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on Conflicts in Space and the Rule of Law

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Protecting Planet Earth from Military and Non-military Space Threats

Good morning ladies and gentlemen.

I want to say right away that this is the first time I'm speaking publicly in English.

The last time I studied English was at my high-school in 1980. So do please keep that in mind. My friend and member of our team Elena De Winne is here to help help me with translation if needed.

Anyway, I am attending this conference as the founder and editor-in-chief of **'ROOM: The Space Journal'**, an international space magazine based in Vienna and London - and as chairman of the Moscow-based **'International Expert Society on Space Threat Defence'**.

The topic of my presentation today is **'Protecting Planet Earth from Military and Non-military Space Threats'**.

And surely, what can be more important than protecting our own home?

SLIDE 1. Earthling

While one can move home many times during one's lifetime, when it comes to Earth - our home in space, our own and only spaceship which takes us through the Universe - cannot be changed in the foreseeable future.

The bad news is that the crew in charge of flying this giant space ship has no wheel, no brakes, no sails.

So, let's talk about protecting planet Earth from space threats - and a little bit about the international legal groundwork necessary for providing this protection.

Typically, when we talk about aerospace safety, we start quite literally at the bottom - air defence, anti-missile defence - and then we move further and higher up, as far as the technological and financial possibilities, as well as the geopolitical demands of the times, will allow.

Today, I'd like to move in the opposite direction and start from the very top - from deep space.

And perhaps we can use this counter-motion to find a happy medium in space defence as it relates to defending our entire planet. Because all of our intra-planetary geopolitical fighting will simply disappear in the face of global threats that originate in space.

For most of its existence, humanity was in the dark about any threats from space - especially if one discounts the 'horror stories' of pagan religions. This went on until the beginning of the Space Age in the 1950s - in essence, less than three quarters of a century ago.

We developed space probes with data trackers that enabled us to define the main characteristics of the geo-magnetosphere, to discover the Van Allen radiation belt, and figure out the composition of the Earth's upper atmosphere. Each of these components, as well as many others, plays its part in protecting life on Earth.

The new, 21st century is not only the century of humanity's greatest progress, but also of the realisation that our planet is vulnerable - both in the face of man's technological and military actions, and in the face of natural dangers originating in aerospace.

Let's talk about what this means.

An analysis of space, in my opinion, brings out seven types of space-related risks that pose a danger to Earth.

Of course, this classification is subject of scientific consideration and discussion but hopefully in the near future we will all be able to agree a standard form of classification.

My first point is to try to classify the following space threats –

1. Sun storms and sun flares, known as coronal mass ejections.

2. Changes in the Earth's magnetosphere which result in the destruction of

the protective shield that could deflect coronal mass ejections.

3. Potentially dangerous asteroids and comets, which could impact Earth and lead to mass destruction of humanity.

4. Man-made space debris.

5. Climate change resulting from the effects of human technology, industrialisation and solar radiation on Earth's atmosphere.

6. Cosmic radiation - Earth is constantly affected not only by solar radiation but also by cosmic rays from novas, supernovas and pulsars. This also needs to be taken into consideration.

7. Finally, there is potential danger of Earth being infected by biological threats from inside meteors and other small bodies that reach the planet's surface.

This situation reminds one of Russian roulette - only with rocks, huge pieces of metal, solar energy and other surprises, acting as bullets and putting all of humanity at fatal risk.

Let us just briefly look at some of the previously mentioned issues.

SLIDE 2 - Solar storms and flares

The Sun is our main source of radiation. It sends energy out into the Solar system, with ultraviolet, x-ray, and gamma-rays making it to Earth. Billions of stars in the Universe act in much the same way, and our current understanding of solar activity, solar flares and coronal mass ejections are based on studying other stars in the galaxy and beyond.

Solar activity has an 11-year cycle, as they say. The last cycle peaked in the fall of 2013. The amount of energy reaching the Earth from 150 million kilometres away exceeds the combined energy used by all of humanity by 10 thousand times.

