The background features a stylized globe with a grid of latitude and longitude lines. Numerous small white dots, representing satellites, are scattered across the globe and along several orbital paths that circle the Earth. The overall color scheme is dark blue and purple, with a starry space background.

# LEO Mega-Constellation is Deeply Influencing Space Activities of the World

**China Xi'an Satellite Control Center  
June, 2022**

# LEO Mega-Constellation is Deeply Influencing Space Activities of the World

The rapid development of LEO mega-constellations has brought great convenience to the world, covering the Internet, communications, navigation, remote sensing, etc. It is not only an important symbol of commercial spaceflight, but also a milestone in the history of human space exploration.



# LEO Mega-Constellation is Deeply Influencing Space Activities of the World

However, it also poses great challenges to space activities of the world and is changing the current space order.



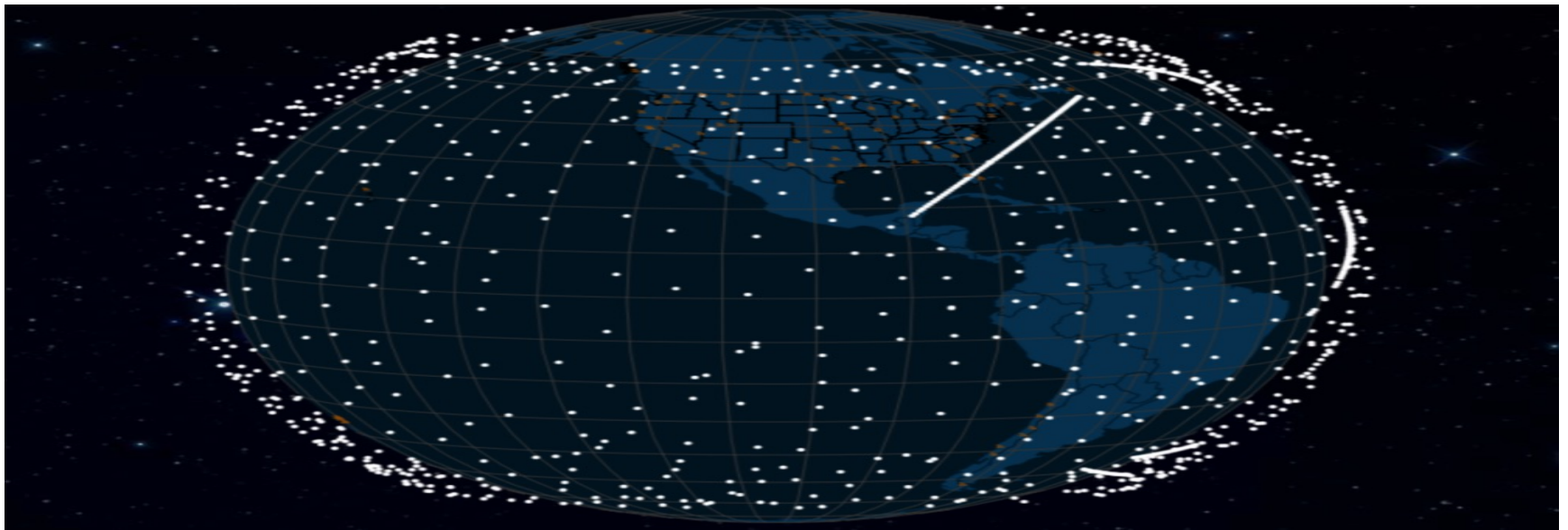
# LEO Mega-Constellation is Deeply Influencing Space Activities of the World

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# 1. Current Status and Developing Trend of LEO Mega-Constellation

