

## **Remarks of NASA Administrator Sean O'Keefe**

### **Administrator's Symposium Risk and Exploration: Earth, Sea and the Stars**

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Courtesy Tigerfish Transcribing-Editing

Sean O'Keefe: Thank you ... I want to thank the Naval Postgraduate School and all our friends here for hosting the conference. Admiral Patrick Dunne and his staff here have been most gracious in accommodating us in pulling together this very ambitious endeavor, and an awful lot of folks who worked very hard to pull it together. [Bob Jacobs] and the Public Affairs team have just done a masterful job, I think, of easing the process here of pulling together what is arguably one of the most eclectic collections of people. I think that last night our discussions at the reception were testimonial to where this is off to a tremendous start. It is an honor to be in the presence of so many remarkable aquanauts, mountain climbers, cave spelunkers, astronauts, and a couple of people fall into all of those categories: [John Grunsfeld] and [Mike Full] come to mind as fitting every one of those squares as extraordinary people who have experienced the full depth and breadth of some of the exploration opportunities. And, indeed, there are so

many here, I think, who make up an extraordinary collection of folks that could arguably be referred to as the League of Extraordinary Explorers.

There is no historic analogue, I don't think, to a gathering like this. Certainly no records exist of people living in Lisbon 500 years ago attending a candlelight symposium featuring Amerigo Vespucci or Vasco da Gama or Ferdinand Magellan. So, this is an opportunity given to modern technology and the ease of transportation that Scott referred to as a means to pull together this really extraordinary group, I think, of folks who've experienced the full extent and breadth of exploration and the risks attendant thereto. I want to particularly thank the folks -- thank you very much for attributing the idea of this to me, Scott, but quite the contrary: this was something to which I was persuaded by far superior intellectual logic as to why such a gathering was important for the purpose of parsing this larger question of risk and return of the exploration ventures we are about. In that regard, I am particularly grateful to John Grunsfeld, who has really provided the intellectual horsepower behind this kind of an effort to think about these questions in a structured way, and to [Keith Cowing], two very disparate kinds of folks but folks who share the passion and desire for exploration and an understanding, I think, of the attendant risk to it. So, to Keith and to John, I am most grateful for that extraordinary nudge that you all provided in pulling this together and the structure upon how we've done this.

We are gathered here, I think appropriately in a place like Monterey, at the edge of a great ocean, to discuss exploration in all of its facets: of extreme environments here on earth and in space. Indeed, this historic location is testimonial in so many ways and steeped in a history of exploration in an era gone past. The ventures that it took of so many people to explore and to establish a site of civilization that we see in this marvelous area here around Monterey is testimonial to that. Indeed, that which we enjoy each day in this community and understand of the full breadth of the aspects of exploration and its benefits are here and evident each day. Certainly this evening we will have an opportunity to see that more specifically at the aquarium, I'm sure.

I want to provoke some thought and reflection about a central question which is what we're about discussing here in these two-and-a-half days. Why do we take such risks to explore? As humans, what is it about us that really wants to understand that which is on the other side of the horizon? That which is on the other side of the ridge? In doing so, there are periods of our human history in which the acceptance of those risks have resulted in great gains and, in other cases, a mere footnote because it ended in a way that was less than fulfilling. In each case, there was always a contribution to that human desire to want to know and understand. How we assess those risks and deal with the challenges of exploration is the central question we are about in this two-and-a-half days, and I am most grateful to all of you for accepting the invitation to participate in this kind of debate and

discussion of how we may structure this question, not only in a public but also in a specific way.

I am certain we will have a lively discussion of where you draw the line between the benefits of exploration and the inherent risks, especially as technology changes and as we learn more about the environments in which we explore. Now, this is in part about NASA participation, to be sure, but it is mostly about those of us from NASA to have the opportunity to learn from so many others who are engaged in the broader exploration agenda of the central questions we pose. Several folks here from NASA, certainly astronauts spanning -- I am most grateful to see the Apollo Shuttle and Space Station veterans who have gathered here with us to share their thoughts. Indeed, I think that will be historic in and of itself -- to learn so much from them. All of them have dared to sit in a spaceship at one point, and in several cases, like in the case of Jerry Ross, seven different times. To sit on the top of the spaceship with the millions of pounds of explosive fuel, prepared to put their lives on the line in order to advance that cause of exploration and discovery. Now, I asked Jerry why you do this, and he said, "Well, because it's an opportunity to do so," and he would easily sign up for an eighth flight this afternoon, I'm sure. As a matter of fact, I don't think he would wait until noon to sign up as an opportunity.

