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EOS Develops New Laser Technology for Space Debris Mitigation

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Electro Optic Systems Holdings Limited ("EOS" or "Company") (ASX: EOS) has achieved a major breakthrough in laser technology which significantly advances the global effort to mitigate space debris. The innovation involves the use of a Guide Star Laser to allow high speed adaptive optics to form laser beams that can track and move space debris at lower altitudes and faster speeds than ever previously possible. This intellectual property has been developed by EOS in collaboration with the Space Environment Research Centre ("SERC"), and will now be commercialised and owned by EOS, with applications including space debris mitigation and high bandwidth satellite communications.

The Guide Star Laser in operation at the EOS Space Research Centre, Mt Stromlo Observatory, Canberra

Background

In a collaboration with Australian, American and Japanese scientists via the Australian Government-established Cooperative Research Centre (CRC) for space environment management, EOS has developed technology that allows a laser-generated guide star to remove atmospheric distortion from light travelling in both directions: from earth to space and from space to earth.

Lasers are used every day for locating objects in space, measuring tectonic plate movement and tracking space debris. For 35 years Canberra has been at the centre of this activity, with lasers operating from Mount Stromlo, day and night, on a wide range of space missions including measurement of sea levels and maintaining satellite navigation fidelity. Throughout this period EOS has been the world's largest developer and producer of space laser tracking systems for these purposes.

Most of the lasers probing the sky are not visible, but a new mission to help preserve the space environment requires the use of a bright yellow laser. This specific colour is required to stimulate sodium atoms in a narrow band of the Earth's upper atmosphere to glow like a bright star. The yellow light from this artificial 'guide star' is used to measure the atmospheric distortion of light travelling to and from space. Once measured, the distortion can be used to pre-distort a second laser such that the atmosphere will then act as a correcting lens to restore the laser beam to ideal optical properties. This enables the second laser to propagate into space without degrading its intensity or functionality due to the impact of the atmosphere, allowing space debris to be actively manoeuvred from the ground. The technology now facilitates faster and more powerful secondary lasers to move space debris, including in Low-Earth Orbit, where the global space debris problem is most acute.

Space Debris

Around USD$700 billion worth of global space infrastructure currently delivers essential services globally, including communications, navigation, resource management, banking, weather forecasting and climate change monitoring. This infrastructure is at risk from space debris ranging in size from spent rocket stages as large as buses, to flakes of paint measuring only 5mm. This debris typically travels at speeds in excess of 8km per second, so even very small objects can badly damage or destroy satellites.

There are now more launches taking place than ever before, and each launch carries many more satellites. A modern mega-constellation can require more than 18,000 new satellites – ten times more than currently in operation. At the same time, space debris is also increasing. The rate of collision will inevitably increase, further increasing risk by creating more space debris, and potentially risking a catastrophic Kessler syndrome space avalanche.

Space Environment Research Centre

SERC was a CRC funded in three equal parts in 2014 by EOS, the Australian Government's CRC Program, and a group of participants from Australia, USA and Japan. The Australian participants included The Australian National University ("ANU") and RMIT University.

SERC's aims were to reduce the rate of space debris proliferation caused by space debris collisions, and to demonstrate the potential of ground-based lasers to manoeuvre space debris so that collisions can be prevented. By leveraging the substantial existing infrastructure, facilities and research momentum of its participants, SERC was able to achieve these aims within its $62 million budget and its mission was successfully completed as planned on 31 March 2021.

Technology and Applications

Transmitting laser energy through the atmosphere and beyond requires a laser guide star, image analysis to determine the atmospheric distortion for guide star images, and laser beam deformation to pre-distort the laser such that the atmosphere will then act as a correcting lens to restore the laser beam to ideal optical properties.

The guide star laser and beam deformation technologies are developed by EOS, and the guide star image analysis by ANU's Research School of Astronomy and Astrophysics. EOS and ANU intend to continue their collaboration in this technology for future applications.

The space debris management program, including the Guide Star Laser, is located at the EOS Space Research Centre at Mount Stromlo Observatory in Canberra. It is a critical piece of infrastructure in the global effort against space debris.

This technical development allows lasers to be propagated into space so accurately and efficiently that most applications require only 5% of their prior power. A key commercial focus for EOS is the application of this technology to laser-based optical communication to and from space. Wideband communication lasers are very low in power, and the new guide star technology opens entirely new market segments to EOS because those low power lasers can now be used for previously impractical links. This confers significant advantages to EOS in the $120 billion annual market for wideband satellite communications.

Speaking at the operational launch of the new laser capability in Canberra, Dr Ben Greene, Group CEO of EOS, said:

> "Space debris is a major societal threat, globally but especially in Australia due to our heavy economic dependence on space assets. For decades EOS has been a world leader in the tracking and classification of space debris. Our accurate, dynamic database of space objects is the key pre-requisite for the active manipulation of those space objects from the ground using lasers, but this capability has long been out of reach, requiring major advances in technology.
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> EOS progressively researched and developed the required technologies until, in 2014, we initiated an international collaboration (SERC) to accelerate the final stages. This research has recently concluded as planned and expected, and the remote manipulation of suitable objects in space can now be undertaken.
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> EOS already makes a major contribution to mitigation of the space debris threat through our accurate space debris tracking, but after international coordination we expect to make a further contribution by actively moving hazardous debris from impact trajectories.
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> The reduction in risk from space debris has broad societal benefits as well as direct benefits to EOS, as a satellite proprietor and space operator."

This announcement has been authorised for release to the ASX by Dr Ben Greene, director.

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About EOS

EOS operates in three sectors: Space, Defence and Communications

- EOS Space Systems specialises in applying EOS-developed optical sensors to detect, track, classify and characterise objects in space. This information has both military and commercial applications, including managing space assets to avoid collisions with space debris, missile defence, space control and space protection.

- EOS Defence Systems specialises in technology for weapon systems optimisation and integration, as well as ISR (Intelligence, Surveillance and Reconnaissance) for land warfare. Its key products are next-generation remote weapon systems, vehicle turrets and counter-UAS systems.

- EOS Communications Systems provides global satellite communications services and systems. It specialises in innovative optical, microwave and on-the-move radio and satellite solutions that deliver high speed, resilient and assured satellite communications anywhere in the world.

This announcement contains certain "forward-looking statements" including statements regarding EOS' intent, belief or current expectations with respect to EOS' business and operations, market conditions, results of operations, financial condition, and risk management practices. The words "likely", "expect", "aim", "should", "could", "may", "anticipate", "predict", "believe", "plan" and other similar expressions are intended to identify forward-looking statements. Indications of, and guidance on, future earnings, financial position and performance, establishment costs and capital requirements are also forward-looking statements. Forward-looking statements including projections, guidance on future earnings and estimates are provided as a general guide only and should not be relied upon as an indication or guarantee of future performance. This announcement contains such statements that are subject to risk factors associated with an investment in EOS. Forward-looking statements involve known and unknown risks, uncertainties and assumptions and other important factors that could cause the actual results, performances or achievements of EOS to be materially different from future results, performances or achievements expressed or implied by such statements. Readers are cautioned not to place undue reliance on these forward-looking statements, which speak only as of the date of this announcement.