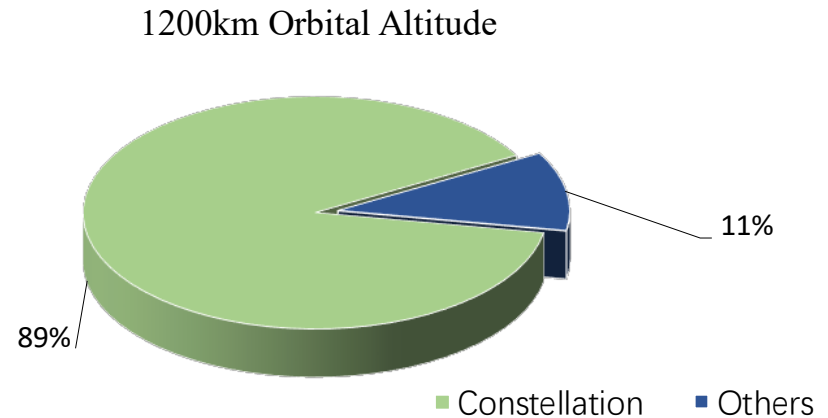
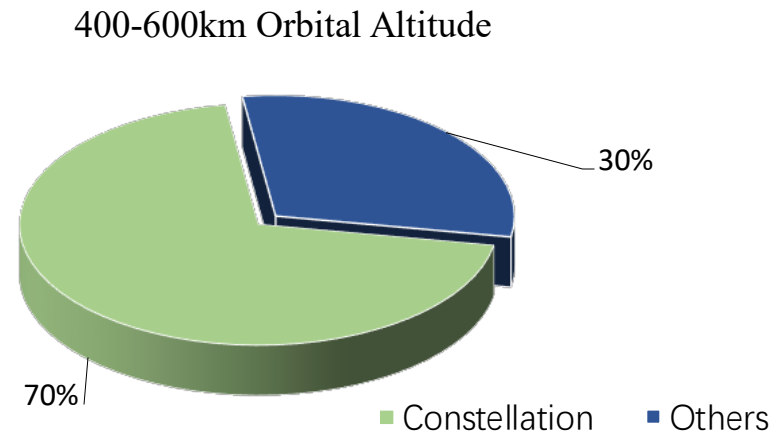
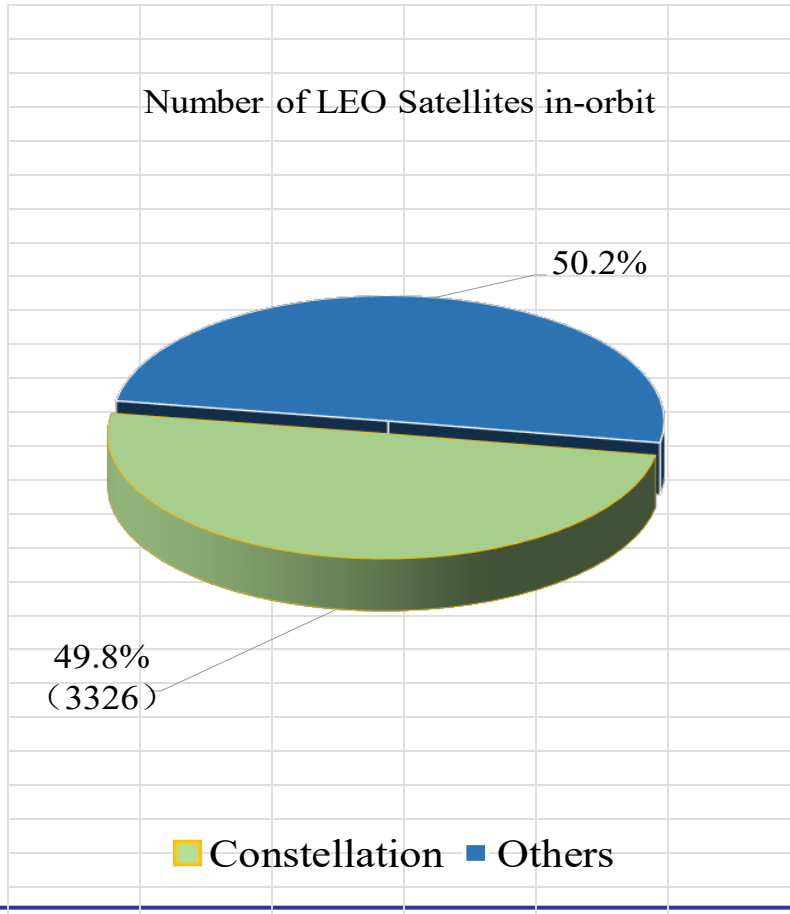
- In 2015, SpaceX announced its *Starlink* project, which indicates emerging development of LEO (Low earth Orbit) mega-constellations, opening a new era of commercial space.
- According to the US SIA annual report, there were 114 launches worldwide in 2020, where 94 were commercial launches. In 2021, the *Falcon-9* rocket alone had carried out 30 launches.





