ILRS Governing Board Meeting

6 Nov 2022
Guadalajara, Spain

Toshimichi Otsubo
Hitotsubashi University
Chair of ILRS Governing Board

Welcome

This meeting is primarily for the 2021-2022 GB members.

Only the election part is for the 2023-2024 GB members.

Welcome Introduction Agenda	Toshi	10 mi
Activity of the GB during the past year	Toshi	10 mi
Report from IAG Executive Committee	Toshi	5 min
GGOS Activities	Mike	5 min
Governing Board Elections for 2023 – 2024 Term Election Process and Results (16 members) Selection of new GB Chair Election of 2 GB selected members *Objective – Fill geographic, technical, and operational voids* *Members of the current and future board may vote* *Votes submitted to CB Secretary on site or by email by December 15.* Comments on the election process *Status of the mailing lists* *Changes in Procedures*	CB	20 min
ILRS Central Bureau Report *(Network Status/New Missions/GB decisions, etc)*	CB	15 min
Report on the ITRF	Erricos	10 min

International Laser Ranging Service

(cont.)

Standing Committees Reports (10 minutes each, 2 minutes for questions)

(Recent progress, important issues, summary, plans)

• Analysis SC.	Cinzia/Erricos	10 min
• Missions SC.	Stephen/Rob	10 min
• Data Formats and Procedures SC.	Christian/Randy	10 min
• Networks and Engineering SC.	Matt/Clement	10 min
• Transponder SC. U. Schreiber/J.M. Torre	Ulli/Jean-Marie	10 min

Study Committee Group Reports

• Space Debris Study Group	Michael/Daniel	10 min
• Lunar Ranging	Jean-Marie/Clement	10 min

Issues:

• GB Election Scheme	Claudia/Toshi	5 min
• Possibility of restructuring of the SCs/SGs	Mike/Toshi	20 min
• Other Issues		

Other items for future consideration

• Review Network organization	Mike	5 min
• Review GB structure – How are the other Services Organized?	Mike	5 min
• Other Business	Toshi	

ILRS Hot topics 2021-2022

ILRS Workshops

Guidelines for planning workshops
https://ilrs.gsfc.nasa.gov/about/reports/workshop/ILRS_Workshop_Guidelines.html

As of January 2021: our workshop plan was:

25-29 October 2021: 22nd International Workshop on Laser Ranging in Kunming, China

Fall 2022: ILRS Technical Workshop in Arequipa, Peru

Due to the pandemic, it was updated in spring-summer 2021:

25-29 October 2021: ILRS Virtual World Tour 2021

31 October-4 November 2022: 22nd International Workshop on Laser Ranging in Kunming, China

Fall 2023: ILRS Technical Workshop in Arequipa, Peru

Latest announcements sent on 1 & 13 June 2022:

7-11 November 2022: 22nd International Workshop on Laser Ranging in Guadalajara, Spain

16-20 October 2023: ILRS Technical Workshop in Arequipa, Peru

(Raul Yanyachi presents their plans on Friday)

Dates TBD 2024: 23rd International Workshop on Laser Ranging in Kunming, China

2025: ILRS Technical Workshop: to be decided by the GB by winter 2023 or spring 2024

ILRS Virtual World Tours 2020-2021

2-6 November 2020

Graz, Zimmerwald, Simosato, Greenbelt and Yarragadee

Herstmonceux, Wettzell, Mendeleevo, Shanghai and Monument Peak

Special sessions also arranged.

ILRS CB Secretary (also a GB member)

December 2020: Carey Noll retired.

January 2021: Rivers Lambs took the CB Secretary position but soon moved to a different section of NASA.

April 2021: Claudia Carabajal took the CB Secretary position.

Russian Invasion of Ukraine

Email sent on 4 March 2022

Dear Members of the ILRS Community:

The ILRS has worked with the IAG and the other IAG Services to issue a statement of concern regarding the Russian invasion of Ukraine. A copy of the statement is included below. Our hearts go out to the struggles of the people in Ukraine and we hope for a swift and peaceful conclusion to this crisis.

The IAG and its Services, including the ILRS, by their charters are non-political cooperative international scientific organizations and do not have the authority to dictate specific actions to its members in reaction to the Russian invasion. Rather, each member institution should examine the relevant sanctions, governing institutional policies, and their own consciences to guide their actions. Some members have already taken action.

We of the ILRS find the current situation to be abhorrent.

Toshi Otsubo Chair, ILRS Governing Board

Mike Pearlman Director, ILRS Central Bureau

ITRF2020

Email sent by Z Altamimi on 19 March 2022

Dear ITRF Users and Colleagues,

The IERS ITRS Center at IGN has the pleasure to announce to the community the availability of the ITRF2020 solution at the dedicated web site:

https://itrf.ign.fr/en/solutions/ITRF2020

I want to take this opportunity to acknowledge the enormous efforts of the IAG Services (IVS, ILRS, IGS, IDS) and their Analysis and Combination Centers for their contributions by providing reprocessed solutions.

(Details to be reported by ASC and also in Monday's sessions.)

