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**HRH The Prince of Wales Honours GPS Inventors at Buckingham Palace**

**London, 3 December 2019**. Today, four US engineers were awarded the 2019 Queen Elizabeth Prize for Engineering (QEPrize) during a ceremony at Buckingham Palace for their work creating the first truly global, satellite-based positioning system, GPS. The QEPrize is the world’s most prestigious engineering accolade, a £1 million prize that celebrates the global benefit of engineering innovation on humanity.

His Royal Highness The Prince of Wales presented the trophy to Dr Bradford Parkinson, Hugo Fruehauf, Richard Schwartz, and Anna Marie Spilker, who accepted the award on behalf of her late husband, Professor James Spilker, Jr.

Dr Bradford Parkinson – often regarded as the ‘father of GPS’ – led the development, design, and testing of the system. Hugo Fruehauf developed a highly accurate, miniaturised atomic clock, a foundational component of the system. Richard Schwartz engineered a satellite hardened to resist intense radiation in space, with a lifespan three times greater than expected. Professor James Spilker, Jr, was the main designer of the GPS civil signal and, with his team at Stanford Telecommunications, built the receiver that processed the first GPS satellite signals.

Lord Browne, Chairman of the Queen Elizabeth Prize for Engineering Foundation, highlighted the critical role of collaboration in engineering, and in groundbreaking innovations such as GPS: “Our laureates’ success was the result of inter-disciplinary collaboration, a drive for excellence, and an ability to turn the fruits of scientific discovery into practical solutions. That is what engineers do.”, he said.

Today, an estimated four billion people around the world use GPS. At just $2 per receiver, GPS provides an accessible service and a powerful tool that people can integrate with their applications. Simple smartphone apps can track disease outbreaks, self-driving tractors can optimise crop harvests, and sports teams can improve team performance. New applications for GPS continue to revolutionise entire industries, and its annual economic value has been estimated to be $80 billion for the USA alone.

GPS combines a constellation of at least 24 orbiting satellites with ground stations and receiving devices. Each satellite broadcasts a radio signal containing its location and the time from an extremely accurate onboard atomic clock. GPS receivers need signals from at least four satellites to determine their position; they measure the time delay in each signal to calculate the distance to each satellite, then use that information to pinpoint the receiver’s location on earth.

This year’s QEPrize trophy was designed by 17-year-old Jack Jiang from Hong Kong. Jack’s elegant trophy design won the 2019 Create the Trophy competition, an international competition that invites those aged between 14-24 around the world to submit innovative trophy designs for the world’s leading engineers. The 2019 competition saw a record number of entries, with submissions stemming from over 50 countries worldwide.

**QUOTES**

**Lord Browne of Madingley**, **Chairman of the Queen Elizabeth Prize for Engineering Foundation**, said: “This year’s laureates have demonstrated that engineering makes things happen. With the first global, satellite-based positioning system, they created an engineered system which provides free, immediate and accurate information about position and time, anywhere around the globe.

“The world now depends on GPS completely and without exception.

“The high-frequency trading systems, telecommunications and electricity grids of today are all built around GPS. And we will rely on it for the drone delivery systems, self-driving cars and climate monitoring solutions of tomorrow.

“In honouring the 2019 prize winners, we hope to inspire the next generation of engineers to continue to push back the frontiers of the possible.”

**Bradford Parkinson** said:“Today marks a landmark moment in all of our lives – there is no prize for engineering greater than this, it is an honour. This recognition reflects the responsibility incumbent upon those developing technology today to strive to do so for the good of humanity. Day-after-day, we are astounded at the new ways in which people across the world use GPS. It is a ‘System for Humanity’ in each and every sense.”

**Hugo Fruehauf**said: “The accuracy of modern GPS satellites astounds me. The atomic clocks we built for the satellites were accurate to within billionths of a second, but today’s generation are working a factor of 100 times better than that. They’re a lot like wine, in a sense – they only get better with time. And they have to be accurate; the timing for GPS is used for core systems around the world – vital infrastructure like banking systems, telecommunications networks, and power grids. Today the world relies on those clocks.”