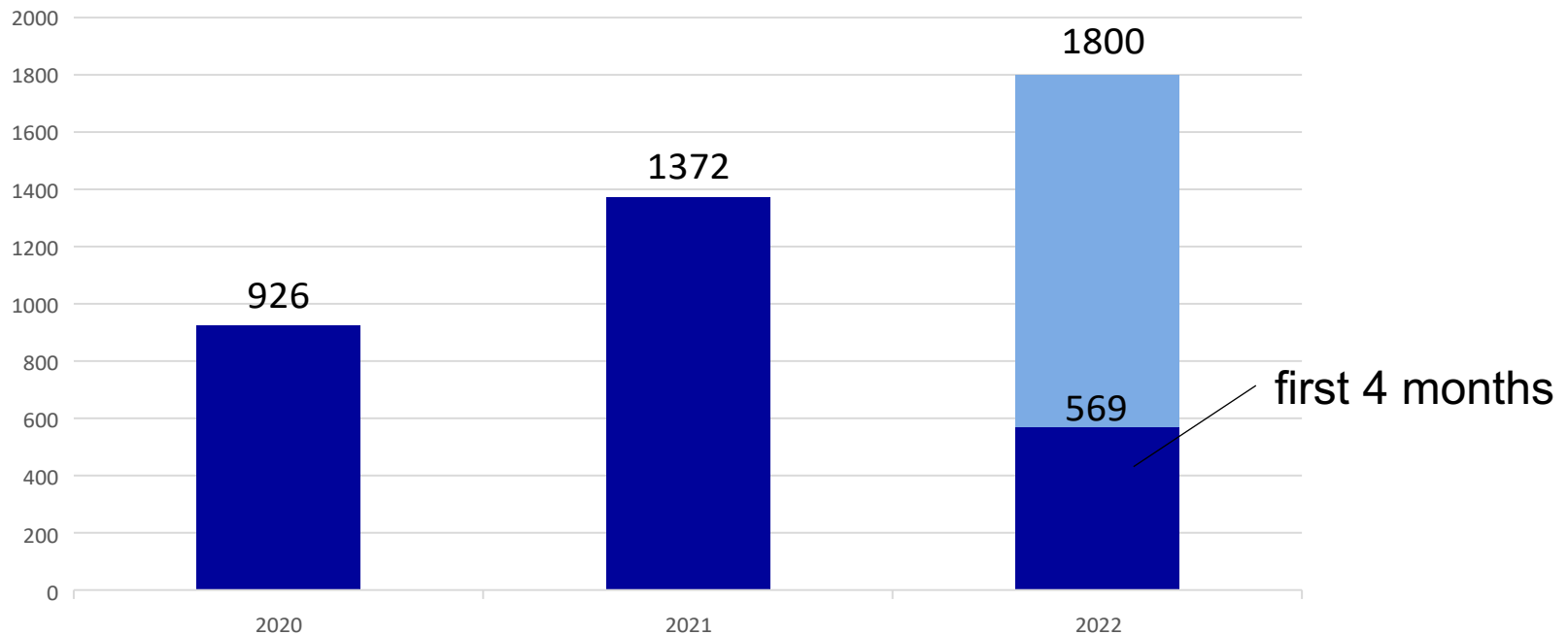
# 1. Current Status and Developing Trend of LEO Mega-Constellation

The most typical achievement of commercial spaceflight is the LEO mega-constellation.



# 1. Current Status and Developing Trend of LEO Mega-Constellation

Counts of mega-constellation satellites annually



In accordance with the current plan, more than 50,000 LEO mega-constellation satellites will be deployed in the next decade, which will exceed the current number of cataloged space debris published on Space-Track.

This will probably become the biggest factor affecting the spaceflight safety.

## 2. Influence of LEO Mega-Constellation on Global Space Activities

### ➤ **Bring risks to the safety of space stations and astronauts**

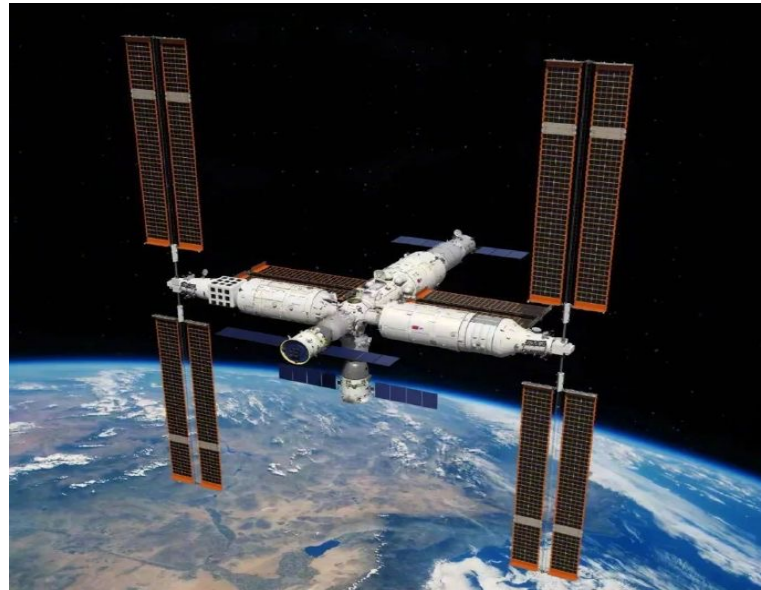
LEO Mega-Constellations make near-earth orbit crowded, which brings risks to the International Space Station and other countries' manned spacecraft.





