Perspectives on Public-Private Partnerships In U.S. Earth Observing Programs

Statement of Mr. Robert H. Schingler, Jr.
Co-Founder and President, Planet Labs, Inc.

Before a Joint Hearing of the Subcommittees for Space and Environment
of the
House Science Committee

November 17, 2015

Chairman Babin, Chairman Bridenstine, Ranking Member Edwards, Ranking Member Bonamici, Members of the Committees:

Thank you for inviting me here today to discuss with the Joint Subcommittee the issues of the the viability of public-private partnerships to support NASA's Earth observation program. My name is Robbie Schingler, and I am co-Founder and President of Planet Labs, Inc. a global commercial remote sensing company headquartered in California that aims to change the way we all see our world, and in particular how we can all see our world change.

I would like to offer you my thoughts about how a changing landscape in commercial space activities has built an environment in which NASA and other government agencies should rethink the nature of their relationship with private sector. The concept of "Public Private Partnerships" needs to expand to be inclusive of the full portfolio of activities where government and private sector activities overlap and intermingle. The primary objective of this portfolio of activities should be to ensure continued U.S. leadership in space activities, and should be inclusive of government programs and government regulatory efforts. I will speak specifically to opportunities in the realm of Earth observations to illustrate this larger concept.

NASA -- The First Revolution in Earth Imaging

In 1972, NASA changed the way we see our world, when the Astronauts of the Apollo 17 mission took a picture of the Earth from their vantage point in space, a picture famously called the Blue Marble photo. From then-on, through the 1970's until today, with programs like the Nimbus satellites, the Earth Observing System satellites, the LandSat program, and so on, NASA has been the world leader in building and operating the space systems that observe our Earth and pioneering the science of understanding its complex processes, how they interrelate, and how they change. NASA has international partners in these endeavours, and many countries now engage in some way toward a global capacity in observing and measuring the Earth. But there can be no doubt that NASA has been and remains the leader of this global community. It was NASA that first taught us about the value in consistently observing the Earth; the value in investing in new sensor technologies to do so; and the value of turning Earth observation data into a globally accessible public good. I will expand on this point below. In sum, NASA and

NOAA both teach us every day how our daily lives can be impacted when we have information from space at our finger-tips.

NASA is Planet Labs' Foundation

On a more personal level, NASA is where I grew up. I spent about ten years at NASA, starting as a research physicist at NASA Ames Research Center and taking on fun and challenging assignments between Ames and NASA Headquarters, starting the Small Satellite Mission Design Center to realize the Office of the Chief Technologist and Space Technology Mission Directorate. I can tell you first hand that NASA's workforce is the reason for NASA's successes. People are dedicated to the missions, working to unlock the questions of the cosmos and bring that understanding to help us live more sustainably here at home. But more than individuals following their north star within NASA's missions, people are compassionate, innovative and entrepreneurial -- people who invent new technology, ask entirely new and inspiring questions about our cosmos and our planet, and people who know how to thrive in a uniquely competitive and collaborative environment to advance the state of the art. It was at NASA that I became an entrepreneur, building teams and technology, looking for funding opportunities and human resources, and the need for a dedicated mission to pull individuals into teams and create that magic of innovation.

There Has Been a Parallel, Separate Revolution in Consumer Industries

Over the past several decades, in parallel to the pioneering work that NASA was doing, a new world of sensor technology was emerging. There has been massive improvement in the technologies of the commercial consumer electronics industries, biomedical/biotech industries, and the internet. We see the ruggedization of components, at low-power and low-cost; the growth in data storage and compute infrastructure; ever improving methodologies in big data analytics and machine learning; and continually advancing, highly capable manufacturing capabilities. These capabilities are most uniquely available here in the United States, they are available commercially, and they are affordable. What this means is the capacity to have highly capable, sensitive, long-lived, low cost components fielded in technology platforms in any location. We see it in our pockets with our highly capable mobile phones, we see it in our cars, in our homes - we see it in the sky with drones - but what about space? As my co-founders and I thought about what we saw around us, we wondered: why have we yet to see the sensor revolution in space?

Planet Labs and the Sensor Revolution in Low Earth Orbit

My co-Founders and I, inspired to think big at NASA, and challenged by colleagues we knew in other industries to innovate faster, posed a hypothesis to ourselves. What if we could build our own satellites without any aerospace companies, ride the new sensor revolution to iterate on them quickly and build a very capable, state-of-the-art sensor platform for space, and then mass manufacture those satellites in large numbers? Stated differently, if we can build a distributed, global sensor network in space, what could we do? A disaggregated sensor system leads to a resilient architecture for many missions - from scientific investigations and exploration

missions, to national security concepts, as well as novel commercial architectures for telecommunications, M2M and remote sensing. The remote sensing mission stuck with us and as we investigated it more deeply, there was absolutely a very unique social and market opportunity that lends itself quite well to this disaggregated space system.

