

# **Space in Transition**

**Remarks**

**at the**

**DC-X/XA Reunion**

**Space Transportation for the 21<sup>st</sup> Century**

**Passing the Torch**

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My formal remarks today will be brief, because I think our time is better spent visiting with each other rather than listening to speeches. Besides, the most appropriate remarks for today have already been made – by Shakespeare in his Saint Crispin’s Day speech, from the play *Henry V*.

Before the Battle of Agincourt against the heavily-armed French army, when Henry’s generals were behind enemy lines, with their supply lines cut and morale low, Henry stands before his men on the morning of the battle and delivers the most rousing speech in the Shakespeare canon:

“This day is call'd the feast of Crispian.  
He that outlives this day, and comes safe home,  
Will stand a tip-toe when this day is nam'd,  
And rouse him at the name of Crispian.  
He that shall live this day, and see old age,

Will yearly on the vigil feast his neighbours,  
And say 'To-morrow is Saint Crispian.'  
Then will he strip his sleeve and show his scars,  
And say 'These wounds I had on Crispian's day.'  
Old men forget; yet all shall be forgot,  
But he'll remember, with advantages,  
What feats he did that day. Then shall our names,  
Familiar in his mouth as household words-  
Harry the King, Bedford and Exeter,  
Warwick and Talbot, Salisbury and Gloucester-  
Be in their flowing cups freshly rememb'red.  
This story shall the good man teach his son;  
And Crispin Crispian shall ne'er go by,  
From this day to the ending of the world,  
But we in it shall be remembered-  
We few, we happy few, we band of brothers;  
For he to-day that sheds his blood with me  
Shall be my brother; be he ne'er so vile,  
This day shall gentle his condition;  
And gentlemen in England now-a-bed  
Shall think themselves accurs'd they were not here,  
And hold their manhoods cheap whiles any speaks  
That fought with us upon Saint Crispin's day.'"

This is one of those days when we feast our neighbors, strip our sleeves, and show our scars – figuratively speaking, of course. I don't want anyone here getting carried away.

Following the logic of Henry V, many of you in this room are my brothers, and we've earned some scar tissue together. We display it today with some measure of pride and fond memories, not only for our *esprit de corps*, but for having accomplished something new, worthwhile and, we hope, long-lasting. We clink our glasses knowing that we maintained our convictions, through thick and

thin, against seemingly insurmountable odds, when we felt sometimes that we were operating behind enemy lines, like Henry V's men.

Most of us are engineers, and we like to talk about the machines we are building and the intricacies of how they work. But we all know that it is really people who make the difference, people who surmount the difficulties of spaceflight every day on the shop floor, in the clean room, and out at the launch pad. It is people who make the hard work of aerospace engineering “indistinguishable from magic”, in the late Arthur C. Clarke's apt phrase.

Wernher von Braun was one of the most technically astute and charismatic leaders in NASA's fifty year history. A few months before he died, he made an observation about what held his team together: “While the members of this magnificent team changed with time, the fundamental characteristics of the team itself never did. It always has been characterized by enthusiasm, professionalism, skill, imagination, a sense of perfectionism, and dedication to rocketry and space exploration. How can the story of such people and of the exciting programs with which they are involved ever end?”

Exactly so. The “band of brothers” who built the *DC-X* captured the same lightning that von Braun instilled in his team when they built the *Saturn V* rocket a generation earlier.

Many of you know and share my views regarding the strategic mistake our nation made in abandoning that *Saturn V*, and the ability it afforded our nation to propel astronauts, including our late companion Pete Conrad, to the moon. I regret that in the troubled times of the Nixon Administration and the Vietnam War, our nation abandoned its interest and investment in the Apollo program, throwing away tools for space exploration which NASA has only just begun to rebuild.

Newt Gingrich attracted some controversy recently – how unusual for Newt – when he observed in a Viewpoint article in *Aviation Week*, “[The Apollo years] was a time of boundless optimism and great excitement. Then it all fell apart. In the ensuing years, funds began to be cut just as more administrative red tape began to emerge... In just a few decades, NASA managed to accomplish something which any of us living during the late 1950s and ‘60s would have thought to be impossible: They made space boring. NASA bureaucratized adventure.”