## 2. Influence of LEO Mega-Constellation on Global Space Activities

China Space Station operates at an altitude of 380 to 400 kilometers, an area in which the satellites of LEO constellations often enter, operate or deorbit, increasing the risk of collision.



# 2. Influence of LEO Mega-Constellation on Global Space Activities

In July and October 2021, the *Starlink* satellites approached China Space Station twice, forcing the space station to perform orbital maneuver, posing a realistic threat to the safety of the space station and astronauts.

United Nations

A/AC.105/1262



General Assembly

Distr.: General  
6 December 2021  
English  
Original: Chinese

Committee on the Peaceful  
Uses of Outer Space

### Information furnished in conformity with the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies

Note verbale dated 3 December 2021 from the Permanent Mission of China to the United Nations (Vienna) addressed to the Secretary-General

The Permanent Mission of China to the United Nations (Vienna) presents its compliments to the Secretary-General of the United Nations and has the honour to refer to article V of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies<sup>1</sup> (the Outer Space Treaty), which provides that "States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the Moon and other celestial bodies, which could constitute a danger to the life or health of astronauts". In accordance with the above-mentioned article, China hereby informs the Secretary-General of the following phenomena which constituted dangers to the life or health of astronauts aboard the China Space Station.

The China Manned Space Programme completed five launch missions in 2021, with the successful launching into orbit of the Tianhe core module of the China Space Station, the Tianzhou-II and Tianzhou-III cargo spacecraft and the Shenzhou-XII and Shenzhou-XIII crewed spacecraft. The China Space Station has travelled stably in a near-circular orbit at an altitude of around 390 km on an orbital inclination of about 41.5 degrees.

During this period, Starlink satellites launched by Space Exploration Technologies Corporation (SpaceX) of the United States of America have had two close encounters with the China Space Station. For safety reasons, the China Space Station implemented preventive collision avoidance control on 1 July and 21 October 2021, respectively.

#### 1. The first collision avoidance

As from 19 April 2020, the Starlink-1095 satellite had been travelling stably in orbit at an average altitude of around 555 km. Between 16 May and 24 June 2021, the Starlink-1095 satellite manoeuvred continuously to an orbit of around 382 km, and

<sup>1</sup> General Assembly resolution 2222 (XXI), annex.

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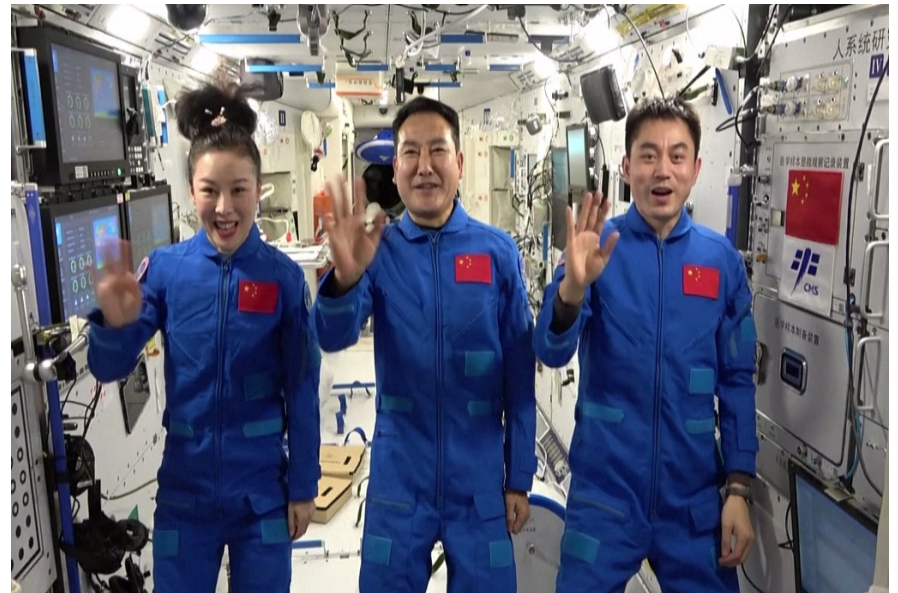


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## 2. Influence of LEO Mega-Constellation on Global Space Activities

Once the currently planned LEO mega-constellations are deployed, it can be expected that the threat to space stations will further increase, which will seriously affect the safety of astronauts and on-orbit scientific missions.



