**Committee: Committee on the Peaceful Uses of Outer Space**

**Issue: Robots vs humans; who should explore space**

**Student Officer: Eve Vazaiou**

**Position: Deputy President**

## PERSONAL NTRODUCTION

Dear delegates,

My name is Eve Vazaiou and I will have the honor to serve as the Deputy President of the Committee on the Peaceful Uses of Outer Space in this year's ATSMUN. On a personal note, I am currently attending the 12th Grade of the Arsakeio Tositseio Highschool of Ekali. This will be my 7th time in a conference and my 3rd time as a Chair and I am proud to have been active in MUN as long as this.

In this study guide I will be elaborating on the first topic of this year's Agenda, Robots VS Humans; who should explore space, so as to provide you with a comprehensive view of the causes of the conflict, the dangers it entails, how it has escalated and measures that should be taken in order to confine it.

I strongly encourage you to read this document attentively, in order to be well prepared and have a fruitful debate at the conference. Note, however, that the purpose of this study guide is not to be your sole research material but rather a basis of further research on the topic so that you are able to go into more detail of UN documents (eg. Treaties, conventions, etc.) as well as your country's policy.

For any questions do not hesitate to contact me via email, at: vazaiouevaki@gmail.com.

I wish you the best of luck and well-spent time with preparation. I am looking forward to seeing you at the conference!

Best regards,

Eve Vazaiou

## INTRODUCTION

Decades before anyone had built a rocket, humans had already argued in science fiction related movies about who is more suited for space travel: humans or machines. Robots have done all the recent planetary exploration within the scheme. In past decades, rovers, landers, and orbiters have visited the moon, asteroids and comets, each planet in the star system and lots of their moons as well. However, does their work compare to it of human astronauts?

In terms of sheer scientific output, manned exploration of space incorporates a smart track record. Over 2,000 papers have been revealed over the last four decades important data collected throughout the manned Phoebus Apollo missions, and also the rate of recent papers remains rising. In comparison, the Soviet robotic Luna explorers and NASA Mars Exploration rover program -- Mars Pathfinder, Spirit, and chance -- have each generated around four hundred publications.

When it comes to space exploration, the robots conduct the first data gathering and therefore the primary science. They fly past planets for the first time simply to check what the planet is all about. Then orbiters map the surface followed by landers — if and when possible —that actually touch it. Robots haven't solely been to the moon, even though they have explored each and every planet in our star system.

The human missions are principally concerning pushing the boundaries of human endurance. Although well trained, physically and mentally, astronauts and cosmonauts tolerate the stress of launch and landing. The negative effects of prolonged weightlessness, and the risks inherent in living in such conditions are many, but it is commonly known that nothing can stop humanity from exploring the unknown. It is the ultimate human adventure, one that provides real role models for young people and demands the highest technology to keep those people safe up there.

The human-robot partnership in area is analogous to hunters with dogs that run ahead to find prey. The robots race ahead to ‘sniff out’ the territory, establish the foremost attention-grabbing sites and sample the soil, in order for the humans to follow.

## DEFINITION OF KEY TERMS

### Site No.1 or No.1/5

A launching site at Baikonur Cosmodrome located in Kazakhstan. It was used for the Soviet space program and is now managed by the Roscosmos State Corporation for Space Activities. [1]

### Non-terrestrial

Adj. Not indigenous to the earthly plain, not of the terrain/territory. Organism not originating from earth or any planet other than earth. Also known as extraterrestrial.[2]

### NASA

NASA stands for National Aeronautics and Space Administration. NASA was started on October 1, 1958, as a part of the United States government and is now in charge of the U.S. science and technology that is related to airplanes or space.[3]

### Robonaut

Robonaut is a humanoid (built to look like a person) robot designed by NASA's engineers. Robonauts are able to help humans with anything from working on the International Space Station to exploring other worlds.[4]

*Figure 1 Robonauts using human tools*

### International Space Station (ISS)

The International Space Station (ISS) is a moderate modular space station (habitable artificial satellite). NASA (United States), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada) are among the five space agencies involved in the project (Canada). Intergovernmental treaties and agreements control the ownership and usage of the space station.[5]

