

Ensuring Frequency Spectrum and Orbit Resources Sustainability in the New Space Era

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Although I'll be referring to the RRB works in this presentation, please note that the views expressed are not representing the opinion of the Board or ITU Secretariat, just thoughts by the author of the presentation.

So, after one day of lively and enriching discussions, let's turn to a particular aspect of space sustainability whether frequency spectrum and orbit resources sustainability is a wishful thinking or not.

Well, the ITU basic texts already encompass such concept in No. 195 of the Constitution that says that "Members shall endeavour to limit the number of frequencies and the spectrum used to a minimum essential to provide in a satisfactory manner the necessary services"; No. 196 of the same Constitution also states that this natural spectrum and orbit resources must be used rationally, efficiently and economically to facilitate equitable access to all.

In addition, the ITU stakeholders adopted PP Resolution 219 (Bucharest, 2022), on sustainability of the radio-frequency spectrum and associated satellite-orbit resources and Ra-23 adopted Resolution ITU-R 74 on the same issue.

So, at this stage, should we restrict ourselves only to developing an ITU-R website on the subjects or a Handbook on best practices for the sustainable use of frequencies or the efficient deorbiting? Both are definitely quite useful, but if we want to tackle really the issue, we should consider with urgency, and I insist on the term urgency, exploring new ITU regulatory perspectives and opportunities offering new insights and raising new questions and new avenues to address the issue of the long-term sustainability taking account of the ongoing ITU satellite system filings by administrations of satellite constellations comprising tens to hundreds of thousands of satellites. With urgency, I mean studies, discussions and decisions at WRC-27.

Introduction and Current Challenges

RRB's role: Ensuring equitable access and rational use of radio spectrum and satellite orbits

Challenges:

- Exponential growth in satellite networks and systems
- associated growth in orbital debris risk
- increasing use of non-geostationary orbits (NGSO), with explosive growth of extra large NGSO systems not subject to ARTS coordination
- Rush to large constellations as a combination of 'first come, first served' principle and competition to be first to market for broadband and now direct to device services
- Complexity in coordination and bringing into use (BIU) procedures of NGSO systems
- Risk of harmful interference between systems
- Potential for spectrum warehousing and inefficient use



Because of the urgency, let's the philosophical aspects of space sustainability to tomorrow's thinkers and other UN agencies and Committees and try to be more pragmatic in exploring some regulatory aspects of space sustainability with focus on what added value it could offer to the current ITU satellite system registration.

We are witnessing an increased number of low Earth orbit (LEO) satellite system filings that proposed to deploy constellations comprising tens to hundreds of thousands of satellites

notably in frequency bands and services not subject to mandatory coordination nor to Resolution 35 (WRC-19), the famous milestone-based approach for NGSO space stations deployment in specific frequency bands and services. Looking to the “as received” BR site recently, I have noticed filings of such systems with more than 500 planes and more than 75000 satellites or 288 planes with 29988 satellites or 168 planes and 13440 satellites between 340 and 800 Km... If this is the reality of tomorrow, I am frightened by the associated growth in orbital debris risk. And wonder how such behaviour respects No. 195 and No. 196 of the Constitution !

Although the long-term sustainability of the LEO resource may not be defined as such in the ITU instruments, some key constituent parts of this concept belongs to ITU with its focus on the prevention of harmful interference and ensuring the rational, efficient, economic, and equitable use of the spectrum/orbit resources in conformity with the provisions of the Radio Regulations. More larger and larger LEO systems means more difficulty in the coordination and more likely increase in potential harmful interference cases, including harmful interference with GSO networks.

Today’ s behaviour with NGSO filings reminds me of a similar situation back at the beginning of this century with GSO orbital location and spectrum warehousing. The regulatory GSO environment is not perfect nowadays but with the introduction of the cost recovery, a more systematic review of the reality of BIU and continuing use of frequency assignments, the ITU indeed responded to the challenge and improved the situation. Time is now to do the same for all NGSO satellite system filings and not only for the few ones subject to Res.35

Key Findings from RRB Report to WRC-23...still topical!

