

## 2017 ILRS Technical Workshop

*"Improving ILRS Performance to Meet Future GGOS Requirements"*

October 02 through 05, 2017

Riga, Latvia

### First Circular

(February 28, 2017)

The Institute of Astronomy at the University of Latvia and the International Laser Ranging Service (ILRS) will host the 2017 ILRS Technical Workshop on October 02 through 05, 2017 in Riga, Latvia. The workshop sessions will be focused on:

- What are the current and anticipated laser ranging requirements for the various satellites and have we defined them properly?
- How do we evaluate our current performance and is it adequate?
- What factors are currently limiting our network performance?
- What operational steps and tools would help us to better meet satellite ranging accuracy and scheduling requirements?
- What automation capabilities have been implemented or are planned for implementation, and what automation capabilities should stations consider?

The workshop will have four sessions held over four days. A preliminary list of the topics and questions to be addressed in each session is presented below along with a draft schedule.

This workshop will require significant preparation if it is to be successful. The session chairs will need to develop the key questions, organize a few succinct talks to set the stage, stimulate good discussion on the topics and issues, and formulate conclusions and recommendations. At least two recorders should take notes at each session. Session may include small parallel breakout sessions to address relevant topics. Session chairs are strongly urged to meet (telecon, email, face-to-face) with key members of their sessions beforehand to formulate the path that they plan to follow in their session.

Each session will produce a 3 to 5 page chapter to go into a meeting report and give a brief 10 minute report including key points, issues, and recommendations at the wrap-up session on Thursday afternoon.

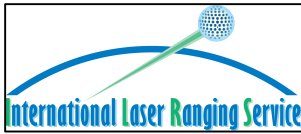
The ILRS Analysis Standing Committee (ASC) and the ILRS Governing Board (GB) will meet on Sunday, October 1. Time will be allocated during the week for the other ILRS Standing Committees and Study Groups to meet. It is suggested that this time be used for topics related to the workshop theme. Some homework beforehand will help greatly.

There will be an opportunity for poster contributions, but they **MUST** be relevant to the session topics. Posters on subjects outside of these topics will not be accepted.

In addition to the program, there will also be an opportunity to visit the Riga station, the local Botanical Gardens, and enjoy together for a special workshop dinner.

**We need your help:** We are still making the local arrangements and organizing the sessions. To help us, we need some idea on the number of people who are interested in participating in the meeting and which sessions you think you can contribute.

**Please send an email expressing your interest in attending to:** [Kalvis.Salmins@lu.lv](mailto:Kalvis.Salmins@lu.lv)



## Workshop Outline

The session topics include:

### Session 1 (October 02):

What are the satellite tracking and scheduling requirements?

(Session Chairs: Mike Pearlman, Carey Noll, Jens Steinborn, Frank Lemoine)

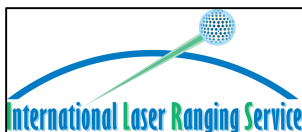
- GGOS related satellite missions
  - Which are crucial to meeting GGOS requirements and which are not?
  - What are the actual required range accuracies and data acquisition requirements (normal point frequency, geographic distribution, etc.)? (Encourage feedback from the GGOS user community).
- Non-GGOS missions
  - Which are scientifically important to track and why (scientific or engineering merit)?
  - What are the required range accuracies and data acquisition requirements (normal point frequency, geographic distribution, etc.)?
  - Which of these missions can benefit from occasional or infrequent tracking?
  - Should any of these be eliminated from the schedule or given low priority due to their lower science/engineering impact?
  - How can we assess their usefulness (maybe this is where we present results of surveys, etc.)?
- How are current research activities like time transfer, debris tracking, etc. impacting the GGOS data yield?
- Shall we establish a means of NP or pass scoring based on a hierarchy of requirements (including both scientific importance and difficulty in tracking) as a criterion for routinely rating each station, and thereby encouraging them to set the most beneficial priorities?
- Do we want to put stations in classifications (operational verses something else)?
- Are the new technology stations doing better than the legacy stations?

### Session 2 (October 03):

How do we evaluate our current performance?

(Session Chairs: Erricos Pavlis, Toshi Otsubo, Horst Mueller, Cinzia Luceri)

- What is the status of the Range bias pilot project and the other evaluation tools used by the AC's
- What tools do we have at the stations? Are they the right ones? Can we define diagnostic procedures?
- Reporting procedures (feedback)
- How does the performance of the new technology stations compare with the legacy stations? What are the observed differences? What should the differences be?
- Do differences in data screening procedures have any impact on the consistency of our data products?