What we did was form Planet Labs. Planet is a mission-driven company, founded to use space to help life on Earth. Our first goal, which we call Mission One, is to view the whole Earth from space, every day, and to make what we see from space accessible to all. Imaging the whole Earth, every day starts with our satellite constellations. At the heart of what will be our global imaging capability are our small satellites, which we call Doves, based on the cubesat standard. Our Doves are what are known as a 3-U cubesat, with dimensions of 10 x 10 x 30 centimeters. Our satellites are built with the most advanced, ruggedized and high performing technologies we could find; specifically sensors, connectors and integrated circuits that are part of an existing consumer electronics market cycle of increasing capabilities at decreasing costs.

We build our satellites rapidly, get them launched to space and tested often, and cycle through this process several times in short order. We call this Agile Aerospace, and we think it has been a great success. To date, we have launched a total of 101 R&D satellites to space, and we are currently operating nearly four dozen in two different orbits, providing useful imagery to us and our customers. We design our Doves ourselves; we build and integrate them ourselves in our San Francisco office; we test them and qualify them for launch ourselves; and once they are in space we have our own Mission Control where we operate close to 3 dozen ground stations to communicate with our satellites. Our Doves use a supply chain of sensors, electronics, and power supplies that come from the consumer electronics industry and other mass markets, meaning they evolve rapidly, are produced in large numbers at high tolerances while maintaining affordability, and can be quickly replaced almost on-demand. We have gone through thirteen total design iterations on our satellites, optimizing our supply chain and our internal quality assurance processes along the way.

To accomplish our goal of whole-Earth, every day imaging, we will be placing more than 100 Doves in a single, sun synchronous orbit. As many of the Members of these Committees know, sun synchronous orbit is an orbit used by most environmental observing satellites because it provides global coverage; though a single satellite, like Landsat, may need roughly two weeks to cover the entire globe, everywhere, at at least once. By operating in excess of 100 Doves in sun synchronous orbit we will be able to image the entire globe, everywhere, every single day. With our constellation we will be able to see a new image of the same place on Earth, in every place on Earth, every day, in the Red, Green, Blue, and Near-Infrared bands. Given our pace of development and learning, and our planned launch manifest, we anticipate having the global, daily monitoring capability from space operating by this time next year.

Our Dove constellation is complemented by the RapidEye satellite constellation, which Planet Labs acquired as part of our acquisition of the Canadian-based BlackBridge Corporation. The RapidEye satellite constellation is five satellites, also in sun synchronous orbit, collecting imagery similar to our Dove satellites in both resolution and spectral bands. Combined, our

Dove and RapidEye constellations give Planet Labs the greatest commercial capacity for viewing the Earth at any one time.

As noted, Planet Labs operates as a commercial remote sensing company. We are focused on the mission at the core of our company -- to make global change, visible, accessible and actionable -- but we also need to wrap a business model around the company to be sustainable. Our customers are working with us now, in advance of Mission One, to develop early tools for the most beneficial utilization of our unique, high-revisit rate imagery. For the past two years we have been building an international customer base in several market verticals, such as agriculture, consumer mapping, finance, GIS services, big-data analytics, and others. With the addition of BlackBridge, now a Planet company, we've grown from launching our first satellites to having customers in over 100 countries in only two years.

Planet Labs is one of several companies leading a second revolution in Earth imaging. Companies with a similar perspective on innovating quickly with new technology, pursuing a meaningful mission, and disrupting markets and industry sectors. Companies that are privately funded, looking for a commercial market return first before approaching the government. These companies aim to bring higher resolution imaging, higher revisit Earth imaging, video-from-space, commercial weather data, and other capabilities to bear as the space-based Earth imaging contribution to the global sensor revolution.

NASA is Already a Key Enabler of This Second Revolution

I will expand on my ideas for what a Public-Private-Partnership means in the context of NASA's Earth Observations. But first, I am compelled to note that at Planet Labs we consider ourselves to be in partnership with the civil government Earth observation community every day. This based on the unparalleled foundation of openly available data NASA and NOAA collect, which I mentioned previously. We use Landsat-8 data for a variety of purposes: to help us accurately geolocate our satellite imagery and develop rectification algorithms; and to help calibrate our sensors and accurately color balance our imagery so that it most accurately reflects the true surface of the Earth. We use both Moderate Resolution Imaging Spectroradiometer (MODIS - http://modis.gsfc.nasa.gov/) data and Landsat data to help vary our camera setting to account for surfaces with different brightnesses. We use archived data from the Shuttle Radar Topography Mission (SRTM) and the the National Elevation Dataset for ortho-rectification of our data. We use cloud data from the NOAA NOMADS system (http://nomads.ncep.noaa.gov/), which provides global cloud cover forecasts (at different layers) for up to 10 days, which we use in part to help plan our satellite imaging operations. In sum, NASA and NOAA provide a critical foundation for our activities, and without their publicly available data we would be significantly challenged to accomplish our goals.

