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ROYAL AERONAUTICAL SOCIETY

"THE STRATEGIC CHOICES FOR SPACE"

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I want to first thank the President of the Royal Aeronautical Society, Air Commodore Bill Tyack, for affording me this opportunity to join you for this important conference. I also want to commend this organization for 148 years of remarkable leadership, service, and advocacy on behalf of the global aerospace community. Thanks also to the UK Space Agency for your long-standing partnership with NASA on planetary exploration and on so many other critical missions.

As NASA continues to make major strides in an unprecedented human journey to Mars, we are pleased that so much of the international community is in agreement about "the strategic choices" for space in the 21st century.

It is my belief that we are entering the golden age of global cooperation in space exploration. As I have said many times, the success of our modern space programs will be judged in large part on how well we continue to make space exploration about global partnership – particularly since it is clear that no one nation can do it alone and that the benefits to be gained are for all of humanity.

That was the message sent by the space agencies of 12-member nations of the International Space Exploration Coordinating Group (ISECG), including the UK Space Agency, with the release of an update to our Global Exploration Roadmap in August of last year. The Roadmap sent a clear signal that the global community is interested in implementing a coordinated strategy of deep space exploration that builds on each nation's interests and expertise to support robotic and human missions to near-Earth asteroids, the moon and Mars.

The Launchpad for that bold future is one of the greatest examples of international cooperation in human history – the International Space Station (ISS), where astronauts from around the world, including the UK, have been conducting groundbreaking research for almost 14 years now without interruption.

As in so much that unites our countries, the United Kingdom has been an indispensable partner with the United States in space and aeronautics research for many years. In fact, the United Kingdom is NASA's fourth largest partner in terms of number of active agreements overall (41), and the UK Space Agency ranks fifth among other space agencies with 16 active agreements.

The UK is also the fourth largest contributor to ESA. Next year, Timothy Peake, the first British citizen selected as an astronaut by ESA, is scheduled to make his first flight to the International Space Station.

We are especially pleased that the UK Space Agency is a supporter of ESA's contribution of a Service Module for *Orion*, NASA's next generation space capsule which is being built to carry astronauts farther into the solar system than ever before – to an asteroid and to Mars. *Orion* is being prepared for its first test flight in December of this year.

That is really what I want to talk with you about today – the progress NASA is making towards realizing a dream that has eluded humankind for centuries – a human journey to Mars.

While humans have been fascinated with Mars since the beginning of time, there are a number of very tangible reasons why we need to learn more about our closest planetary neighbor. For one thing, Mars' formation and evolution are comparable to Earth's and we know that at one time Mars had conditions suitable for life.

What we learn about the Red Planet may tell us more about our own home planet's history and future and help us answer a fundamental human question – does life exist beyond Earth?

While NASA has been on a path to Mars for decades with our earlier Mars rovers and orbiters, a critical national policy statement in support of our strategy was made on April 15, 2010 during a visit by President Obama to Kennedy Space Center when he challenged the nation to send humans to an asteroid by 2025 and to Mars in the 2030s. The U.S. National Space Policy, released in June 2010, further supports those goals and over the past several years NASA has been developing the capabilities to meet these goals through a bipartisan space exploration plan agreed to by the Administration and Congress and embraced, as I mentioned earlier, by the international space community in the 2013 *Global Exploration Roadmap* (GER).

While robotic explorers have studied Mars for more than 40 years, NASA's journey for the human exploration of Mars begins in low-Earth orbit aboard the International Space Station, our springboard to the exploration of deep space. As we speak, astronauts aboard the ISS are helping us learn how to safely execute extended missions deeper into space. The key to the success of ISS has been the cooperation between NASA and our international partners. In a world rife with geopolitical conflict and uncertainty, this unique orbiting laboratory is a clear demonstration of the benefits to humankind that can be achieved through peaceful global cooperation. We are guaranteed this unique international treasure for at least another decade by the Obama Administration's commitment to extend the ISS until at least 2024. This means an expanded market for private space companies, more groundbreaking research and science discovery in micro-gravity and opportunities to live, work and learn in space over longer periods of time.