In 1859, a giant coronal mass ejection hit the Earth and caused a number of large-scale events, including the failure of all telegraphic systems that existed on the planet at the time. If a similar event was to occur today, electrical lines, telecommunications and navigation satellites, oil and gas pipeline systems around the world would be destroyed.

The 1998 Montreal ice storm and the 2003 Halloween Solar Storm in Scandinavia are more recent examples of coronal mass ejections that can cause the breakdown of energy systems and vital infrastructure. We don't know when the next large solar event may occur, but if it is anything like the Carrington event in 1859, the results may be catastrophic.

SLIDE 3 – Geo-magnetosphere

The threat posed by strong solar storms and flares are disturbing not only because of population increase and the expansion of electronic infrastructure on Earth and in space, but also because of their influence on our protective layers, such as the Van Allen radiation belt and the Earth's magnetosphere and atmosphere.

The North and South pole shift that had been noted by satellites in different countries, is also no longer a secret. And perhaps they're getting ready to switch sides. The Earth's magnetic field is changing, the geo-magnetosphere has become 15 per cent less effective in deflecting supercharged ions in coronal mass ejections than only 20 years ago. Many specialists think that there's simply no protection at all against a truly strong solar storm.

SLIDE 4 - Asteroids and comets

The reality of the danger posed by asteroids and comets was scientifically proven at the end of the 20th century. It has been proven that in cases of Earth colliding with bodies of a few kilometres in length (in reality, anywhere from one-and-a-half kilometres in diameter), can destroy our civilization in a split second, or, at the very least, throw its development back by centuries.

If bodies that are tens or hundreds meters in diameter fall into the ocean, they may cause tsunamis that would destroy coastal settlements. If they fall on solid ground - they may destroy a large city or state, disorganize the work of telecommunication, energy and other systems, destroy nuclear facilities, chemical plants, toxic waste repositories.

This is why scientific, social and government circles and international organizations all over the world have been paying more and more attention to this problem.

Since asteroid and comet danger poses a great risk to our civilization,

developing solutions to this imminent problem must become over the most important tasks that humanity has to solve in the 21st century.

During the last 600 million years there have been about 60 collisions with celestial bodies of about 5 kilometres in diameter, which led to global catastrophes.

Collisions with objects of a hundred metres to a kilometre in diameter leading to regional catastrophes happen on average between ten and 100 times every thousands years.

During the last 100 years, four celestial bodies ranging from 40 to 60 meters have fallen on the land mass of planet Earth. That means that when one takes into consideration the ocean areas as well, collisions with such objects happen on average once a decade. Explosions of up to one mega tonne in the upper layers of the atmosphere happen almost every month.

Currently over 90 per cent of space objects of about 1 km in size have been discovered and do not pose a threat to Earth for the next few centuries. Thirty per cent of objects of 150 metres or so have also been discovered, and only one per cent of objects of about 50 metres or so has been recorded. These small and medium-size objects present the greatest real danger to the planet.

We also know that asteroids of up to 30 meters traveling at a high enough speed are known as "city killers", and they are able to destroy a large populated area. About 500,000 to one million such objects cross Earth's orbit annually, and most of them have not been studied at all.

In the 21st century there have already been five notable instances of such celestial bodies falling in India, Peru, Norway, Russia.

SLIDE 5 - Chelyabinsk meteorite

The 20-metre Chelyabinsk meteorite that fell in Russia led to significant damages.

If it had entered the atmosphere at a little bit sharper angle or if it had travelled for a fraction of a second longer, instead of exploding at a height of 25 kilometres it would have exploded in immediate proximity to the Earth by the city of Chelyabinsk.

It would have been one of the greatest catastrophes of modern times.

The impact of such celestial bodies on military or civil nuclear facilities, chemical plants, toxic waste repositories and so on can lead not only to great loss of life and material damages, but also become the trigger for a global ecological crisis or create military conflict.

Even in case of Chelyabinsk, there were some hot heads that speculated about Russia being attacked by a new type of missile.

The funniest thing is, considering the object's mass and size, its speed, trajectory, and height, the Chelyabinsk meteorite could have been destroyed by a simple anti-missile system, such as S-400 or Patriot.

