselves and our country.

Our Constitution established a relatively weak federal government and guaranteed strong individual freedoms. By doing so, what it really did was to allow the old Yankee Traders to go wherever they wanted to go, build up businesses, and generally outdo and outsell the rest of the known world hampered by

kings and queens and imperial potentates.

That's how Americans got to be so rich. All those dollars and all the wealth that surrounds us didn't just happen because we're blessed. Our forefathers got out there and scratched for it using the freedom they had to do it.

You've heard of Yankee Traders. That's our heritage. We drive a hard bargain, and we make a profit. It's our way. Along the way, we just happen to bring our important values along with us—that of life, liberty, the pursuit of happiness, and the triumph of the individual over the government, any government, even our own.

A country needs a purpose, especially this country. I think we need an eternal frontier to push up against, our purpose to conquer and settle it. The nice thing about doing that is the solar system is a very rich place, filled with not only mineral wealth but energy, a nearly inexhaustible supply. And if there's one thing this country and this planet desperately needs and is willing to pay for now and forever is energy. The solar system is where it is. We've got to go after it.

I believe, then, that Americans have both a self-interest and a patriotic duty to convince ourselves it is time to take another giant step into space. The way to do that is to do what Dr. von Braun did—cut metal and start flying. Success engenders success. If we start flying advanced propulsion drives, we will, I believe, energize the country and perhaps inspire a new generation of Rocket Boys and Girls.

I call on NASA today to lay out a fifteen-year program to produce a working advanced propulsion engine in space, and

that engine should most probably be powered by nuclear fission. Our elected representatives and the leaders of NASA should, in concert, move immediately to put this engine in NASA's budget with a fixed schedule for us to build it. If we can just get our first big, bad rocket booming around space, I believe there will be no holding Americans back from the new frontier.

In *Rocket Boys*, I tell of the time when I asked my father what was the hardest thing he'd ever learned. He leaned on the rail outside his office and said, "entropy," and then he explained. Entropy, he said, is the tendency of everything to move toward confusion and disorder as time passes. I was only fourteen at the time, so I'm certain I looked blank. "No matter how perfect the thing," he explained patiently, "the moment it's created, it begins to be destroyed." I asked him why that was so hard to learn. "Because," he smiled, "I don't want it to be true. I hate that it's true. I just can't imagine," he concluded, heading back inside his office, "what God was thinking."

Entropy ultimately killed Coalwood. When the coal was gone, everything fell into disrepair, and my father's hopes for the town crumbled. I don't want that to happen to my country, but it could, and I believe it will if we don't develop the solar system, open up a new frontier.

Dr. von Braun's grand dream need never die. NASA can spark a twenty-first-century revolution in transportation and energy that could fundamentally change the way we fly through space, power the world, even care for the sick if we do it right. All those things require cheap and clean energy. It exists in the solar system in a variety of forms. Solar energy is the most obvious form, but there

are others, including helium-3, which may be the perfect fuel for fusion reactors, and also just happens to cover the Moon. I believe we must go after it. We just need to believe in ourselves and our purpose. I call on all of you here today to join together, get things moving again, and get serious about conquering space. If we do, we'll assure the country's prosperity, and the world's survival, too, for centuries. Along the way, maybe we'll finally understand why my old preacher thought St. Peter's comment about looking for new heavens was so important.

According to His promise, it's a big challenge, a huge responsibility, to try to fulfill such a promise and prophecy. I believe, however, the Rocket Boys and Girls of today are up to it.

So let's do it! Let's go!

