



SA Photonics Free Space Optical Communication Systems

July 13, 2017

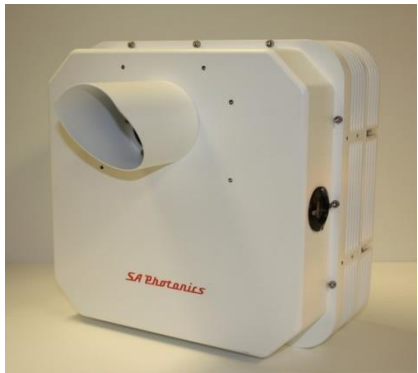
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FSO Challenges

- **Need to have advantages compared to RF systems**
 - RF systems are the go-to communication solution, need compelling reason to do something different
- **Need con-ops or use-cases that accommodate outages due to clouds/fog**
 - RF backup or link/network diversity
- **Need to be low cost and simple to use**
 - RF systems enjoy economy of scale and low-cost manufacturing
- **Need to be provide reliable and robust communications when operating through the atmosphere**
- **Need to have a solution the operates easily on moving platforms without large and expensive gimbals**

SA Photonics FSO Systems

- SA Photonics has developed or have in development FSO systems for terrestrial, airborne, space and underwater applications
- Our focus is on developing complete FSO systems including all modem processing and integrated beam steering and stabilization
 - Optimize the total system design to minimize system deployment costs and enable use on a variety of platforms
- **Additional focus on making systems simple and low cost**
 - Utilize COTS components and volume manufacturing techniques to drive down system costs
 - Simplify optics design to reduce manufacturing costs
- **Optimize the system design to work through the environment**
 - HARQ and optimized PAT system to work through atmospheric scintillation effects



10 Gbps Terrestrial FSO



1U Cubesat Terminal



Fully Stabilized Optical Head

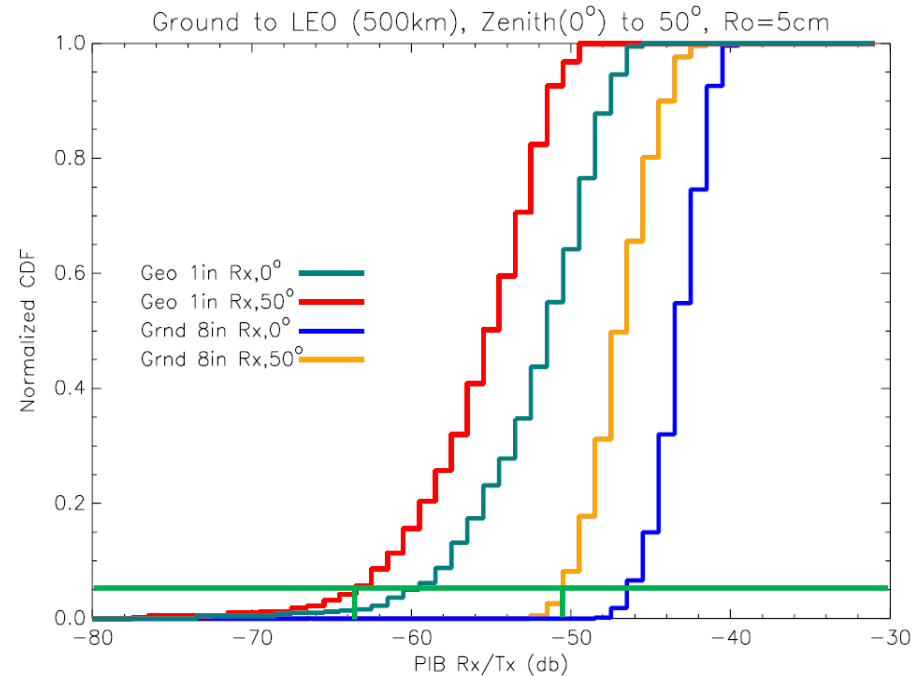
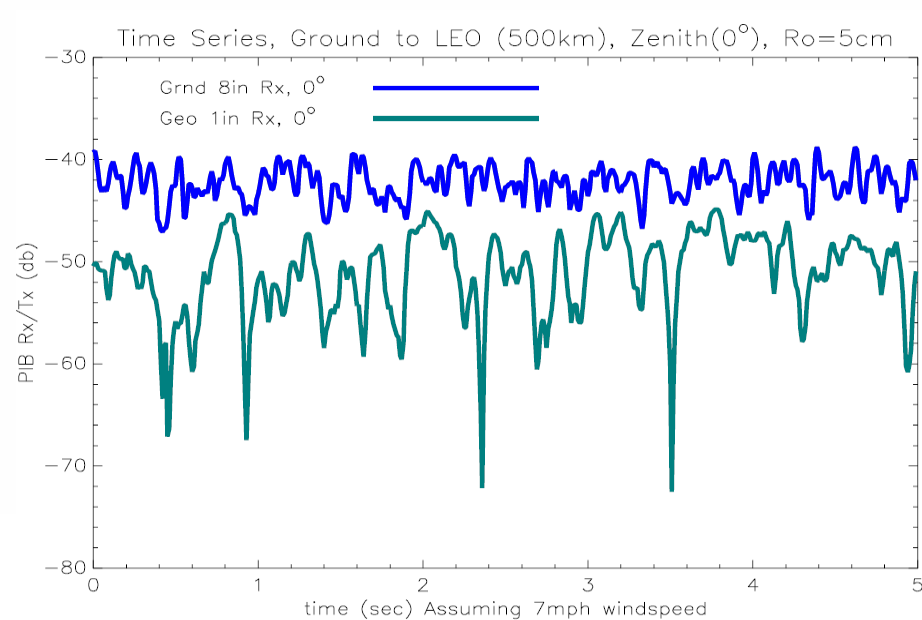


