Interoperability and Space Exploration Seminar
September 7, 2006 Harrison Freer, NGIS remarks

First, thank you to CSIS, AAS and GMU for addressing this important subject. Thanks for the opportunity to share some ideas and more importantly, listen to many others who have shared their thoughts and passions. I would like to start by saying whatever Jeff Volosin says this afternoon you should think to cut and paste as my first main point. Second, I would like to talk about interoperability in the digital age as fundamentally different than how we commonly think about it as an industrial age challenge. Finally, I would like to exhort, that while we will not get it perfect every time, this is OK and is in my view that this is preferable to spending inordinate effort and money with paralysis of analysis.

I would like to make several comments about the points made yesterday. First, I think the container example as to a breakthrough technology is a stretch with regard to global transportation. I would put it at about version 3.111 of the improvements to global transportation behind the steam engine, metal ships, supertankers and certainly way behind the airplane. I would submit the pallet adopted in 1948 Berlin airlift is more important than the container if one has the right metrics namely value of goods transported. Further, I believe we can learn far more about global speed and consistency from the FedEx and UPS freight models than the surface shipping industry because when one thinks in single or double digit knots and days and weeks instead of high velocity and seconds and minutes one could easily learn the wrong lessons. This is perhaps a good time to challenge some conventional thinking about transportation systems or architectures. I maintain that being early is bad, being on time is good and being late is very bad. Think about whether you agree with this and we can get around to it again in the question session if there is an interest. But is the simplistic way I try to articulate the value of synchronization, which is important.

I also was intrigued by the discussion about at what level should interoperability should occur and how many different standards are enough or too many. I think trying to get to

one standard is way too tough and not constructive because of all the monopolistic inefficiencies which tend toward this approach. I think ADA mentioned yesterday is a good example. I think if you get more than 3 standards all but the top three will quickly atrophy and there will be at most 3 legitimate standards. So interoperability can be viewed as having at least 2 choices with which to interface with. It doesn't really matter what they are so much as one has a choice which drives competition and efficiencies.

I was also fascinated that nobody brought up war as a technology engine which has implications to interoperability in the space business. Certainly war played a huge role in the rapid evolution of aircraft in the 20th century and the cold war was what got us to space in the first place. And many of the innovations applicable to space flight improvements have been first applied to the conduct of military and intelligence missions. This includes huge investments in rockets, command and control, communications, weather, navigation satellites. It is interesting to note the Chinese space program is completely contained in the military.

I am happy to discuss further any of these observations during the Q&A, but let me return to the points I prepared prior to yesterday's exchange.

At one level interoperability and the flexibility it provides is a shared goal and at another it is a customer call I believe there is short term overhead and cost associated with this, and as Dr. Hamre rightly noted yesterday the public cash situation is quite grim. From an industry standpoint if we can have reuse which lowers cost and reduces risk in an offering these will likely be the drivers. And, unless there is a perceived or actual incentive for interoperability it will be a challenge to get to the front burner of the trade space. We are customer centered and want to be aligned with the customer on this topic and all the others on achieving the Vision for Space Exploration. If NASA wants us to build a universally interoperable Space Exploration set of products and services, we will work hard to win some of this business. We will also do our best to bring to light the unintended consequences of such desires and decision. This could be looked at as a dimension of requirements creep and while NASA currently appears to be disciplined in

their efforts to quote Einstein or Horowitz, whomever you prefer "to keep it as simple as possible and no simpler," large scale NASA procurements have been known to suffer on occasion from this challenge. There is only a limited amount of money and time, so there will always be tough calls to balance custom design and common design. The space business has been focused on tight power and weight budgets and performance standards for a hostile, unforgiving environment where repair capability is very limited, so the incentive to squeeze out the last bit of capability has predominated. We should bring the customer a comprehensive set pros and cons for discussion of the trade space for such subjects, but if they want, for example, to specify the Architecture in English units we will comply. While I was personally disappointed in the English units call on CEV and believe it is short sighted in some ways, this was a customer call. At a more basic level, I am hopeful we collectively will be strictly disciplined about making sure we have clear mechanisms to insure the safeguards are in place to note, caution and warn appropriately when there is a potential for confusion. At another level as citizens including taxpayers and voters, we want NASA to succeed and will work hard to bring good ideas to the table including interoperability in the design and CONOPs for the systems we may be fortunate enough to win a contract to build and fly.

I think the Commercial Orbital Transportation Services undertaking holds considerable promise to provide some healthy competition, which if properly channeled could as a by-product improve interoperability. Here I am reminded of Adam Smith's concept of the hidden hand of the market which tends to drive efficiencies into the system as a whole even as each individual concentrates on his or her economic self interest. To date human space flight has been principally an instrument of national prestige and politics with interoperability across systems only as an afterthought. The market, which invented money to facilitate trade can go a long way to enhancing interoperability and COTS holds some hope that we can make progress in this area.

Now please look at the person next to you and nudge him or her if they are using their blackberry because they are likely not taking notes on what I am talking about. Rather, they are more likely communicating virtually, either across the room, perhaps trying to

get a date or with the same goal with someone across town, across the country or maybe even around the world. Let me caveat this part of my remarks with the obvious observation that I am a stale, pale, male, and therefore an immigrant to the digital age. My working definition of the digital immigrant versus digital native break point is around 27 years old, give or take. However, when it comes to the topic of interoperability I like to paraphrase James Carville and shout "it's the software s_____," What I mean by this is once things are digitized, the journey toward interoperability is inherently easier. A one and a zero are easily translated at the design level if there is a driving interest to do so. This is a new way of thinking, but is, in my view central to the topic at hand. There are some choices to be made about whether the native design language is Parametric Technology's "Pro E" or Dassault's CATIA but in the digital age, reliable translations are achievable and de facto standards will emerge. We will also use software based tools and systems which are becoming more intuitive and distributed to manage almost every aspect of projects. These systems become integrated into the business in insidious ways so that trade offs in training, recapitalization and cost all play a role in these choices. Here I favor international best practice standards as guidelines for making such decisions. Some call them consensus standards, whether it be IEEE, ISO, PMI, I like to think of them as available best practices and one better have a darn good reason for deviating from them and recognize the lack of interoperability as a risk incurred in doing so. From a hardware standpoint if there are multiple hatch diameters, pick one and hedge your bets. Your design tool will assist if you are unlucky. Otherwise you may become obsolete. But the trip to the moon this time will have a much higher percentage of the money spent on software than the last time.

This gets me to my final point. I am a huge Mike Griffin fan. I think the world, America, and NASA are truly blessed to have Mike leading the space efforts to return humans to the moon. People will argue for more international cooperation and others will argue for less dependency or different architectures and visions. Mike has thought about this extensively and is in fact traveling to China, Japan and Russia soon on an historic visit which I hope will bear long term fruit for the entire world space community. I can think of no other leader alive today who I would rather follow in the important

venture of human exploration beyond Low Earth Orbit. I recently read a description of George Washington in David McCullough's book 1776 and it reminded me of Mike, stoic, introspective, not a gifted public speaker, but a life long learner. And the bottom line to Washington's greatness was persistence. This Space stuff is too important to give up on. While we live in a world fraught with unrest and turmoil, one of the great virtues of the human spirit is innovation and I am continually amazed by the diversity of ideas and ingenuity I see around me, driven by this spirit and powered by our democratic and market principals. I hope history is as kind to Mike Griffin as it has been to George Washington. He certainly had his share of difficulties, but didn't let them deter him from persevering. And so it should be with all of us as we strive to find ways to work together for an important pursuit.

Thank you for your attention and I look forward to your questions