High Data Rate Communications for NASA Missions

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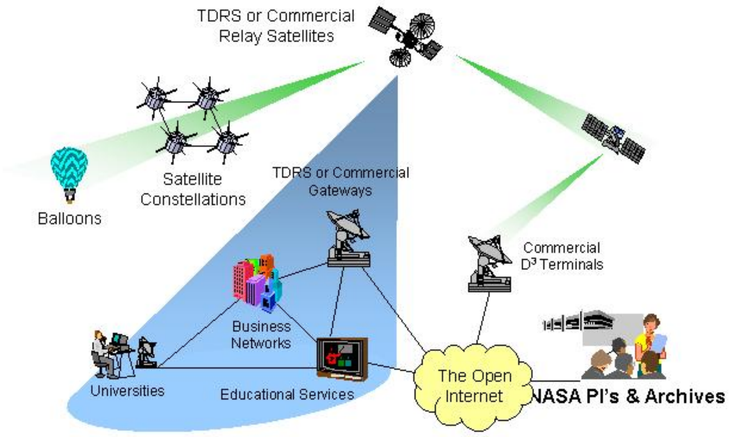
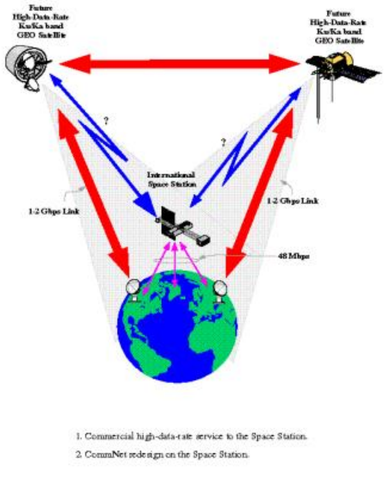
- **Objectives & Goals:**
  - –Develop architectures for supporting communications for next generation (near-earth) NASA missions; Study the performance of alternative solutions, evaluate trade-offs.
  - –Investigate alternative solutions for supporting broadband communications to and from ISS payloads.
  - –Investigate the use of commercial technology and commercial assets and infrastructure (in space and on the ground) for mission support.



Emerging Communication Architectures for NASA Missions



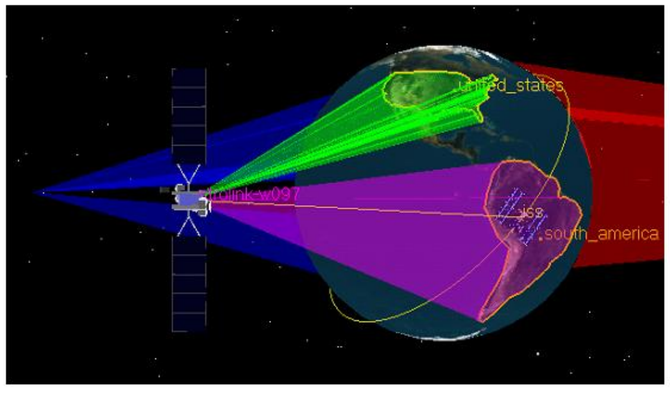
Supporting Broadband Communications to and from the ISS Alternative Solutions

Future Mission Network Evolution:

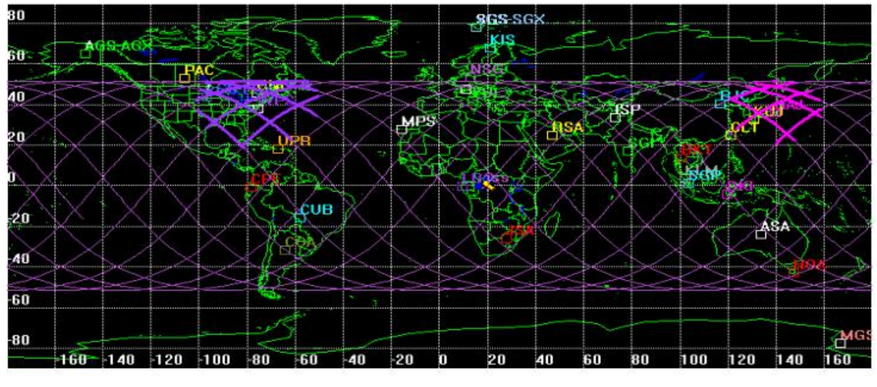
- NASA network supports large numbers of single or constellation spacecraft with IP-addressable instruments.
- Mission Operation gradually evolves to a dynamic concept and uses a NASA & commercial assets for communication support; direct-to-ground as well as GEO relay solutions are employed.
- Commercial technology and standard communication protocols are employed (where possible).

How do we help in achieving this transition?

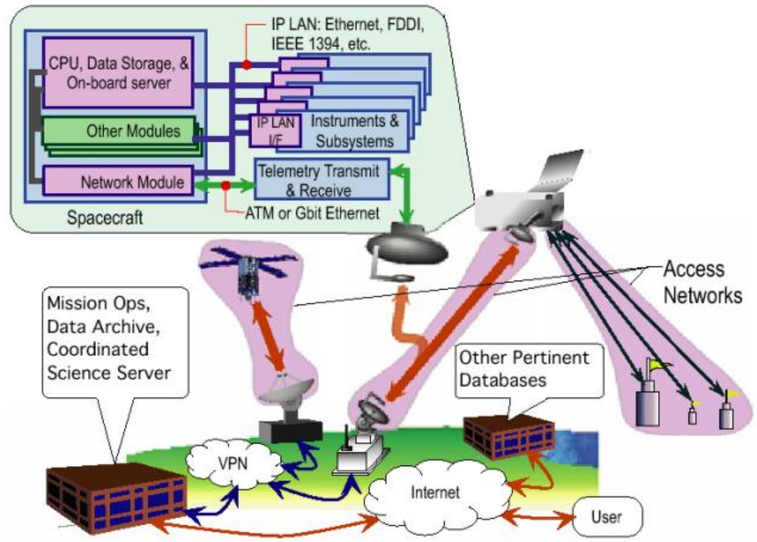
- Performed high level study of potential communication architectures that could support "anytime, anywhere", IP-compatible access to space.
- Developed (following the conclusions/recommendations of that study) an initial framework for investigating the performance advantages of an on-demand access scheme for dynamic mission operations.
- Participated in a study that addressed network issues in future nanosatellite constellation missions (Constellation Client/Server Architecture Testbed)
- Completed modular, OPNET-based, simulation model consisting of the ISS, possible candidate satellite constellations and a ground network architecture.
- Performed selective coverage/visibility analysis for service to ISS and other NASA missions using commercial satellites or commercial ground facilities(ISS-to-ground).



Commercial Satellite Covering American Continent and the ISS



Direct-to-Ground: Data downloaded to several global terminals



Access Network Topology

Benefits & Significance for NASA & Industry

- ***For NASA:***
  - –High quality broadband communications connectivity to future NASA missions is a critical mission requirement.
  - –Internet access throughout NASA missions would be desirable for scientists in order to achieve "tele-presence" in space.
  - –Important to achieve better and easier dissemination of NASA mission and experimental data to scientists around the world.
  - –National Space Policy mandate for NASA to commercialize its space communications operations, in order to achieve reduction in cost for its communication needs.
- ***For Industry:***
  - –Important to bring commercial communication services to commercial space experiments.
  - –Commercial Space needs high data rate and high quality communications for experiments with ISS,distributed spacecraft linkage, future planetary missions.
  - –NASA and commercial space will be large customers (markets) for commercial communication companies
  - –Extensive Internet infrastructure already deployed can be used to support these services.

The material is based upon work supported by NASA under award No NCC3528.