### GALAXY

A galaxy is a vast collection of stars, gas and dust, typically 10,000 to 100,000 light-years in diameter and containing billions of stars (from galaxias kyklos, Greek for "circle of milk", originally used to describe our own Milky Way). Galaxies may be spiral (with one or

[1] www.wikipedia.org Gagarin's start
[2] www.definitions.net
[3] www.nasa.gov What is NASA?; The article is part of the NASA Knows (Grades K-4) series
[4] www.nasa.gov What is Robonaut?; The article is part of the NASA Knows (Grades 5-8) series
[5] www.wikipedia.org International Space Station

more spiral-shape arms), elliptical (shaped less round, egg-like), or irregular (chaotic appearance).[6]

### ESCAPE VELOCITY

Escape velocity is the speed that an object needs in order to escape a planet or moon's gravitational pull. For example, the escape velocity for a spaceship to leave the surface of earth is approximately 25,000 miles per hour.[7]

## BACKGROUND INFORMATION

Historically, the role of robotics in space exploration has been significant due to the uninhabitable conditions of non-terrestrial planets in the solar system. In this part of the study guide you will learn some basic history about robots and humans regarding space exploration.

### Before the Robot Era

Before scientists began sending robots to the outer space, animals such as monkeys (the first one to ever be in space named Albert ll-a Rhesus monkey) and dogs (the Soviet Union sent two dogs, Tsygan and Dezik) were often sent to conduct experiments and complete some particular tasks in order to gather data regarding the conditions on other planets and the Moon.


*Figure 2 first monkey sent to space*

### First Robot in Space

The first robot to ever be sent to space was Sputnik 1 (Russian for satellite when interpreted in an astronomical context; other meanings: spouse or traveling companion), a robot sent by the USSR on the 4th of October, 1957, according to the National Aeronautics and Space Administration (NASA). Sputnik 1 was launched during the International Geophysical Year from Site No.1/5, at the 5th Tyuratam range, in Kazakh SSR (now known as the Baikonur Cosmodrome). This exact robot was both the first ever artificial Earth satellite and the first object created by humans to orbit Earth. The satellite's unanticipated success precipitated the American Sputnik crisis and marked the beginning of the "Space Race" between the United

[6] www.skyandtelescope.org Astronomy terms in alphabetical order
[7] www.stacker.com Space terms; Providing a better understanding of the universe

States of America and the USSR, part of the Cold War. The launch was the beginning of a new era of political, military, technological and scientific developments.

### First Venus flyby

On December 14, 1962, the American space probe Mariner 2 became the primary robotic space probe to complete a successful Venus flyby. Mariner 4, the first artificial satellite sent to space, then took the first proximal photos of Mars on July 14, 1965. Whereas the role of landers is primarily to find signs of life on planets, the role of orbiters is primarily to take photos for scientists to look at and analyze. Since the roles of those robots are different, orbiters and landers have often been sent to explore space in tandem.

### Humanoid Robots in Outer Space

The first Robonaut sent to space was Robonaut 2, also known as R2. It was launched on February 24, 2011 in order to be delivered to the ISS (International Space Station). On August 22, R2 was powered up for the first time while in Space, although in low earth orbit. Later that year Robonaut 2 made its first ever moves while in Space. Engineers have noted that R2, and every humanoid robot developed for Space exploration, could get further updates to allow them to work both inside and outside in the vacuum of Space, performing repairs, conducting scientific experiments or even making additions to the station.

Robonaut 2 was brought back on Earth in order to be fixed. It was sent home on the SpaceX CRS-14 Dragon cargo spacecraft, arriving back at the Johnson Space Center (JSC) in May 2018. Months later it was reported that R2 would return to the ISS, after confirmation from the engineers.