But this could ONLY happen if we knew well in advance where and when such an object is coming from. Today this is technically almost impossible to achieve.

SLIDE 6 - space debris

I also like to talk about the space debris problem with a little bit more detail because it is also related to military threats issue.

The beginning of the Space Age marked not only newfound opportunities for scientific, technological, economic, military and social development of humanity, but also practically unavoidable negative consequences of near-Earth space exploration.

After the launch of the first artificial satellite, a fundamental ecological change occurred in near-earth space - the appearance and accumulation of man-made space debris, the amount of which is continuously increasing, presenting an increasing threat.

The vital difference between man-made space debris and natural space debris is the following. While meteors, having come from outside the Earth's orbit, quickly pass through near-earth space and either burn up in the endo-atmosphere or (in rare cases) reach the Earth's surface, man-made space objects, having been launched from Earth into orbit, remain in orbit for a long time, creating a constant threat for active spacecraft, objects on Earth and even the planet's population.

How long they remain in near-earth space depends, first and foremost, on the height of their orbit and may reach thousands or millions of years (for instance, for geostationary space objects). This factor of constant debris accumulation in space has been greatly under estimated by society.

Based on what was known at the end of August 2015, the total number of man-made space objects was 17,250. Out of those, 1,362 space objects were classified as active spacecraft, and the remaining 15,888 space debris.

The largest constellations among the active spacecraft belong to the US (446 spacecraft), Russia (135 spacecraft) and China (132 spacecraft).

Spatial distribution of space debris objects (inactive spacecraft, rocket stages, rocket final stages, and their fragments) in near-earth space as of August 31, 2015, was as follows:

77.9 per cent in low near-Earth space orbits
13.1 per cent in high elliptical orbits
9 per cent in geostationary and medium-height orbits and other parts of space

One of the major dangers of space debris is the possibility of the cascade effect (otherwise known as the Kessler syndrome) - a fast-moving chain reaction in which secondary fragments of space objects are created due to increasing collisions between space objects, which in turn is due to the excessive increase in space debris density in near-Earth space.

The space debris factor simultaneously plays an important role from the point of view of state national security interests in the following manner:

- data on space debris characterises target environment that is necessary for operations planning in near-Earth space

- situations related to space debris may be used as pretext for the beginning of wide-scale military action against the spacecraft belonging to a potential enemy, if they're seen as an infringement on the rights, technology and freedom of operation in space.

- space debris is a convenient cover-story for covering up purposeful actions against spacecraft belonging to a potential opponent.

An example of a potential conflict situation would be the sudden failure of a spacecraft that plays an important role in a country's defence system. If there is no available data to determine the cause of failure, such an event could be interpreted as a result of a deliberate external force, including the use of another small spacecraft.

Only recently we witnessed escalation in the political situation between a number of countries, all caused by three tragic air catastrophes - Boeing-777 in the Ukraine, Airbus-321 in Egypt and SU-24 in Turkey. International commissions are still working on figuring out the reasons behind these tragedies, while diplomats are working to prevent escalation to military conflict.

Imagine if something like this had happened in space, where there are no black boxes, no traces of explosives, and no wreckage of any kind.

SLIDE 7 - military threats

In connection to what was said earlier, its time to say a few words about military threats in aerospace.

The good news is that these are the threats that we humans can fully control ourselves.

The bad news is that never during the entire history of our existence have we been able to fully control these threats that we s create on our own planet ourselves.

Today's challenge is to ensure that humanity does not carry its military conflicts over into space. We have already carried them into the airspace a hundred years ago, when we began using air ships to drop bombs.

SLIDE 8 - Universal Robotic Battle Cosmic Platform

Now, we arrive at the second major point of my presentation – the logical culmination in providing a practical answer to the threats I have outlined so far.

Let me emphasise that I'm talking right now *JUST* about a concept – the creation of a potential orbital system that would protect planet Earth from space threats as well as from our own military threats.

I'd like to name it: URBOCOP - Universal Robotic Battle Cosmic Platform.

In terms of **Universal**, the system would be bi-directional – capable of monitoring both Earth and space.

