Industry Sub-Working Group

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Agenda

- SATCON2
  - Provide summary of Industry working group SATCON2 output
- D&QS
  - Provide an update of the ongoing work of the sub-working group of the Satellite Constellation working group

SATCON2 Summary – Pre-Launch Mitigation Approaches

- For many proposed constellations, it will be less disruptive to assess any mitigations needed in spacecraft design, constellation architecture or operational changes before system is in production. Course-corrections once initial production is underway more likely to be prohibitively costly and cause significant delays in manufacturing and deployment.

- Report will explore availability and feasibility of laboratory testing and modeling techniques for satellite manufacturers in design/test stage, including Bi-directional Reflectance Distribution Function (BRDF) measurements

SATCON2 Summary – Post-Launch Mitigation Techniques and Analytical Resources

- Industry will require comprehensive, scientific and reliable observation of spacecraft, both prior to any mitigation and after to assess effectiveness
  - Observations Working Group is developing this concept
- Astronomers will require transparent location data after deployment in order to schedule around constellations where possible
  - Satellite operators are working on increased fidelity and availability of location data
- RECOMMENDATION: Encourage dialogue on what kinds of information could be published and how to keep it secure.
  - Determine from satellite operators, how quickly they require observational feedback to refine visibility mitigations.
  - Request information from astronomers on how widely/often observatories are prepared to use position data for actual scheduling of observations.

SATCON2 Summary – Performance Based Metrics

- Technical work on mitigation techniques and analytical tools to predict visibility prior to launch are in early developmental stages. There is ongoing research, modeling, and analytical work underway to better inform and understand this new research intersection of satellites and astronomy.

- RECOMMENDATION: Any mitigation best practices, guidelines or recommendations, should focus on performance-based metrics and general design approaches, rather than on any specific, overly-prescriptive mitigations. Different mitigations will be suitable for different types of constellations and operators. This will also encourage ongoing technology research and innovation into additional mitigation strategies.

SATCON2 Summary – Conclusion

- Considerable progress in raising awareness of satellites constellation potential to impact astronomy
  - Further outreach required with industrial base and other host countries
- Refine and rebalance the SATCON1 Mitigation goals
  - 7 mag brightness remains the highest priority
- Encourage operators to consider effects on astronomy early in constellation development
  - Share mitigation approaches and lessons learned
- Build accurate, cost effective and readily available testing and modeling during early stages of constellation design
- Routinize observational data and expand transparency from satellite location data
- Best practices, guidelines should focus on clear outcomes and performance based metrics, not proscriptive approaches
  - Foster ongoing innovation in mitigation and voluntary measures

D&QS Industry Sub-Working Group of the Satellite Constellation Working Group

- Developing best practices list for satellite operators, initially developed by the American Astronomical Society
- Reaching out to a broader set of satellite operators
- Developing a framework to implement the D&QS recommendations (4 questions assigned to Industry)

D&QS Industry Sub-Working Group of the Satellite Constellation Working Group

- Sat_Con 3. Raise awareness of the impacts on astronomy amongst designers, investors, regulators, manufacturers and operators, and include impact mitigations as a core component of corporate social responsibility and sustainability strategies.

- Sat_Con 6. Provide timely, transparent and reliable data to the astronomy community and observatories to allow sufficient planning to avoid impacts and post-hoc analysis of incurred impacts. Data required include: spacecraft design, brightness data, mission designs and orbital profiles, attitude control, and predicted and real-time orbital elements.Developing best practices list for satellite operators, initially developed by the American Astronomical Society

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- Sat_Con 4. Design missions to minimize negative impacts on astronomical observations by: a) minimising operational altitudes — satellites in constellations with higher orbital shells are illuminated by the sun for longer during the night and appear more ‘in focus’ to telescopes; in general, the impact on astronomy increases with constellation altitude. Scientific analysis shows that orbits on the order of 600km or below offer a compromise between brightness and the length of time satellites are illuminated during the night; b) minimizing the number of satellite units as second priority to altitude while maintaining safe operational practices; c) minimising the time spent in orbit when not in service.