- Proliferation of large LEO constellations - Concerns for orbital sustainability, and spectrum congestion. Challenges for new entrants
- Challenges to ITU regulatory framework - Criticism of ITU’s absence of true response to large constellations. Some countries considering rules outside ITU
- Increased risk of satellite interference - Complex scenarios with many satellites/planes.
- Misuse of regulatory provisions (No. 4.4) - Bypass normal procedures. Growing use for commercial services
- Long-term space sustainability - Need for additional deployment information and precise sharing strategies for large systems. Concerns about space debris mitigation and fleet maintenance.

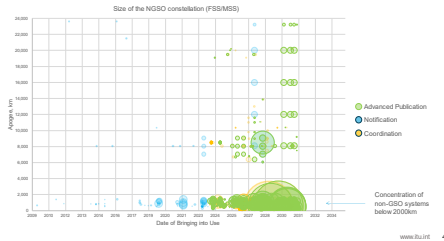


Many large constellations combined with a flurry of smaller constellations may effectively preempt entire frequency bands and services. I have read criticisms against the ITU for not being proactive enough against such filing behaviour (especially for the very largest non-GSO systems) and in response to what is perceived as a lack of action by the ITU, suggestions emerged encouraging countries to work outside of the ITU’s well-established framework with national procedures deviating from the framework for equitable spectrum and orbit resources access embedded in the ITU basic instruments.

“Wild west” or law of the jungle!

Such behaviour may lead to unresolvable and continuing harmful interference between satellite networks and systems, preventing the delivery of vital services to the population, in particular the so called unconnected ones, in need all over the world. Such approach may also adversely affect Internet broadband access and much-needed support communications in the wake of disasters and emergencies.

However, I am a born optimist and I command the ITU general Secretariat and the BR to have organised this first ITU Space Sustainability Forum to support space’s ongoing growth and identify clear actions, including regulatory ones within the purview of ITU for an exciting space future.



Two charts to illustrate the situation.

Based on the latest SRS data base the first chart shows NGSOs with at least a frequency assignment in FSS or MSS and for:

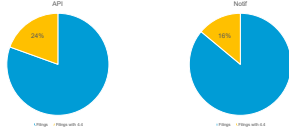
API not subject to ART 9 coordination – only No.11.31 examination by the Bureau at Notification stage

Coordination – published (status 50) with regulatory BIU deadline after 2024

Notification – recorded (status 50 meaning favourable findings).

he bigger the bubble - the bigger the constellation (number of satellites in ten thousands....)

Percentage of filings containing No. 4.4 assignments



For the second chart (No. 4.4), it considers all NGSO in status 50 meaning favourable findings for all service (not limited to FSS or MSS).

What this 24% of satellite system filings at API stage highlights is an increased reliance on No. 4.4 by administrations and operators as a means to secure access to spectrum and orbital resources they wished to use outside of the mandatory service allocation table and coordination process.

Can we describe such behaviour as a sustainable one? My personal response is NO.

Indeed, a large number of NGSO system filings under No. 4.4 although operational remains at API stage and are rarely notified under No. 11.18. An abuse of the RR where entire frequency bands and service are pre-empted with almost no practical possibility for administrations to comment under No. 9.3 to resolve sharing difficulties

There are alternative though by improving the RoP onNo. 4.4, for exemple calling for more precise sharing strategies and explanations for the non-GSO filing, in particular when thousands of satellites are operating in non-conforming frequency assignments under No. 8.4, including measures taken in order to comply with the requirement to immediately eliminate harmful interference pursuant under No. 8.5, or to more regularly check the status

of NGSO systems at API stage to ensure that those operational ones have been or are being notified.

May be for systems notified under No. 4.4 to introduce a shorter AP 4 period of validity (A2b), for example 5 years.