To a certain extent, I can agree with Newt. While today’s space program is the antithesis of “boring” for those of us who are in the middle of it, it clearly does not convey to the public the sense of outward-focused excitement of the Mercury, Gemini, and Apollo years. But I’m going to take specific exception to the idea that this is NASA’s fault. Whatever our faults may be, “NASA” did not make it “boring”, nor did we “bureaucratize adventure”. Budget cuts at NASA began in 1966, and agency managers responded, as they must, by shrinking or eliminating

plans for the future. When Apollo 20 was cancelled a few weeks after the Apollo 11 landing, followed by Apollo 18 and 19 some months later, the space program as we knew it in the 1960s was over, finished, and done. It didn't matter what NASA did, or didn't do.

If the abandonment of the capability our nation purchased at such great cost during the Apollo years was a mistake of strategic proportions, and I believe it was, it was a policy mistake. NASA, as the implementing agency simply carries out policy within the resources provided. We don't make it. The termination of the Apollo program, the failure to sustain America's journey beyond low-Earth orbit, and the loss of the future we could have had, was a policy decision perpetrated by the Nixon Administration and ratified by the Congress of that time, essentially without public debate.

But while I do not consider NASA to be the entity responsible for that decision, I do agree with the core of Newt's observation. For the lack of a guiding vision as to why space exploration was more important than funneling a few extra billion dollars into the Vietnam War, policymakers of two generations ago gave away the future. Unfortunately, it sometimes takes a crisis like the tragedy of the *Columbia* accident for our nation's leadership, and NASA, to grasp the damning truth of Admiral Hal Gehman's observation: "The U.S. civilian space effort has moved forward for more than thirty years without a guiding vision." This failure

in leadership spanned multiple Administrations, Congresses, and NASA Administrators.

The *Columbia* Accident Investigation Board also noted the failures in developing the National Aerospace Plane, the X-33, X-38, or any replacement for the aging Space Shuttle during the 1990s with the observation, “previous attempts to develop a replacement vehicle for the aging Shuttle represent a failure of national leadership.” They then recommended that, “the country should plan future space transportation capabilities without making them dependent on technological breakthroughs.” And again, “The Board notes that this approach can only be successful: if it is sustained over the decade; if by the time a decision to develop a new vehicle is made there is a clearer idea of how the new space transportation system fits into the nation’s overall plans for space; and if the U.S. government is willing at the time a development decision is made to commit the substantial resources required to implement it.” And they concluded, “Continued U.S. leadership in space is an important national objective. That leadership depends on a willingness to pay the costs of achieving it.”

These findings have guided the development of the *Constellation* architecture. Unfortunately, some critics – perhaps even some of you in this room – have called for us to throw away these plans, claiming that other ideas offer faster, cheaper, better access to the Space Station, Moon, and Mars. In this vein, I

hear that NASA is “stifling dissent”. If so, we must be doing an extremely poor job, as I have not noticed any shortage of it. But so far, on the rare occasions when data is offered to support contrarian opinions, I have found it to ignore engineering reality, funding constraints, or the law of the land.

I am not putting my thumb on the scales. I am always looking for better ways to solve a problem. We have – I have – explained quite carefully why our new spaceflight architecture looks the way it does. We have the numbers to back it up. If you have a better idea that doesn’t conveniently ignore one of our constraints, we’ll listen. But saying that it is a better idea doesn’t make it so.

Yes, I wish NASA could invest more into cutting-edge technology development, or dedicate even more than the \$500 million already devoted to the development of COTS, or fund large prizes to the Moon and Mars. I really, really do. But the fact remains that NASA simply does not have the funding to do everything everyone wishes us to do. As I say, at NASA we execute policy, we don’t make it. In fact, we are fortunate when those who do make the nation’s space policy ask what it is that we at NASA think should be done. But when asked, we have endeavored in our budget recommendations to balance carefully the many competing priorities for the funding provided to the agency.

Now, speaking bluntly, it has been my experience that the many advocates for spending NASA money differently have a vested interest in the outcome, or

lack an appreciation of the dangers and difficulties of spacecraft engineering, let alone the economics of the space business with its upfront investment requirements.