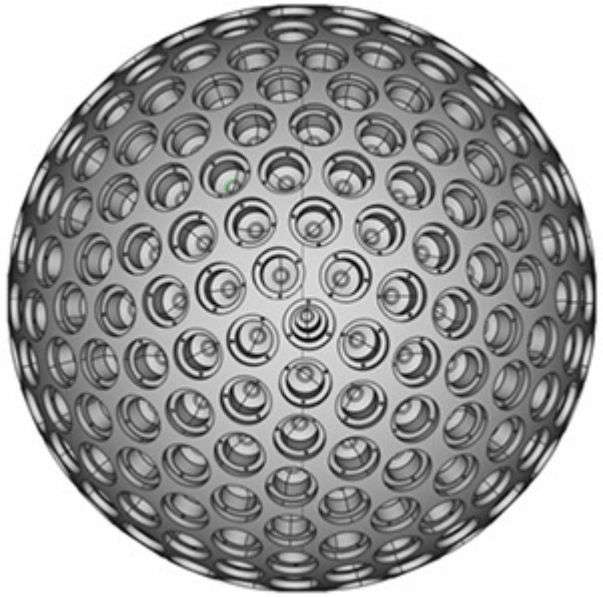
LARES-2

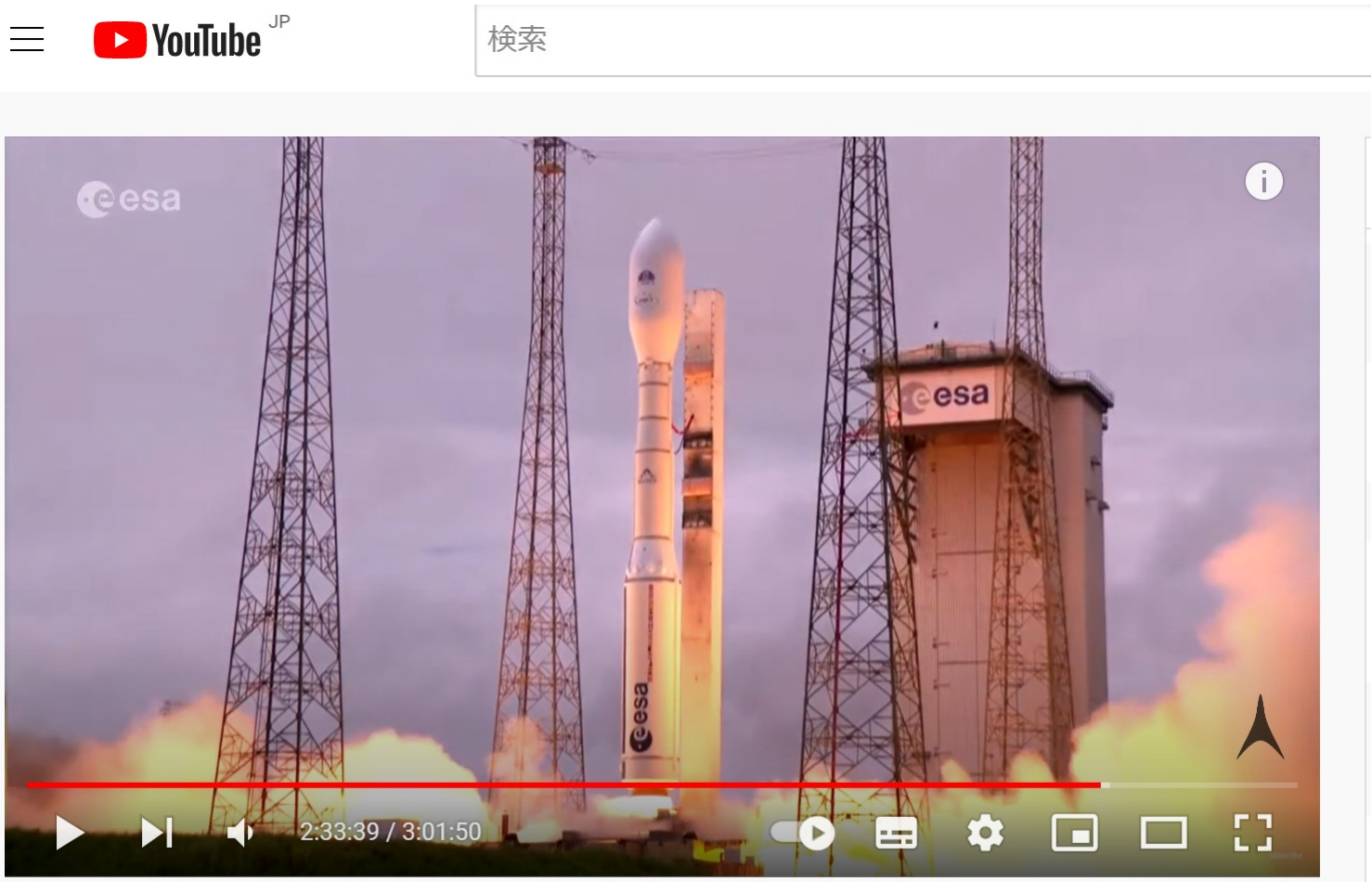
Launch: 13 July 2022

Altitude: 5900 km, Inclination 70 deg

(Analyses already begun)

(Reports to be given this week)



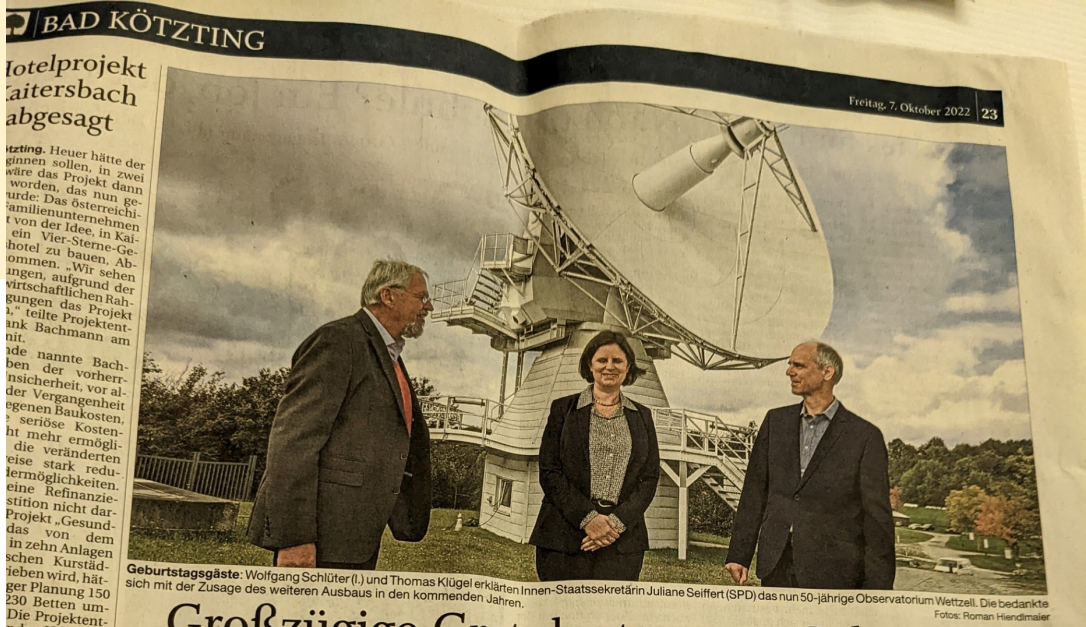


Wettzell's half century

BKG and TUM jointly celebrated their 50 years milestone on 7 Oct 2022, with about 100 attendees from Germany and foreign countries.

Congratulations!

photo: Ulrich Schreiber



BAD KÖTZTING

Freitag, 7. Oktober 2022 | 23

Geburtstagsgäste: Wolfgang Schlüter (l.) und Thomas Klügel erklärten Innen-Staatssekretärin Juliane Seiffert (SPD) das nun 50-jährige Observatorium Wettzell. Die bedankte sich mit der Zusage des weiteren Ausbaus in den kommenden Jahren. Fotos: Roman Hiendlmaier

Großzügige Gratulanten zum Geburtstag

Observatorium Wettzell feiert 50 Jahre seines Bestehens – und wird in Zukunft größer und jünger

Von Roman Hiendlmaier

Bad Kötzting. „Hidden Champion" – der Begriff wurde am Mittwoch häufig verwendet, bei der Geburtstagsfeier des Observatoriums Wettzell. Vor 50 Jahren begann im Kötztinger Vorort der Bau der ersten Schutzhütte für einen Laser zur Entfernungsmessung, Wettzell wurde ausgewählt, weil es damals „am Ende der Welt" funk- und lichtmäßig so „dunkel" war und darüber – damals wie heute – keine Flugzeuge flogen.

Heute gehören Laser zur Entfernungsmessung zur Ausstattung jedes gut sortierten Baumarkts und aus dem Häuschen ist eines der modernsten Observatorien seiner Art geworden - und zwar weltweit. Aktuell stehen Anlagen für geschätzt rund 80 Millionen Euro am Wettzeller Berg.

Höchste Genauigkeit

Wenn die Gäste einer Feier ein Maßstab für die Bedeutung sind, ist das Observatorium spätestens seit Mittwoch über jeden Zweifel erhaben: Aus Berlin war Staatssekretärin Juliane Seiffert angereist, im Auftrag ihrer Chefin, Bundesinnenministerin Nancy Faeser, die oberste Verantwortliche für den Forschungsplatz. Damit war sie aber bei weitem nicht die weitest gereiste: Dieser Titel ging an Prof. Toshimishi Otsubo, Vorsitzender einer Vereinigung von Laser-Experten, die weltweit über 40 Stationen in Betrieb haben. Seinen Reisegrund erklärte er bei der Einreise am Münchener Flughafen stolz so: Nicht FC Bayern, nicht Oktoberfest – Wettzell!

Das größte Geschenk aber hatte die politische Beamtin aus Berlin mitgebracht. Zunächst einmal betonte sie die Bedeutung von Wettzell für die **Aufgaben der Bundesregierung, die in ihren Augen künftig noch zunehmen werden.**

Die Bedeutung von Erdbewegungen, Sonnenaktivität, Zeit – alles das wird in Wettzell mit höchster Genauigkeit gemessen – seien bereits heute unverzichtbar. Ohne Wettzell kein Navi, kein automatisiertes Fahren, so die Staatssekretärin, die zwei aktuelle Verwendungen der in Bad Kötzting ermittelten Datengrundlagen nannte: Mit Wettzeller Messungen wurde dem Fischsterben an der Oder auf den Grund gegangen und das Bundeskriminalamt kann die Positionen von Mitarbeitern zentimetergenau verschlüsselt bestimmen – ein im aktuellen Bedrohungsszenario wichtiger Parameter.

