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Cyber Security Challenges on Critical Satellite Communications of GovSATCOM and the upcomming IRIS2

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SatCom Categories

ComSATCOM

Commercial Satellite
 Communications

GovSATCOM

Governmental Satellite
 Communications

MiliSATCOM

• Military Satellite Communications



- Mobility
- Flexibility
- **IoT**
- High Data rates

Moderate Security
Public Safety Communication
Maritime awareness
Medium data rates
Reliable Communications

High Security Robustness (anti-jamming) 24/7 Availability Secure telemetry Low data rates

Financial grow on SatComs in Europe

Demands for GovSATCOM:

- Reliable and Secure SATCOMS for Mission Critical Communications (or P.P.D.R.) sector that aims first responders on the field.
- Communications for Border Surveillance, Maritime Awareness & Cris Management.
- On the interconnection between Goveremental Critical Infrastructures, i.e , GreeCom in Greece.

Financial growth on Satcom

- Revenues from SATCOM services on 2021 \$98.5 Billions and estimated to grow more \$ 112.4 Billions.
- Revenues from GEO Satellites was € 6,350 millions, expected to shrink more on € 3,235 millions until to 2031.
- Revenues due to NGSO constellation was on €328 millions on 2021, expected to be more than €10,748 millions at 2031.

Revenues for Data segments, billion € (2021 – 2031) (1)(2)

Revenues for Video segments, billion € (2021 - 2031) (1)(2)



** EUSPA Secure Market and User Report 2023/ISSUE 1







New technologies and trends on Satcoms

New demands for GovATCOM:

- Higher data Rates throughput
- Increase the Security GovSATCOM and wiretapping .

New technologies on SATCOM:

- Adding new frequency bands on Ka-band , X-band , Q/V
- Free Space Optical links between satellites
- Adding cryptographic keys ,QKD technology to encryption .

Key Performance Parameters (KPPs):

- Improve the latency on Satellite Communication below from 250ms, with new LEO constellation.
- Improve Mobility
- Support multiple different Bitrates (Mbps), based on the User requirements .

Typical enabled data rate (Gbps) ⁽¹⁾	~0.5 Gbps	~1.5-3 Gbps ⁽²⁾	~15-30 Gbps ⁽²⁾
Optical links			
EHF ; Q/V etc ⁽³⁾			
Ka-band ⁽⁴⁾			
X-band			
UHF			
	2010-2020	2020-2030	2030-2040





Predecessors of GovSATCOM in Europe :

- France, Syrecuse-III (3A & 3B 2-Sats) supporting State Department (Defence)
- UK, Skynet-5, (2 -Sats) for Defence, Department of Defence
- Germany, SatcomBw's, (SatcomBw's 1,2) for Defence, Department of Defence
- Italy, Sicral, (Sicral -1A, 1B) for Defence, Department of Defence
- Spain , Secomsat, (SpainSat, XTAR-EUR) for Defence, Department of Defence

<u>Cross-Border Collaborations</u>:

- Sircal -2, (Syrecuse-3C payload) by Frace-Italy (2010)
- Athena-FIDUS, Sircal-2 (complementary, 2014)
- ESCPC by 8 Countries (from 2013) Secure Satellite Communication in Europe.



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Evolution of GovSatcom ...2

Main Pillars of GovSATCOM:

- Integration all Satcom Infrastructure, tools & Services of the EU member States, to maximize the geographical coverage and efficiency.
- Strengthening the Civil Protection Mechanisms to support Natural Hazards and Crises in EU and Globally.
- Cost efficient solution to support Secure Satellite Communications for Governmental and Defence Agencies.

1st Phase GovSATCOM:

- Horizon 2018-2025, existing SATCOMs by EU Member States.
- Access through **Hubs**, where all Users (Governmental) connected with their Operation Centres.

2nd Phase GovSATCOM :

• Developing additional infrastructure expanding the partnerships with Private Sector to fulfil the requirements on interoperability with more manufactures.









Transition to IRIS2 ...1

"Infrastructure for Resilience , Interconnectivity and Security by Satellites "

Objectives of IRIS2:

- Geopolitical changes (wars, conflicts)
- International collaborations in Space Comms (China and Russia)
- High competition in Space launching LEO constellations.