Continued Success Means Reframing the Industry-Government Relationship

In broad strokes, the changing nature of the space industry -- smaller more affordable satellites, the potential for more affordable launch, commercial entrants creating new missions and building new markets -- means we are on the cusp of the need for new thinking about how

the government and the private sector should communicate and collaborate to maintain U.S. leadership in space activities for the decades to come. Since the beginning of the space era in the middle of the previous century, space activities in the U.S. had two pillars - the national security space domain, and the civil space domain led by NASA. Broadly speaking, industry's relationship to the government was primarily as a contractor. And though industry clearly brought capabilities to the table, and to this day remains home to some of the greatest talent in the world, the government's requirements process, procurement regulations, and program management methods were at the forefront of new technology development and innovation. The private sector has evolved to the point where it is clearly a third pillar unto itself. It is therefore time to reconsider that historical government-to-contractor relationship.

A new perspective on the industry-government relationship considers several factors wholistically. These factors include:

- government agencies who can act as consumers in the market, able to recognize that they are one of many customers in a marketplace of new data and services;
- government programs that foster innovation by creating a white space for new concepts, creativity, and exploration that could lead to new capabilities, products, and services without constraining industry on how it is created;
- government programs that utilize the kinds of Agile Aerospace methods practiced at Planet and elsewhere to more rapidly advance their internal technology projects and train their professionals in multiple methods of program management; and,
- a regulatory environment that is responsive to and supportive of the innovations the come from the private sector, with an eye toward recognizing that more innovation happening in the U.S. industrial base is better for our national security than less, particularly in our current, globally competitive environment

I will try to address how these general factors can be applied specifically to NASA's Earth Observing programs and needs.

NASA is Poised to Start this New Kind of Relationship

The ISS Provides an Example Relevant to Earth Observations

In the area of creating a "white space" for innovation, as I noted, Planet Labs has launched 101 satellites to space so far. This has been on the back of 9 successful launches, the majority of which have been to the International Space Station (ISS), where they have been deployed into orbit from Nanoracks deployers. We have gone to the ISS a total of 5 times, out of which 4 were U.S.-based cargo launches. These latter launches were commercial launches enabled by NASA's COTS program, that upon transitioning to an operational capability created very frequent cargo missions to the ISS. Nanoracks has been a long-time partner with NASA to bring scientific and technology experiments to the ISS to fully utilize this national laboratory. The ISS has a predictable need for supply, which in turn creates a predictable launch manifest and secondary payload market. The ISS program is also making some of its external platform space available for commercial Earth observing opportunities, and the market is seeing the firms that take advantage of this expand into broader offerings not related to the need for ISS access.

This is an excellent example of NASA using its unique place in the space ecosystem to enable innovative ideas to emerge that are not tied to NASA's requirements.

A question facing NASA and industry general, when examining the success of ISS in this regard is -- how can this be replicated? Where within the technology programs, the science programs, and the data analysis programs across all of NASA can doors be open to industry that cost NASA little-to-no funds, give industry unique opportunities to access space, and allow for the development of new capabilities that can't otherwise emerge? NASA should be free to explore ideas like this with industry even more than they already do.

More Great Ideas Are Already Taking Shape Relevant to Future Earth Observing Needs

NASA recently announced that its Launch Services Program (LSP) has awarded new contracts for what it is calling Venture Class Launch Services (VCLS). These are contracts to new launch providers that are specifically targeted at providing increased, affordable, and reliable access to low-Earth orbit for for small satellites. As NASA's press release about these recent contract awards note, these VCLS launches "are able to tolerate a higher level of risk than larger missions and will demonstrate, and help mitigate risks associated with, the use of small launch vehicles providing dedicated access to space for future small spacecraft and missions." It is noteworthy that NASA's Earth Science Division is jointly funding the VCLS awards, as small satellite applications to Earth science have the potential to be significant. NASA deserves great credit for taking this step toward fostering and nurturing the burgeoning small launch community -- it is another example, like the Commercial Cargo Program, that demonstrates how NASA can structure a program that creates benefits for multiple parties.