Robotic implies the system should be unmanned. This isn't the International Space Station. The control system must be free from human bias, for instance in cases where a decision must be made about striking dangerous military launches, regardless of the country of origin.

Battle - the platform will have on-board weapons that can be used to strike at both natural and man-made space objects, including ballistic missiles in the early stages of their trajectories and beyond the atmosphere.

Cosmic - the platform will be solely space-based and capable of switching orbits, if necessary.

Platform - the system will have a long operating cycle, modularity, ability to expand, open architecture and maximum automation of vital activities.

The key points here are that:

1) This new generation of orbiting platform would not be a replacement for the International Space Station.
2) It must be an international platform with completely transparent intellectual property rights and open architecture.
3) Funding and the right to use it must belong to all mankind – not only for advanced nations already involved in space but also for developing countries, with no restrictions or boundaries.

Perhaps such ‘space outposts’ - URBOCOPs - will one day protect our planet from both outer space threats and from those who seek to disturb the peace on Earth?

SLIDE 9 - legal issues

Though I am not a lawyer, I would now like to talk briefly about legal aspects of protecting planet Earth.

First, I would like to express my immeasurable and sincere gratitude to the organizers and masterminds behind today's event. The task that you were brave enough to set for us is truly planetary in scale. And I say that without pretence or exaggeration.

Humanity is only a step, or perhaps half a step, away from a new leap forward in space.

Its perhaps a strange paradox - but this is truth: to protect our Earth from space threats and from ourselves, we have to fly and live in space.

I won't discuss specific legal aspects of peace on Earth today - many have tried and continue to hit a brick wall in regards to this issue.

But the task of building an international legal foundation for humankind's ascent to space remains a truly worthy goal.

Given our history, the question I now pose is inevitable and perhaps a little sad – but is key for international law makers. At some point the first murder of a person, either from space or in space, will take place?

If, or rather when, this happens - will a legal framework to deal with it already be in place – before it is unavoidably popularised by a bestselling book and a Hollywood blockbuster?

Despite the fact that space development is currently largely the domain of around 10 countries from more than 200 across the globe, I maintain that space law should not be the law of the rich and powerful.

We do not need space cowboys in space saloons, or a new gold rush in pursuit of the natural resources space.

We all share responsibility for a world of 8 billion people and as we move into a new era of space exploitation and exploration we will need steadfast and robust laws and treaties – much like the laws we already have governing our oceans and land masses.

SLIDE 10 - destiny

At the beginning of the 20th century, the forefather of theoretical astronautics Konstantin Tsiolkovsky said: "Earth is the cradle of humanity, but one cannot live in the cradle forever".

Space exploration originated in the idea that we are destined to live on other planets, that Earth is a starting point from which we will move on, bringing and creating life in other parts of the universe.

It is, essentially, a global Manifest Destiny that pushed us to not only look up at the skies, but to actively seek the means to go into space.

But as the Cold War and the Space Race took hold of the world, philosophical ideas behind space exploration took a back seat to competition for technological advancement.

For many decades, the ideological push behind space innovation was based on pure competition between nations, a technical antagonism – instead of for technological advances and scientific achievements the focus became geopolitics.

Of course, one cannot discard such geopolitical motivation as unsuccessful - after all, it led to the first man in space, to man's first steps on the Moon and to setting up the technological foundation for modern space science.

However, today, in order to create an effective method of protection from space-based threats, close international cooperation is essential. Any one-sided action on behalf of one country, even the richest and most technologically advanced, can be faced with multiple legal, political and strategic barriers.

So now, as we move forward into a new era is also the time for new kind of terminology, which I will suggest we might call ‘astropolitics’.

In conclusion, I want to stress that technology alone - despite all its real and promised benefits for humankind - means absolutely nothing without a higher goal and vision.

Our further progress in near-Earth space and global space exploration calls for the return of altruistic motives, and the return of inspiration and a sense of human community. We should be united in our desire to both reach for the stars and to protect our precious home, our planet Earth.

Thank you for your time - and a special thank you to the organisers of this conference.