

## **Space Exploration: Real Reasons and Acceptable Reasons**

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Thank you for having me here tonight; I think most of you know that this is one of my favorite places. I've been coming to Houston and the Johnson Space Center for over thirty years, and over time I've come to know the area and the people quite well. So it is a real treat to be honored by those of you who are here tonight.

I must say that while I appreciate the honor, I think it is misplaced. All I've really done is to pick very good people, put them in their jobs, and then try to make sure we're all going in the same direction. Some of them are people that you know, people like Mike Coats, who has returned to Houston as the JSC Director, or Skip Hatfield, who's running the *Orion* project, or Jeff Hanley, our Constellation program manager. These are people that I believe can follow in the footsteps of folks like Glynn Lunney and Chris Kraft. They will become new legends that yet another generation will look up to, as we do to the Apollo generation.

I had a few things I wanted to talk about tonight that don't have anything to do with this award, and because you're a captive audience, I'm going to do it.

We have a very interesting conundrum at NASA, and we have been spending a lot of time lately thinking about it. In national polling, NASA as an American institution enjoys a hugely positive approval rating, broadly in the range of 65-75%, an amazing result for a government agency. But when you ask people why, they are not really sure, or at least cannot express it clearly. When you ask people what we do, beyond the broad category of "space", again they aren't quite sure. And if you ask them what we're planning to do, they're even less sure. But they know that they love NASA. So NASA has what in the marketing discipline would be called very strong brand loyalty, even though people are not familiar in detail with what we do or why they like it.

I have been trying to understand why this is so, because it is important to our agency's future. If we don't have public support that is both strong and specific, the things we want to do, and believe to be important, will not survive. There are many competing priorities for public funding, and always will be. So it really is important for us to communicate to the public how we're spending the fifteen cents per day that the average American contributes to NASA, because there are other places where that money can go.

I've reached the point where I am completely convinced that if NASA were to disappear tomorrow, if the American space program were to disappear tomorrow, if we never put up

another Hubble, never put another human being in space, people would be profoundly distraught. Americans would feel less than themselves. They would feel that our best days are behind us. They would feel that we have lost something, something that matters. And yet they would not know why.

This is an interesting conclusion, and so I've thought about it a good bit, and I've come to believe that the reason is, we in the space business don't talk about it in the right way.

If you ask why we're going back to the moon and, later, beyond, you can get a variety of answers. The President, quite correctly said that we do it for purposes of scientific discovery, economic benefit and national security. I've given speeches on each of those topics, and I think these reasons can be clearly shown to be true. And Presidential Science Advisor Jack Marburger has said that questions about space exploration come down to whether or not we want to bring the solar system within mankind's sphere of economic influence. I think that is extraordinarily well put.

These reasons have in common the fact that they can be discussed within the circles of public policy making. They can be debated on their merits, on logical principles. They can be justified. They are what I am going to call tonight "Acceptable Reasons." You can attach whatever importance you want to any of those factors, and some citizens will weight some factors more and some will weight them less, but most of us would agree that they are, indeed, relevant factors.

But who talks like that? Who talks about doing something for purposes of scientific or economic gain or national security other than in policy circles? If anybody asked Lindberg why he crossed the Atlantic – and many did – he never indicated that he personally flew the Atlantic to win the Orteig prize. His backers might have done it in part for that, but Lindberg did it for other reasons.

If you ask Burt Rutan why he designed and built *Voyager*, and why Dick Rutan and Jeanna Yeager flew it around the world, it wasn't for any money involved, it was because it was one of the last unconquered feats in aviation. If you ask Burt and his backer Paul Allen why they developed a vehicle to win the X-Prize, it wasn't for the money. They spent twice as much as they made.

I think we all know why people do some of these things. They are well-captured in many famous phrases. When Sir George Mallory was asked why he wanted to climb Mount Everest, he said "Because it is there." He didn't say that it was for economic gain.

We know these reasons, and tonight I will call them "Real Reasons". Real Reasons are intuitive and compelling to all of us, but they're not immediately logical. They're exactly the opposite of Acceptable Reasons, which are eminently logical but neither intuitive nor emotionally compelling. The Real Reasons we do things like exploring space involve competitiveness, curiosity and monument building. So let's talk about them.