Another example comes from NASA's Space Technology Mission Directorate, which recently released a Request for Information (RFI) titled, "Pathfinder Technology Demonstrator," in which they sought information about how industry may respond to its needs for a rapidly provided spacecraft bus to enable integration of new payloads, and potentially future services such as Indefinite-Delivery, Indefinite Quantity (IDIQ) contracts for spacecraft and satellites as a service. Similarly, NASA JPL released an RFI to collect a catalog of ready spacecraft buses in either the 3-U or 6-U cubesat form factor. We believe that the idea at the heart of this RFI is precisely the right direction for NASA in this new era of a commercial space renaissance. NASA can intelligently leverage as much industrial capability as possible from across the entire landscape without having to define new requirements or justify new development program starts. Satellite bus hardware is a solved problem. Spacecraft manufacture, quality assurance, launch and commissioning, and autonomous operations are happening every day - including at Planet Labs. If NASA were to engage with industry to more rapidly access these capabilities in a truly commercial fashion where they can be available as a service, and then leverage that service to support NASA's unique needs, they could have a transformative impact on NASA's Earth observations programs, creating in-space test and demonstration opportunities for new sensors much more rapidly and at significantly lower cost than has ever been available.

We believe a program to work with industry on satellites-as-a-service can be complemented with internal-to-NASA projects that seek to rapidly develop new technologies and demonstrate them in space without following NASA's standard "Phase A, Phase B"

approach to project management. If given the opportunity to have more flexibility, if empowered to put the full weight of their skills and experience to work behind their ideas without strict adherence to all former practices, there is no doubt that the NASA workforce would unleash countless innovations and demonstrations that would bring about new revolutions in Earth science, space science, and planetary exploration.

Together We Can Continue to Expand the Scope for Earth Observing Needs and Benefits

Early Access Data Buys to Explore Unique Benefits of Collaboration

We think it is within the collective interests of Planet and other commercial providers to work with NASA and NOAA in support of shared goals and to contribute to the unique scientific, public-good mission of both agencies. We think cooperation and partnership starts with access to, utilization of, and dialogue on the benefit to NASA and NOAA of commercial data, including our data. There was no expressed, market requirement for daily, global data at 3-5 meter resolution before we started Planet Labs, yet we have been able to find commercial opportunities for the application of that data. We recognize that NASA may not have an established, previously documented requirement for that data either, and yet we are confident that there will be benefit to both NASA and NOAA, as well as others, from the application of this data. As an example, we are exploring with partners at the Carnegie Institution for Science in California and Woods Hole Research Center in Massachusetts how daily imagery of global forests can contribute to both our understanding of forest health worldwide, and our understanding of how measuring changes in those forests can translate into understanding changes in atmospheric carbon content. We know there are experts on this and countless other areas of investigation at NASA or NOAA who can even further unlock the potential of our data to add value to their work.

The U.S. commercial remote sensing industry, and NASA and NOAA, would all benefit tremendously if questions and examples like this were explored in a 1-on-1, targeted, collaborative evaluation process specific to scientific objectives that includes some combination of a data buy, customer feedback sessions, trial applications, and sharing of lessons learned. Indeed, the government may best position itself to efficiently utilize new commercial data streams as they come online if they enter into early partnerships while those data sets are still in development. For example, with Planet Labs, a short-term data buy for evaluation could offer unique insights into what daily, whole-of-Earth imagery could mean for NOAA or NASA's applications when it becomes available. Following that an appropriate arrangement can be made for global access based on a deeper understanding of its value and benefit to the government's mission. NASA and NOAA should therefore be encouraged and funded to explore the use of new or emerging commercially available data in an R&D-like environment to assess its benefit to different needs.

Reimagining How NASA and NOAA Data is Visible for the World

For Planet Labs, building a global monitoring space capability is only part of accomplishing Mission One. The capacity to collect imagery must be complemented by a

method of making that imagery accessible. More to the point, access to the imagery we collect, and the information it tells us about the change we see on our planet, should be intuitive, easy to manage, and tailorable to the needs of different kinds of users. We are building a web-based platform using the latest in cloud computing and cloud storage, with a front-end experience that we believe accomplishes that task. We want anyone to be able to search for, find, and compare imagery in ways that are important to them. We want developers to create applications that use our data and show meaningful change over different time scales, from days to seasons to years. We want a platform that allows anyone to bring their own, unique data sources and combine them with geospatial data and create new information to tell stories, build new maps, or direct resources to those in need.