## 2. Influence of LEO Mega-Constellation on Global Space Activities

### ➤ Pose a realistic threat to the near-earth space satellites

The surging number of LEO objects will increase the risk of on-orbit collision and affect safety of satellites around near-earth space. Existing LEO satellites are mainly distributed in orbits with an altitude between 400 and 1000 kilometers, so they frequently approach mega-constellation satellites, which poses a great threat to the safety of LEO satellites for all space countries.

SN NEWS OPINION LAUNCH CIVIL COMMERCIAL MILITARY POLI

#### NASA outlines concerns about Starlink next-generation constellation in FCC letter

by Jeff Foust — February 9, 2022



A set of first-generation Starlink satellites being launched. The proposed second-generation Starlink system, with 30,000 satellites, could raise the risk of collisions and interfere with science missions, NASA says. Credit: SpaceX

MOUNTAIN VIEW, Calif. — NASA says that SpaceX's proposal for a second-generation Starlink constellation with 30,000 satellites could lead to a "significant increase" in potential collisions in low Earth orbit and interfere with the agency's launches and scientific activities.

The [five-page letter](#) was submitted to the Federal Communications Commission Feb. 8 on NASA's behalf by the National Telecommunications and Information Administration, along with a separate one-page letter from the National Science Foundation. The letter was submitted to the FCC's proceedings on [SpaceX's proposal for its Starlink "Gen 2" system with approximately 30,000 satellites in LEO.](#)



## 2. Influence of LEO Mega-Constellation on Global Space Activities

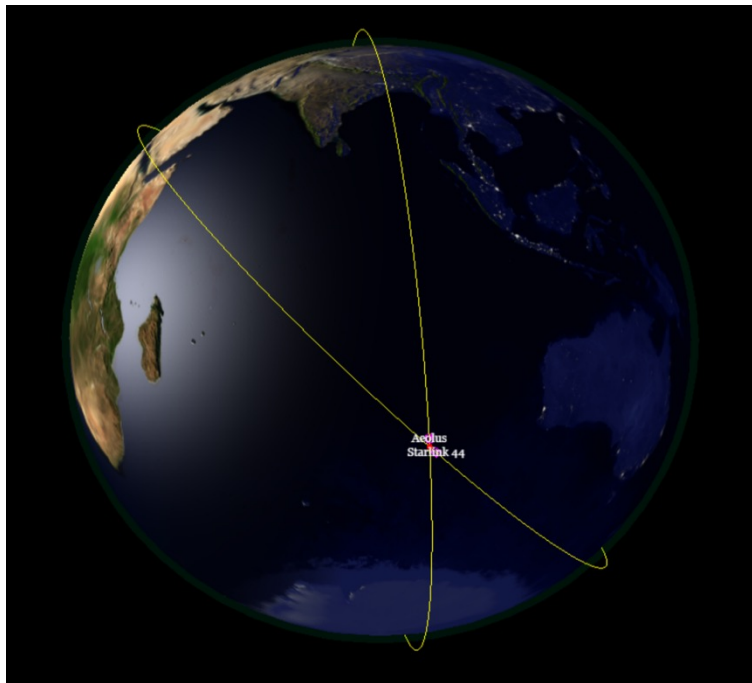
From ephemeris on the official website of some mega-constellation companies, we can see that the LEO mega-constellation is not only deployed on a large scale, but also continuously maneuvers when entering orbit and deorbiting, which makes it more difficult to analyze an event of close approach, further increasing the risk of collision.





## 2. Influence of LEO Mega-Constellation on Global Space Activities

On September 2, 2019, ESA performed a collision avoidance manoeuvre to protect its scientific spacecraft Aeolus from colliding with a constellation satellite.



### ESA spacecraft dodges large constellation

03/09/2019 32263 VIEWS 415 LIKES

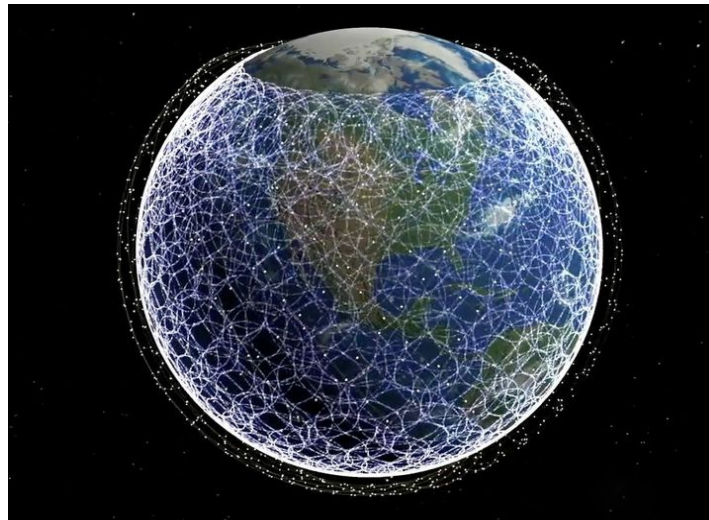
[ESA / Safety & Security](#)