Important Milestones:

- European Council (proceedings 10/2020), support secure communication with Industry collaboration in Space.
- > Funding approved for IRIS2 (2023 2027).







Transition to IRIS2 ...2

Framework of IRIS:

- IRIS will **complement** the GovSATCOM infrastructure.
- IRIS & GovSATCOM Services are registered and will be distributed with **priority** on users from Hubs.

Supported Services:

- Governmental users
 - **Over Govermental Infrastructures**
 - Robust **Service globally**, low latency <250ms
 - Data relay between satellites LEO to LEO , LEO to GEO .
 - Over Commercial Infrastructures
 - Guaranteed services low latency <250ms, globally
 - Push –to Talk Communications .

Other Benefits:

- > The capacity of GovSATCOM infrastructure will be increase.
- > Near real-time interoperability between critical infrastructures.











Satcom Requirements:

- A Communication system offers
- a) Secure connectivity b) Autonomous,
- c) Reliable d) Cost Efficient system Governmental Users and Authorities .

European Quantum Communication Infrastructure -EuroQCI

- In 6/2019 all the 27 European member States signed the declaration of EuroQCI that is planed to operated on 2027.
- EuroQCI will be major pillars in EU strategy for cyber security in coming decades.
- EuroQCI Program Categories :
 - Quantum Key Distribution QKD, A-B produce a random secret key that is known only by them and this can be used to encrypt and un-encryption of data.
 - Quantum Network Services QNS
 - Quantum Communication Infrastructure QCI







• **QKD** technology.

Will play crucial role against eavesdropping actions, is an encryption technology prevents tracking of keys by third-party users, QKD enables secure transferring keys between two connected sites with such a way that only that sites –owners knows these keys. A third-party cannot track or watch this connection <u>without affecting it</u>, so only these 2 users can detect any interference in distribution of keys.

QkD technology will operate on Optical Ground Stations that they need to interconnected via QCI network for sharing the keys.

- Distance Limitations:
 - QKD is limited by the optical signal is decreasing over communication path (Photon Loss) and is effective (x100km).
 - Quantum Repeaters, needed to applify the signal without affect it i.e to measure it ,(preserve the quantum state).







- Infrastructure challenges:
- QKD required unique equipment on optical systems (i.e Quantum Generators, single photon detectors)
- Dedicated for point to point communication links .
- Interoperability with existing networks requires significant upgrade, needed to be addressed to enable seamless deployments.
- The Scalability of the network to support large networks with multiple nodes and users is challenging
- Lack of **Standards** is challenge for wider adoption , need to ensure compatibility between different vendors .
- Faces problems for applications that requires high data throughput, currently generates and transmits keys at a slow rate few Mbps, needed to improved by research.







Critical Satellite Communications on the filed

Mission on Antinoch Crisss from massive earth quake (Turkiye 6-2-2023):

- Hellenic FireService sent support rescue teams:
- 36 fire-rescuers (2-Special Units for Disasters (E.M.A.K.)
- 3 special trained dogs
- 3 special vehicles

Crisis Situation:

- Outage on Telecommunication Infrastructure.
- Outage on Energy Grid.
- Communications over Satellite terminals supported by Private SATCOM with terrestrial networks
- 2-GEO Satellites are used.









- Europe roadmap set IRIS2 as complementary to the GovSATCOM and separate it form other SATCOMs like MiliSATCOM.
- Expands cooperation between EU Member States supporting Civil Protection on Natural Disasters, Crises Management and Border Surveillance.
- Urges manufactures to interoperability on SATCOM infrastructures.
- Convergence long term Program of GovSatcom IRIS2, plan to operate with more than 170 LEO Communication Satellites to ensure secure Communication among Governmental users.

Security

- EuroQCI is in development with a great participation from Institutes, Companies and Academia. (very promising)
- QKD technology will play crucial role on eavesdropping actions, (encryption and authentication).
- Practical Quantum repeaters, Standardization, Scalability and Faster encrypted QKD links, remains a significant technical challenges.







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Thank you for your attention !!!