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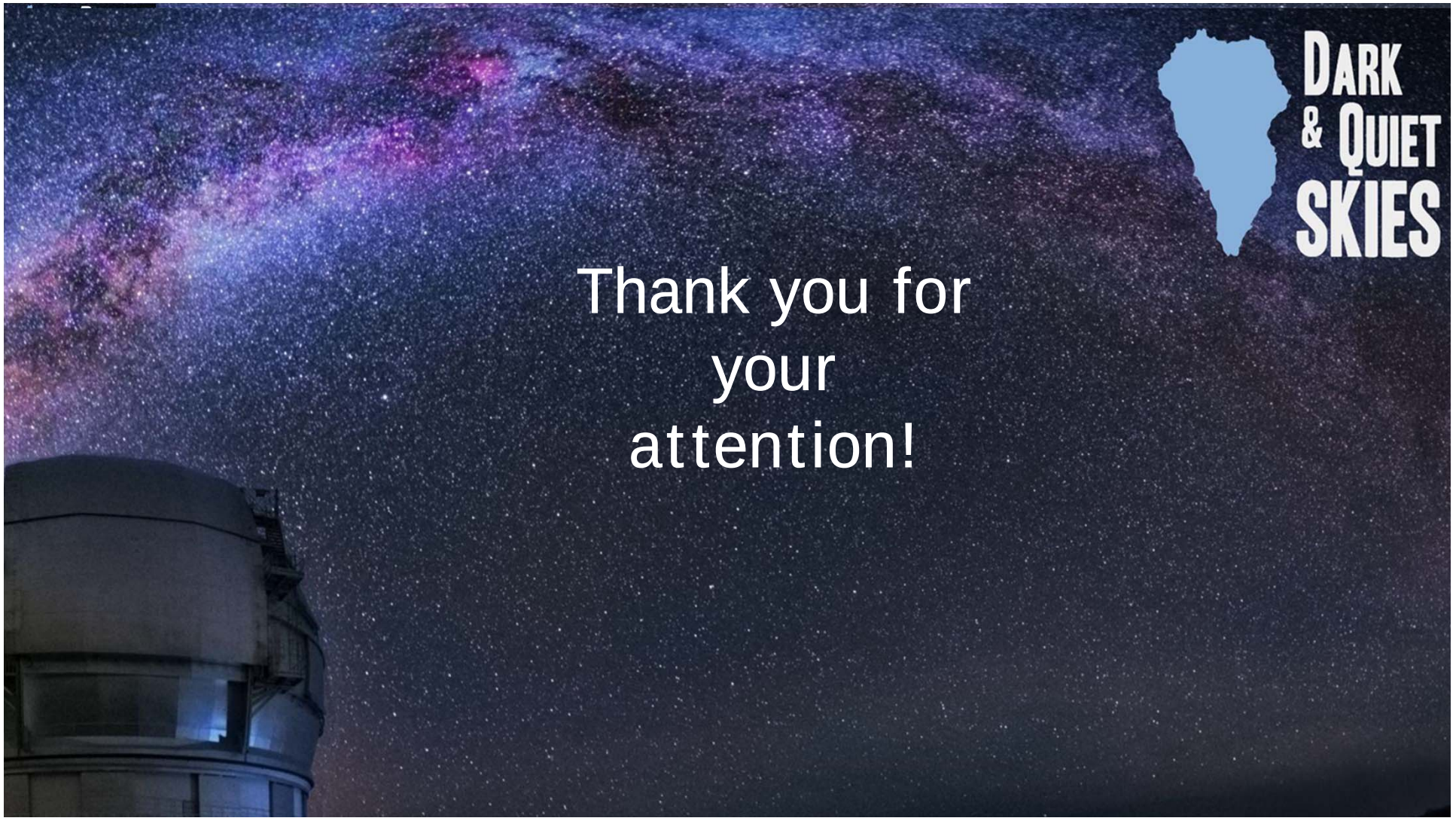
- Sat_Con 5. Design satellites to minimize negative impacts on astronomical observations by: a) guaranteeing that all satellites appear fainter than 7.0 Vmag +2.5 × log(SatAltitude / 550 km) with a minimum value - corresponding to maximum brightness - of visual magnitude (Vmag) 7 during all flight phases, which makes them undetectable to the unaided eye; b) minimizing antenna sidelobe emissions such that their indirect illumination of radio observatories and radio quiet zones do not interfere, individually or in the aggregate; c) preventing direct illumination of radio observatories and radio quiet zones with a satellite's main antenna beam.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Thank you for
your
attention!