Subject: Re: The importance of LARES-2

Date: Saturday, November 24, 2018 at 6:55:53 AM Eastern Standard Time

From: Antonio Paolozzi

To: Erricos C. Pavlis, Frank.G.Lemoine@nasa.gov, Peter Dunn, t.otsubo@r.hit-u.ac.jp, Bianco Giuseppe, simone.dellagnello@lnf.infn.it, Reinhart, josrod@nerc.ac.uk, matwi@nerc.ac.uk, jan.f.mcgarry@nasa.gov, SCOTT.WETZEL@honeywell-tsi.com, Kirchner, Georg, john.degnan@sigmaspace.com, prochazk@cesnet.cz, Pearlman, Michael R. (Mike), stephen.m.merkowitz@nasa.gov, David Arnold

CC: Ignazio Ciufolini, Antonio Paolozzi

Dear all,
There is an ASI official document that nominated Sapienza University as the design authority of LARES 2 and we wrote that to David Arnold several times. So why is he writing to all of you recommending that he should be substituted in the design activity? Furthermore we repeat that David Arnold was not doing the design, he was doing the analyses on the designs that we prepared for ASI and he was checking if the design was within the 1 millimetre ILRS requirement so matching his role in the International Laser Ranging Service. So we do not understand of which additional agreement between ASI and NASA on the design he is talking about.
Incidentally David Arnold should be more careful in sharing information that are protected under the Art. 10 of the agreement between ASI and Sapienza University. In fact we did not say to David Arnold that we needed to change the design, who told him about that? Anyway, we already presented the final modified drawings to ASI so that the design phase is finished and the design is protected under the article 10 of that agreement.

Best Regards
Ignazio Ciufolini (Principal Investigator of the LARES 2 space mission)
and Antonio Paolozzi (Responsible of the LARES 2 design)-

Il giorno ven 23 nov 2018 alle ore 00:37 David Arnold <david-arnold2006@earthlink.net> ha scritto:

> Dear Colleagues.
>
> LAGEOS-1, LAGEOS-2, and LARES-1 all use the same design of cube corner. The design goal for LAGEOS was 5 millimeters. The design goal today is one millimeter. LARES-2 uses a new approach designed to provide the one millimeter accuracy needed by the earth physics and terrestrial reference frame programs.
>
> LAGEOS uses the same type of cube corner as the Apollo Lunar arrays. The cube corners on the Apollo arrays are optimized for Lunar ranging. This type of cube corner is not optimized for the velocity aberration at the LAGEOS altitude.
>
> When I was working on the design of LAGEOS it was clear that the cube corners were too large for the velocity aberration. LAGEOS should have used smaller cubes. The problem was that this would require a lot more cube corners and significantly increase the cost of the satellite. My analysis showed that the 5 millimeter goal could be met with the Apollo type cube corners as long as a dihedral angle offset is used on the cubes. I recommended an offset of 1.25 arcseconds. Since there was no need to change the cube corners to meet the design goal, the decision was made to go with the Apollo type cube corner but add a dihedral angle offset.

The basic principles of how to optimize the cubes for the LAGEOS altitude were known at the time LAGEOS was designed. Since the present goal is one millimeter it is time to optimize the design for the LAGEOS velocity aberration to achieve the one millimeter goal.

I wrote a paper for the Canberra conference describing how to optimize the design. The full paper and the oral presentation are available at:

https://cddis.nasa.gov/lw21/docs/2018/papers/Session3_Arnold_Paper.pdf

https://cddis.nasa.gov/lw21/docs/2018/presentations/Session3_Pavlis_presentation.pdf

Since I was not at the Canberra conference, Erricos Pavlis kindly presented the paper for me. I hear he did a great job.

The design of LARES-2 has not been finalized. Critical decisions still have to be made. As I have said in previous emails, I am legally prohibited from doing any further work on the design of LARES-2 due to the failure to set up an agreement between ASI and NASA that would allow my work to be funded by NASA. In fact, I should not have received any funding from NASA for the work already done. I have sent an email to ASI requesting that ASI take whatever steps are needed so that I can legally continue to work on the design of LARES-2 (and be paid for the work already done).

I do not think it is critical for me to be further involved unless some unexpected problems arise. The paper I wrote for Canberra shows how to do the design. Other than myself, the person who has the best understanding of all the optical and thermal issues involved in the design is Simone Dell'Agnello. I would recommend that he be consulted regarding any questions that arise in the design.

Best,

David Arnold