- For the first time, ESA has performed a 'collision avoidance manoeuvre' to protect one of its spacecraft from colliding with a satellite in a large constellation.
- On Monday morning, the Agency's Aeolus Earth observation satellite fired its thrusters, moving it off a potential collision course with a SpaceX satellite in the Starlink constellation.
- Constellations are fleets of hundreds up to thousands of spacecraft working together in orbit. They are expected to become a defining part of Earth's space environment in the next few years.

## 2. Influence of LEO Mega-Constellation on Global Space Activities

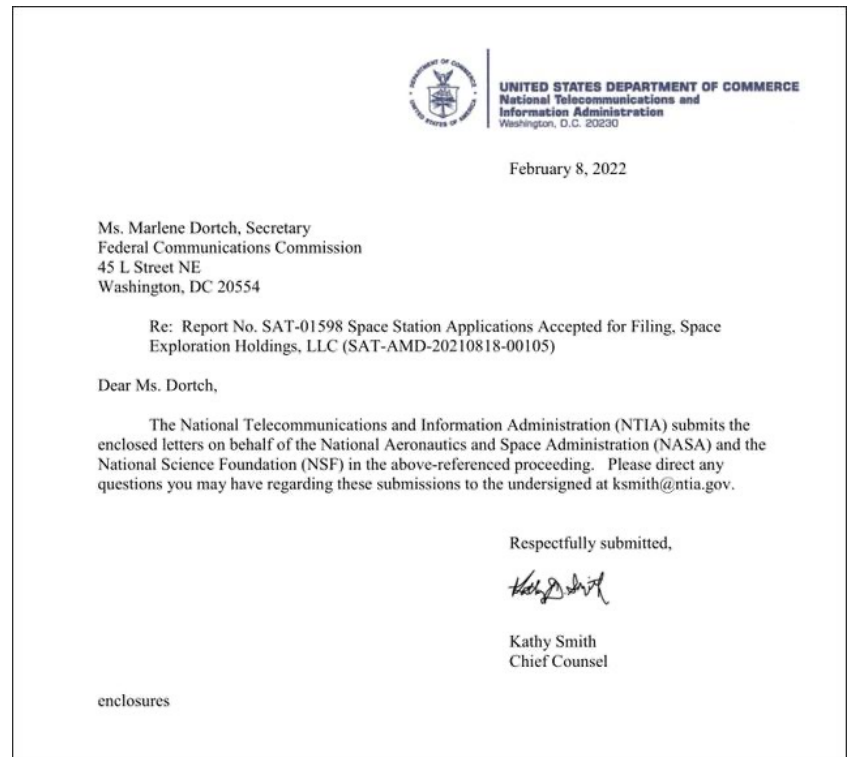
### ➤ Adverse effects on spacecraft launching

The LEO mega-constellation could form a high-density ‘space grid’ in the near-earth space, which tightly wraps the Earth in multiple layers. LEO areas become more crowded, which indicates greater collision risks, significantly reducing global safety launch windows.



## 2. Influence of LEO Mega-Constellation on Global Space Activities

On February 8th, 2022, NASA sent a letter to the FCC (Federal Communications Commission) arguing that the second generation *Starlink* constellation would interfere with NASA's normal launch and scientific activities, affecting the transportation of personnel and cargo on the International Space Station, and worrying that the safety launch window would become less available.



## 2. Influence of LEO Mega-Constellation on Global Space Activities

### ➤ Pose a serious challenge to the equal usage of frequency and orbit resources

At present, SpaceX has declared 37 pieces of network material to the International Telecommunication Union ( ITU ), which has occupied the priority of network resource coordination and is actually occupying LEO high-quality frequency/orbit resources with rapid deployment.