Solutions for Long-Term Sustainability (1/2)

- * Regulatory Compliance - Ensure genuine use of frequency assignments. Address misuse of provision No. 4.4 – strict application of the RoP No.4.4
- * Technical Measures - Require detailed deployment and operational information or milestones for ALL NGSO systems e.g., rationale for the requested number of satellites and planes, planned launch schedule...
- * Sustainable Use - Balance innovation with sustainable use of resources. Plan fleet maintenance, timely desorbiting strategies and mitigation of space debris...
- * ... to be added to AP4 requirements, new/reviewed Res. 35, ... at WRC-27



So would space sustainability be another wishful thinking based only on harmonised comprehensive guidelines, best practises or non-constraining accepted framework flouted with no consequence, with any stronger regulations to take years to be adopted and make an impact.

I read recently that forty percent of all satellites in low Earth orbit that should have de-orbited in 2022 under international guidelines failed to do so, with most of them making no attempt, a performance slightly worse than in the two previous years. I read also that some new generations of satellites designed to connect directly to smartphones shine nearly five times brighter in the sky than traditional ones, poor radio astronomers!

It still remains me full of details that could be regulated by e.g. the ITU RR, Resolutions, Rules of procedure or recommendations. Paris or Rome was not made in one day but in the case of ITU, there may also be a constructive role for it to play at WRC-27, beyond a Handbook on best practices for the sustainable use of frequencies and associated non-GSO orbits.

Let's be practical with some workable and easy implementable approaches as suggested on the slide:

Requiring mandatory additional deployment and operational information or milestones of ALL non-GSO systems, for example on the rationale for the requested number of satellites and planes to secure the intended services to customers; at that early stage such information would be of informative nature, the goal being for operators beyond the filings to be more accountable for such filing behavior; also information on the satellite's responsible design and mitigation of space debris; the planned launch schedule to support the implementation of the system which could be derived from the information and experience gained with the application of Resolution 35 (WRC-19) ; I am just wondering how long it could take to launch 75000 satellites for a single constellations ... in less than 7 years!

All such information and data may be consolidated in an improved AP4 at WRC-27, or if time is short for a formal new AP4, it could be part of a Resolution or even of a Rules of procedure, should WRC-27 have the courage to study it and not postponing it indefinitely, (to the famous Greek Calends in French))

Solutions for Long-Term Sustainability (2/2)

- Consideration of a "sustainability finding" for NGSO filings. DPA4A to develop a file and a future WRC to incorporate this into ADR or through a Resolution
- International Cooperation - Strengthen cooperation for interference resolution, improve international monitoring systems
- Equitable Access - Conduct ITU-R studies on fair access to orbits and frequencies
- Study of operational, technical and frequency requirements to provide In-Orbit Services (IOS) (space inspection, life extension, maintenance, repair, relocation, refuelling), End-of-Life (EOL) and active debris removal (ADR) services to GSO and non-GSO satellite
- ... at WRC-27!



Let be "avant gardiste" with an approach fitting in well with the policy of sustainable development. Why not to introduce a "sustainability finding" associated with each NGSO filing, with a checklist that could include the following:

[5 to ...5 years] to deorbit after end of life

Collision avoidance scheme during operation and end of life

Controlled or Uncontrolled re-entry at end of life

Space Traffic Management policies

Measures to promote dark and quiet skies

Fleet renewal plans...

May be too forward thinking but why not for appropriate Study Groups and working parties to develop such checklist as a Recommendation and WRC-27 to incorporate it into the RR or through a Resolution

Also beyond the regulatory approach to the current ITU registration process for satellite systems and for supporting it, we should not delayed the development of studies on the operational and technical requirements, characteristics, performance and possible benefits associated to technologies and innovative solutions being developed to provide In-Orbit Services (IOS) (space inspection, life extension, maintenance, repair, relocation, refuelling), End-of-Life (EOL) and active debris removal (ADR) services to GSO and non-GSO satellite, all parts of the space sustainability environment and within the ITU responsibility.

Merci!

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So wishful thinking or not,

Let me quote a Chinese proverb that says:

"When the wiseman points at the moon, the fool looks at his finger."

Let's all together look at the moon and not to the wiseman's finger.

WRC-27 is next to us and we shall overcome all difficulties for the conference to be the one that has responded to the challenge of Ensuring Frequency Spectrum and Orbit Resources Sustainability in the New Space Era.

Thank you