Und weil die Aufgaben immer mehr und immer komplexer würden, so Juliane Seiffert, müsse man sich dafür auch wappnen: Weltraumschrott, Umweltschutz, Landesverteidigung zählte sie als Datenempfänger auch – natürlich sicher und 24/7 abrufbar.

Schon in den vergangenen Jahren sei Wettzell sukzessive ausgebaut worden, elf neue Stellen wurden bereits geschaffen, zwei Millionen Euro investiert. In naher Zukunft sollen weitere Gebäude entstehen, in die fünf weitere, junge Wissenschaftler einziehen sollen – und künftig sogar auch angehende:

Ein Schülerlabor einzurichten, dafür standen Isabella Bauer und Prof. Paul Becker mit ihrem Namen.

Nicht FC Bayern, nicht Oktoberfest – Wettzell! Prof. Toshimishi Otsubo reiste aus Tokio an.

Das Observatorium

Aufgabe: Messtechniken zur exakten Bestimmung der Position der Erde im All und zur Entfernungsmessung zu Satelliten sind am Geodätischen Observatorium Wettzell vereint. Gemessen wird auch die Figur der Erde, also Meereshöhen, Gebirge, etc.

Für den Wirtschaftsverein Aktionskreis Landkreis Cham unterschrieb Isabella Bauer eine Vereinbarung, die ein „Schülerlabor" aus der Taufe heben soll. Der Aktionskreis macht sich dafür auf die Suche nach Schulklassen und Lehrern, die mit Besuchen oder in Praktika an die Materie herangeführt werden.

Wandel der Region

Das war natürlich auch ganz nach dem Geschmack der politischen Gratulanten. Landratsstellvertreter Sandro Bauer freute sich, dass das Observatorium künftig noch stärker den Wandel der Region vom Rand gebiet zur Zukunftsregion unterstützen werde.

Und Bürgermeister Mark Hofmann sah Bad Kötzting schon als „quasi Hochschu standort", weil nach dem G sundheitscampus, nach Pla tenweg und Weltraumauss lung im Sinocur der „Hid Champion" seine Tore we öffne. Dass am Hight Standort der Teufel im D liege und es beim Ausbau Mobilfunknetzes Nachh darf gebe, sprach der Bü meister zwar an, gab sich auch hier zuversichtlich zur nächsten Geburtstag in Wettzell werden hoffe auch die weißen Flecke schwinden, wie es die du schon lange sind.

Wie das BRK Elke Meyer ihren Geldbeutel zurückbracht

Reports from IAG EC

IAG Executive Committee Meetings

Roughly 2 per year. Additional meetings arranged for IAG Scientific Assembly 2021.

#1 : 18 July 2019 Montreal

#2 : 7 Dec 2019 San Francisco

#3 : 8-9 Oct 2020 Virtual

#4 : 23 and 26 March 2021 Virtual

#5 : 24 June and 1 July 2021 Virtual

#6 : 8 Dec 2021 Virtual

#7 : 27 Apr 2022 Virtual

#8 : 5 Dec 2022 Paris

EC members:

ZA	Zuheir Altamimi,	*President*
RG	Richard Gross,	*Vice President*
MP	Markku Poutanen,	*Secretary General*
CK	Christopher Kotsakis,	*Comm. 1*
AJ	Adrian Jäggi,	*Comm. 2*
JB	Janusz Bogusz,	*Comm.3*
AK	Allison Kealy,	*Comm. 4*
JoB	Johannes Böhm,	*Service Representative*
TH	Tom Herring,	*Service Representative*
TO	Toshimichi Otsubo,	*Service Representative*
SC	Sonia Costa,	*member-at-large*
YD	Yamin Dang,	*member-at-large*
SR	Szabolcs Rozsa,	*COB*
BM	Basara Miyahara	GGOS
PN	Pavel Novak	ICCT
HS	Harald Schuh,	*Immediate Past President*
HD	Hermann Drewes	*Immediate Past SG*

IAG EC : Recent topics

- IAG Scientific Assembly 2025: Rimini Italy.
- IUGG 2013 Berlin: Session arrangement etc ongoing.
- End of the 4-year term approaching. Nominations for the next term just finished (→ extended to 8 Nov).
- IAG Structure being reviewed. Committees etc.
- Journal of Geodesy: IF 4.2. Hard to find reviewers, etc.
- IGRF (Int Gravity Reference Frame) → ITGRF, due to a conflict with Int Geomagnetic Reference Field.

- Helmut Moritz passed away 21 Oct 2022.

IAG EC (2023-2027) elections

Email sent on 19 July 2022

Dear Franz, Harald and IAG Nominating Committee,

On behalf of ILRS Governing Board, I would like to nominate:

Dr Vincenza Luceri (Italy) <cinzia.luceri@e-geos.it>

as a Service Representative 2023-2027. If you need any further information, please let me know or contact her.

Best regards,

Toshi

(In 2019, elections were conducted from January to May. The 1st EC meeting held in July (Montreal).)

GIM International and IAG Newsletters

(1) GIM International

Email from Szabolcs Rózsa on 26 Sept 2022

Dear Colleagues,

I'd like to ask your help and cooperation in publishing a series of short articles in the GIM International Magazine on the IAG Services. To do this, COB asks the IAG Services to provide us a short article on their activities and products. The paper should have the maximum length of 450 words.

:

→ ILRS target date: GIM Issue 3, 2023 = 1 March 2023 (or later)

---

(2)

IAG Newsletters (Monthly)

→ Reports on Guadalajara Workshop: by LOC (if IGN Spain agrees)

Discussions

Thank you!