**Richard Schwartz**said: “One of the best things about GPS is its accessibility. We designed the system to produce a signal that anyone can use, regardless of where they are on the planet. Today, engineers around the world can still access that signal, for free, and use it to build creative solutions to benefit people around them. It took a great deal of collaboration to make the system work, and it’s great to see the next generation collaborating on innovative products now because of that.”

**Anna Marie Spilker,** on behalf her late husband, Professor James Spilker, Jr, said: “Jim's mission statement has always been to create, teach, and mentor for world-changing benefits to humanity through his engineering talents. When working on GPS, Jim knew that it could be of profound benefit globally, and he was right; because of their work, Jim and his colleagues have helped billions of people around the world. He was immensely proud of that. He said many times that "Engineering technology is the necessary catalyst for progress to world changing benefits to humanity; it's magic.””.

**Ends**

**Additional quotes from the judging panel**

**Dr Dan Mote**, President of the US National Academy of Engineering, said of GPS: “We would not be on the same planet without GPS. It’s game changing, future-creating and the scale at which it delivers is truly mindboggling. It’s creating the future and its capabilities haven’t yet been fully realised, which is exciting.”

**Professor Mary Boyce** at Columbia University, said of GPS: “GPS is very sophisticated, but invisible to everyone who uses it. We take for granted that we know where we are every moment of every day.

“Being open-access, GPS spurs constant innovation, with ongoing development of the ways in which it can be employed for society’s benefit. The impacts are varied – autonomous cars and shipping, disaster relief, tackling climate change, but all wouldn’t be possible without GPS.

“What’s most exciting is its many applications are only just being realised and the future for where this can go it truly limitless.”

**Dr Henry Yang** at the University of California Santa Barbara, said of GPS: “Technology should be complex but what it ultimately delivers must be simple – GPS is a perfect example of this. Most people who use GPS take it for granted; they don’t realise how often they use it, yet they’d be lost without it.”

**Professor Jim Al-Khalili** at the University of Surrey, said of GPS: “The unanimity of the judges was remarkable – when asked how the world would be without GPS, complete silence followed.

“GPS has switched on the lights; before it we were moving about in the dark. To have a blanket of global positioning satellites around us, they are the world’s eyes that we all can use to see daily. It not only allows us to see the world around us at ground level, but it also lets us look down on things from above – seeing things we otherwise wouldn’t, like the melting of polar ice caps. As a physicist, seeing how science and knowledge are put to the benefit of mankind is inspiring.”

**Ilya Marotta**, from the Panama Canal Authority, said of GPS: “GPS helps people across the world, both professionally and personally, every single day. It gives you the freedom to relax, knowing where you are and where things around you are. Without it, life would be much more complicated.

“It’s a technology that can be taken advantage of even where you don’t have internet access. We use it every day for the Panama Canal to survey and mapping hydrograph charts. Something that would take you a week can be done in a few hours bringing huge efficiency savings and safety benefits.”

**Professor Lynn Gladden**, at the University of Cambridge, said of GPS: “The difference that GPS has made to society is profound. So many people around the globe, and certainly almost everyone in the UK, has a mobile phone. We use that mobile phone to see where we are. Aviation authorities, as another example, use GPS to track aircrafts. We all hail taxis, and we know both where taxis are and how long we have before they arrive.

“On a more scientific level, when you use even more accurate positioning technology then you can start looking at trends in environmental factors. We can see movements in tectonic plates, we can optimise agricultural practice, and we can track the rate at which ice caps melt. Its application is pervasive around the globe.

**Dr Jean-Lou Chameau**, President Emeritus at King Abdullah University of Science & Technology, said of GPS: “It’s the 50th anniversary of the Apollo Moon landing this year, and now we’re celebrating this tool based on satellites. It has changed the way we live day to day, and impacts people across the globe in a number of ways, whether that be navigating via your phone, or farming in India. It truly is global impact at scale.”