First, most of us want to be, both as individuals and as societies, the first, the best, the most, in at least some activity. We want to stand out. This kind of behavior is rooted in our genes. We are today the survivors of people who wanted to outperform others. Without question that can be carried to an unhealthy degree; we've all seen more wars than we like. But because this trait can be taken too far doesn't mean that we can do without it completely. Competitiveness is rooted in the genes of successful people.

As to curiosity, who among us does not know the wonder and mystery and awe and magic of seeing something, even on television, never seen before, an experience brought back to us by a robotic space mission? And how much grander when one of our own, a representative of other human beings, is there to see it for herself? Who doesn't know that feeling? The urge to know what's over the next hill is one of the most common feelings we share, whatever our backgrounds.

We like to do what I'll call monument building. We want to leave something behind for the next generation, or the generations after that, to show them that we were here, to show them what we did with our time here. This is the impulse behind cathedrals and pyramids and many, many other things. We could have done a lot of different things to honor George Washington. But what was done, was that in the early 1800's people started to work on a 550-foot high obelisk to honor him.

But it is not only George Washington whom the monument honors; it says fully as much about the people who built it. And that's okay. It is my observation that when we do things for Real Reasons as opposed to Acceptable Reasons, we produce our highest achievements. The people who do things for Real Reasons, and who know it, are also the ones who are the most successful by the standards embodied in Acceptable Reasons.

All of you in the space business know this, whether you realize it or not, because none of us is in this business for the money to be made. But I believe we see it most obviously, in our society, in sports. In my own sport, golf, certain people have over the decades risen to the very top of the game, and stayed there. People like Bobby Jones, Ben Hogan, Jack Nicklaus, or, today, Tiger Woods. In other sports, people like Wayne Gretzky or Michael Jordan come to mind.

What do these people have in common and what is the lesson for the rest of us? The lesson is that they became legends because they wanted to be the very best at what they do. They wanted to leave something behind them, lasting records in their sport. And they wanted to do it because the challenge was there. Who thinks that any of them played, or kept playing, for the money?

I think that tells us something. When you do things for Real Reasons instead of Acceptable Reasons, you have a chance to obtain Real Success. And so we have a conundrum. The cultural ethos in America today requires us to have Acceptable Reasons for what we do. We must have reasons that pass analytical muster, that offer a favorable cost/benefit ratio that can be logically defended. We tend to dismiss out of hand reasons that are emotional, or are value-

driven in ways that we can't capture on a spreadsheet. But, Acceptable Reasons alone don't take us where we really want to go.

In my view, the space business more than most other endeavors suffers from the fact that the most important, the best, and the most basic reasons for doing it are Real Reasons and not Acceptable Reasons. The Acceptable Reasons – economic benefit, scientific discovery, national security – are, in fact, completely correct. But they comprise a derived rationale, and are not the truly compelling reasons. And again, who talks like that, about anything that really matters to them?

Why in today's culture do we focus so much on requiring Acceptable Reasons? Only a couple of generations ago, it was not so much this way.

One observation I would make is that in the shaping of policy, the kinds of things I've cited as Real Reasons are "right-brain" things; they're intuitive, subjective and difficult to quantify. And they are running around loose in a left-brain world! All of us here tonight got where we are by being analytical and objective and very left-brain oriented. Spaceflight cannot be successfully accomplished without these traits. And so I think we tend not to pay appropriate respect to the deeper parts of human nature which are intuitive and qualitative. This one-sided focus isn't always to our benefit. In a very important sense, we're not the right people to make the arguments as to why we should be encouraged to do what we do!

Some of you here tonight must, as I have, read Norman Mailer's book from 1970, entitled "Of a Fire on the Moon." Now Mailer was a unique and controversial novelist. I think of him, in the sense that I was just talking about, as quite possibly the ultimate right-brain kind of guy. And he wrote about Apollo in a very, very interesting book, but from a perspective I've not seen another writer choose. He didn't write about the engineering of it, or the operational aspects, or the astronauts who flew the missions, or anything like that. He wrote about what people were feeling, and the power and majesty of the event, and the nature of the people who would engage in such a thing. It's a compelling story, but it is not like any other book about the space program that you will read. That's the kind of person, that's the kind of work that we need to exemplify the Real Reasons for what we do.

