International Telecommunication Union

Workshop On The Efficient Use Of The Satellite Orbital Resource

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Regulatory Best Practices for Earth Stations on Mobile Platforms

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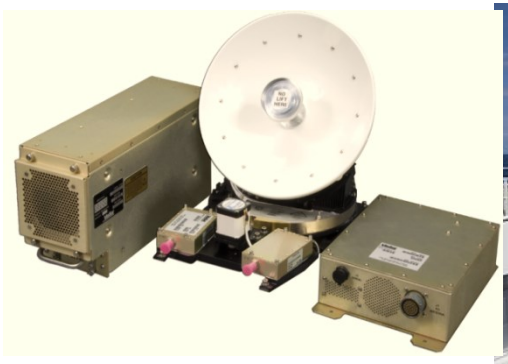
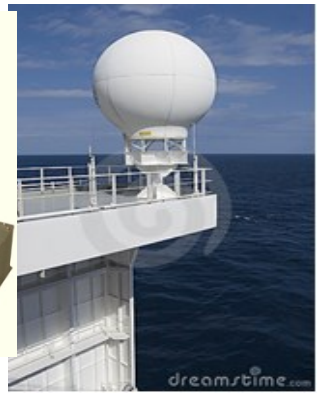
Earth Stations on Mobile Platforms (ESOMPs)

- ESOMPs are not new. Operating in the Ku band since before 2003 and in Ka band since 2013
- ESOMPs have been, and are being, designed to operate with FSS satellites while meeting the same performance parameters that apply to traditional FSS earth stations
- Many of the same best practices that apply to traditional FSS earth stations also apply to ESOMPs, but motion of the platform requires attention to additional details and new best practices

ESOMPs are not conventional MSS terminals

ESOMPs look like this:





Not like this:

Motion Related Effects

- Antenna stabilization and antenna pointing accuracy
  - Must keep antenna beam within off-axis e.i.r.p. density mask
  - Inhibit transmission if antenna pointing error exceeds threshold
- Aerodynamic or height constraints require smaller diameter or lower profile antennas
  - Smaller antennas may require low density waveforms or spreading of return links to meet off-axis emission limits
  - Asymmetric antennas typically have wider beamwidth in the elevation plane and require attention to skew angle during operation to control spread of main beam width

ESOMP Reports

- ITU-R Report S.2223 and Report S.2357
  - Technical and Operational Guidelines for ESOMPs communicating with GSO FSS spacecraft in the 20/30 GHz band
- ECC Report 184
  - Use of ESOMPs with GSO satellite networks in the 20/30 GHz band

Performance Requirements

- ITU-R Recommendation S.524-9, ECC Decision (13)01, ETSI EN 303 978
- What are some of the main requirements?
  - Operate under control of a network management system
  - Meet the off-axis e.i.r.p. density mask in the plane of the GSO under all motion conditions or inhibit transmission
  - Resume transmission only when emissions will be back under the mask.
    - e.g., normal pointing error of less than 0.2°, ability to cease transmissions if pointing error exceeds 0.5° and restart transmissions when pointing error returns to less than 0.2°

Requirements Continued

- Be self-monitoring and cease transmissions if a fault potentially effecting emissions is detected
- Insure that aggregate off-axis e.i.r.p. levels of all co-frequency earth stations in the network must not exceed levels coordinated for typical FSS earth stations for that transponder

