

**SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION:
QUESTIONS FOR THE RECORD**

**HEARING ON
NASA AT A CROSSROADS: REASSERTING AMERICAN LEADERSHIP IN SPACE EXPLORATION
Wednesday, July 13, 2016**

**Questions for Mr. Michael Gold, Vice President of Washington Operations and Business
Development, Space Systems Loral**

From Senator Rubio

Question 1. Kennedy Space Center and the state of Florida is the world's space capital with the largest concentration of aerospace launch providers and suppliers. We've already seen Apollo, Shuttle, and ISS cargo launches from there and soon both Commercial Crew and SLS/Orion will be launching. Could you discuss what this means for the future of Florida's Space Coast, and what you foresee happening in the State in the next few years?

Response to Question 1.

I believe that the future is extraordinarily bright for Florida's Space Coast. Due in no small part to the vision and leadership demonstrated by NASA Kennedy Space Center leadership and personnel such as Robert Cabana, Amy Houts-Gilfriche, and Doug Gruendel, as well as the tireless efforts of Frank DiBello and his staff at Space Florida, the sunshine state has become a hub for commercial space activity. SpaceX's operations and footprint continues to grow on Florida's Space Coast and new additions such as Blue Origin and Moon Express have added even greater vitality and potential to a region that is already synonymous with space exploration.

However, the renaissance that Florida's Space Coast is experiencing could be ephemeral if the United States Government ("USG") does not take decisive action to ensure that the fundamental underpinnings of public and private sector launch activities remain strong. Specifically, the United States must not abandon human spaceflight in low Earth orbit ("LEO"). Although NASA and the private sector should continue to leverage the benefits of the International Space Station ("ISS") for as long as possible, the ISS era will soon come to an end. Even with an additional extension for the ISS beyond 2024, work must begin immediately to develop a commercial replacement. America is currently dependent on Russia for launching astronauts, and if NASA and the private sector don't address this issue with alacrity, soon after the U.S. regains its ability to send its own astronauts to orbit, the only destination for those astronauts to travel to could be a Chinese space station. Although international cooperation is commendable, international dependence is deplorable, and policymakers must take action to avoid repeating the same mistakes that were made with crew transportation.

Without an American destination in LEO for astronauts, the growing demand for crew and cargo launches from Florida's Space Coast could quickly atrophy. Moreover, as demonstrated by SpaceX, there is a synergistic relationship between the development of human spaceflight transportation systems and the ability of domestic companies to successfully compete for global commercial space launch opportunities.

Beyond the need to continue to support human spaceflight, the USG must take expeditious action to bolster domestic satellite manufacturers. If the U.S. falls behind other nations, particularly China, in next-generation satellite technologies such as satellite servicing, optical communications, and high throughput satellites, a great deal of launch activity could shift back overseas.

Moreover, Congress must continue to aggressively support the development and launch of the SLS. The heavy-lift capacity provided by the SLS is critical to implementing robust beyond LEO human spaceflight exploration missions. Other nations are striving to develop heavy-lift capabilities and the U.S. cannot fall behind its global competitors in this critical arena.

If these public and private sector activities receive sufficient support from NASA and the USG generally, the future of Florida's Space Coast will remain bright. However, international competition remains fierce and neither Florida nor the country as a whole can afford to rest on its laurels.

Question 2. During the birth of the Apollo program, the United States, under the leadership from President John F. Kennedy, was determined to beat the Soviets to the moon. Is the United States still in a position to remain competitive and challenge the likes of other global powers?

The U.S. is still in a position to challenge other global powers but the nation's ability to be successful remains in question. As described previously, the competition in the commercial satellite marketplace is fierce. Rival satellite manufacturing companies in Europe and China receive direct funding and subsidies from their national governments not just to conduct scientific or military missions, but also to support commercial activities. If the U.S. is going to continue to be able to compete and challenge other global powers much more must be done to bolster domestic private sector capabilities. Specific concepts and strategies are described in response to the following question.

Question 3. As the Senate looks to reauthorize NASA in the coming year, what reforms do you suggest?