The International Laser Ranging Service: Status and Plans

Michael Pearlman
Claudia Carabajal
Erricos Pavlis
ILRS Central Bureau

22nd International Workshop on Laser Ranging

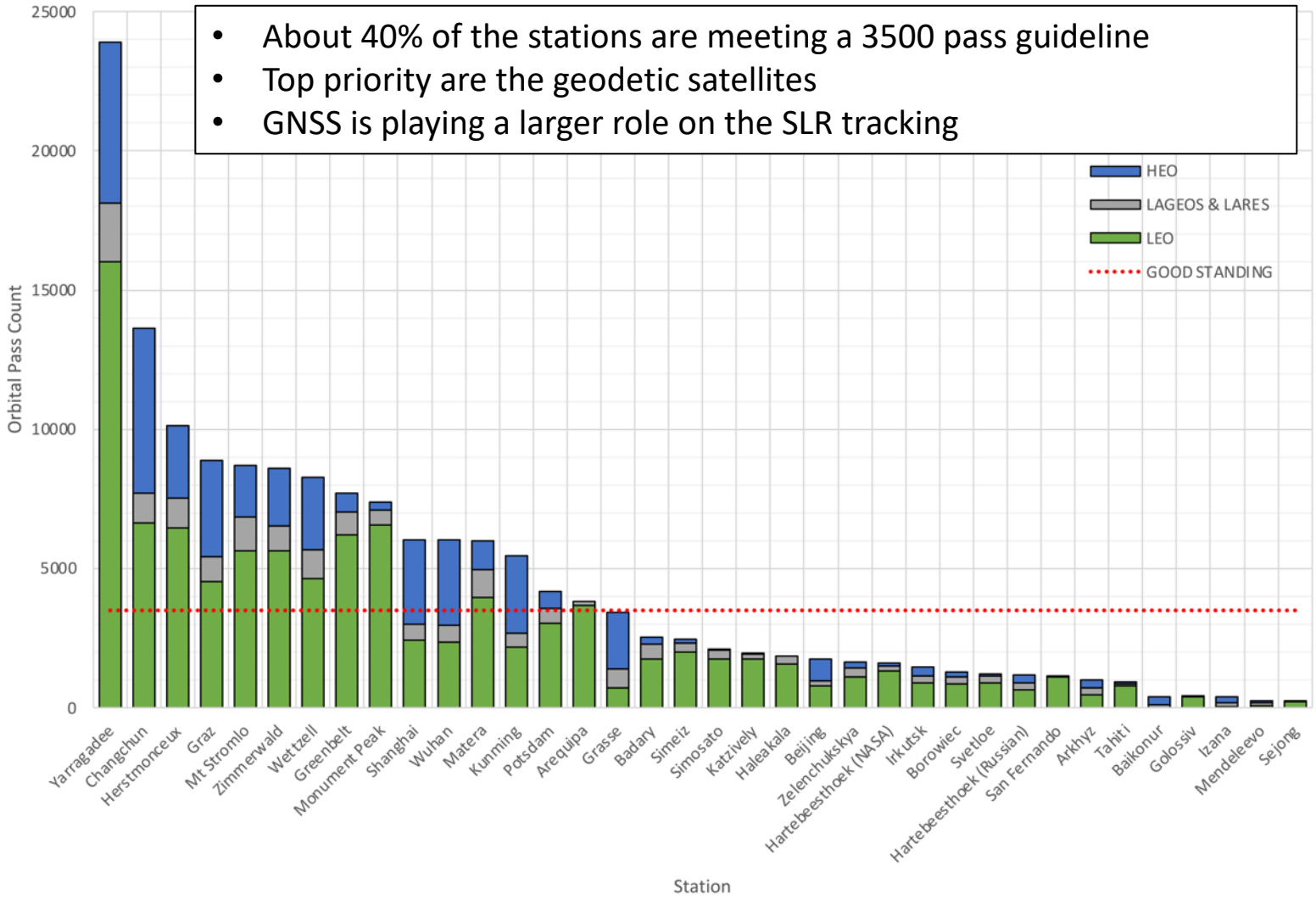
Guadalajara, Spain

November 7th – 11th, 2022

SLR Network

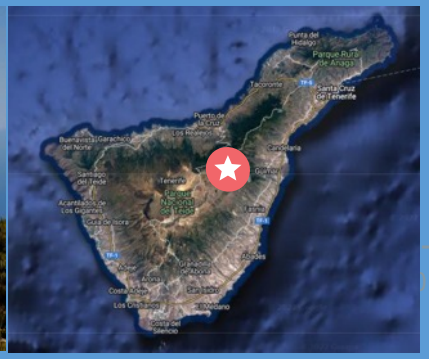
- New operational station in Tenerife and engineering station in Stuttgart
- Russian testing of new Toshka SLR systems in co-location at Mendeleevo and Irkutsk
- New stations scheduled for operation in 2023: Yebes (Spain), La Plata (Argentina)., Metsahovi (Finland), Mt. Abu and Ponmundi (India)
- NASA/NASA affiliated: Ny Ålesund (NMA, Norway) (2025), McDonald (2026), GGAO (2027),and Haleakala (2028)
- New Russia stations planned at Ensenada (Mexico), Java (Indonesia), Canary Islands (Spain) (no recent update)

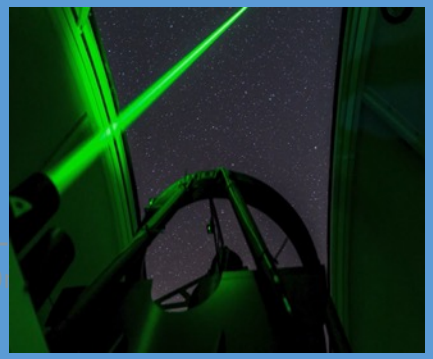
Total number of passes (07.01.2021-06.30.2022)



- About 40% of the stations are meeting a 3500 pass guideline
- Top priority are the geodetic satellites
- GNSS is playing a larger role on the SLR tracking

The ESA Laser Ranging Station at Tenerife, Spain





Station deployed in June 2021

- R-C Telescope (80 cm)
- Visible and IR SPADs
- Nd:YAG (7ps, 500µJ @1064 nm)
- Laser safety system
- Remote Operations

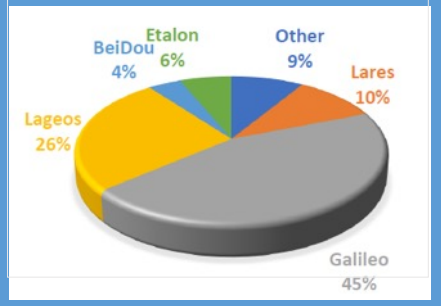
Satellite Laser Ranging

- SLR Operation at 532 nm and 1064 nm since end of 2021. Range biases < 10mm confirmed at both wavelengths
- More than 850 passes uploaded to EDC mainly at 1064 nm
- ILRS engineering station; Validation completed in April 2022
- On-demand SLR support

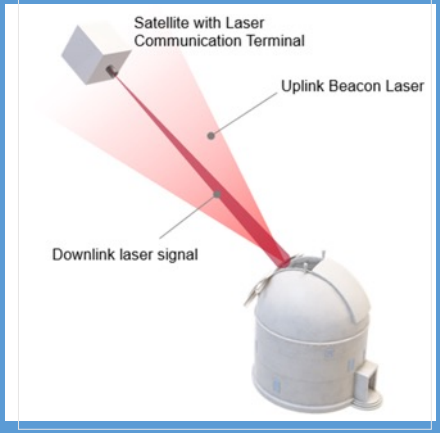
Space debris observations

- FLI ML16070 camera for passive observations
- Station upgrades by 2023 for SDLR, targeted range
- accuracy 10's cm
- SDLR networked operations in cooperation with other
- debris tracking stations

IZN-1 SLR passes until June 2022



Optical Comms Mode



LEO-DTE optical communications (CCSDS O3K)

- Detection and decoding of optical downlink signals from LEO missions
- Laser beacon uplink for satellite acquisition (6W @1590 nm)

IGN/CNIG Laser Ranging Station in Yebes, Spain

YLARA – Yebes Laser Ranging Station

Preliminar Station Design (Estudio AIA, 2021)

European Regional Development Fund
Investing in your future

➢ To be operational on March 31st, 2023

Telescope and Mount

- Biaxial telescope. Az/El mount, several foci
  - Receiving system: $D_{Main\ mirror}$ = 70 cm
  - Transmitting system (Coudé focus): $D_{Mirrors}$ = 45,7 mm
  - Beam pointing accuracy: ≤3''
  - High slew rate: 12°/s Az and El

Dome

- Slit dome, 5.3 m diameter

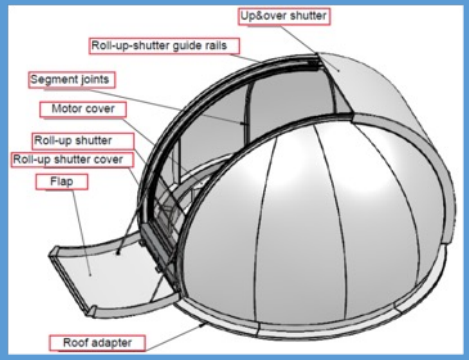
Laser subsystem (piggyback configuration)

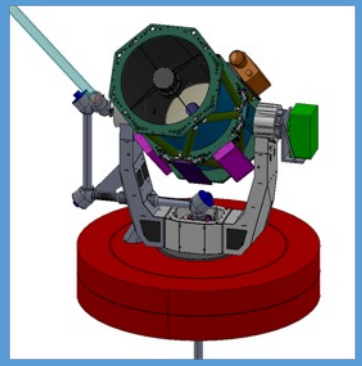
- Solid state pulsed laser
  - Repetition rate: 1000 Hz (adjustable)
  - Wavelengths: 532 nm and 1064 nm (Nd:YAG)
  - Energy: 0,26 mJ @ 532 nm, 0,35 mJ @ 1064 nm
  - Pulse width: 7 ps @ 532 nm, 8,5 ps @ 1064 nm
  - Transmitting system: $D_{Mirrors}$ = 75 mm