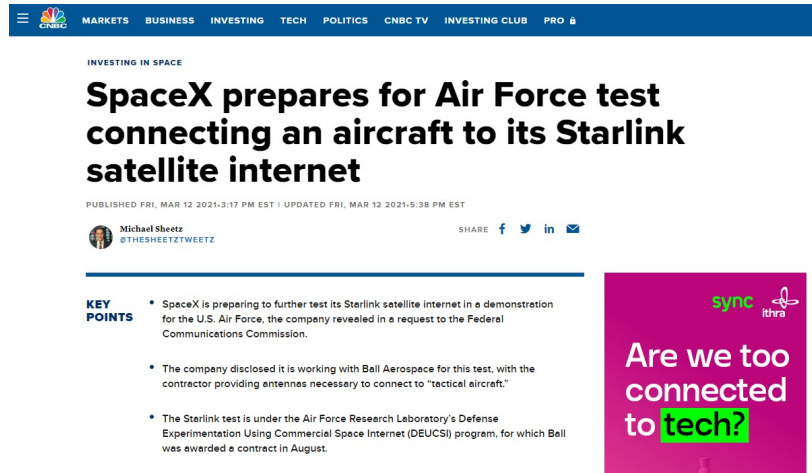
The Ku-band communication resources from LEO to MEO have basically been occupied by several major constellations, therefore other countries and institutions have less and less opportunities.

Band	Frequency	Usage	Status
C	4-7GHz	Satellite communications	near saturation
Ku	12-18GHz	Satellite communications	near saturation
Ka	27-40GHz	Broadband communication	being widely used

## 2. Influence of LEO Mega-Constellation on Global Space Activities

### ➤ LEO constellations begin to step out of business to get involved in the military field

According to US SpaceNews, after the launch of *Starlink* in 2018, the US Air Force and the US Army successively signed a *Starlink* communication service contract with SpaceX. Up to now, *Starlink* satellites have participated in joint combat exercises of the US military multiple times, such as the ‘Advanced Battle Management System’ (ABMS).



INVESTING IN SPACE

### SpaceX prepares for Air Force test connecting an aircraft to its Starlink satellite internet

PUBLISHED FRI, MAR 12 2021, 3:17 PM EST | UPDATED FRI, MAR 12 2021, 5:38 PM EST

Michael Sheetz @THESHEETZTWEETZ

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**KEY POINTS**

- SpaceX is preparing to further test its Starlink satellite internet in a demonstration for the U.S. Air Force, the company revealed in a request to the Federal Communications Commission.
- The company disclosed it is working with Bell Aerospace for this test, with the contractor providing antennas necessary to connect to "tactical aircraft."
- The Starlink test is under the Air Force Research Laboratory's Defense Experimentation Using Commercial Space Internet (DEUCSI) program, for which Bell was awarded a contract in August.

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Are we too connected to tech?



SN NEWS OPINION LAUNCH CIVIL COMMERCIAL MILITARY POL

### U.S. Army signs deal with SpaceX to assess Starlink broadband

by Sandra Erwin — May 26, 2020



The U.S. Army signed an agreement with SpaceX to test the use of Starlink broadband to connect units in the field. In this photo soldiers train at the National Training Center at Fort Irwin, Calif. Credit: Army

The Army is trying to fill a growing demand for connectivity in the field.

WASHINGTON — The U.S. Army will experiment using Starlink broadband to move data across military networks. An agreement signed with SpaceX on May 20 gives the Army three years to try out the service.

The Army and SpaceX signed a Cooperative Research and Development Agreement known as a CRADA, an Army source told *SpaceNews*.

The project will be overseen by the Combat Capabilities Development Command's C5ISR Center based at Aberdeen Proving Ground, Maryland.



# LEO Mega-Constellation is Deeply Influencing Space Activities of the World

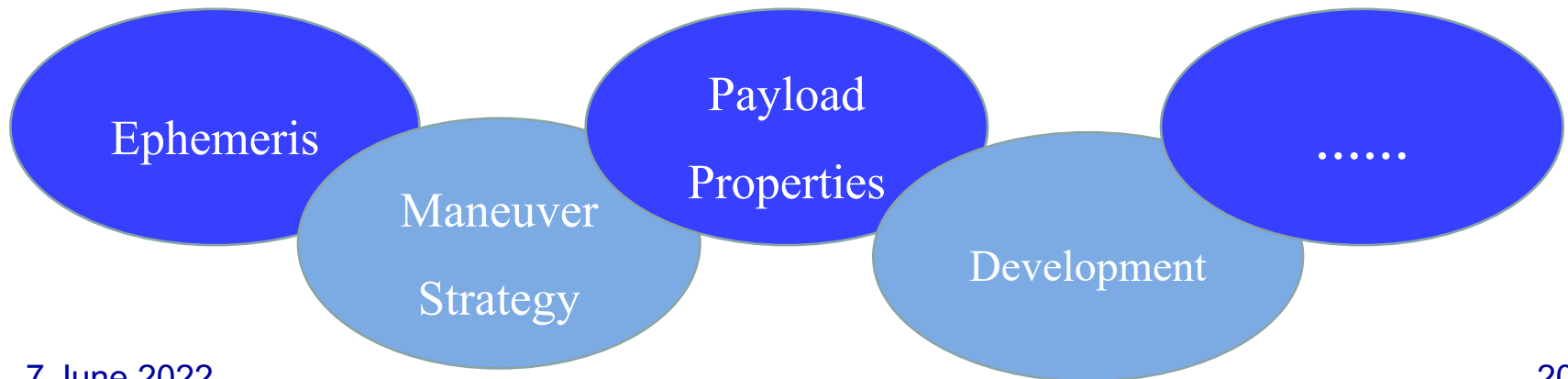
- That's the current situation of constellations and their influence on global space activities.
- It could be said that the development of mega-constellations is out of order to some extent.
- It is very necessary to take some immediate action to make it develop orderly and sustainably.