NASA is still deciding what the future of the Robonauts will look like. Robonaut 2 will conduct more tests aboard the space station, and may even take its first steps. This testing

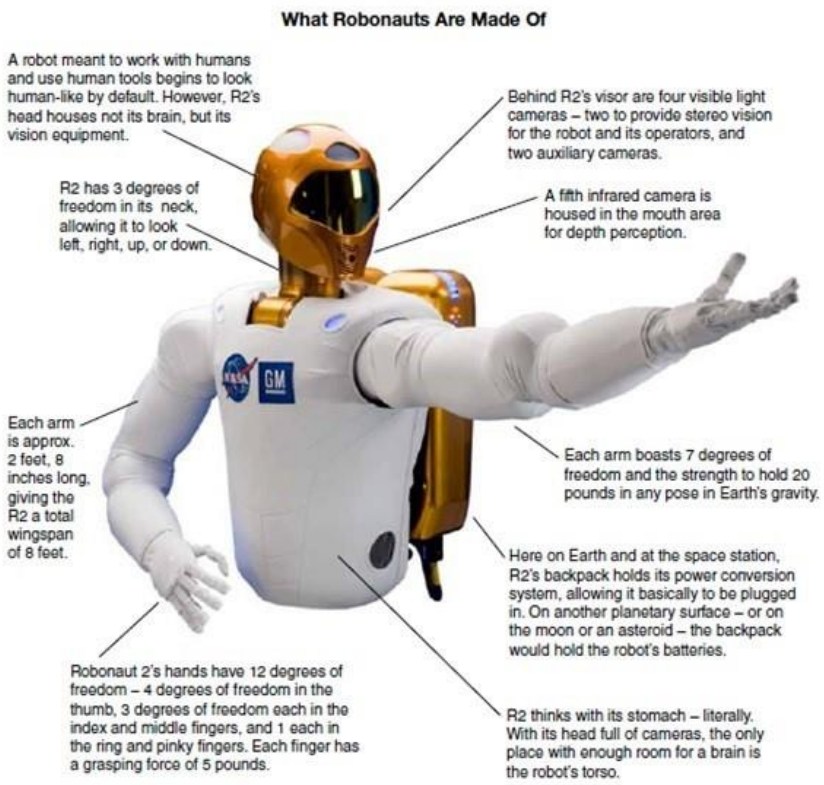


*Figure 3 BASIC STRUCTURE OF A ROBONAUT*

[8]would determine how well Robonaut could move around spacecraft environments to help astronauts. Robonaut's designers even have ideas for sending a robot like Robonaut to future destinations like the Moon and Mars.

## MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

### United States of America (USA)

The U.S. is presently leading the chart of the top ten countries in space technology, accounting for over 30% of the operational spacecraft currently in orbit around Earth. It launched its 1st satellite into space in February 1958 and currently operates a large fleet of communications, electronic intelligence, missile detection, weather, technology, navigation, and surveillance satellites. The National Aeronautics and Space Administration (NASA) is America's civil program and the international leader in space exploration. The agency includes a numerous force of slightly below 18,000 civil servants, and works with many more U.S. contractors. The U.S. is currently leading the chart of the top 10 countries in space technology, accounting for over 30% of the operational spacecraft currently in orbit around Earth.

[8] www.nasa.gov What is the basic structure of the infamous Robonaut

## People's Republic of China

The China National Space Administration [9](CNSA), located near Shanghai, is the national agency for China to co-ordinate its space activities. In contrast to most other space agencies worldwide, the organization is not involved with the International Space Station and, in fact, has a small space station of its own. The People's Republic of China has managed to launch their own Robotic satellite as well as the first "robotic ambassador" into space. China has the world's second largest fleet of spacecraft, constellations of navigation satellites, remote sensing satellites, communication satellites, surveillance and spacecraft in operation.

Since 2003, when Yang Liwei became the first Chinese national in space, CNSA has done several manned space launches. In 2013, a three-person crew aboard Shenzhou 9 made the first Chinese manned docking in space, attaching to the single-room station, Tiangong 1. The agency succeeded in making the first soft landing on the moon in decades in December 2014 with its Chang'e 3 lander and its rover, Yutu. CNSA also carries out periodic launches by itself using its Chang Zheng (Long March) rocket series.

## Russian Federation

The world' initial artificial satellite Sputnik 1 was launched by the Soviet Union within the year 1957. Russia currently operates the third largest fleet of spacecraft as well as communications, meteorological and intelligence operation satellites. a number of their famous projects are the Soyuz manned spacecraft, salyut 1 space station and Lunokhod 1 space rover. Their space agency, known as the Russian Federal space Agency (Roskosmos), specializes in civilian superintendence space activities. Their alternative agency called the Russian area Forces (VKS) handles defense satellite launches and military control assets. Venera 7, a Soviet spacecraft, landed on Venus, the first unmanned probe to touch down on another planet and transmit data back to Earth.

