U.S. Space Transportation Policy: Increased Military Role, Decreased International Cooperation, and Impacts to the Vision for Space Exploration

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Approximately one year after the release of the Vision for Space Exploration (VSE), a United States Presidential Directive established the U. S. Space Transportation Policy on January 6, 2005. The policy supersedes aspects of previous Presidential Decision Directives pertaining to National Security Council Policy, National Space Policy, Defense Space Sector Guidelines, Commercial Space Guidelines, and others. The new U. S. Space Transportation policy explicitly supports the VSE and has as its goal assuring access to space. The policy advances four major ideas: (1) encouraging commercial and private industry participation in space-related endeavors; (2) increasing the role of the military in the development of launch platforms and related technology; (3) limiting NASA's role in the development of launch platforms only to those that cannot be acquired through military or commercial venues; and (4) establishing appropriate legislative, regulatory, and licensing frameworks to facilitate commercial/private and military involvement. Despite increasing indications that the VSE will be international in its development and implementation, the role of international cooperation in access to space appears severely limited by the policy and legislation such as the International Traffic in Arms Regulation (ITAR) and the Iran Nonproliferation Act (INA). It could be argued that the U.S. Space Transportation Policy is built around two goals: maintain U.S. hegemony in space and maintain U.S. independence/autonomy in space. While the merits of these goals can (and will) continue to be debated, the consequences of implementation of Policy recommendations in the existing legal and regulatory framework may have the effect of increasing, rather than decreasing, existing barriers to international cooperation. This paper analyzes the U.S. Space Transportation policy as it impacts human and unmanned access to space as well as the international development of launch capabilities, the development of joint space programs, and the domestic and international implications of an increased militarization of space. A major thesis of the paper is that the Space Transportation policy in its current form will adversely impact the very program it is purported to support, i.e. the Vision for Space Exploration.

I. Increased Military Role

The Policy makes clear that the Department of Defense is responsible for management of the U. S. EELV program.[1] The Policy also strongly encourages NASA to utilize EELV in the civil space program, a circumstance with implications for the Vision for Space Exploration. Although the Policy provides for consultation among the NASA Administrator, the Secretary of Defense, and other agencies, the wording of the Policy gives the Department of Defense a significant voice in determinations regarding launch platforms as used in the civil space program, particularly as pertains to payloads and cargo.

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In the context of space exploration, the policy mandates that NASA and the Secretary of Defense cooperate to develop options for heavy lift beyond the capabilities of the existing EELVs. As with the recommended use of EELV as the baseline launch platform for payloads for national security, homeland security and civil purposes, options for Heavy Lift are also expected to "emphasize the potential for using derivatives of the Evolved Expendable Launch Vehicles to meet space exploration requirements."[2] The NASA Administrator is also expected to perform trades on the development and use of a Shuttle-derived system; however it is clear that whatever the decision about Heavy Lift, it will be a joint recommendation from NASA and the DoD and must address national security needs as well as space exploration needs. In effect, the Policy places DoD into the position of majority partner with NASA in decision-making regarding development of any launch platforms for space exploration.

With the exception of a new Heavy Lift Vehicle, the policy makes clear that NASA shall "engage in development activities only for those requirements that cannot be met by capabilities being used by the national security or commercial sectors".[3] NASA can argue that it has needs specific to civil human space flight that are exclusive to the agency, and therefore can proceed with development of any system or systems intended to address those functions. However, the Implementation Guidelines in the Policy make clear the government's intention to leverage the Evolved Expendable Launch Vehicle program however possible. For example, the Policy includes a mandate to the Secretary of Defense, the Director of Central Intelligence, and the NASA Administrator to carry out a long-term program evaluation by 2010, including recommendations for reallocation of EELV program funding away from the Department of Defense and, presumably, toward NASA as it adopts EELV. While these recommendations presumably are concerned primarily with the use of EELV for launching intermediate or larger payloads, the Guidelines also indicate that new launch systems or components derived from EELV can include human rating. Given the pressure on the DoD to justify the EELV program's rising costs and relatively low frequency of launches relative to the initial hopes for the program, one clear implication of the Policy is to increase pressure on NASA to utilize the EELV to support human space flight.

