Distance Participants - Collaborative Document

Guidance for this document:

- Work from the top down.
- Try to add new thoughts or topics and new paragraphs at the bottom of the document.
- Consider leading each new paragraph with your name.
- Feel free to use the collaborative features of Google Docs with commenting and tagging. Tagging @jnbrassa@mtu.edu will alert Jessica, one of the Workshop organizers

(Jess) We are back from break.

(Jess) Please feel free to send in comments or thoughts here or in the Google Hangout.

(Jess) We are back from lunch and Alexei Korolev is leading a discussion.

Thoughts from Anthony Davis (watching and listening from JPL):

As the workshop organizers and a few others know, my main interest is in light (solar or laser) propagation and scattering in all kinds of clouds, i.e., radiative transfer (RT). These interests overlap strongly with the JPL team focusing on ground-to-satellite free-space optical communication (FSOC) in the presence of clouds. The main notions that matter have thus been captured during the breakout session (group #3, as I recall), including the possibility of dual-use of the facility and inter-agency sponsorship (NSF, NOAA, NASA, DOD, and maybe more).

A very interesting controlled experiment to conduct (in our imaginations for the moment) is to quantify direct transmission through the kind of spatial variability we expect to have in real clouds over a wide range of fixed physical distances, from sub-meter to the scale of the facility. Imagine a CW laser aimed straight up from the center of the floor of a large chamber. At each sensor, the turbulence-type spatial variability translates into a time-series sampled as rapidly as necessary (small eddy turnover time comes to mind). From there, we can study PDFs, means, variances, higher moments, space- and time correlations, etc. My main concern here is to keep the spatial variability both realistic and statistically stationary for long enough to collect meaningful time series samples.

Of course we want the mean optical distances (hence direct transmissions) from source to sensors varying over a wide range. As soon as that range includes unity (1/e in transmission probability)—and we want more than that (hence smaller transmissions)—there is a high chance light being scattered out of the beam. Once a single scattering has happened more will occur at least occasionally with probability 1. Accordingly, "multiple scattering" was duly noted at the breakout and in the following plenary. This brings up observation issues if the focus is strictly on non-scattered light, not intractable in my mind. It also raises the question of the effect of lateral

walls of the chamber which are necessarily at finite range. How to minimize (or maybe exploit) their effect that is unavoidable since RT in scattering media is a fundamentally non-local problem. We have given this some thought and back-of-envelope-type quantification at JPL, with FSOC in mind.

Many thanks to the organizers and participants for very interesting discussions today already. I'll be tuning in the workshop channel as much as possible tomorrow.