It is not just Planet's data that should be made accessible in both a user friendly and powerful way. NASA's data is publicly available, as noted, but not always easily accessible to the lay-person. Our interest in extensive utilization of Landsat data as described above is part of the reason we worked closely with USGS to make Landsat data available to all via Amazon Web Services (http://aws.amazon.com/public-data-sets/landsat/). Landsat 8 data is available via our APIs as well. As part of any collaboration with NASA and NOAA we believe industry would bring ideas to the table for NASA that could revolutionize how people see their data, access it, make it part of their workflows, and integrate it into their daily lives to an even greater extens.

Utilize Multiple, Broad Authorities

In order to work effectively with industry to gain access to new data sources, collaborate on the evaluation of that data, and introduce industry to communities across the government space, the government should utilize all means at its disposal. For example, NASA should utilize commercial data buys via simple, commercial fixed price contracts or funded Space Act Agreements (SAAs), or both, depending on the specifics of a partnership or the interest of the specific firm. These may have to be in place in parallel with unfunded SAAs or Cooperative Research and Development Agreements (CRADAs) for information sharing and collaboration with other agencies. In all cases, the government should recognize that commercial firms often develop technology useful to the broadest possible market they can reach, and not specifically in response to a government-only requirement; and that maintaining their intellectual property is key to maintaining their differentiation in the market.

There is some Regulatory Risk to Commercial Success

The foundation of any successful, long-term relationship between government and the commercial remote sensing industry rests on the capacity of industry to provide commercial data, products and services on a reliable, predictable basis. This in turn relies on a predictable, reliable, and transparent regulatory environment that provides clarity of rules, consistency in implementation, and confidence to industry, investors, and the public at-large.

Our most frequent interactions with regards to the many agencies that touch on regulatory aspects of commercial, space-based remote sensing, are with the Office of Commercial Remote Sensing Regulatory Affairs within NOAA. This office has the lead responsibility for licensing private remote sensing space systems and coordinates the interagency process for these new

remote sensing capabilities, in coordination with the National Security Community. As this committee knows, the office has been operating under the weight of a continuously increasing number of applicants seeking licenses, pushing the boundaries of innovation in remote sensing. These applicants come from U.S. industry, from some international firms, and from an ever-growing university community that wants to use small satellite technology as a way to give students real hardware development experience. This increase in the number and diversity of prospective licensees has come without any significant increase in NOAA's capacity to respond. This office at NOAA is under-staffed, and under-resourced. If this trend continues NOAA's capacity to conduct even its most basic administrative functions may become unsustainable, and this surely is an unnecessary risk to the success of the U.S. commercial remote sensing industry. We encourage both the Administration and the Congress to increase funds to this NOAA office so that they can scale up with Industry, and provide a timely and responsive regulatory framework for industry. A robust regulatory team in the government has insight, oversight and foresight; it cannot be overly burdened with administrative tasks and not have the experts on the team to turn this industry opportunity into strengthening the third pillar of a robust US aerospace ecosystem.

Even with limited resources and over burdened staff, in general we are happy to report that our working relationship with NOAA, and the broader interagency community that works with NOAA, has been mostly positive. For example, in working with NOAA following our acquisition of BlackBridge, we were able to submit a license request to assume operations of the RapidEye satellite constellation and receive approval to do so in two months. We appreciated NOAA's willingness to coordinate an interagency review and provide us an answer in a timely, responsive fashion and to come up with a rational step-wise approach to balance national security concerns and globally efficient commercial operations. That said, we are concerned that, given the trends noted above, such timely responses may not be possible in the future.

In Conclusion - The Future is Bright

I hope that my remarks above provide to you the framework for a new relationship between government and industry, and a new perspective on what should be considered when we use the term "Public-Private-Partnership." NASA has excellent foundations under its feet for this already, with examples I provided above relevant to a new future supportive of innovation in general, but with specific value to the field of Earth Observation as well. As a former NASA employee it is my great pleasure to applaud these efforts. I have offered additional thoughts, and I hope both NASA and the Committee find them useful, around the ideas of data buys, and empowering NASA to experiment internally with Agile practices to empower their supremely talented workforce. And lastly, this framework goes beyond civil Earth Observation partnerships and can be applicable to arrangements for other U.S. government missions and needs. We are at the beginning of a space renaissance and in working between the strengthening commercial space industry and the government we will be on sustainable trajectory to maintain and grow our global leadership in aerospace.

Thank you for the opportunity to appear before you today, to share with you information about Planet Labs, and my opinions on the great potential for a substantial, substantive, and

mutually beneficial relationship between industry and the government in general, and between the growing commercial remote sensing sector and NASA, NOAA, and the civil agencies of the Federal government in particular. I look forward to answering your questions.