**Professor Viola Vogel** at ETH Zurich, said of GPS: “GPS doesn’t just enable lives, it saves them every day. It also lays the foundation for the next technology development and lays down the gauntlet for future generations to find new ways in which the technology can be applied to benefits society and the lives of billions globally.”

**Paul Westbury**, Senior Vice President for Development & Construction, Strategy & Operations at The Madison Square Garden Company, said of GPS: ““The two most striking things about GPS are the many ways in which the engineering behind it has benefited society, and the fact that we are only at the beginning of realising its true potential.

“GPS solves the challenge around doing more things with fewer resources, with less emissions and greater efficiency, resulting in higher productivity. It’s everywhere, instant and free, meaning it is truly for everyone and the very definition of an engineering innovation that delivers benefits to billions simultaneously across the globe each day.

“What’s highly unusual is that the technology has barely changed since it became available to the public, very much like the internet. Instead, it’s the many ways in which is applied – whether that be autonomous or precision farming. GPS is bringing together multiple disciplines of engineering and technology, and it’s about the integration of them to create something wonderful. We’d be lost without it.”

**Dr Raghunath Mashelkar**, Chairman of India’s National Innovation Foundation, said of GPS: “Without GPS the world wouldn’t be the same, it’s a true game-changer and represents absolutely excellence in engineering. The ASSURED acronym characterises any great innovation: Affordable, Scalable, Sustainable, User-friendly, Rapid, Excellence, Distinctive – GPS comprises them all which reinforces its monumental impact as a global tool for society.

“What’s important now is that thoughtful young engineers continue to find new and innovative ways for GPS to be utilised for societal benefit.”

**Dr Hiroshi Komiyama**, Chairman of Mitsubishi Research Institute, Inc, said of GPS: “Engineering means combining different, necessary elements of a project to achieve a common goal and GPS is a perfect example of this. It combines high-precision time measurement, robust satellite development and a means by which it can safely be enjoyed by the user – all of which has delivered consistently for decades.”

**Jinghai Li**, Vice president of the International Council for Science (ICSU) for Scientific Planning and Review, said of GPS: “With GPS, distance becomes zero. It connects everything and everyone, making the world smaller and totally changing the way society operates.”

**Brito Cruz**, Science Director for the São Paulo Research Foundation (FAPESP), said of GPS: “GPS builds on the two most important concepts in people’s lives; space and time, telling you where you are, and when. These two notions are very profound for any human being and the many applications of GPS globally make humans happy each day without them evening knowing it.”

**Professor Reinhard Huettl**, Scientific Executive Director and Chairman of GFZ-Potsdam, said of GPS: “The Queen Elizabeth Prize for Engineering gives engineers recognition in the same kind of magnitude as the Nobel prize. This is very important; the 2019 QEPrize winners have played a fundamental role in society and their work has now been recognised around the globe.”

**Interview Requests**

For more information or to request an interview with any of the judging panel please contact alex.garvey@edelman.com

**Assets**

Images and videos are available to download from qeprize.org/press.

**Social Media**

Twitter, Facebook and Instagram: @QEPrize #QEPrize2019

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**About the Queen Elizabeth Prize for Engineering**

The Queen Elizabeth Prize for Engineering (QEPrize) is the world’s most prestigious engineering prize, celebrating the engineers responsible for a ground-breaking innovation in engineering that has been of global benefit to humanity. The £1million prize is awarded every two years; it aims to raise the public profile of engineering and inspire young people to take up the engineering challenges of the future.

The inaugural winners in 2013 were Robert Kahn, Vint Cerf, Louis Pouzin, Sir Tim Berners-Lee, and Marc Andreessen for revolutionising the way we communicate. Their seminal contributions led to the development of the Internet, the World Wide Web, and the Mosaic browser. In 2015, the QEPrize was awarded to Dr Robert Langer for his revolutionary advances and leadership in engineering at the interface with chemistry and medicine. His pioneering work in controlled release large molecule drug delivery systems has benefitted the lives of more than two billion people worldwide. In 2017, Eric Fossum, George Smith, Nobukazu Teranishi, and Michael Tompsett were awarded the prize for their combined contributions to digital imaging.