Coude Path Beam Director



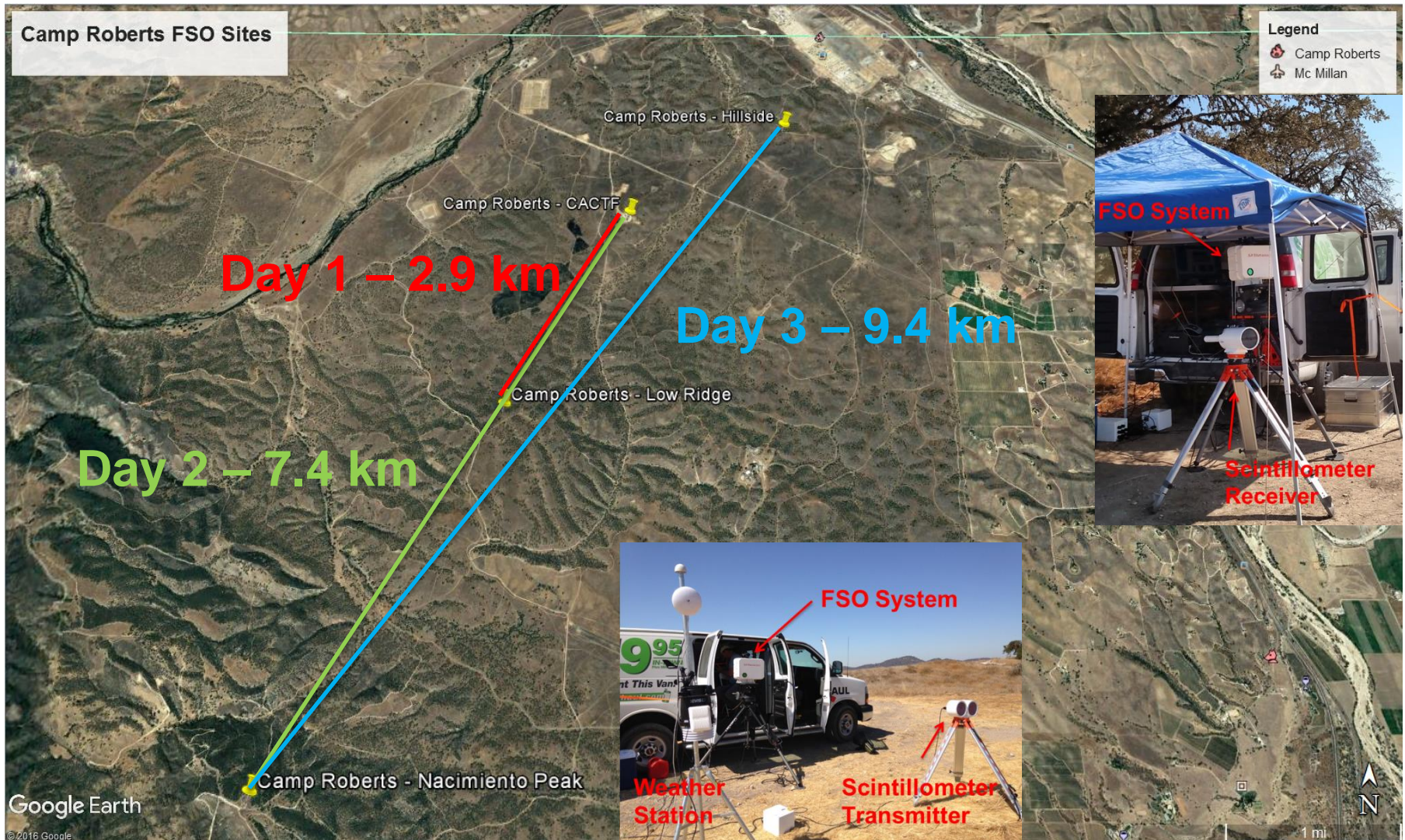
Underwater FSO

Mitigating Fading with Physical Layer Retransmission

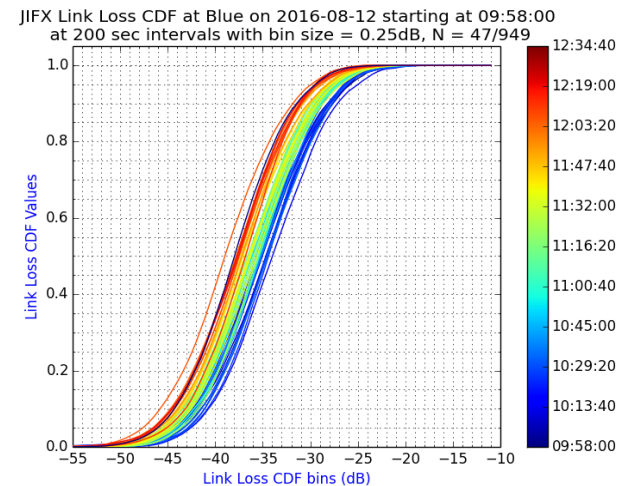
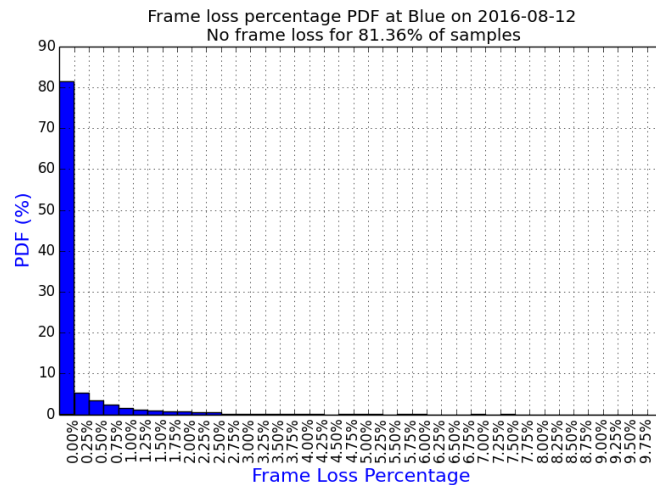
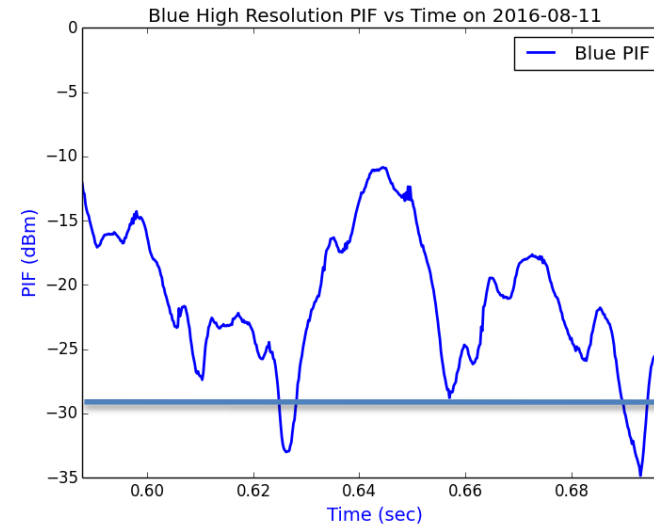
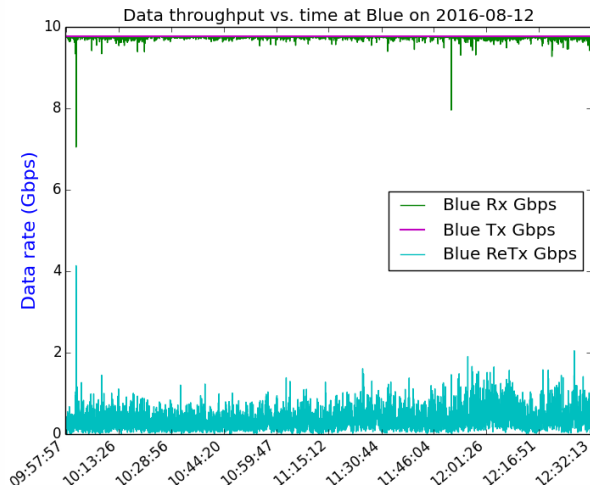


- Low latency PHY layer re-transmission exploits time diversity of the atmospheric channel
- Reduces required fade margin, minimizing Tx power requirements
- Soft-combining of received FEC blocks provides SNR gain

Camp Roberts JIFX FSO Site Overview (Aug 2016)



Day 3 Test Results, 9.4 km Link



Greater than 9 Gbps data throughput with minimal frame loss over entire test