Leveraging existing capabilities into uses for which they were not originally designed can represent an efficient use of infrastructure that is all too often absent in the "stovepiped" government programs, where development is focused on the mission of a given organization rather than on national or international goals[4]. However, retaining control of the EELV program solely within the defense infrastructure while simultaneously directing the space agency to utilize EELV wherever possible removes from NASA the freedom to independently assess its own needs and develop solutions which may or may not include utilization of existing systems. Should NASA choose to utilize EELV for payloads or, eventually, for human rated flights, the intended or unintended consequences of the Policy appear to include placing NASA under the DoD with regard to mission planning and operations vis-à-vis launch capabilities.

Finally, the Policy builds on years of development, primarily within the Air Force, to "transform U.S. access to and use of space". In particular, the policy calls for the United States to demonstrate "an initial capability for operationally responsive access to and use of space to support national security requirements" by 2010.[5] *Operationally responsive* refers in part to the ability of the United States military to respond to threats to its space-based assets, at this time comprised primarily of satellites utilized for Command, Control, Communications, Computers, and Intelligence (C4I) systems as applied to joint and combined military operations at the national and unified command levels. Threat response for space-based assets necessarily includes the ability to target and "kill" automated or partially-automated vehicles or weapons targeting U.S. assets. It also refers to the ability to intercept ballistic missiles in flight by means of sophisticated targeting and guidance/navigational systems. While it is beyond the scope of this paper to discuss the tactical and policy implications of various military space operations, the U.S. intention to proceed with military transformation of and utilization of space is causing great concern in both domestic and international space communities.

II. Decreased International Cooperation

An omitted option for NASA is procurement of services and/or development of services available in the international arena. If the EELV system is selected for human space flight, as encouraged in the Policy, this option would significantly reduce the likelihood of international cooperation as the Secretary of Defense "shall maintain overall management responsibilities for the EELV program."[6] Indeed, NASA would end up with fewer options while the Department of Defense would have a significant voice in determinations regarding international involvement in the human access to space program.

Access to international capabilities "is permitted consistent with U.S. law and regulations, as well as nonproliferation, national security, and foreign policy goals and commitments and U. S. obligations …"[7] Additional wording makes clear that such use will not be allowed in cases where the result may be placement of a foreign component, technology or service on the *critical path*, i.e., where participation of a foreign government or other institution can drive cost, schedule, or risk of a program to a significant extent.

In his speech announcing the VSE, President George W. Bush invited international participation in the program. NASA has recently engaged in meetings aimed at discussing international roles, and U. S. industry has made its own decision in this regard; both industry teams currently competing for the CEV procurement have international team members (EADS is teamed with Lockheed Martin and Alenia Aerospaziale is teamed with Northup Grumman and Boeing). However, international cooperation is not addressed in the Policy except in the context of the constraints imposed by legal and regulatory frameworks, foreign policy, and national security. Rather than cooperation, this approach may be better characterized as directed participation. Many international partners currently engaged with NASA in the International Space Station program, as well as other nations with spacefaring capability or ambition, have expressed reservations regarding the nature of cooperation, as it may be defined by the United States.[8] In general, these concerns are focused upon the constraints placed upon exchange of information, both technical and programmatic, by ITAR, INA, and the highly dynamic nature of U.S.-International relations, as well as upon the absence of involvement in the early planning stages of the VSE. These concerns were succinctly, if bluntly, expressed by the Asahi Shimbun, Japan's most prominent newspaper, which stated that "any unilateral approach under which the United States calls the shots and other countries are supposed to follow its lead will not work".[9]