I am one of Burt Rutan's biggest fans. Period. It is difficult to be too lavish in praising Burt and his team for their many achievements, including winning the \$10 million *Ansari X Prize* in 2004 with the *SpaceShipOne* suborbital flights. But it is equally difficult for me to extrapolate this appreciation to the belief that the best way to get the first team of astronauts to Mars is to establish a \$20 billion prize for the feat, while doing away with NASA as an organization, as some have recommended. It is an intriguing thought experiment, but the engineering reality is that the energy expended on a suborbital flight is about 2% of what is needed just to get into low Earth orbit, let alone carry out a mission to the Moon, Mars, and other planets. This matters.

No one has a greater appreciation than I do for the efficacy with which small, focused teams, freed of the more onerous requirements of government program management – procurement restrictions, detailed reporting, Congressional oversight, and “help” from the OMB – can accomplish their goals. I have had the enormous privilege of having a leadership role in several such campaigns, and I can tell you that there is, for me, no greater satisfaction. I know I don't have to explain this to you who helped to bring about the *DC-X*. But the goals which such

teams can reach must be carefully chosen to lie within the art of the possible, to match what small teams can reasonably do. True, such goals evolve with time. Today, a small private team can accomplish a suborbital human spaceflight, a feat that it once took the resources of a government to achieve. I am personally convinced that manned orbital flight is within reach, just barely, of private enterprise today. I have recommended that a sizeable piece of NASA's budget be set aside to reward those who demonstrate cargo delivery to the International Space Station, the first step in what may ultimately result in commercial manned orbital transportation. So far, that recommendation has been supported by the White House and Congress. But I do not believe that manned flights to the Moon or Mars are within reach of private enterprise for at least the next few generations.

Many people in Washington are advocating "change", a call we have come to expect at this point in every electoral cycle. Well, change has occurred in the nation's civil space policy, and at NASA, and it continues. These changes, driven by tragedy rather than politics, were in my opinion vitally necessary. But now what is needed in space policy, and at NASA, is stability. NASA's plans for *Constellation* must offer a constancy of purpose, must maintain the momentum of hard work going into building *Orion* and *Ares* as well as COTS. As we retire the Space Shuttle, we must transition our workforce to the task of developing the heavy-lift *Ares V* rocket and *Altair* lunar lander. If we flag or fail, we will be

abandoning human spaceflight beyond low Earth orbit for yet another generation, repeating the seminal mistake of U.S. space policy.

That said, I believe that real change is occurring within NASA's scientific and engineering culture, as we adapt to the requirements of new tasks. We are developing new human spaceflight systems for the first time in more than a generation, and as we do so, we must strike the right balance between listening intently to good ideas from the past, while still incorporating the lessons of current practice. As government managers and stewards of public funds, we also have the obligation to disagree respectfully with bad ideas. When we as engineers establish a design approach, we must be ready, willing, and able to justify it, and we must be ready to answer criticisms regarding cost, schedule, or performance. We need people with critical thinking skills, great system engineers, people who see the whole board and are willing to pull up their sleeves and earn a few scars of their own.

As I learned earlier, during my experience with the Space Exploration Initiative of the early '90s, when I had Rick Gilbrech's job, those of us in the space business need to do a better job of curtailing petty bureaucratic infighting. Today, NASA's Center and Mission directors are judged not only in terms of their own performance, but also for how effectively they work with other members of the NASA management team. It is not easy, and it never was. I am frequently

reminded of the James Webb's assessment of management at NASA: "The process of management became that of fusing at many levels a large number of forces, some countervailing, into a cohesive but essentially unstable whole and keeping it in a desired direction." I have long admired Webb; he certainly had it right with this observation.

The space business operates on the frontier, and frontiers are not for the faint of heart, timid souls, or weak spirits. In achieving any measure of success in this business, you will also acquire some scars. As I look around the room here today, and around NASA, my hope is that not only are we building rockets to carry Americans back to the Moon, but that we are also reigniting a passion for space exploration among ourselves, our nation, and the rest of the world, while we write the next chapter in the story of space exploration.

"This story shall the good man teach his son  
And Crispin Crispian shall ne'er go by,  
From this day to the ending of the world,  
But we in it shall be remembered"

Thank you.