Real Reasons are not amenable to cost/benefit analysis. I'm reminded of the famous quote "A cynic is a man who knows the price of everything and the value of nothing," by the character Lord Darlington in Oscar Wilde's play "Lady Windermere's Fan." It's one of my favorites. Well, in today's America it's smart, it's popular, it's clever to be a cynic. And a certain amount of it is appropriate; a healthy skepticism of bold claims is necessary. But too much skepticism causes us to deny a part of what we are.

Real Reasons are old fashioned. How many of us grew up reading Tom Swift, or Jack Armstrong, All American Boy? Or other similar books stories? Not great literature, for sure, but they exemplified many of the values I think we like to see in people: inventiveness, competitiveness, boldness, and a sense of good feeling about what it was to be an American, in very simplistic ways but ones which hit close to home.

To read those books was to understand, even as a child, that achievement is to be valued, and is not something to be set aside. So, how do we talk about our achievers today? Other than in the field of sports, we talk about today's achievers as "geeks" and "workaholics". People are advised to lead "balanced lives". I don't know about you, but I haven't led a balanced life. But people who want to accomplish something are not balanced. And they are geeks, and workaholics. I think we owe our country to people who were like that. I don't know that one could say that folks like George Washington and Thomas Jefferson led balanced lives. Any rational cost/benefit analysis would tell you to stay out of a quarrel with the mother country, and let other people deal with it! Who today would talk about pledging "their lives, their fortunes, and their sacred honor" to a cause? Today we are uncomfortable with such value discussions, and I think it's a shame.

Now, I talked earlier about building monuments, and I mentioned the cathedrals and the pyramids. Cathedral builders knew what I am talking about tonight. They knew the awe and the mystery of their God. They built monuments to him, and also to themselves, just as the Washington Monument speaks to the people who built it as well as to the person for whom it was built. But they wanted to build the best cathedrals, and if you study cathedral building from a civil engineering perspective, you can see the evolution of that discipline, and you will be impressed. You should be.

When I arrived here tonight, I was told that this very lectern from which I am speaking is the one from which John Kennedy gave the speech you saw earlier on tonight's video. Within the space business, Kennedy is probably best remembered for his "Man, Moon, Decade" speech, which, by the way, is also a classic of program management. And it's a great speech. But the JFK quote about space that I love more than anything in the world, because it evokes exactly the things I'm talking about here tonight, was the one he gave from this lectern at Rice University in September of 1962, when he said "We choose to go to the moon, and to do the other things, not because they are easy, but because they are hard." I'll say it again: "not because they are easy, but because they are hard".

The cathedral builders knew that reason. They were doing something that required a far greater percentage of their gross domestic product than we will ever put into the space business, and they knew it was hard. We know it too. We look back across 600 or 800 years of time, and we are still awed by what they did. What is it that Americans make sure to see when they go to Europe? Who goes to Europe and does not, at some point, see the cathedrals? We are still awed across the centuries by what they accomplished.

To me, the irony is that when we do hard things for the right reasons – for the Real Reasons – we end up actually satisfying all the goals of the Acceptable Reasons. And we can see that, too, in the cathedrals, if we look for it.

What did the cathedral builders get? They didn't just build cathedrals and then stop there. They began to develop civil engineering, the core discipline for any society if it wishes to have anything more than thatched huts. They learned how to build high walls and to have them stand up straight. They learned how to put a roof across a long span. They learned which materials would work, and which ones would not. And by finding the limits on how high walls

could be, how broad roof spans could be, and what materials wouldn't work, they created the incentive to solve those problems, so that they could build things beyond cathedrals, so that they could, fundamentally, build Western civilization.

They gained societal advantages that were probably even more important than learning how to build walls and roofs. They learned to embrace deferred gratification, not just on an individual level where it is a crucial element of maturity, but on a societal level where it is equally vital. The people who started the cathedrals didn't live to finish them; such projects required decades. The society as a whole had to be dedicated to the completion of those projects. To be able to do that for cathedrals was to be able to do it in other areas as well. We owe Western civilization as we know it today to that kind of thinking – the ability to have a constancy of purpose across years and decades.

The medieval builders formed guilds, establishing professional trades beyond that of agriculture. Now, agriculture is at the root of human technology. Nothing good happens to human beings without getting beyond the hunter-gatherer stage, and agriculture is that first step. But the second step is to be able to build physical works that didn't previously exist. The organization and systemization of that in Western society today began in medieval Europe, with the cathedral builders. They learned how to organize large projects, a key to modern society. And, probably most important of all, the cathedrals had to be, for decades at a time, a focus of civic accomplishment and energy. A society, a nation, a civilization, needs such foci.