To some, it may seem that NASA has made space travel routine, though. Let there be no mistake: I think we all fully appreciate and understand that space flight and exploration is still a very risky proposition. It is something that, despite our efforts to eliminate that

risk, there will be no means by which to accomplish that. There will always be an attendant risk to such a venture. And as a result, here, also, are NASA scientists, engineers, and managers, whose job it is to have constant vigilance about that risk. And in that regard, I view myself as included in that requirement for constant diligence to assure that risk is mitigated as much as we can. From the discussions that will take place here, I hope we will gain a greater appreciation of our responsibility as a public organization to take on bold and risky ventures and to learn from those who have accepted private ventures and other approaches to how we explore risk. How we may take that, frame that discussion and debate, and evaluate that risk in a different way.

But again, it was also a requirement that we do that in a diligent manner that minimizes and mitigates to the maximum extent we can what that risk may be, but that we understand what it is as much as possible and in some cases, accept it relative to the returns we think are feasible. That's the price of admission of what we do each and every time we're engaged in any exploration venture, be it of human space flight or robotic probes. It is always measured in the public domain and in the public eye relative to what our expectations are to that return. Indeed, NASA is an agency that has been defined over the course of its forty-six years by great, great triumph and unbelievably deep tragedy, and we've learned from both ends of that spectrum. It's a consistent set of themes. It is, indeed, the singular aspect of what has described this agency throughout the course of its four decades.

We have purposely, again, expanded the list of invitees, and again, we are very, very grateful to the folks who have accepted to do so and be a part of this, to gain an added perspective the people engaged in exploration of the Earth's most extreme environments can bring to the question of why explore in the face of danger. What is it about that act of exploration that makes it so appealing? And so important? And so much of an acceptance of human desire to want to understand and know that which we don't? Within the NASA family, we have great respect for all who put their lives on the line: Not just to seek thrills, but rather to gain knowledge, wisdom, and experience that will benefit all humanity. All of those assembled here have a unique and exciting story to tell about what drives us to explore, whether engaged in it directly or specifically involved in supporting its effort, all with the same objective. All of those stories, I have no doubt, if last night was any indication, we'll hear most of them, if not all. Also, we'll learn from the experiences of how folks work to minimize and mitigate the risk and learn where the fine line is between responsible and imprudent risk. Where is the differentiating line that marks that? Even when we've applied a careful calculus to these kinds of circumstances, in many cases and in many circumstances, the events of nature will provide a set of risks that must be responded to, and challenges independent of whatever control we might have over it. In some cases, it's next to none.

Our colleagues at the Kennedy Space Center right now after, now, their second hurricane in the span of a few weeks, are dealing with just that set of challenges; of risks that they are working through. And

because of their extraordinary diligence, having survived two unbelievable events of what are natural disasters in their own right, nonetheless have survived those experiences with all the shuttle orbiters intact, all the space station hardware in great condition, and no loss of life, no injuries. It's an extraordinary testimonial to the amazing diligence of Jim Kennedy, the director of the Kennedy Space Center, and the Kennedy team have done to ride out this set of natural disasters. I was down at the Kennedy Space Center with Bill Reedy a week ago and the poetic kind of discrimination with which nature provides us a set of challenges on risk were evident to us. I got an opportunity to see the vertical assembly building, which was the dominant structure on the skyline of the Kennedy Space Center that all recognize, and you could literally tell – literally -- which way the wind was blowing when Hurricane Frances blew in. Three of the four sides of the vertical assembly building were relatively good shape. One side of it, better than a thousand panels off the side of it were blown off. Several of those panels have also departed as a result of the latest hurricane that just came through. As a consequence of striking some of the buildings of the area, ripping off big chunks of roof, all manner of consequence and destruction that occurred as a result of that, all of which mitigated in some way, shape or form. And yet, the irony is that right next to the thermal protection building, where a portion of the roof blew off next to the vertical assembly building, was the irony of a pressure-treated lumber gazebo without a scratch. Nary a hint.

Nature discriminates very profoundly, and why it does, we don't understand. It certainly is a case that reminds all of us, even in such a

simple, little example as that one, that despite our best efforts, there are unknowns that will always rise up in any of these circumstances, in any case of exploration, to be sure, for which the only defense we have is diligence and the hope that we have mitigated against it as well as we can.