## Japan

Japan launched its 1st satellite Osumi into space in February 1970, becoming the fourth nation after the USSR, the US and France to possess native satellite launch capability. It presently operates a fleet of communications, meteorological, earth observation and astronomical observation satellites. Notable Japanese space programs are the Japanese Experiment Module (KIBO)-ISS, H-II Transfer Vehicle KOUNOTORI5 (HTV5) and H-II launch vehicle. The national aerospace analysis and development activities are controlled by the Japan Aerospace Exploration Agency (JAXA). Through the merger of three previously

[9] http://www.cnsa.gov.cn/english/ CNSA

independent organizations, JAXA was formed on 1 October 2003. Japan is part of the countries that have already sent a robotic spacecraft and a 'mini-astronaut' robot in the Outer Space.

### United Kingdom (UK)

The United Kingdom launched its first satellite, Ariel 1[10], in the year 1962. The country presently operates a large range of satellites as well as civil and military communications satellites, earth observation satellites, and scientific and exploration spacecraft. European space Agency (ESA) gets most of its contribution from the uk. This has helped in advanced science and exploration missions corresponding to BepiColombo, Euclid and ExoMars Rover carried out by the ESA. The United Kingdom space Agency (UKSA) is responsible for the implementation of the national civil space programme. The United Kingdom was part of the nine countries in the world able to send a robotic satellite into space.

### India

India has launched more than eighty spacecraft since its maiden satellite launch in 1975. In 1980 India launched a robotic satellite using its own launch vehicle, having a major role in robotics concerning space. The nation's space research activities are controlled by the state-owned Indian Space Research Organization[11] (ISRO). The Indian Space Research Organization is the space agency of the Government of India headquartered in the city of Bangalore. Its vision is to "harness space technology for national development while pursuing space science research and planetary exploration."[12]

India presently operates INSAT and GSAT series communication satellites, earth observation satellites, and IRNSS series navigational satellites. India' fleet conjointly has hybrid satellites admire TES and Cartosat. They serve both civilian and military applications. India also features a dedicated defense satellite GSAT-7 that serves the military. India also executed the Mars artificial satellite Mission (MOM) at a value of 75 million USD, which is simply one-tenth of NASA' budget of the mavin Mars mission.

### Germany

Germany came into the space game within the year 1969, with the launch of the Azur satellite. The country has since then launched many spacecraft including telecommunications, navigation and earth observation satellites. Germany is additionally involved in the core missions such as Cassini-Huygens mission to Saturn and its moons, European space laboratory

[10] https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1962-015A NSSDCA/COSPAR ID: 1962-015A
[11] https://www.isro.gov.in/ ISRO
[12] www.isro.gov.in public notice-Attention; Government of India-Mission Statement

Columbus[13], Dawn - Mission to Vesta and Ceres and also the European Galileo navigation system. The national space programme is directed by the German aerospace Center (DLR) and supports the EU programmes associated with the ESA and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT).

The German Aerospace Center, abbreviated DLR, is the national center for aerospace, energy and transportation research of the Federal Republic of Germany. Its headquarters are located in Cologne and it has multiple other locations throughout Germany. Germany has also created the Aila robot, intended to improve artificial intelligence and data analysis in space.

## Ethiopia

The main objectives of the Ethiopian Space Science and Technology Institute [14](ESSTI) are to enable the country to fully exploit multi-dimensional uses of space science and technologies; to produce demand-based knowledgeable, skilled, and attitudinally matured professionals in the field of aerospace science that enable the country to become internationally competitive in the sector; and to decentralize space science and technology research and development.

## France

The French space programme represents both civil and military space missions. Its space policy is implemented by state-owned Centre National d'Etudes Spatiales [15](CNES). The organization is responsible for the development and execution of space programmes alongside industry and the scientific community. The nation' in-orbit spacecraft constitute earth observation and reconnaissance satellites, electronic intelligence activity satellites, civil and military communications satellites. Besides the United Kingdom, France is one of the most important contributors to the EU Space Agency (ESA). The ESA is headquartered in Paris. The space research and development is allotted at the Toulouse Space Centre whereas CNES, ESA and Arianespace conduct launches from the Guiana space Centre. France is also one of the countries that have successfully launched robotic spacecrafts using its own launch vehicles.