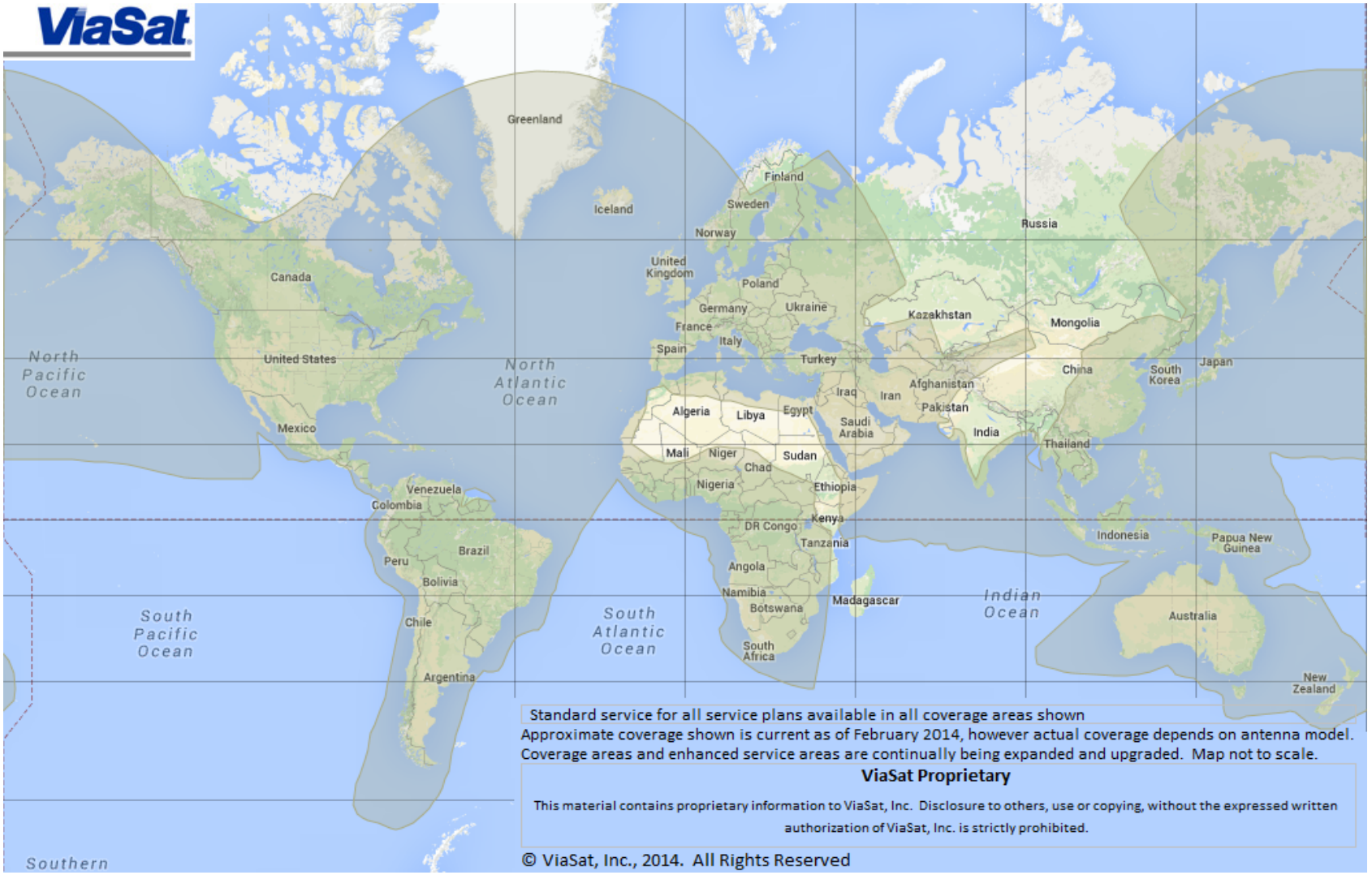
Conclusion

- ESOMPs are designed to inhibit transmissions if e.i.r.p. density mask would be exceeded or if anomalies in equipment occur
- Operation under control of a network management system insures individual earth stations are meeting performance requirements
- Operational experience shows that ESOMPs compare favorably with fixed Ka band VSATs

Real World Experience

- ViaSat operates a world-wide Ku band network with roughly 3500 operational aero and maritime terminals
  - Licensed since 2004 with zero complaints of interference
- ViaSat's Ka band aero network has 400+ operational aircraft terminals (JetBlue/United)
  - Licensed since 2013 with zero complaints of interference

ViaSat Ku band Mobility Coverage



ViaSat High Capacity Ka-band Coverage