Per my testimony, NASA should leverage its influence as a customer to encourage the private sector to invest in, develop, and operate commercial satellite servicing systems. Specifically, the upcoming NASA Reauthorization bill should instruct the Agency to identify

when and which satellites will require servicing and release contingent contracts for domestic companies that can execute the requisite missions. As described previously, this will drive private sector investment into satellite servicing systems obviating the need for further substantial government investments and leveraging private sector efficiencies. America will become a global leader in a vital new technological and economic arena while simultaneously saving NASA money by avoiding the need for the purchase and replacement of existing satellite systems. Several domestic companies are already developing such capabilities in response to DARPA's Robotic Servicing of Geosynchronous Satellites ("RSGS") program and NASA's Restore-L mission. If the NASA Reauthorization bill leverages this progress with the introduction of contingent contracts to service NASA satellites, America could quickly develop a vital new capability that would enhance scientific, commercial, and military operations.

Moreover, NASA must do more to bolster American technological innovation and even the playing field with subsidized foreign competition. DARPA has already demonstrated how a government agency can play an important role in supporting domestic innovation. DARPA uses standing Broad Agency Announcements ("BAAs") to ensure that any company or entrepreneur with a good idea can quickly bring it forward without having to wait a year or more for a relevant NASA Request for Proposal to be developed, approved, and released. The NASA Reauthorization bill should direct the Agency's Space Technology Mission Directorate ("STMD") to adopt this approach and establish a series of standing BAAs to support domestic technological innovation. Congress should also encourage STMD to mimic DARPA's process which begins with the submission of a one-page executive summary. Requiring only a single page executive summary substantially reduces the barrier to entry that other NASA programs suffer from and will ensure that small businesses can participate in the program without immediately dedicating substantial resources to proposal development.

In regard to human spaceflight, again, NASA cannot abandon LEO. In order to avoid becoming dependent on a foreign space station the Agency must act now to bolster the development of crewed, private sector LEO platforms. The first and best way to do this, is to direct the Agency to develop a node that can be attached to the ISS that will accommodate several commercial habitats while also providing additional docking opportunities for crew and cargo delivery systems. This node would support the demonstration of multiple habitat technologies and commercial operations, preventing the need for NASA to select winners and losers and instead properly leaving such decisions to market forces.

The NASA Reauthorization bill should also direct the Agency to, in conjunction with a private sector partner, support the demonstration of orbital satellite assembly as an ISS pilot program. Like satellite servicing, this is another critical capability for domestic companies to develop for the U.S. to remain competitive in the global marketplace. If NASA can demonstrate the value of orbital satellite assembly it will quickly lead to substantial private sector investment in such capabilities. Orbital satellite assembly would not only lower costs and increase the capabilities of future NASA satellites, but such operations could provide substantial commercial and national security benefits as well.

Finally, the Reauthorization bill should provide strong support for robotic exploration missions. Robotic missions will play a vital role in exploring the Moons of Mars, Europa, and destinations throughout the solar system. Robotic exploration can gather critical data to support human exploration missions to Mars and other destinations in an affordable and effective fashion. Moreover, the technologies developed for robotic space exploration also have commercial applications and can help bolster the ability of the American aerospace sector to compete in an increasingly challenging global marketplace.

Question 4. What programs within the agency pull its focus away from its intended main goal of placing humans on the surface of Mars?

Most if not all of NASA's activities can play some role in contributing toward the goal of placing humans on the surface of Mars. However, some programs certainly have greater relevance than others. For example, a Mars mission will require robust propulsion capabilities in general and the further development of solar electric propulsion in particular. Similarly, developing affordable habitat systems will also be necessary to execute a crewed mission to Mars of any kind. NASA should focus on low-cost options such as repurposing upper rocket stages to serve as habitats. Robotics also have a vital role to play in supporting a Mars mission. The technologies being developed for satellite servicing via Restore-L and DARPA's RSGS program will make strong contributions to a future Mars mission.

Beyond technological developments, NASA should also focus its global outreach efforts on assembling an international coalition to support a human mission to Mars. This coalition should not only involve all of the traditional ISS partners, but should also focus on developing strong relationships with emerging space powers such as the United Arab Emirates which is already planning a historic robotic Mars exploration mission.

It's also worth considering the role the Moon has to play as a stepping stone toward the ultimate goal of a human mission to Mars. Almost the entire international space community supports a return to the Moon and such a mission could also create some excellent opportunities for robust commercial participation. Additionally, the technologies and lessons learned from establishing a permanent human presence on the Moon would have both direct and indirect relevance to supporting missions to Mars. Mars remains an important horizon goal for NASA and the entire world's human space exploration efforts. However, the Moon may represent a critical stepping stone to develop the technologies, knowledge base, and global partnership necessary to execute a successful human landing on the surface of Mars.