Detector Package

- CSPAD + IR Detector

Operational: early 2023





Baader Dome and Officina Stellare Telescope Assembly

The miniSLR® - Design

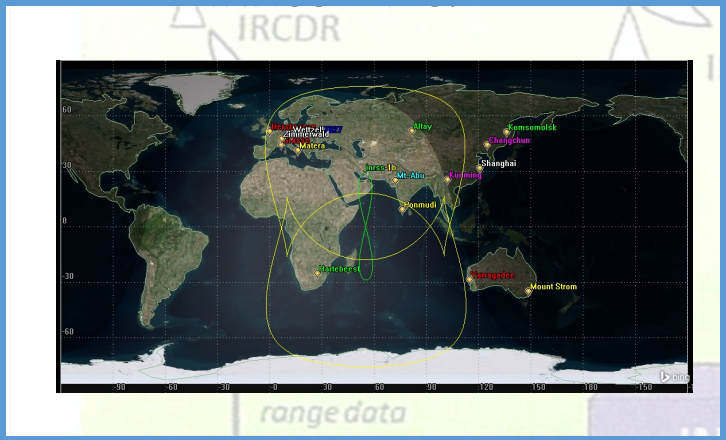
- High-performance:
  - Sub-cm precision for Normal Points
  - Range from LEO up to GNSS targets
  - Long-term stability
  - Remote-controlled and highly automated

- Low budget:
  - Small footprint
  - Transportable (can be integrated at factory)
  - Simple design
  - Fully encapsulated (no dome)
  - Based on amateur mount and small telescope

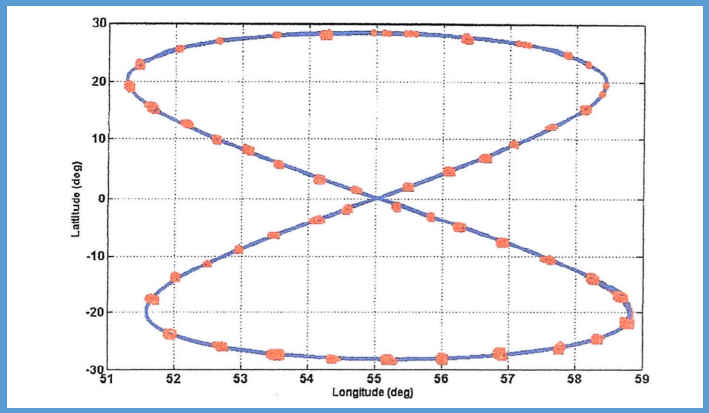
The miniSLR at German Aerospace Centre (in operation since February 2022)

ILRS/ISRO IRNSS Campaign

- ILRS/ Indian Space Research Organization (ISRO) Tracking Campaign on the IRNSS synchronous satellite constellation (7 satellites) planned for 2023;
- Seeks uniform coverage over the IRNSS satellites from the ILRS network plus new Indian stations in Ponmundi (southern India) and Mt Abu (northern India)
- 10-day sessions would be organized into two satellites at a time
- Map of satellite orbits and desirable dispersion of Normal Points in orbit



Map showing orbits of 1I and 1B satellites



Desirable dispersion of Normal Points

- First test with the ILRS network conducted April 17 – 30, 2022 gave significant data from Yarragadee and Grasse; some data from several others
- Further campaigns await evidence that progress is being made on the new SLR systems

Space segment addition: LARES-2

Compact distribution of small retroreflectors reduces the variation of return signal strength as a function of aspect angle

Estimated weekly biases by station, based on the use of the nominal CoG correction of ***174mm***

Reference Frame of Analysis: **SLRF2014**

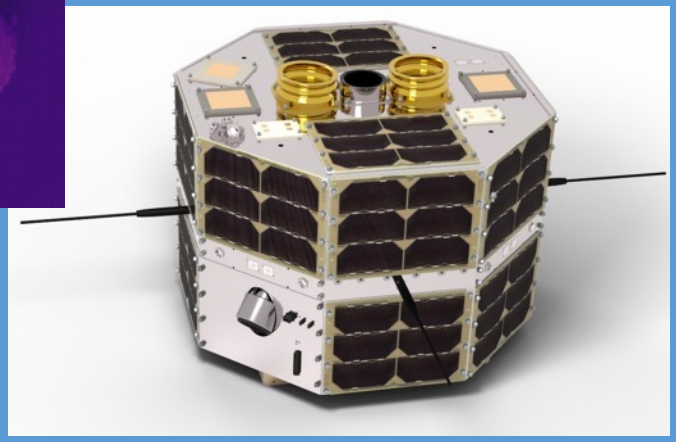
	Mean	Std. Dev.	Count
Station A	4.8	± 1.7	8
Station B	1.0	± 5.1	**5**
Station C	-9.5	± 7.1	7
Station D	4.5	± 3.5	9
Station E	4.3	± 2.0	**3**
Station F	-6.5	± 2.5	9
Station G	-8.1	± 3.0	8
Station H	-9.7	± 5.4	9
Station I	**-18.9**	± 3.3	9
Station J	-5.5	± 1.8	9

TUBIN

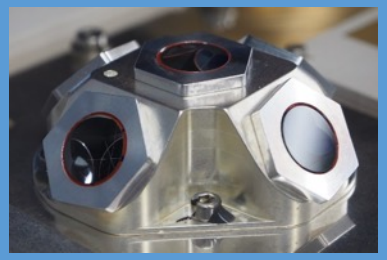
Technische Universität Berlin, Germany

- Demonstrate wildfire detection with TIR microbolometer on a microsatellite
  - Launch: June 30th, 2021
  - Orbit: SSO, 21:00 LTAN, 520 km
  - Body size: 305 x 456 x 456 mm
  - Mass: 22 kg
- TUBiX20 satellite platform
  - Modular and single failure tolerant bus
  - UHF TM/TC + S band payload data downlink
  - 3-axis stabilized with 4 reaction wheels, 2 star trackers, GPS, fiber optic & MEMS rate sensors, sun- & magnetic field sensors
- Payloads
  - 2 TIR microbolometer (7.5 – 16.5 µm)
  - 1 VIS CMOS camera (400 – 800 nm)
  - 1 S/X band transceiver
- 10 mm corner cube Laser Retro Reflectors
  - 4 side faces equipped with 2 reflectors each
  - Top & bottom faces equipped with pyramid assembly of 5 reflectors each

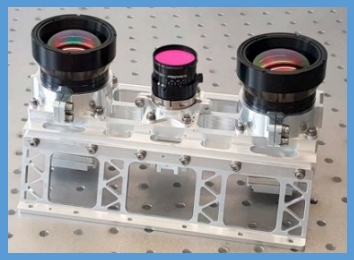
TUBIN TIR image, volcanic eruption on La Palma, 2021