In a recent analysis of U.S. Space Policy, Abbey and Lane discuss the current situation with ISS as example of multinational interdependency[10]. Subsequent to the Columbia tragedy, the continued utilization – even the basic functioning – of the ISS has been dependent upon Russian contributions to the program. As this paper is written, NASA has completed a successful Return to Flight mission with Discovery but has again stood down the Shuttle program as a result of foam shedding events on the STS-114 flight. Russian commitment to support the ISS with Soyuz and Progress flights ends early in 2006, and payment to the Russians to continue support of the station is currently precluded by the INA (although efforts are underway to establish waivers enabling financial support to Russia for the specific purpose of supporting the ISS). Thus, the International Space Station program continues to be vulnerable to the participation of the two partners currently able to manage human and cargo missions to the outpost, only one of which is functional. Assuming that the Shuttle program does continue, only 3 people can occupy the station at a time, since the Soyuz also acts as a "lifeboat" for emergency situations necessitating temporary or permanent abandonment of the station by a resident crew. Abbey and Lane point out the dangerous inherent in being "completely dependent on any one nation's space program…when lives are at stake,"[11] and yet the Policy emphasizes the constraints and risks, rather than the benefits and necessities, of multilateral cooperation. The creation of a Space Transportation Policy that emphasizes military use of space and fails to address any of the complex technical or political issues currently facing the civil space program – particularly with respect to international partnerships – is at odds with the successful development and implementation of the VSE.

When it comes to international cooperation, the US has a mixed reputation in terms of reliability, funding cancellation, and early withdrawal. For example, the ISS program received severe critics all along, and survived a significant financial crisis. However, the ISS program is still alive. The international partners have heavily invested in it and for many years. If the program is cancelled, it will not only reinforce the US reliability issue but also jeopardize other nations' participation in future big projects. Not only the US should not forget their partners but they should involve them in any major decisions.

The space program is a leveraging tool for the U.S. foreign policy that is dominated by two main issues, both related to the war on terrorism: one is homeland security, the other the non proliferation of weapons of mass destruction[12]. Certainly, space cooperation carries a proliferation risk. Any development in the space transportation arena has to take into account the issues related to export control and non-proliferation, especially the Missile Technology Control Regime (MTCR). A voluntary arrangement among 33 countries, the Regime consists of a common export policy (MTCR Guidelines) applied to a common list (MTCR Annex) of controlled items. Originally

concerned only with nuclear capable delivery systems, the Guidelines were extended to cover delivery systems capable of delivering all weapons of mass destruction and restrict transfers of "missiles" (defined as rocket systems, including ballistic missiles, space launch vehicles and sounding rockets) and their related equipment and technology.

Despite this challenging situation, there are interesting and successful examples of cooperation[13]. Of course, the first one that comes in mind is Atlas V as it incorporates the Russian-made RD-180 engine, the Swiss-made fairing (the same than Ariane V), as well as the Spanish-made vehicle equipment bay and payload adaptors. Another example is the Delta IV with the RL-10B2 upper stage engine incorporating a French-made carbon-carbon nozzle. So, despite the non-proliferation and the national needs, the international cooperation has progressed at the industrial level, and this trend should be build upon for the exploration initiative.

III. Impacts to the Vision for Space Exploration

Consistent with the VSE, NASA plans to develop a Crew Exploration Vehicle (CEV) to replace the Space Shuttle as the primary means of assuring U.S. human-rated access to space. The launch solution for the CEV is likely to be either a human rated EELV or a modified Solid Rocket Booster (SRB) such as is currently used on the Space Shuttle, together with the addition of an upper stage. At present, the most likely avenue for EELV use is to support cargo shipments to the International Space Station; however this is not assured and discussion regarding the development of human-rated EELVs continues as of this writing. Previous analyses of the modifications necessary to human-rate EELVs suggest that the cost would be in the billions and would take several years. Given the insufficient budget allocated to execute the VSE to date, including the fact that implementing the VSE will already require significant reallocations of funds away from existing NASA programs[14], the cost and time burdens would be a major threat to implementing the VSE.Publication by AIAA