### 3. Suggestions for LEO Mega-Constellation to Develop Sustainably

#### ➤ **Improve information transparency of mega-constellations**

Countries should use the UN platform to actively promote the formulation of rules and regulations, encouraging mega-constellation companies to disclose their information to support collision avoidance. In this way, it could help reduce the probability of collision events and ensure space safety.

Meanwhile, countries should construct mechanisms to supervise relevant sections and companies within the nations to enforce transparency in time.



### 3. Suggestions for LEO Mega-Constellation to Develop Sustainably

#### ➤ **Be vigilant to militarization of LEO mega-constellations**

Some LEO constellations have begun to step out of business circle to get involved in the military field. The militarization of LEO mega-constellations starts to sprout. This must arouse great attention across all countries. People shall unite and act proactively, and take various methods to ensure LEO mega-constellations to be used for commercial purposes in a sustainable manner.



### 3. Suggestions for LEO Mega-Constellation to Develop Sustainably

#### ➤ Facilitate the development and application of space debris removal and mitigation technologies

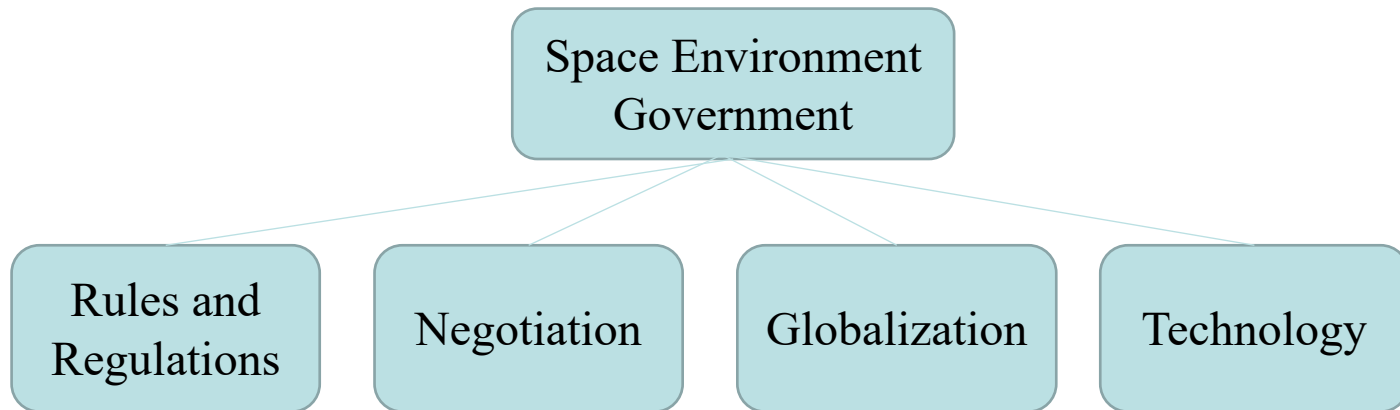
In order to protect the space environment and maintain the sustainability of outer space, all countries should take precautionary measures to strengthen research and cooperation in space debris removal and mitigation technologies, promote the development and application of technologies, and prepare for the ‘large-scale debris generation’ that may occur in the future.



### 3. Suggestions for LEO Mega-Constellation to Develop Sustainably

#### ➤ Accelerate space environment governance

All countries must unite to make full use of the platform of COPUOS, cooperate closely to accelerate discussion and formulation of outer space environmental governance, and space traffic governance rules and regulations; speed up the integration of laws and technologies, technical standards and mechanisms. Take active actions to make efforts for a Community of Shared Future for Mankind in space.





A globe of the Earth is centered in the image, showing the continents of North and South America. The globe is overlaid with a white grid of latitude and longitude lines. The background is a dark, starry space. A solid blue rectangular box is positioned horizontally across the middle of the globe, containing the text "Thank you for your attention!" in white serif font.

Thank you for your  
attention!