The TUBIN satellite

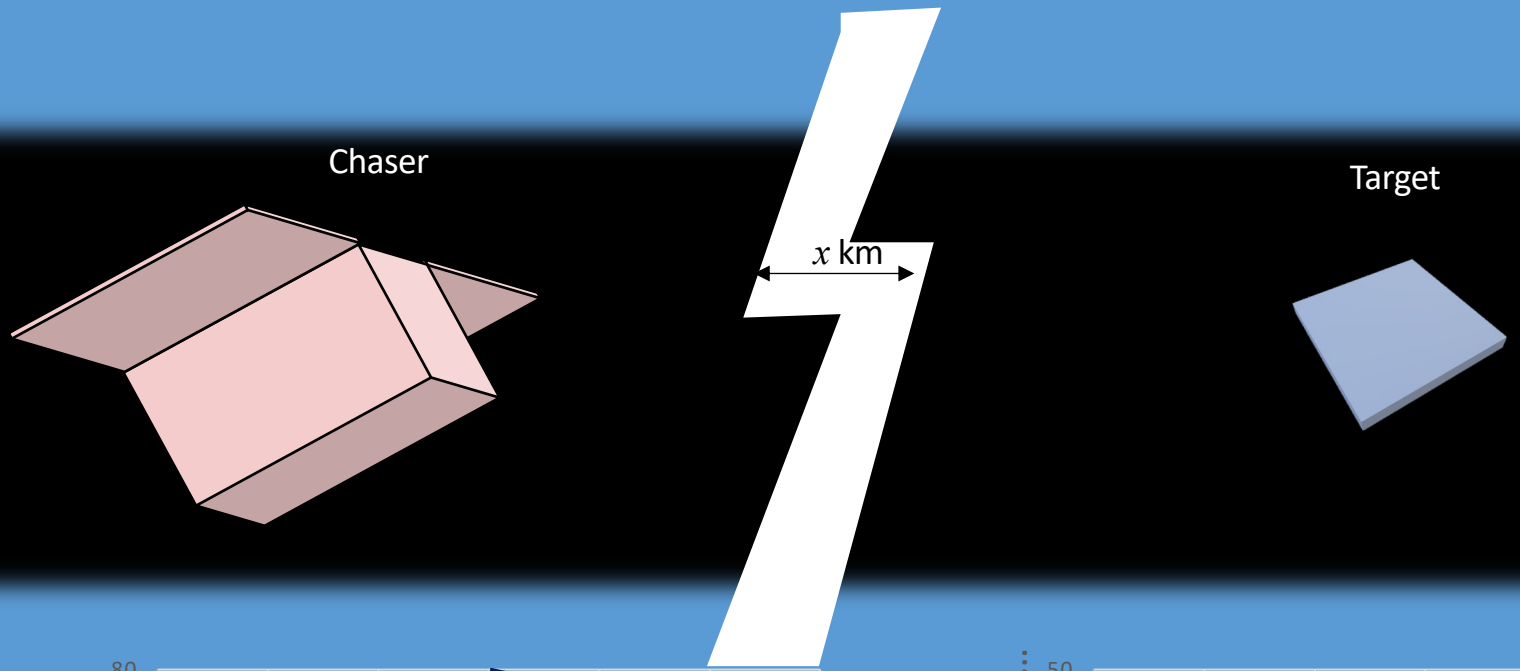


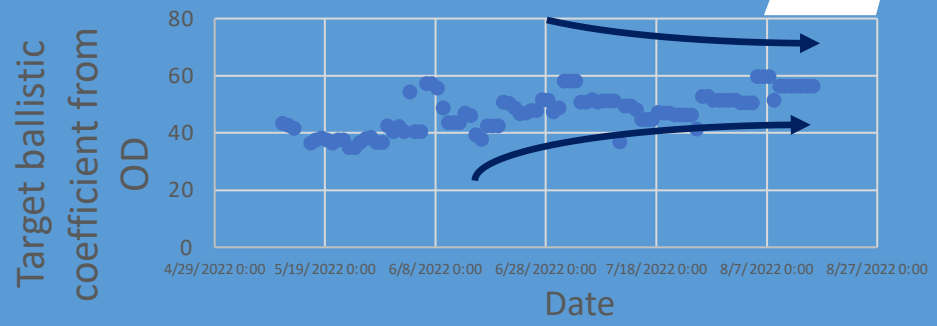
Retro reflector pyramid

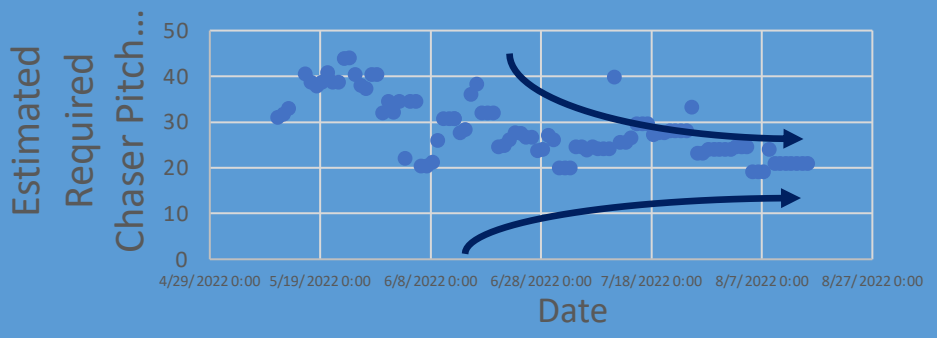


Payload assembly

ELSA-d Objectives Q4 2022->Q2 2023





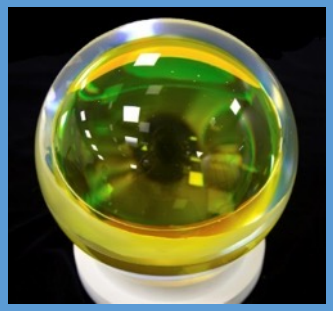


Looking at the dynamics of trying to capture a tumbling target in orbit

©Astroscale

OPEN JOINT-STOCK COMPANY - RESEARCH-AND-PRODUCTION CORPORATION "PRECISION SYSTEMS AND INSTRUMENTS"

Mass: 17 kg
Radius: 110 mm
2.5 times increased cross-section compared to BLITS (Sokolov et al., 2016).



Zero-signature target. Made of radiation-resistant glass with high-reflectivity dielectric interference phase-shift coating instead of aluminum coating, used for BLITS.

BLITS-M2 (Ball Lens In The Space-M2)

Mass: 17 kg
Diameter: 210 mm

Small signature effect. Made of glass to avoid induction of eddy currents, preventing the satellite spin slow down.

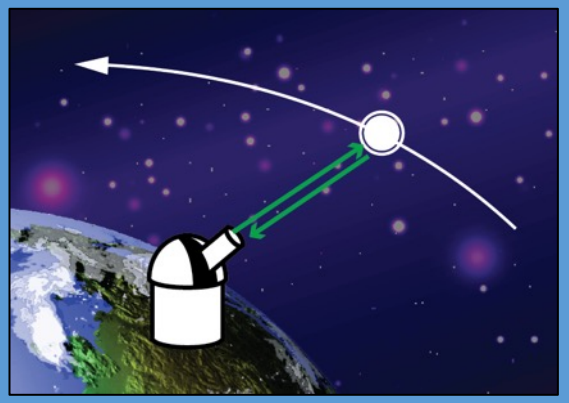
Geodetic Laser Autonomic Spherical Satellite (GLASS)

Analysis activities (ASC)

- Final version of ITRF2020 released by ITRS on April 15, 2022
- Developing the SLRF2020 edition, to include historical stations not part of ITRF2020
- A new ILRS ASC analysis product under development; required for proper use of ITRF2020:
  - The new approach in handling systematic errors relies on the SSEM model valid for 1993.0 - 2021.0
  - To use ITRF2020 beyond 2021.0 an extension of SSEM is necessary as well as continuous maintenance
  - A new weekly ILRS solution which will adjust freely station positions, orbits and station systematics is under development
  - This product will lag the standard weekly series by a week, in order to capture all tracking data
  - The results will be used to extend the SSEM by a week and into the future, and insert "breaks" in case a change in the mean bias of a station is identified with sufficient confidence
- Improved corrections in the current model for target signature corrections (CoG) are being calculated, including the consideration of new targets (LARES-2)
- Include LARES and LARES-2 satellites in the operational data products (2023)
- Estimation of low degree/order gravity field terms to be included in a future product (2023)
- Add loading corrections (at the observation level) to a special internal operational product (2023)

Issues & Challenges

- Many geographic gaps, primarily in Latin America, Africa, and Oceania
- Mix of new and old technologies, levels of financial support, weather
- Lack of standardization in system hardware and operations
- Data quality issues (significant progress made in detecting and reducing systematics)
- Number of target satellites continues to increase as new missions use SLR for orbit determination and other applications ; currently tracking ~120 satellites, soon to be ~140 satellites



