2017 ILRS Technical Workshop

University of Latvia, Riga, Latvia
October 02-05, 2017

Day 1: October 02, 2017

Session 0: Workshop Welcome

Time	Topic	Presenter/Remarks
Session 0	**Workshop Welcome**	***(30 minutes)***
09:00	Riga Station History	Kalvis Salmins

Session 1: What are the ILRS Tracking Requirements from our users and how well are we addressing them?

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

Discussion points:

- What is your station doing to increase its productivity and data quality?
- What is limiting the capacity of your station? Is your station fully committed or do you have additional capacity to track?
- What other activities are you doing at your stations?

Time	Topic	Presenter/Remarks
Session 1A	**Overview**	***(45 minutes)***
09:30	Introduction	Mike Pearlman
09:40	What is the role of GGOS? What is the ILRS role in GGOS? - 20 min)	Markus Rothacher
10:00	Results of the ILRS User Survey	Mike Pearlman
10:15	**Break**	***(15 minutes)***
Session 1B	**Requirements by Discipline**	***(90 minutes)***
10:30	Requirements for the ITRF	Erricos Pavlis
10:45	Requirements for Altimeter Missions	Frank Lemoine
11:00	Requirements for GNSS (Galileo, GLONASS, Beidou, etc.)	Grzegorz Bury
11:15	Requirements for GLONASS	Mikhail Sadovnikov
11:30	Requirements for CubeSat	Markus Rothacher
11:45	Requirements for Supporting Other Applications (time varying gravity field, atmospheric drag)	Toshimichi Otsubo
12:00	**Lunch**	***(60 minutes)***

Session 1C	Current ILRS Network Performance	***(75 minutes)***
13:00	Review of ILRS Network Performance	Mike Pearlman
13:15	Rating Station Performance	Evan Hoffman
13:30	Setting ILRS Tracking Priorities	Mike Pearlman
13:45	Discussion	***(30 minutes)***
14:15	**Break**	***(30 minutes)***
Session 1D	**ILRS Network Procedures**	***(130 minutes)***
14:45	Issues with Satellite Predictions	Jens Steinborn
15:00	Impact of Supporting Other Applications	Georg Kirchner
15:15	Long-Term View	Mike Pearlman
15:25	**Poster Briefs**	***(2 minutes each)***
	The Progress and developments of Shanghai SLR station/Setting ILRS tracking priorities with 4 kHz repetition rate and Its application	Zhang Zhongping
	Combined multi-GNSS+LAGEOS solutions with the focus on SLR station coordinates, Earth rotation parameters, geocenter and the scale of the reference frame	Krysztof Sośnica
	Ground station requirements for the ELT experiment	Johann Eckl
	The Copernicus Sentinel-3 mission and the tandem constellation of Sentinel-3A and -3B	Jaime Fernández
	Information on the development of new equipment for the control of the laser station 1824 - Golosiiv-Kyiv	Mikhailo Medvedskyy
	EUROLAS Data Center (EDC) - Updated Procedure for Station History Logs and Site Logs	Christian Schwatke
	COTS reflectors application on Technosat	Peiyuan Wang
	Transfer Function of the Lares-2 satellite	David Arnold
	Visibility Aspects of Station Locations for Space Debris Laser Ranging	Christoph Bamann
	ILRS Site Configuration Project: 2015 Questionnaire Summary	Keith Evans
	ILRS Tracking Data Requirements Survey 2017	Magdalena Kuzmicz-Cieslak
16:00	**Data Formats and Procedures Standing Committee meeting**	***(120 minutes)***
18:00	**Ice Breaker**	

Day 2: October 03, 2017

Session 2: How do we evaluate our current performance?

Session Chairs: Erricos C. Pavlis, Toshimichi Otsubo, Horst Mueller, Cinzia Luceri