We're living in an era of great potential, one in which the exploration of the solar system and of the Earth's most extreme environments will boost the opportunities we have to become a smarter, safer, healthier, and more intelligent world. Certainly we're more informed about the neighborhood we live in, a neighborhood defined as this little, bitty solar system around this little, puny star, in a gigantic galaxy that is part of a massive universe. We are just on the cusp of understanding what our role is in that broader case, and it's only been in the last forty years that we have come to understand it in ways that are really quite profound. I'm confident that if we do this right, we'll be amazed by the rapid pace of progress our future exploration activities will bring about.

But we also know from history about the consequences of forsaking exploration when we evaluate and determine as individuals, groups of people, or collections of people and nations, that when we elect to forsake those exploration opportunities, it has consequences. In the fifteenth century, China had the opportunity to be the world's foremost maritime power and indeed, possessed that capability. The Chinese ruling class, nonetheless, decided that the sponsorship of the fleet was an indulgence. History in the course of that several centuries thereafter

are certainly a part of how the rich culture was formed and those choices that were made.

Certainly, we have the same opportunity in this country to make similar kinds of choices. When in the 1875 time frame the director of the Patent Office advised the President of the United States that it was a good time to close down the Patent Office because everything that needed to be invented had been. Had that wizened sage's advice been accepted by the President of the United States at the time, imagine where we'd be! Yet nonetheless, that was based on a calculated understanding of what folks thought was the potential of understanding. It wasn't reached whimsically, it was reached by those who really believed that we had already incurred an enormous evolution of change of technology, revolution in industrial affairs, and as a consequence, we were on a roll, and anything beyond that was going to be, simply, derivatives of the same. In the last century, we've seen an explosion of growth in the exploration of seas, remote regions of the Earth, and, indeed, space. All of which, arguably, might not have happened had that original set of recommendations been followed.

It is no accident that NASA's founding occurred some forty-six years ago this very week, in the same decade that Edmund Hillary and Tenzing Norgay first stood on our planet's highest peak and that Jacques Cousteau used the good ship Calypso to conduct his epic voyages of undersea exploration. As explorers, we all share that common bond. We dare to dream grand dreams, and in the process of

doing so assume tremendous risks -- some of it beyond the scope of our knowledge of the time in which they're assumed and accepted. We do so for what we know to be great purposes. We also, in the depths of those tragedies that occur, grieve when our brethren are lost in the cause of exploration. And indeed, this conference -- this symposium -- and the impetus for it was brought about in debates that occurred in the aftermath of the Columbia tragedy.

It was a tough report that the Columbia Accident Investigation Board released. It told us an awful lot about the technical problems that led to it, the engineering challenges that we did not understand and as a result paid an ultimate price with nine people, as Scott points out -- the seven members of the crew as well as two engaged in the recovery of Columbia after its destruction. We learned that that is a horrendous price -- again.

But it also brought about, as a consequence of debate, a discussion about how we participated and we led, we contributed, to that tragedy - - and a broader public debate about a renewal of the purpose of why we explore. And that debate has gone on in a broader public policy sense and certainly an understanding that was best described and best captured by the video that we began this conference with. This is the direction we're about. The year after that horrific tragedy, it nonetheless was an impetus for motivating a debate by answering the fundamental question of why we explore and for what purpose and to what gain and what that strategy and path ahead should be in pursuit of that human desire to understand.

Well, in the process it also raised a series of questions that we have the opportunity here, I think over this couple of days, to at least debate how they should be framed. We have, I think, as a consequence of the strategies the President has levied and the direction that he has provided to us at NASA for exploration, a better understanding now of exactly how to pursue those exploration goals. And it's laid out in a series of objectives and programs to achieve it and a stepping stone approach and a whole range of different ways in which we're going to achieve that task.

But communicating the why of this venture has just begun as a public debate, just in the last few months. Again, this is an extraordinary moment in time in which there has been a renewal of that spirit of discovery, of exploration. In part it must then engage in this broader public dialogue because we are, after all, a public organization for which there is trust that is rendered to us by the public for our acceptance of these kinds of challenges. And that trust is fragile, and at each of the intervals in which we have seen either those great triumphs or great tragedies it has been tested.

So understanding the why and being able to communicate that in a way that's effective -- of why we accept the risks and what we have done to effectively demonstrate that we understand what those risks are and have mitigated them as much as we believe is feasible or to the extent that we've accepted them, that we understand why we've accepted those risks -- is part of what this discussion is all about.