ILRS ASC Activities

Erricos C. Pavlis and Cinzia Luceri

ILRS Analysis Coordinators

ILRS Governing Board Virtual Meeting

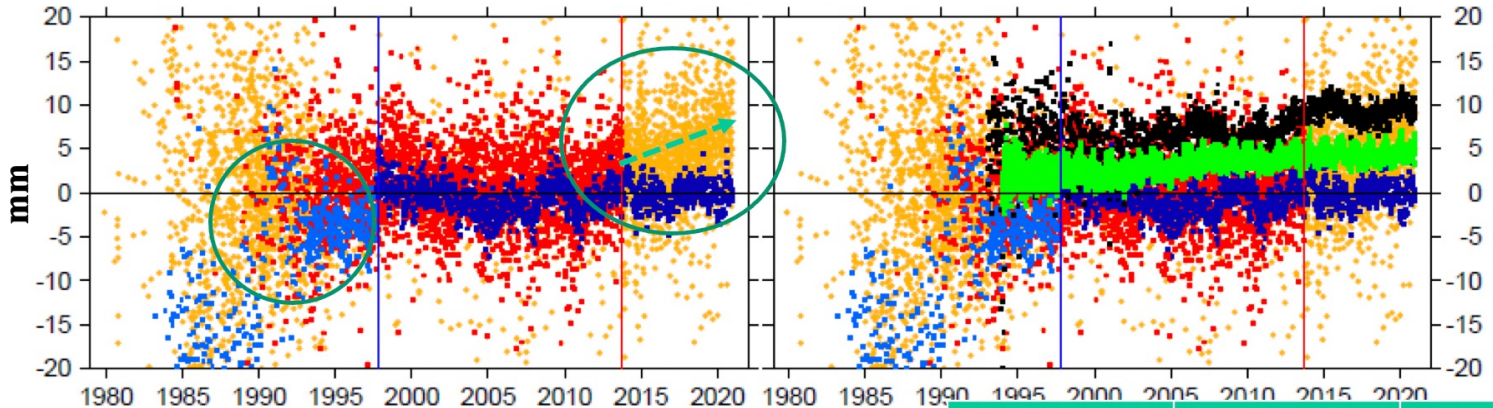
November 6, 2022

ILRS ASC - Analysis Activities - 1

- Final version of ITRF2020 released by ITRS on April 15, 2022

- ITRS verifies the ILRS preliminary findings that the new reanalysis resolves the SLR-VLBI scale discrepancy at the 1 mm level (0.15 ppb)
- ILRS needs to work on the historical data to improve the current results

Scales with respect to ITRF2020



- Orange: all VLBI Sessions
- Red: Selected VLBI Sessions (convex hull volume ≥ 10^{19} m^3)
- Light blue: all SLR time series
- Dark blue: Selected SLR time series
- Green: IGS/Repro3
- Black: DORIS

ITRF2020 scale: Average of red (VLBI) and dark blue (SLR)

Scale offset between SLR & VLBI is 0.15 ppb
(1 mm at the equator)

Solution	Scale at 2015.0 (ppb)	Scale rate ppb/yr
IGS/GNSS	0.682 ±0.018	0.018 ±0.001
IVS/VLBI	0.075 ±0.040	0.000 ±0.003
ILRS/SLR	-0.075 ±0.038	0.000 ±0.004
IDS/DORIS	1.386 ±0.037	0.028 ±0.003

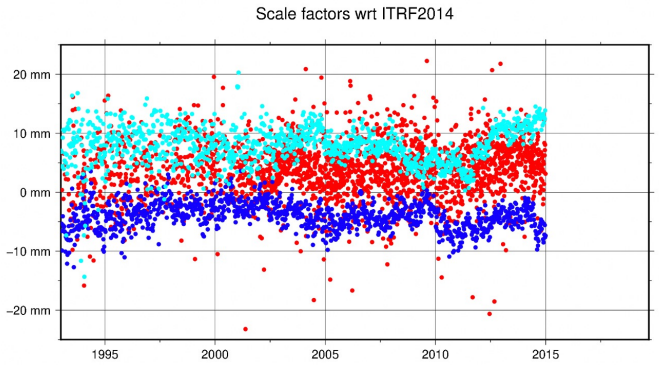
Altamimi et al., REFAG Symposium, Thessaloniki, 17-21 October, 2022

ILRS ASC - Analysis Activities - 2

- A significant part the SLR series (> 6 yrs) defines the ITRF scale @100%; due to an unexplained VLBI trend in their scale time series over that period, VLBI was not considered in the ITRS scale definition (just for that period)
- Developing the SLRF2020 edition, to include historical stations not part of ITRF2020
- A new ILRS ASC analysis product under development; required for proper use of ITRF2020:
  - The new approach in handling systematic errors relies on the SSEM model valid for 1993.0 - 2021.0
  - To use ITRF2020 beyond 2021.0 an extension of SSEM is necessary as well as continuous maintenance
  - New weekly ILRS solution adjusting freely station positions, orbits and systematics is under development
  - This product and the standard weekly series will lag by a week the current series, in order to ensure that we captured all tracking data from all stations
  - The results will be used to extend the SSEM by a week each week into the future, and insert “breaks” in case a change in the mean bias of a station is identified with sufficient confidence
- Improved corrections in the current model for target signature corrections (CoG) are being calculated, including the consideration of new targets (LARES-2)
- Plans for the near Future :
- Include LARES and LARES-2 satellites in the operational data products (2023)
- Estimation of low degree/order gravity field harmonics to be included in a future product (2023)
- Add loading corrections (at the observation level) to a special internal operational product (2023)

ILRS ASC - Analysis Activities - Past

SLR Scale in ITRF2014 Systematically Different



In 2015 ILRS launched a multi-year effort to address and resolve the SLR scale issue: Station Systematic Error Modeling Pilot Project (SSEM PP).

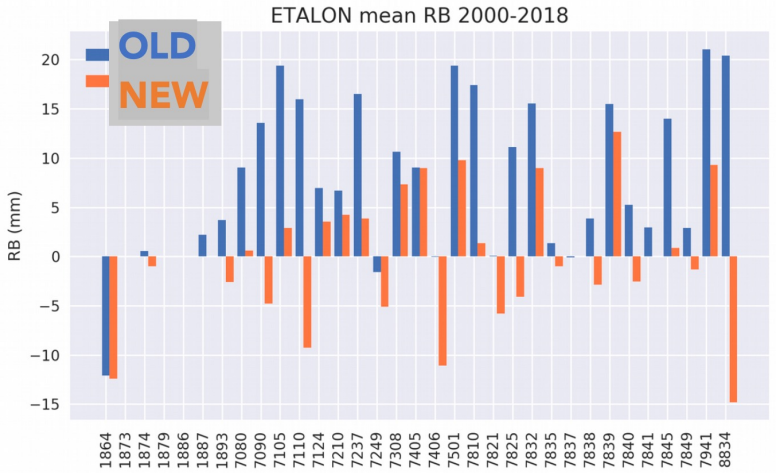
VLBI contribution to ITRF2014 +4.4 + 0.11 (t − 2010) mm
SLR contribution to ITRF2014 −4.4 − 0.08 (t − 2010) mm
DORIS contribution to ITRF2014 +7.2 − 0.11 (t − 2010) mm

VLBI - SLR = 8.8 mm ≈ 1.375 ppb

Credits: ITRS Center, ILRS ASC Meeting, Oct. 1st, 2019, Observatoire de Paris

Improved Target Signature Corrections

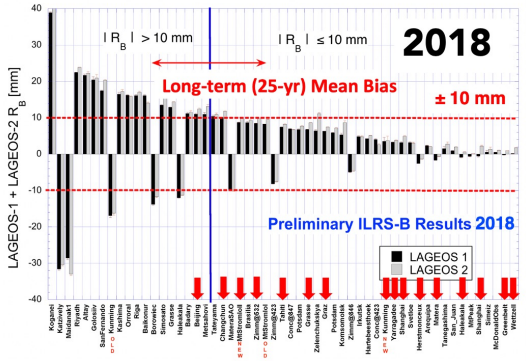
- These errors introduce a direct scale "bias"
- Most stations had inadequate modeling even at cm-level, e.g. for the Etalon satellites
- A non-random distribution in the network, resulted in significant distortion of the scale