Another consequence of implementing the Policy together with the plan for the VSE as outlined by the President in January 2004 is a significantly reduced role for the United States in the operation and utilization of the ISS after 2010. The VSE specifies that the ISS will be completed and that the United States will launch a refocused research effort aimed at understanding the challenges to human health inherent in an interplanetary exploration effort, and on developing methods to overcome those challenges. Retirement of the Shuttle in 2010 removes a range of capabilities that are necessary to maintain and operate the station and to carry out this research agenda. Many of these capabilities are not otherwise available or are available in only limited ways, including boost, re-supply, and downmass or "cargo recovery".

Currently, Russian Progress vehicles provide limited re-supply as well as the station boost necessary to counteract the ever-present drag on the structure and maintain orbit. However, the capacity of the Russian vehicle is limited relative to the Shuttle, resulting in a reduction of crew size to two – the number that can now be maintained on the consumables ferried to station by the Progress. As a result of the reduced crew size, most of the available crew time is spent on maintenance and basic operational issues, leaving very little time for science and engineering research. Further, no vehicle other than the Shuttle can currently support cargo recovery, which is critical to both the operation of the ISS and to research performed there. Examples of recoverable cargo include equipment and orbital replacement unit (ORU) for evaluation, maintenance and refurbishment, crew support items such as medical samples and other equipment, and scientific payloads. With regard to research, an additional capability of the Shuttle is found in the onboard facilities for both "passive" and "active" payloads. Passive payloads are those that can be transferred and returned in a self-contained mode, while active payloads require additional support such as power and thermal control which his provided by interfacing the payload systems with systems aboard the Orbiter.

Finally, the Russian commitment to carry human passengers from Earth to the ISS and back ends in April of 2006. The Shuttle provides the only other method for astronauts and cosmonauts to access the ISS. The current Administrator of NASA has expressed his intention to accelerate the CEV in order to replace the shuttle's human transport capabilities as early as 2011. Every effort should be made to facilitate this acceleration. Emphasis on EELV utilization for this purpose will, as previously described, add cost and time to the CEV program and is thus not conducive to meeting the objectives of the VSE.

Overall, neither the VSE nor the Policy address how these near-term challenges will be met; however the VSE relies on the completion and utilization of the space station as a key building block for the entire program. While NASA and other agencies, as well as commercial entities, are developing carriers to address some of these concerns, there remains a significant gap in capabilities after the Shuttle retires which is unlikely to be met without modifications to either the Policy or the VSE.

IV. Policy Recommendations

A. Clarify the responsibility and funding issues relative to use of the EELV.

Should NASA choose to utilize the EELV, coordination with the DoD is certainly appropriate; however for the purposes of management, mission planning, and operation, the responsibility and budget for such missions should be retained and controlled by the space agency.

B. Re-evaluate the international cooperation considerations.

Ultimately, it is circumstance and the common need for space services that will move the United States (and other space nations) to seek expansion of the security and economic interests by open markets and greater cooperation. No one nation will have the political will to seek and fund space development alone. By decreasing international cooperation, the United States may get into a situation even more challenging than it was with the Shuttle grounded between February 2003 and August 2005. If the return to flight had been delayed further, the US would have had to rely on Soyuz (as it did, and apparently will continue to) for a longer period of time, assuming the INA-related issues are resolved. One view of the Policy is that the US is isolating itself from the rest of the world, while other nations reinforce their space cooperation and rethink their strategic alliances.

C. Make provisions to address the gap in US capabilities vis-à-vis ISS.

Policy provisions should be made to address the gap in U.S. capabilities which are developing as a result of funding shortfalls and development schedules vis-à-vis the International Space Station. Of course, policy that specifies the manner in which the gap might be shortened or eliminated is simply an unfunded mandate without sufficient budget; therefore consideration must be given to making additional monies available to NASA, or else to revising substantially the objectives of both the VSE and the Space Transportation Policy.

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