So really communicating the why is part of what this venture in this couple of days is about here. And while participating in the panel discussions I would ask that each of us pose the following kinds of questions: how do we integrate the risk calculation with the benefits to be derived? What's the return? How do we communicate that as well? Because it's apparent when tragedies occur what the depth of the risk was that was accepted and then therefore not responded to effectively. But understanding what the benefits were to be derived sometimes gets lost in the translation, so how do we integrate that better? And that's on a personal as well as a societal level. There are any number of colleagues here and those who've elected and chosen to participate in this venture who can articulate this on a personal level. But also how we translate that in a broader societal context I think is very important, why we've accepted those risks for what potential gain.

Also ask the question: how do we regularly remind ourselves of the risk and is that really important? Is it something we really need to focus on and to what level of depth and degree? Certainly being accepting of it or dismissive of it is not one of the options, but what is the appropriate balance? What's the point at which we become I think [unintelligible] knowledgeable and witting of what that risk is for what gain, but at what stage do we declare that is either far and excessive of what is potentially the benefit or for which that is an accepted risk for which we have worked our way through rationally and logically?

Also pose the question: how do we avoid complacency? It is human nature, it is part of our human makeup -- all of us -- that that which we see repetitively we begin to accept as normal. If you've never seen it before it suddenly becomes a remarkable circumstance, something which you respond to because you've never seen it before. And yet it may be far less significant than that which you see every single day as risk, yet because we see it so regularly we accept it. What is it about -- a chat I had with a couple of folks last night -- our view as a culture, as a society, of why it is understood that there is a risk attendant to driving an automobile, flying in a commercial airplane? These are things we take and understand as being part of that, either intuitively or intellectually, and have recognized that despite the fact that lots and lots of folks every single year die in horrific automobile accidents we accept that as humans because of the transportation and opportunities it provides -- the facilitation of discourse and communication between and among each other and the means to get from here to there. What is it about it that makes that an accepted level of risk? And yet in the act of exploration when the tragedies occur what is it about that that makes that either intolerable or why we question it? And again, the root of this may yet well be, I believe, to be grounded in how understood the benefit is that we think we gained as a consequence of the activity and the effect of accepting that risk.

Also, for those who are involved in wider-ranging sets of exploration opportunities, what is it about the risk that you accept that's different than that which NASA accepts in what we do and, of course, that

which is similar? How do you parse between both and determine what we can learn from this about that?

And I guess the ultimate question: what can we learn from each other by how to frame this question differently and, indeed, communicate it more effectively as an opportunity for great gain? Over the course of human history every major advance has occurred because of the temerity on the part of human beings to want to understand and to explore and to do something that has not been tried or has been tried so irregularly as to have no pattern to it. If you think of every major advance in the course of our existence it has been attributed to that attribute, that characteristic of us as human beings.

This week we have an opportunity, I think, to learn from each other's experience so that we can forward boldly into the unknown, informed by a responsible sense of how we communicate that in a way that conveys the reasons why it is or is not accepted as an appropriate level of risk. We are resolved at NASA to better communicate with the public about why it's necessary to take those risks or why it is inherent in the way we as human beings conduct our lives that would give meaning as well as purpose to this larger exploration agenda -- and knowing at its core that it's best summarized by a comment President Bush made in Houston just days after the Columbia tragedy, that this cause of exploration is not an option we choose. It's a desire written in the human heart. And when we can confront that even on both ends of the equation -- in its great triumph as well as in its depths of tragedy -- and we're reminded why we're driven to this, what is it we can do

responsibly as public servants, for those of us at NASA, and I think as the broader range of community represented here of explorers to communicate that more effectively?

I thank you all for your participation and I look forward to sharing with all of you the spirit of exploration and discovery that I think is certainly evident in this group by so many people who have elected to spend their time to engage in these important questions. The manner in which we have, hopefully, framed this over these couple of days will bring those kinds of questions to bear in ways that as we move forward in this next step of exploration, to return to flight, to complete the International Space Station, to develop through Project Constellation an opportunity to explore beyond Earth's orbit, all of this may be the beginnings again of an opportunity to frame that discussion and debate, not only among ourselves, but in the broader public in ways that highlight those purposes of exploration and why we engage in the risks and accept them, knowingly, for the purposes for which NASA began.

I thank you all for your willingness to participate in that discussion. And if last night's discussion and this morning's debate before we began is any indication, it promises to be a very exciting opportunity. I thank you all very much for coming. I appreciate it.