

1                   **Major General Howard “Mitch” J. Mitchell (USAF, Retired)**  
2                   **Testimony to the Committee on Commerce, Science and Transportation**  
3                   **and the Subcommittee on Strategic Forces of the Committee on Armed**  
4                   **Forces Joint Hearing**  
5                   **On “Options for Assuring Domestic Space Access”**  
6                   **July 16, 2014**

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8                   Co – chairs, thank you and good morning. Members of the committees, good  
9                   morning, and thanks for the opportunity to discuss the RD-180 Mitigation  
10                  Study that I recently chaired under a Terms of Reference signed by the  
11                  Assistant Secretary of the Air Force (Acquisition). I have provided the  
12                  Committees with a version of the briefing that has been previously released  
13                  to the Committees and the contractors that supported the study.

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15                  The Terms of References requested that the effects of the potential non-  
16                  availability of Russian built RD-180 be examined and that the worst case  
17                  scenario, as well as others, be presented along with near-term and far-term  
18                  recommendations for mitigation. The Study panel was also asked to look at  
19                  implications for other than DoD users, impacts to the industrial base, costs,  
20                  etc.

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22                  The major findings of the study fall in four categories; 1) a disruption of  
23                  RD-180 engines would have a significant impact on the United States’  
24                  ability to launch, DoD, Intelligence Community, NASA, NOAA and  
25                  Commercial satellites scheduled to launch on Atlas V through 2020; and that  
26                  neither Delta IV or New Entrants can mitigate the impact until 2017 and  
27                  beyond; 2) there are several upcoming events that bear monitoring as they  
28                  can provide indications of the Russian, and US, intents; 3) that the current  
29                  Air Force strategy for competition can be adversely affected should the Atlas  
30                  not be available for competition; and 4) that in the 2022-23 timeframe with  
31                  appropriate near term funding for technology maturation, the Nation could  
32                  have new launch capabilities based on Liquid Oxygen/Hydrocarbon engine  
33                  technology.

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35                  The Committees asked that I address the following topics:

- 36                  1) Discuss the government-wide implication of the various scenarios we  
37                  investigated.
- 38                  - The worst case scenario we examined was that the recent Atlas  
39                  V launch, May 22, 2014, would be the last RD-180 launch due  
40                  to Russian actions, Congressional actions, Court actions or a

41 catastrophic failure that the Russians would not assist in  
42 resolving. While it does not appear that any of the above is  
43 occurring, it is the worst case scenario.

- 44 i. The Government-wide implications of this scenario are 2  
45 – 3 year delays in satellite launches and several \$B in  
46 cost.
- 47 ii. A second implication is that the launch order of the  
48 satellites would need to be addressed in an inter-agency  
49 process and would affect the DoD, Intelligence  
50 Community, NASA, NOAA and Commercial missions.
- 51 iii. Third, the planned EELV competition would be adversely  
52 affected because the Atlas V would not be available, and  
53 the Delta IV production could not be ramped up fast  
54 enough to provide addition launch system to compete (all  
55 Delta IVs would be needed to recover from the launch  
56 delays).
- 57 - The second scenario we examined was that the RD-180 engines  
58 in stock would be allowed to fly out in the current order, but no  
59 additional RD-180s could be used.
  - 60 i. This scenario results in fewer launch delays for a shorter  
61 period, but is not the optimal use of RD-180 engines due  
62 to the fact that some Atlas V missions would be driven to  
63 fly on a Delta IV Heavy, which is a much more expensive  
64 alternative.
- 65 - The third scenario we examined was that the RD-180 engines in  
66 stock would be allowed to fly out in an optimum launch order  
67 but no additional RD-180s could be used.
  - 68 i. This scenario results in fewer launch delays for a shorter  
69 period, and is the optimal use of RD-180.
  - 70 ii. Additionally, the launch order of the satellites would  
71 need to be addressed in an inter-agency process and  
72 would affect the DoD, Intelligence Community, NASA,  
73 NOAA and Commercial missions.

## 74 2) Options for pursuing a domestic propulsion system.

- 75 - The Study team recommended that the Government invest in  
76 critical technologies needed to mature Liquid  
77 Oxygen/Hydrocarbon engines and make that technology  
78 available to industry.
  - 79 i. A decision on Engineering and Manufacturing  
80 Development would not need to be made until FY 17, but

81 funding would have to be laid in during the FY 16 POM  
82 development.

- 83 ii. Other options exist depending on the viability (i.e., does  
84 the business case close) of the Industrial Base – the Study  
85 did not have time to delve into an Acquisition Strategy,  
86 but did acknowledge that public-private partnership  
87 should be pursued.

88 3) Overview of potential commercial partners for launch system  
89 development.

- 90 - We were briefed by all the contractors in the engine and launch  
91 system business and feel that a healthy environment would exist  
92 for competition. It was not clear how much Government  
93 funding and/or oversight would be necessary.  
94 - We did provide a worst case estimate of how much the  
95 development of a totally new launch system would cost, but if  
96 the program was tailored after the original Evolved Expendable  
97 Launch Vehicle program the costs could be substantially less.  
98 However, we did not have time to investigate this further than  
99 the worst case.

100 4) Discuss any other relevant issues.

- 101 - The only other issue I would like to briefly discuss is that the  
102 development of a Liquid Hydrogen/Hydrocarbon engine is a  
103 National decision to reverse a decision we made when the  
104 Government agreed to allow the RD-180 engine to be used on  
105 the Atlas V.
- 106 i. The Government essentially decided to outsource large (1  
107 million pounds of thrust at altitude) Liquid  
108 Oxygen/Kerosene engine procurement and significantly  
109 scale back US technology investment.
- 110 ii. Having an entire suite of propulsion options (Solid  
111 Rocket Motors, Liquid Oxygen/Liquid Hydrogen, Liquid  
112 Hydrogen/Hydrocarbon) for future launch vehicle  
113 development available allows the designers to optimize  
114 the launch system design for the mission requirements.  
115 The missions that the EELV is designed for are very  
116 different than the mission requirements that the Space  
117 Launch System (SLS) is being designed to meet.