It is my contention that the products of our space program are today's cathedrals. The space program addresses the Real Reasons why humans do things. It satisfies the desire to compete, but in a safe and productive manner, rather than in a harmful manner. It speaks abundantly to our sense of human curiosity, of wonder and awe at the unknown. Who doesn't look at a picture of the Crab Nebula, synthesized from visible-light Hubble photographs and Chandra x-ray images, and say "Oh my God?" Who can look at that and not experience a sense of wonder?

Who can watch people assembling the greatest engineering project in the history of mankind – the International Space Station – and not wonder at the ability of people to conceive and to execute that project? And it also addresses our sense of monument building, of leaving something behind for future generations. Not for nothing, thirty-one years after its opening, is the National Air and Space Museum still the most heavily visited museum in Washington DC. And what do people come to see? They come to see early airplanes and Apollo spacecraft.

Of course the space program also addresses the Acceptable Reasons I've mentioned. In the end this is imperative. Societies will not succeed in the long run if they place their resources and their efforts in enterprises that, for whatever reason, don't provide concrete value to that society.

But my point earlier is that if things are done for the Real Reasons that motivate humans, they also serve the Acceptable Reasons. In that sense, in the practical sense, space really is about spin-offs, as many have argued. But it's not about spin-offs like Teflon and Tang and Velcro as the public is so often told – and which in fact did not come from the space program. And it's not

about spin-offs in the form of better heart monitors or cheaper prices for liquid oxygen for hospitals. Yes, you get those things and many more, and they are real benefits. But that's not the right level on which to view the matter. The real spin-offs are at a higher level. We need to look at a broader landscape.

What is the economic value to a society of upgrading the precision to which the entire industrial base of that society works? Anyone who wants to put together space artifacts, who wants to bid on a competition for space artifacts, who wants to be a subcontractor or supplier, or who even wants to supply nuts, bolts and screws to the space industry, must work to a higher level of precision than human beings had to do before the space industry came along. And that fact absolutely resonates throughout our entire industrial base. What is the value of that? I can't calculate it, but I know it's there.

What is the scientific value of discovering the origins of our universe? Or of discovering that literally 95% of the universe consists of dark energy or dark matter, terms for things that we as yet know nothing about? But they make up 95% of our universe. Is it even conceivable that one day we won't learn to harness them? As cavemen learned to harness fire, as people two centuries ago learned to harness electricity, we will learn to harness these new things. It was just a few years ago that we discovered them, and we would not have done so without the space program. What is the value of knowledge like that? I cannot begin to guess. A thousand years from now there will be human beings who don't have to guess; they will know, and they will know we gave this to them.

Let's think for a moment about national security. What is the value to the United States of being involved in enterprises which lift up human hearts everywhere when we do them? What is the value to the United States of being engaged in such projects, doing the kinds of things that other people want to do with us, as partners? What is the value to the United States of being a leader in such efforts, in projects in which every nation capable of doing so wants to take part? I would submit that the highest possible form of national security, well above having better guns and bombs than everyone else, well above being so strong that no one wants to fight with us, is the security which comes from being a nation which does the kinds of things that make others want to work with us to do them. What security could we ever ask that would be better than that, and what give more of it to us than the space program?

What do you have to do, how do you have to behave, to do space projects? You have to value hard work. You have to live by excellence, or die from the lack of it. You have to understand and practice both leadership and followership, and both are important. You have to build partnerships; leaders need partners and allies, as well as followers. You have to be willing to defer gratification, to spend years doing what we do, and then stand back and see if it works. We learn how to leave a legacy, because we work on things that not all of us will live to see – and we know it. And we learn about accepting the challenge of the unknown, where we might fail, and to do so not without fear or apprehension, but to master it and to control it and to go anyway.

These are lessons that we all need to learn, and they are lessons the space business teaches us. And I would submit that our country is a better place for those who have learned those lessons.

These are the values that the space program brings. This is why it must be supported. And this is why, although we don't acknowledge it, we don't admit it and most of us don't understand it, this is why if we didn't have a space program, we Americans would feel less than ourselves. We can never allow that to happen.

Thank you.