As most of you know, the United States has already returned space station resupply launches to American soil – and will soon do the same for human spaceflight launches

Already, two American companies – SpaceX and Orbital Sciences – are making regular cargo deliveries to the Space Station. Last month, NASA selected two American companies, Boeing and SpaceX, to complete the NASA certification for human space transportation systems capable of carrying people into orbit and ending our sole reliance on Russia. Once certification is complete, NASA plans to use these new systems to ferry astronauts to the International Space Station and return them safely to Earth. If the U.S. Congress fully funds our FY 2015 budget request, we believe we can do this by the end of 2017.

In parallel, we are working on our next step, deep space, where NASA will send the first mission to capture and redirect an asteroid to orbit the moon.

Astronauts aboard the *Orion* spacecraft will explore the asteroid in the 2020s, returning to Earth with samples. This experience in human spaceflight beyond low-Earth orbit will help NASA test new systems and capabilities – such as Solar Electric Propulsion (SEP) – we'll need to support a human mission to Mars. Beginning in 2018, NASA's powerful Space Launch System (SLS) rocket will enable these "proving ground" missions to test new capabilities.

Human missions to Mars will rely on *Orion* and an evolved version of SLS that will be the most powerful launch vehicle ever flown.

A fleet of robotic spacecraft from several nations and NASA rovers with significant international involvement already are on and around Mars, dramatically increasing our knowledge about the Red Planet and paving the way for future human explorers.

The Mars Science Laboratory *Curiosity* rover measured radiation on the way to Mars and is now sending back radiation data from the Martian surface. This data will help us plan how to protect the astronauts who will explore Mars. Just a few weeks ago, after a nine-month journey, NASA's *MAVEN* orbiter entered orbit around Mars. As the first orbiter dedicated to studying Mars' upper atmosphere, *MAVEN* will greatly improve our understanding of the history of the Martian atmosphere, how the climate has changed over time, and how that has influenced the evolution of the surface and the potential habitability of the planet. It also will better inform a future mission to send humans to the Red Planet in the 2030s.

Future NASA missions like the Mars 2020 rover, seeking the signs of past life, also will demonstrate new technologies that could help astronauts survive on Mars.

Engineers and scientists in the United States and around the world are working hard to develop the technologies astronauts will use to one day live and work on Mars and safely return home.

It is important to remember that NASA sent humans to the moon by setting a goal that seemed beyond our reach. With Mars as our focus, we are steadily building the capability to enable human missions to the Red Planet. The challenge is huge, but we are making real progress today as a radiation monitor on the *Curiosity* rover records the Martian radiation environment that our crews will experience; advanced entry, descent and landing technologies needed for landing on Mars were tested high above the waters of the Pacific Ocean in June; and *Orion* is finishing preparation for its first test flight December. This uncrewed mission will see *Orion* travel farther into space than any human spacecraft has gone in more than 40 years.

Finally, I think we can all agree that beyond the scientific and economic benefits of launching into space – of literally leaving this planet – there is something intrinsically unifying about humankind's exploration of the heavens. As one who has flown into space four times, I can tell you that when viewed from orbit, our borderless Earth inspires a sense of humility, unity of humanity and wonder. As the great British astronomer Sir Fred Hoyle said in 1948, "Once a photograph of the Earth, taken from outside, is available, a new idea as powerful as any in history will be let loose." How true was his vision!

I firmly believe that the original picture of our "blue planet" from the vantage point of the Apollo 8 crew returning to Earth from their trip around the moon forever changed humanity's perspective on our planet.

The partnerships we have forged are giving more people around the world the opportunity to experience the wonder and exhilaration of spaceflight – to realize the dream of leaving Earth for even a short time to float above our planet, Earth, in microgravity and to see the stars and the majestic tapestry of the Milky Way unobstructed by the artificial lights and dust of our atmosphere. These citizen space travelers will also help us imagine and realize new benefits that can be brought back to Earth.

We are grateful for the strong collaboration between NASA, the UK Space Agency and European Space Agency in human space flight, our exploration of Mars and many other planetary and Earth science missions. Both of our countries understand that space exploration is important for every nation on Earth and can only be achieved through international cooperation.

While we are proud of NASA's global leadership, we are also mindful that the scientific and human space flight achievements of the past half-century would not have been possible without the UK and our other partners around the world.

The future of space exploration is bright, but it will be up to all of us in this assembly to continue working together on this great adventure. If we do, I am confident we will improve life on Earth and transform our shared vision of space exploration into a shared reality of unlimited discovery.

Thank you.