Subject: LARES-2
Date: Friday, January 4, 2019 at 6:55:13 AM Eastern Standard Time
From: Reinhart
To: Bianco Giuseppe
CC: Ignazio Ciufolini, Antonio Paolozzi, David Arnold, Ludwig Grunwaldt

Dear Dr. Bianco,

Dr. Paolozzi asked me to join the discussion on the optimum concept for LARES-2 on July 18, 2016. At the same time David Arnold was asked to contribute as an expert in optical analysis of spherical satelites. His famous SAO special report 382 "method of calculating retroreflector-array transfer functions" is the knowledge base for all working in the field. Within one week he sent an improved optical concept for LARES-2 and computed the orientation dependence of the centroid range correction as well as the radar cross section. His concept is using small (1 inch diameter) uncoated cube corners without offset angles which are well matched to the expected aberration of a satellite at 6000 km orbital height. This concept improves the ranging precision and is less affected by thermal distortion compared to the original LARES design.

What followed was a year of intensive exchange of ideas between the team at University Rome, David Arnold and GFZ. We tested 10 samples of 1 inch cubes ordered from stock by the University Rome. Dr. Paolozzis group constructed a mounting cell with minimum heat contact and conducted a vibration test. Any change in the distribution of cube corners on the sphere was analysed by David Arnold.

At the end David Arnold's concept has been accepted in July 2017

In the following David developed a ray tracing model to compute the change of the far field of individual cubes by thermal gradients. He started with an own thermal model and later Dr. Paolozzi provided temperature fields computed by commercial software. Main result of the thermal simulations was the fact that the far field distortion of one inch cubes can be neglected if the temperature of the satellite is kept well below 400 K and care is taken for weak thermal coupling between the cube and mounting cavity.

David Arnold published a summary of his contribution in a clean paper presented at the 22th Laser Ranging Workshop in Canberra. It would be very useful to enable him to prepare a detailed report as a basis for future work. I dont know why it was not possible to manage adequate fundung for his more than one year work. May be this problem can be solved.

with best regards an best wishes for the year 2019

Reinhart Neubert

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Dr.Dr.h.c. Reinhart Neubert

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