Scan of Emerging Issues

Space in 2030

Space matters for nearly everything in our world.[1] It is essential for communication, navigation, surveillance, research and exploration. It is also a fundamental domain for the emergence of a global digital economy, the Internet of Things, and cyber security. Space-based technologies are required for any transaction in societies that uses digital technology. With such a cross-cutting presence, space's future will matter for many aspects of Canadian society and, as a result, Canadian policy.

Access to space has traditionally been open to a small number of major countries who were able to cooperate with informal agreements. Now, access to space is open to a large number of smaller countries and private actors. This is especially true for low earth orbit, the area of space where most satellites and manned-space missions operate. Yet low earth orbit has a finite amount of 'territory': only a certain amount of satellites can be in orbit before the risk of collision and debris potentially prohibits more satellites from going up. The result is a fast-growing number of state and non-state actors competing for a limited amount of room with little formal regulation and control.

This scan explores four inter-related insights about the future of space. Taken together, these insights could help in developing forward-looking policy to address this increasingly complex and important domain.

Insights

Access to space is becoming cheaper

Access to low earth orbit is quickly becoming cheaper. The average cost of launch for NASA's space shuttle program was $450,000,000(USD) per launch, or $40,000 per kilogram. SpaceX's Falcon 9, which had its first mission in 2012, cost $61,500,000 per launch, or $8,000 per kilogram. SpaceX's current reusable rocket program could cut this cost by another 30%. As this trend continues, aided by ever more frugal innovation,[2] more and more national and private players could be able to access space.

Space is becoming an area of economic growth

The traditional space-based sectors of robotics, optics, communications, and propellants could be joined by cosmic mining, tourism, manufacturing, and data processing. Satellites will be able to process their own data on the fly rather than having to transmit data to terrestrial processing centres. New satellites and space station parts will be 3D printed in zero gravity and assembled in open space by robots. These advances could create, by some estimates, a new industry worth 10% of the world's economy.

New forms of space-based partnerships are emerging
Private enterprises and new spacefaring nations like China, India, and, more recently, the U.A.E are bypassing partnerships with the traditional space players. At the same time, entrepreneurialism is replacing internationalism as the main dynamic in low earth orbit activities. As a result, new partnerships and private commercial interests could incresingly compete with the longstanding authority that Western government agencies have had in space.

Space may be weaponized
Maintenance satellites' dual ability to repair and damage other satellites, the potential nefarious uses of orbital UAVs, and the ability of satellites to conceal weapons like orbital lasers creates growing concerns that equipment in orbit could be surreptitiously weaponized in ways not covered by the UN's Outer Space Treaty.

Challenges and Opportunities

The assumption that space will remain an open and viable global commons is one of the most ubiquitous yet fragile ideas shaping the abovementioned advances in space. The following challenges, if left unaddressed, could turn space into a highly contested domain:

- 20th Century partnerships could struggle to keep up with 21st Century space activities. National space agencies could be less relevant as they are replaced by commercial interests as the major players in low earth orbit.
- Space law could be unable to keep up with the number of players and range of activities happening in low earth orbit. As the U.S. moves to legalize activities like cosmic mining, other nations may question the validity of one nation attempting to regulate a common domain like space.
- Space jurisdiction could become an important concern. If celestial jurisdiction and enforcement remain quasi-anarchic, space could be subject to heightened geopolitical tensions as more players develop space interests.
- Inadequate regulation of space could detract from private sector investment in this domain. As a result, countries could miss out on long-term socio-economic benefits of space investement.
- A collaborative and international approach to space may be replaced by self-interest and exclusion, creating harmful consequences for the removal of space debris.

A common message for Canada's role in space could help ensure that its space-based interests and needs are met. Proactive strategies that capitalize on lucrative space-based economic opportunities could help Canada be an attractive home for public and private sector space innovation.

Moreover, space could be important for soft power regarding the Arctic. Being a seller rather than a purchaser of weather data and communications infrastructure is already a source of clout. As more actors gain the ability to send satellites into orbit, being at the leading edge of the relevant space activities could help Canada maintain a strong voice around Arctic stewardship.

Canada has been an important and respected player in space since the beginning of cosmic exploration. The country has a privileged relationship with NASA and the European Space Agency that has allowed us to be nimble and pragmatic with space activities. Continued diplomatic leveraging of our position in the international space community and forward-looking policies that encourage sustainable space-based investments could help make Canada a leader in the 21st Century's space race.

References

1. In this paper, 'space' refers to geospace. This is the region of outer space that, roughly, goes from Earth's upper atmosphere to somewhat before the moon. Geospace can be divided into low, medium, and high Earth orbit.

2. 'Frugal innovation' is defined as reducing the complexity and cost of a good and its production. In other words, frugal innovation strives to deliver the greatest value at the lowest cost.

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