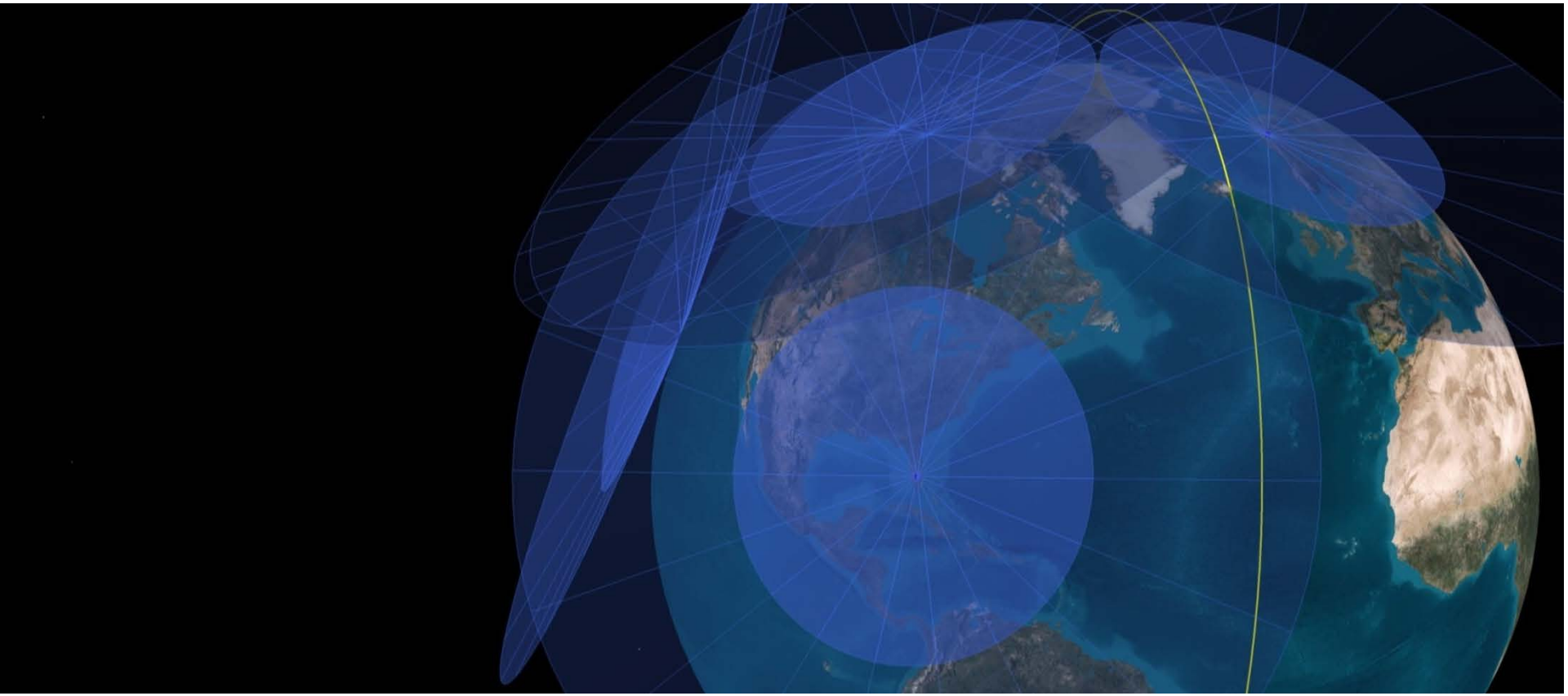
5-Minute briefing on Optical, SSC view



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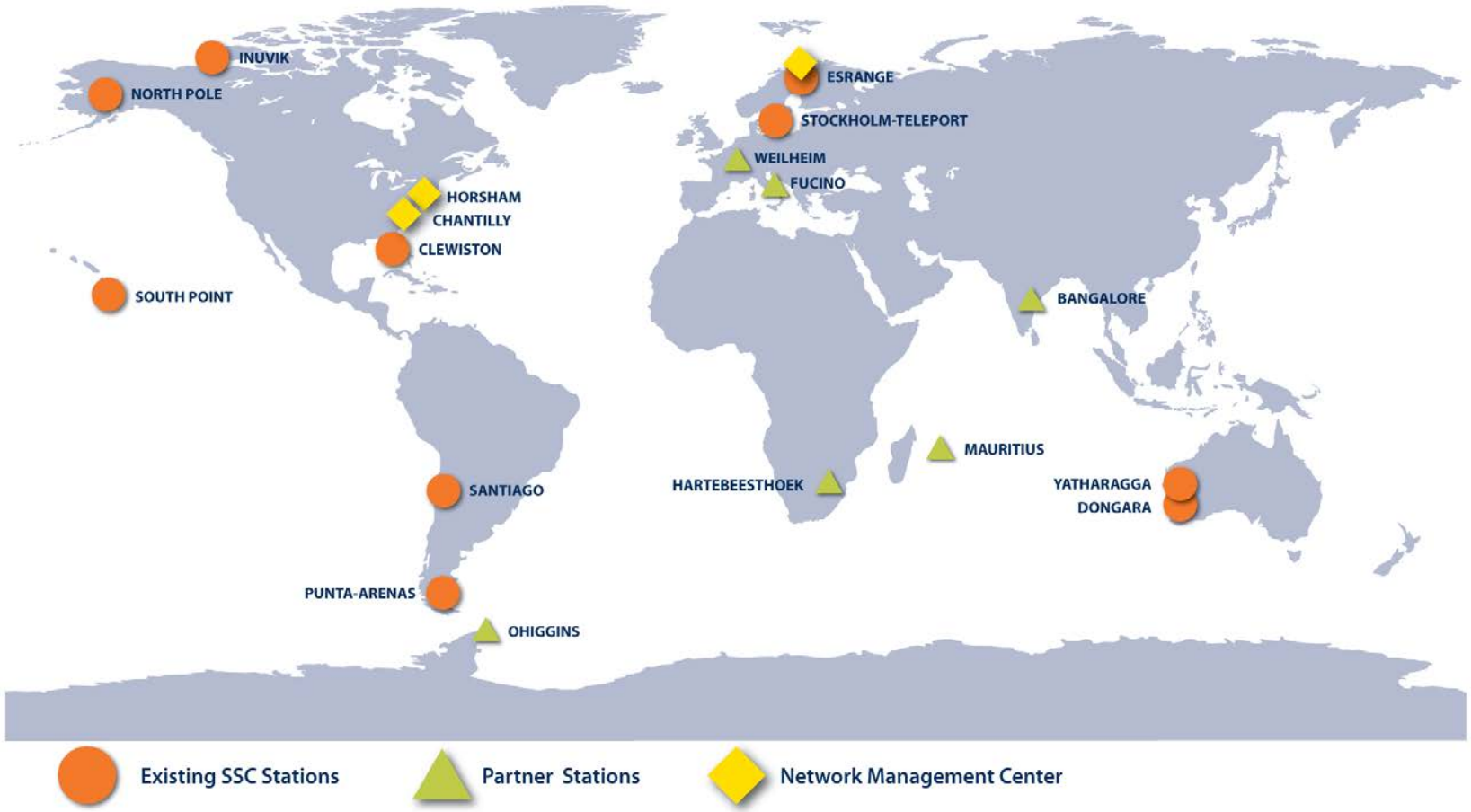
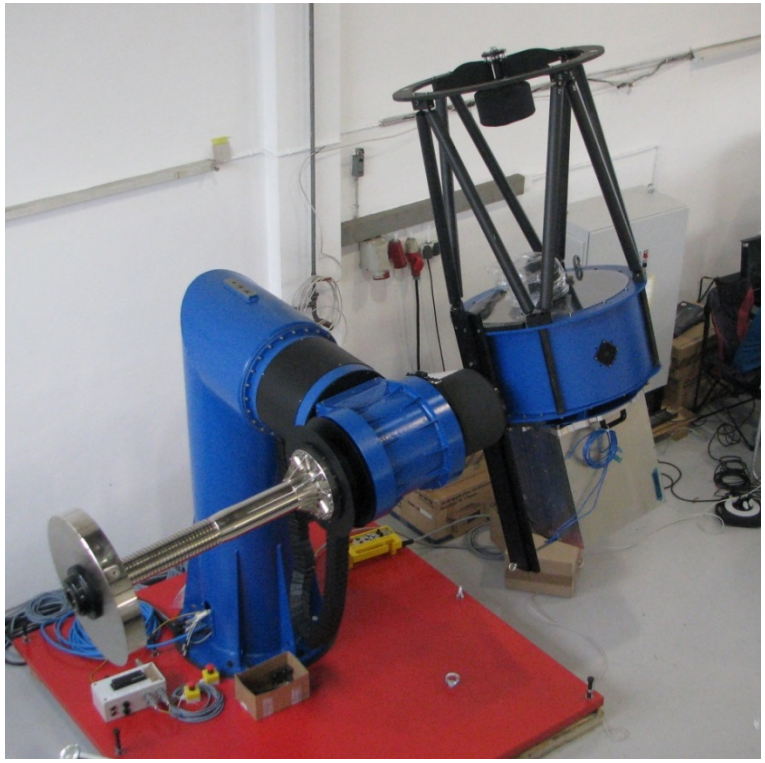
Satellite Management Services
Service and Technology Development, SSC

Our background: RF Ground Network Services



The optical promise

- The high bitrates in optical is highly attractive
- Higher data volumes in the future
- More satellites - constellations
- Potential for short high capacity contacts with each satellite
- SSC involved in the OEI AG led TESLA optical link project / Optel-u
- The ground network becomes very important piece of the system, but traditional operations will need to change…



TESLA Ground station prototype
(picture OEI AG)

General overview of operational concept in RF

- Rough planning of supported passes 1-2 weeks ahead
- Detailed schedule and pass confirmations made 2 days ahead
- For payload data, spacecraft is often pre-programmed to start transmitting a well defined data amount during the contact slots
- Very high pass success rate on RF, outages are mainly technical failures, environmental factors hardly influence successful pass rate

The process is mature, well defined, and repeated hundreds of times per day. The process it is not very flexible and outages may lead to a chain of scheduling issues.

Need to think differently

- Operations by passes as the main quantifier needs to go away;
  - *a pass can be completely cloudy,*
  - *a pass can be partly cloudy, or in the best case*
  - *a pass can be fully utilised.*
- Forget predicted scheduling
- Forget blind downlinks by time tagged commands

  - All data downloads must be triggered from the ground station
- Focus on data delivered

Way forward

- We need to bridge the “uncertainty” of optical links in high volume operational environment by using ground networks with multiple sites
- In order for users and spacecraft designers to manage this “uncertainty” a new operational concept is needed
- The current traditional roles and interfaces need to change within the space and ground segment
- Design of ground networks becomes an interesting optimization of orbits, geography, communications and weather
- SLA-based service formulation from the network gives stability in the system design, for example: 6 TB / 24h at 99% probability

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