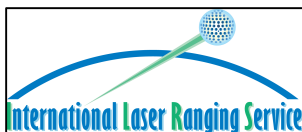
## Workshop Outline (continued)

### Session 3 (October 04):

What operational steps and additional tools can we take to better meet satellite ranging accuracy and scheduling requirements?

(Chairs: Evan Hoffman, Kalvis Salmins, John Degnan, Ludwig Grunwaldt)

- What are the factors that are currently limiting performance (data quantity and quality)? Maybe a survey before the meeting to get this discussion going?
- Should we provide individual tracking schedules for stations located in clusters? Are weather and tracking schedules similar enough over a cluster to consider the stations to be redundant? We should examine these ahead of time.
- Should we schedule simultaneous observations by clustered stations on selected satellites as a tool to provide insight into station biases, without requiring an expensive and inconvenient colocation? What has been our past experience?  
Return signal strengths and satellite return rates even for the new generation of single photon sensitive SLR stations can vary by orders of magnitude, from single photons to many photons as a function of satellite altitude, zenith/elevation angle and atmospheric visibility, potentially introducing small range biases. If we operate at the single photon level, we minimize the biases but it also takes longer to generate a 1 mm quality normal point and the point represents a much longer segment of the satellite arc. At the multi-photon level, we take the data much faster thereby enhancing interleaving opportunities and sampling a smaller portion of the satellite trajectory but also possibly introducing some range biases. The current philosophy is to reduce return rate to about 10% to try to capture primarily singles. Is this the optimum mode in which to operate? What would we lose if we expanded the capture rate to 20%, 30% or more? Should we try to control returns at the single photon level or is it better to generate normal points more quickly with higher return rates and shorter NP averaging times?
- Do we need a better or a more satellite and station specific definition of the NP? We currently ask for 1000 FR points per NP. Should the number of FR points per NP be a fixed number for all systems or should the number be set for each system to reach 1 mm precision?
- Does past performance (data yield, system stability, data quality) history warrant an ILRS recommendation for even the best legacy stations to go kHz?
- What tools and procedures do we need to expedite station discovery and reporting of problems and measures being taken to address the problems



## Workshop Outline (continued)

### Session 4 (October 05):

Automation and autonomous station operations

(Chairs: Jan McGarry, Georg Kirchner, Chris Moore, Pierre Lauber)

- What is the current experience with automated and autonomous operated stations?
- Who is doing what? What can we expect to do?
- What is holding us back from more implementation?
- Is there a common theme that might work as guidance for groups just starting to contemplate automation and not yet engaged?
- Can we automate safety issues and systems integrity issues (weather, etc,)?
- Can we automate diagnostics and testing procedures (maybe avoid some safety issues)?
- What is the experience with centralized control of a network of stations?
- Are there hardware items and software tools that we should be aware of?
- What software is available for smart scheduling of the network ( )?

### Wrap-Up Session (October 05):

Overview and Summary (resolutions, action items, future work)

(Chairs: Mike Pearlman, Kalvis Salmins)

### Tentative Schedule:

Date/Time:	Sun. Oct. 01	Mon. Oct. 02	Tues Oct. 03	Wed. Oct. 04	Thurs. Oct. 05	Fri. Oct. 06
08:00 – 09:00	Available for splinter meetings					
09:00 – 10:00	ASC	Workshop Session 1a	Workshop Session 2a	Workshop Session 3a	Workshop Session 4a	Available
10:00 – 11:00						
11:00 – 12:00						
12:00 – 13:00	Lunch	Lunch	Lunch	Lunch	Lunch	
13:00 – 14:00	ASC	Workshop Session 1b	Workshop Session 2a	Workshop Session 3a	Workshop Session 4b	
14:00 – 15:00						
15:00 – 16:00						
16:00 – 17:00	ILRS GB	DFPSC/TSC	NESC	Station, Botanical Garden Visit/ WS Dinner	Wrap Up Session	
17:00 – 18:00						
Evening		Ice breaker	MSC			

ASC: Analysis Standing Committee

DFPSC: Data Formats and Procedures Standing Committee

MSC: Missions Standing Committee

NESC: Networks and Engineering Standing Committee

TSC: Transponders Standing Committee

GB: Governing Board (invitation only)