Time	Topic	Presenter/Remarks
08:00	**Transponder Standing Committee meeting**	***(60 minutes)***
Session 2A	**Overview & Ongoing ASC Efforts**	***(50 minutes)***
09:00	Introduction	Erricos. Pavlis
09:15	The ILRS ASC Pilot Project on systematic error estimation	Cinzia Luceri
09:35	BKG's Contribution to the ILRS Pilot Project on Systematic Errors	Daniel Koenig
09:50	**Break**	***(30 minutes)***
Session 2B	**State of the Network and Sources of Errors**	***(100 minutes)***
10:20	Evaluation of the present SLR tracking stations	Horst Mueller
10:35	SLR error sources in the kHz repetition era: How should we improve the range measurement and the products?	Toshimichi Otsubo
10:55	Variability of LAGEOS normal point sampling: causes and mitigation	José Rodríguez
11:15	Effect of pulse length, rise time, signal strength, and type of detection system on the range correction for LAGEOS-2	David Arnold
11:35	Discussion	***(25 minutes)***
12:00	**Lunch**	***(60 minutes)***
Session 2C	**Hardware & External Tools to Improve Performance**	***(60 minutes)***
13:00	From Time Transfer by Laser Ranging to space geodetic products	Alexandre Belli
13:20	Methods to increase ranging performance and accuracy implemented in the Russian new generation laser station <<Tochka>>	Sergei Martynov
13:40	Discussion	***(20 minutes)***
14:00	**Break**	***(30 minutes)***
Session 2D	**ILRS Tools for Network Support**	***(130 minutes)***
14:30	JCET Tools for the Assessment of the ILRS Stations' Performance	Erricos C. Pavlis
14:50	GOVUS – a new on-line tool for the evaluation of SLR observations to GPS, GLONASS, Galileo, BeiDou and QZSS	Radosław Zajdel
15:10	The ILRS Rapid Service Mail a tool to inform stations quickly about potential problem	Toshimichi Otsubo
15:30	Discussion/Closing Remarks	***(30 minutes)***

	Posters	
	Model Comparisons and Optimizations of SLR Data Processing	Xiaoya Wang
	The SLR observations to GNSS satellites with improved modelling: Preliminary results and open questions	Dimitrios Ampatzidis
	Orbit determination and SLR evaluation of China's space laboratory	Gang Zhao
	Improved general relativistic equations of motion in geodesy and astronomy	Joseph O'Leary
	Required Improvements of Debris Laser Ranging to Support Collision Avoidance solution	Benedikt Reihs
	Simulation of Multi-Technique Terrestrial Reference Frames with Focus on Benefits from Enhanced SLR Network	Rolf Koenig
	Studying different tracking strategies to LAGEOS and Etalon with respect to the weekly ILRS solution	Florian Andritsch
16:00	**Networks & Engineering Standing Committee**	***(120 minutes)***
18:00	**Missions Standing Committee**	***(120 minutes)***

Day 3: October 04, 2017

Session 3: Accuracy and Scheduling

Session Chairs: Evan Hoffman, Kalvis Salmins, John Degnan, Ludwig Grunwaldt

Discussion Points:

- What are the factors that are currently limiting performance (data quantity and quality)?
- What tools and procedures do we need to expedite station discovery and reporting of problems and measures being taken to address the problems
- 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?
- Do we need a better or a more satellite and station specific definition of the NP?
- Does past performance (data yield, system stability, data quality) history warrant an ILRS recommendation for even the best legacy stations to go kHz?
- Would simultaneous observations by clustered stations on selected satellites provide insight into station biases, without expensive colocations?
- Should the ILRS provide individual tracking schedules for clustered stations to optimize satellite coverage?

Time	Topic	Presenter/Remarks
08:00	**Space Debris Study Group meeting**	***(60 minutes)***
Session 3A	**What are the factors that are currently limiting performance (data quantity and quality)?**	***(90 minutes)***
09:00	Introduction	Evan Hoffman
09:05	Survey Results and Discussion	Evan Hoffman
09:20	Discussion – Tools for tracking performance and reporting problems	***(20 minutes)***
09:40	Transitioning the NASA SLR Network from the Time Interval Mode to Event Timing Mode with Improved Data Quality and Quantity	Tom Varghese
10:00	**Break**	***(30 minutes)***
10:30	Challenges to Achieving Millimeter Accuracy Normal Points in Conventional Multiphoton and kHz Single Photon SLR Systems	John Degnan
10:45	Single versus multi-photon SLR using SPAD detectors	Ivan Prochazka
Session 3B	**Normal Point Generation**	***(60 minutes)***
11:00	Discussion – Do we need a better or a more satellite and station specific definition of the NP?	***(30 minutes)***
11:30	Discussion – Occurrences of simultaneous LAGEOS/Cannonball Tracking, what do we get out of this? Should this be further studied?	***(25 minutes)***
11:55	Correlation of histograms for LAGEOS with actual returns	Dave Arnold
12:00	**Lunch**	***(60 minutes)***

Session 3C	**Hardware & External Tools to Improve Performance**	
13:00	Delay Compensated Optical Time and Frequency Distribution for Space Geodesy	Ulrich Schreiber
13:15	Time Bias Analysis and Prediction: A Prototype Service	Sven Bauer
13:30	Sky Clarity Comparison between Riga and Metsahovi SLR Stations	Jorge del Pino
13:45	Discussion – Should the ILRS provide individual tracking schedules for clustered stations to optimize satellite coverage?	***(15 minutes)***
14:00	**Break**	***(30 minutes)***
Session 3D	**Poster Session**	***(90 minutes)***
	Impact of atmospheric pressure loading on SLR-derived station coordinates using range measurements to multi-GNSS satellites	Grzegorz Bury
	Sensitivity of SLR observations to horizontal gradients of the tropospheric delay	Mateusz Drożdżewski
	Scheduling the NASA SGSLR Network	Julie Horvath
	Satellite laser ranging with 1.06um wavelength in Shanghai SLR station	Meng Wendong
	The Progress and developments of Shanghai SLR station	Zhang Zhongping
18:00	**Workshop Dinner**	***(180 minutes)***

