中国卫星网络集团有限公司
CHINA SATELLITE NETWORK GROUP CO., LTD.

Challenges and Practice in Protecting the Dark and Quiet Sky: From Observation to Action

China Satellite Network Group Co., Ltd

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01. Company Profile

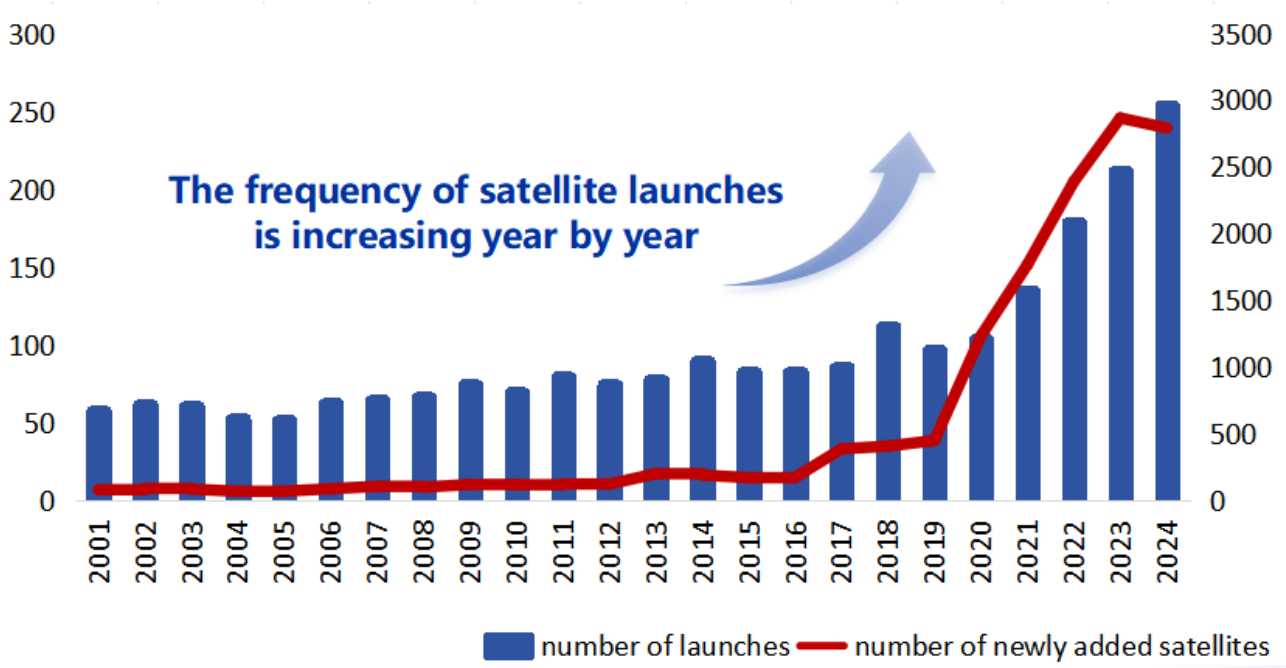
- ✓ China Satellite Network Group Co., Ltd (CSCN) is a state-owned satellite communication operator.
- ✓ CSCN's status is on par with that of major telecommunications operators such as China Telecom, China Mobile, and China Unicom.
- ✓ Since 2021, CSCN is responsible for the **design, construction and operation** of our global satellite network.
- ✓ Our global network is composed of a LEO constellation and several GSO satellites.

Headquarter in XIONGAN New Area

02. Influence of LEO constellation on RAS

➢ Current Status and developing trend of LEO Constellations

- ✓ With the continuous advancement of human space exploration, the space environment is facing a pressure of large-scale constellation.
- ✓ According to statistics, the total number of satellites in announced large-scale constellation plans exceeds 130,000.



02. Influence of LEO constellation on RAS

➢ Influence on RAS and space activities

RFI: The Most Direct Threat

- Radio-frequency interference from LEO constellations poses the most immediate threat on the scientific data.

Intentional Emissions

High-power downlinks can swamp faint celestial signals, rendering observations useless.

Unintentional Leakage

Broadband electromagnetic noise from processors and power systems pollutes adjacent bands, raising the overall noise floor.

Crowded Space & Spectrum

- A dual scarcity challenge of physical space and radio spectrum.

Physical Space Congestion

Tens of thousands of satellites and debris thread through telescope fields of view, increasing collision risks and observation interruptions.

Radio Spectrum Scarcity

Astronomy's "quiet" bands are shrinking as demand from 5G and satellites grows, turning spectrum into a contested resource.

02. Influence of LEO constellation on RAS

➢ Impact of satellite brightness on RAS

- ✓ The brightness in the night sky causes optical interference, while transmission signals create radio frequency interference (RFI), collectively degrading the sensitivity of radio astronomy observations.
- ✓ International efforts are ongoing to develop mitigation strategies, such as satellite dimming.

03. Technical Roadmap

➢ Geographic Avoidance

Set up exclusion zones. The satellite station site is far from the observatory site

In the mission planning phase, Integrate latitude and longitude exclusion zones of major global observatories.

The measure covers both cooperative and non-cooperative observatories worldwide.

03. Technical Roadmap

➢ Beam Avoidance

Non-Cooperative Observatories

- For observatories operating without active coordination, it is recommended that routine avoidance measures be activated once data loss percentage exceeds the thresholds specified in the ITU Recommendation.
- Distinct avoidance zones must be defined for observatories at different latitudes.

Cooperative Observatories

- For observatories who share schedules, the system enables partition-level beam steering.
- This allows for dynamic and data-driven protection to specific, pre-shared astronomical scans.

04. Life-Cycle Stewardship

Life-Cycle Stewardship: With Responsibility Embedded in Every Phase

Dark & Quiet Skies protection runs throughout the satellites network's life cycle.

Feasibility

Incorporating Dark & Quiet Skies requirements into initial checklists and business cases ensures RAS are fully protected

Design

The design of low-reflective coating materials and advanced protective measures serve as core references for design

Operation

On-orbit testing verifies interference with the observatory before operation.

05. Conclusions

Raising Awareness: Confronting an Increasingly Urgent Challenge

A growing number of satellites are filling low Earth orbit, subtly yet profoundly altering the sky above us. This is not only a matter for the future of science but also concerns our shared cultural and natural heritage.

Leading the Way: Our Commitment

CSCN solemnly commits to taking a leading role in addressing both current and future challenges, ensuring the sustainable use of outer space and preserving dark and quiet skies for generations to come.

Building Consensus: A Call for Global Collaboration

We firmly believe that open, inclusive, and multi-stakeholder dialogue among the astronomy community, satellite operators and manufacturers, policymakers, and regulators is essential to advancing practical and sustainable solutions.

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Thank you!