## Egypt

After the House of Representatives approved the law in January 2018, President Abdel-Fattah al-Sisi signed Law No. 3 of 2018, establishing the Egyptian Space Agency[16], with

[13] https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Columbus/Columbus_laboratory European space laboratory Columbus,
[14] https://www.un-spider.org/ethiopian-space-science-and-technology-institute-essti
[15] https://cnes.fr/en
[16] http://egsa.gov.eg/

the goal of developing and transferring space science and technology into Egypt in order to build satellites and launch them from Egyptian territory.

The Egypt Space Program had previously been overseen by the National Authority for Remote Sensing & Space Sciences (NARSS), which was formed in 1991 as a general authority for remote sensing.

### European Space Agency

The European space Agency (ESA) is Europe's entrance to space. Its mission is to form the development of Europe's space capability and make sure that investment in space continues to deliver benefits to the citizens of Europe and also the world. ESA is a global organization with 22 Member States. By coordinating the monetary and intellectual resources of its members, it will undertake programmes and activities far beyond the scope of any single European country.

## TIMELINE OF EVENTS

| Date | Description of Event |
|---|---|
| 1947 | First animals in Space |
| 1957 | First robot in Space |
| 1962 | First Venus flyby conducted by a robot |
| 1966-1968 | Surveyor spacecrafts sent to the Moon |
| 1970 | First mobile robot in Space |
| 1977 | Voyager 2-unmanned space mission |
| 2007 | First mission in the asteroid belt between Mars and Jupiter (NASA) |
| 2004-2014 | Rosetta spacecraft launched to intercept a comet and land a probe on |
| 2011 | Robonaut 2 sent to the ISS |
| 2012 | Voyager 1 into interstellar space |
| 2019 | Robonaut 2 back on Earth for repairing |

## UN INVOLVEMENT: RELEVANT RESOLUTIONS, TREATIES AND EVENTS

The United Nations have a specific Office regarding Outer Space matters, the Office for Outer Space Affairs (UNOOSA). Resolutions adopted by the United Nations GA as well as

documents produced by the Committee on the Peaceful Uses of Outer Space have been a constant driver for the development of space law and international cooperation of Member States in their space activities.

See below for a list of resolutions of the UN General Assembly and COPUOS documents of particular influence on the space activities of States.

- A/RES/68/74 2013- Recommendations on national legislation relevant to the peaceful exploration and use of outer space[17] !adopted without a vote
- ST/SPACE/49 2010- Space Debris Mitigations Guidelines of the Committee on the Peaceful Uses of Outer Space[18] !not reviewed by States yet
- A/AC.105/934 2009- Safety Framework for Nuclear Power Source Applications in Outer Space[19] !many governments haven't established right safety policies, requirements and processes yet
- 2345 (XXII) 1968-The "Rescue Agreement" (Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space)[20] ! this Agreement is yet to have the widest possible adherence
- 3235 (XXIX) 1976-The "Registration Convention" (Convention on Registration of Objects Launched into Outer Space)[21]
- 1967 OST Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)
    - Adoption by the General Assembly: 19 December 1966 (resolution 2222 (XXI))
    - Opened for signature: 27 January 1967 in London, Moscow and Washington, D.C.
    - Entry into force: 10 October 1967
    - Depositaries: Russian Federation, United Kingdom of Great Britain and Northern Ireland and United States of America
- 1968 ARRA Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement)

[17] www.unoosa.org/pdf/gares/A_RES_68_074E.pdf
[18] www.unoosa.org/res/oosadoc/data/documents/2010/stspace49_0_html/st_space_49E.pdf
[19] www.unoosa.org/pdf/reports/ac105/AC105_934E.pdf
[20] www.unoosa.org/pdf/gares/ARES_22_2260E.pdf
[21] www.faa.gov/about/office_org/headquarters_offices/ast/media/Conv_Regi_Objects_Launched.pdf