Day 4: October 05, 2017

Session 4: Automation and Autonomous Station Operation

Session Chairs: Jan McGarry, Georg Kirchner, Chris Moore, Pierre Lauber

Discussion points:

- 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?

Time	Topic	Presenter/Remarks
Session 4A	**Current State of the ILRS**	***(135 minutes)***
	Introduction	Jan McGarry
09:00	Automatic scheduling of satellite passages at the SOS-W	Stefan Riepl
09:15	OOOS: A hardware-independent SLR control system	Daniel Hampf
09:30	Potsdam automation	Sven Bauer
09:45	The new Korean SLR system and its automatic operation	Hyung-Chul Lim
10:00	Automated operations in Changchun station: current (part I)	Zhipeng Liang
10:10	Mt. Stromlo experience gained with automation (part I)	Chris Moore
10:20	Discussion – Based on the talks and other experiences, what automation is now working/operation in ILRS stations	***(15 minutes)***
10:35	**Break**	***(25 minutes)***
Session 4B	**What is Planned for the Next 5 Years?**	***(60 minutes)***
11:00	Mt. Stromlo automation in progress (part II)	Chris Moore
11:10	Automated operations in Changchun station: plans (part II)	Zhipeng Liang
11:20	Plans for a fully automated SGSLR system (part I)	Jan McGarry
11:30	SGSLR acquisition and tracking automation	Evan Hoffman
11:45	Discussion – Based on the talks, what looks like it might work for other stations? What are the plans for other stations?	***(15 minutes)***

Session 4C	**Bringing Automation to More ILRS Stations**	***(60 minutes)***
12:00	Optimization of Automated Tracking with Situational Awareness	Tom Varghese
12:15	When Does Automation Make Sense?	Randy Ricklefs
12:30	Scheduling for the future NASA SGSLR Network	Julie Horvath
12:45	Discussion – Getting automation to more ILRS stations. Is it for everyone? Where should we be attempting to go?	***(30 minutes)***
13:15	**Lunch**	***(75 minutes)***
Session 4D	**Future of Automation in the ILRS and Issues Related to Automation**	***(60 minutes)***
14:30	Plans for a fully automated SGSLR system (future of SGSLR Network) (part II)	Jan McGarry
14:45	Safety/Security Concerns when Automating SLR Systems	Scott Wetzel
15:00	Discussion – What are the big issues in getting SLR systems fully autonomous? How automated will the ILRS be in 10 years? Where would we like to be? What is realistic?	***(30 minutes)***
Session 4E	**Posters**	
	Autonomous Post Processing	Chris Moore
	Mount Stromlo Space Research Centre	Chris Moore
	Satellite laser ranging station “Lviv-1831” in Lviv, Ukraine. Status report	Ya Blagodyr
	Scheduling the NASA SGSLR Network (combined with Session 3)	Julie Horvath
15:30	**Break**	***(30 minutes)***

Session 5: Workshop Wrap-Up

Session Chairs: Mike Pearlman, Kalvis Salmins

Time	Topic	Presenter
	Workshop and Session Summaries	***(55 minutes)***
16:00	Session 1 (Satellite Tracking and Scheduling) Summary	Mike Pearlman
16:10	Session 2 (Performance Evaluation) Summary	Erricos Pavlis
16:20	Session 3 (Accuracy and Scheduling) Summary	Evan Hoffman
16:30	Session 4 (Automation and Autonomous Station Operation) Summary	Jan McGarry
16:40	Workshop Summary and Resolutions	Mike Pearlman
	Standing Committee/Study Group Summaries	***(50 minutes)***
16:55	Analysis SC Summary	Erricos Pavlis
17:05	Data Formats and Procedures SC Summary	Horst Mueller
17:15	Transponder SC Summary	Ulrich Schreiber
17:25	Networks and Engineering SC Summary	Georg Kirchner
17:35	Missions SC Summary	Toshimichi Otsubo
17:45	Space Debris SG Summary	Georg Kirchner
	Other	***(20 minutes)***
17:55	21st International Workshop on Laser Ranging Plans	James Bennett/Michelle Fulton
18:00	Discussion	Mike Pearlman/Kalvis Salmins
18:15	**Workshop Close**	