- Adoption by the General Assembly: 19 December 1967 (resolution 2345 (XXII))
- Opened for signature: 22 April 1968 in London, Moscow and Washington, D.C.
- Entry into force: 3 December 1968 Depositaries: Russian Federation, United Kingdom of Great Britain and Northern Ireland and United States of America

## PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

While many attempts to solve this conflict have been done, these are the main ones that were put into work successfully:

- There shall be a group of specialized programmers, capable of detecting and deleting -if being necessary- viruses, unnecessary cookies or cracking activities on the robot's software;
- When humans and robots are called to work together, there shall be a seminar conducted prior to that in order for humans to understand how robots think and work;
- Robots shall be carefully researched and shown that they can do such tasks needed for space exploration. Each robot shall have a chip showing detailed information about it and its constructor;
- When a robot is launched into earth orbit or beyond, the launching State shall register the robot's code by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary General of the United Nations of the establishment;
- States members of any such organization which are States Parties to this Convention shall take all appropriate steps to ensure that the organization makes a declaration in accordance with paragraph their country's policy on space technology (mainly robots);

While many discoveries have been conducted by robots, especially in the 21st century, many scientists and engineers do not believe that conducting non-manned missions in Space is as reliable as at least astronauts and robots working together to gather data. Over the years many people have attempted to persuade these scientists and engineers (or people in general) that humanoid robots/robotic satellites/robots are capable of conducting an

unmanned mission in order to make discoveries, conduct data as well as take pictures of other non-terrestrials. Some of the main advantages of robot-only or robot & human missions are:

- Robots do not need nurturing, food, sleep or drink
- Robots can support very unhospitable conditions
- Losing a robot, although expensive to design and produce, is far more preferable to that of an astronaut
- Robots have way better memory storage

## POSSIBLE SOLUTIONS

The focus of this guide has been on the issue of who should explore space, highlighting the importance of both robots and humans. As discussed, robot-only exploration entails both advantages and disadvantages for the sake of space exploration, as well as a number of challenges for society and government. The aim of this section will thus be to provide with a number of possible solutions to this issue, vastly reflecting on issues discussed in this guide.

The measures implemented to counter this conflict have focused on economic aspects, technical solutions, and education campaigns:

- The technology needed shall be financially covered. The best way to do that is national funding. By doing that, the nation will not only help with the evolution of their space technology, but also be recognized by others as a devoted ally in matters of space exploration;
- Research by Member States and international organizations in the area of space exploration shall continue in a spirit of international cooperation to maximize the benefits of space exploration initiatives regarding robots;
- Students shall be given the opportunity to show their skills. To do that, they must be informed through school activities, such as field trips, videos/movies related to space technology or face to face communication with an expert. To that end, space robotics clubs should be put into work in both schools and universities;
- The role of technology and the industry shall be further investigated and initiated. Indeed, humans can partner up with robots in conducting research and gathering data. A recent review report cited robots are 97.8% more accurate and faster in doing measurements and difficult mathematical equations.

Everybody may have something different to say or add to the issue. What should be known is that no one can argue that robots have a major role to play in exploring space, with or without humans on the mission with them. It is up to the experts to develop easy to use and carry out task robots in order for more people to accept the future.

Fundamentally there is no real choice between robotic and human exploration of space. Both are synergistic and mutually dependent. Robotic exploration is necessary to enable human exploration by setting the context, providing critical information, and reducing the risk to humans. other than plant the flag.

## LINKS FOR FURTHER RESEARCH

www.cbc.ca

www.researchgate.net

www.scientificamerican.com

https://blog.bliley.com/robots-used-in-space-exploration

'Space Robotics versus Humans in Space'-pdf by Shilpa Sajeev, Jasmine Jerry Aloor and Ayushi Shakya

https://youtu.be/ycLOu8Gi4Sc (Meet the Experts: Robots in space)

https://youtu.be/F1M3Pd4iv00 (Why Astronauts Need Robots in Space)

https://youtu.be/3EWX3idOKQY (The New Tech Heading to The ISS Will Change Human Space Exploration, Here's How)

https://www.cbc.ca/radio/quirks/humans-vs-robots-in-space-we-need-both-1.5175714

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