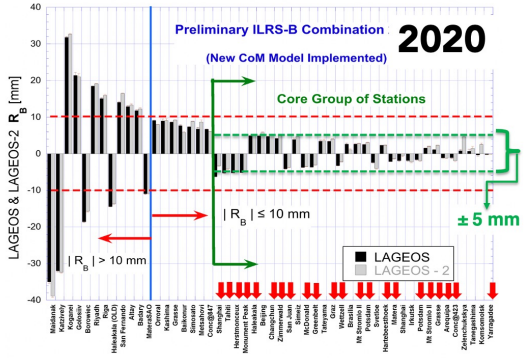


Credits: José Rodríguez & Graham Appleby, NERC 2018

New modeling vastly improved the solution:

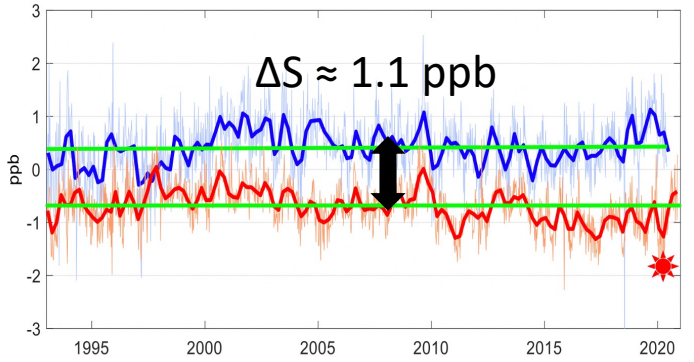
- Long-term mean biases were halved for Core stations
- Biases were more randomly distributed about zero





Revised SLR scale as a result of the SSEM PP 2020 reanalysis:

- Upper curve:
  - SLR scale from SSEM
  - Mean: +0.4 ppb
- Lower curve:
  - SLR scale in ITRF2014
  - Mean: -0.7 ppb
- Mean difference:
  - $SLR_{NEW-OLD} \approx 1.10$ ppb
  - VLBI - SLR ≈ 0.28 ± 0.10 ppb



ITRF2014 SLR series extended beyond 2014 using the weekly ILRS ASC product.

Missions Standing Committee Brief

Stephen Merkowitz and Robert Sherwood

November 5, 2022

MSC Activities

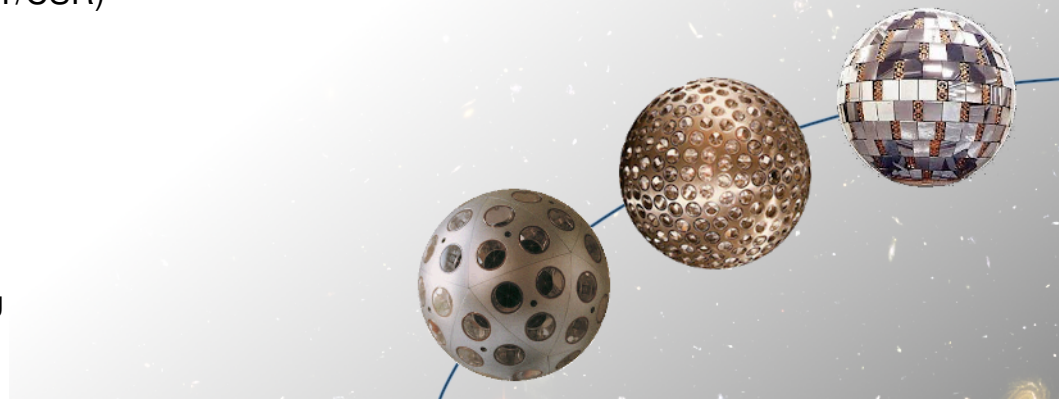
- Reviewed mission support requests and recommended:
  - Beidou3
  - QZS-1R
  - HY2D
- Under review
  - Luna 25
- Interactions with Upcoming Missions
  - Mt.FUJI
  - ALOS-4
- Updating Mission Support Request Form for new lunar retroreflectors

Deutsches Geodätisches Forschungsinsitut (DGFI-TUM)
Technische Universität München

Data Formats and Procedures Standing Committee Status Report

Christian Schwatke[1], Randy Ricklefs[2]

[1]Deutsches Geodätisches Forschungsinstitut, Technische Universität München (DGFI-TUM)
[2]University of Texas / Center for Space Research (UT/CSR)



22nd Workshop on Laser Ranging | Governing Board Meeting
November 6, 2022 | Guadalajara, Spain

DFPSC-Tasks (since 2019)

- Consistent quality control at the operation centers (**Completed on 15 August 2019**)
- Update of site log procedure - format version 2 (**Completed on September 2019**)
- New quality control for station-dependent surface pressure (**Completed on 8 September 2021**)
- Implementation of the new CPFv2 format (**almost completed**)
- Implementation of the new CRDv2 format (**almost completed**)
- Quality check for SINEX products (**in progress**)

CPF (Version 2) - Implementation Schedule and Status

June 2018
- New "v2" directories set up on CDDIS and EDC

July 2018
- Released CPFv2 manual, sample code, and test data on CDDIS website

September 2018
- EDC website provides an online tool for checking data with respect to the new CPFv2 format

January 2019
- OCs, DCs should be able to handle CPFv2
- At least one prediction provider should be producing CPFv2
  - UTX: since 2018-12-05 (only LLR)
  - HTS: since 2019-03-06
  - OPA: since 2019-06-13

CPFv2 used by Graz and Wettzell without problems

CPF (Version 2) - Implementation Schedule and Status

September 2020	• Almost all stations should be able to use CPFv2 (required for those tracking ELT)
December 2020	• All prediction provides should be producing CPFv2
1st October 2021	• CPFv2 became the offical data format for predictions in the ILRS • Prediction providers should continue sending CPFv1 and CPFv2 in parallel until at least 1st October 2022
1st February 2022	• Prediction providers may stop distributing CPFv1 files at its earliest convenience, preferably by the end of this year.
1st January 2023	• Data centers stop processing of CPFv1 data. **Transition to the new CPFv2 format completed!!!**

CRD (Version 2) - Implementation Schedule and Status

June 2018
- New "v2" directories set up on CDDIS and EDC

September 2018
- Released CRDv2 manual, sample code, and test data on CDDIS website
- EDC website provides an online tool for checking data with respect to the new CRDv2 format

October 2018
- MLRS analysis code incorporates CRDv2 code

December 2018
- One or or two stations should be able to produce CRDv2
  - Graz (7839): since 2019-05-02
  - Mt.Stromlo (7825): since 2019-07-15
  - Herstmonceux (7840): since 2019-08-01

All stations are in "data quarantine" until CRDv2 has been approved by the ASC

CRD (Version 2) - Implementation Schedule and Status

January 2019	• OCs, DCs should be able to handle CRDv2
	• Some analysts should be able to process CRDv2 files
	- JCET can handle v2.00 CRD (and soon v2.01)
October 2019	• Final update and release of CRD v2.01
	- New records C7,42 // 'na' instead of -1 for 'not applicable'
December 2020	• All analysts should be able to process CRDv2 files
December 2021	• Almost all station should be producing CRDv2 files
1st October 2022	• CRDv2 became the offical ILRS data format for NPT and FRD in the ILRS
	• All stations were released from "data quarantine"
	• Stations may stop distributing CRDv1 files (if CRDv2 available) at its earliest convenience.

CRD (Version 2) - Implementation Schedule and Status

1st October 2022

- Stations which are submitting only CRDv1 and no CRDv2 will be converted automatically

  Currently converted stations:

  Irkutsk (1874) / Riga (1884) / Arkhyz (1886) / Baikonour (1887)

  Svetloe (1888) / Zelechukskya (1889) / Bardary (1890) / Bardary (1890)

  Irkutsk (1891) / Hartebeesthoek (7503)

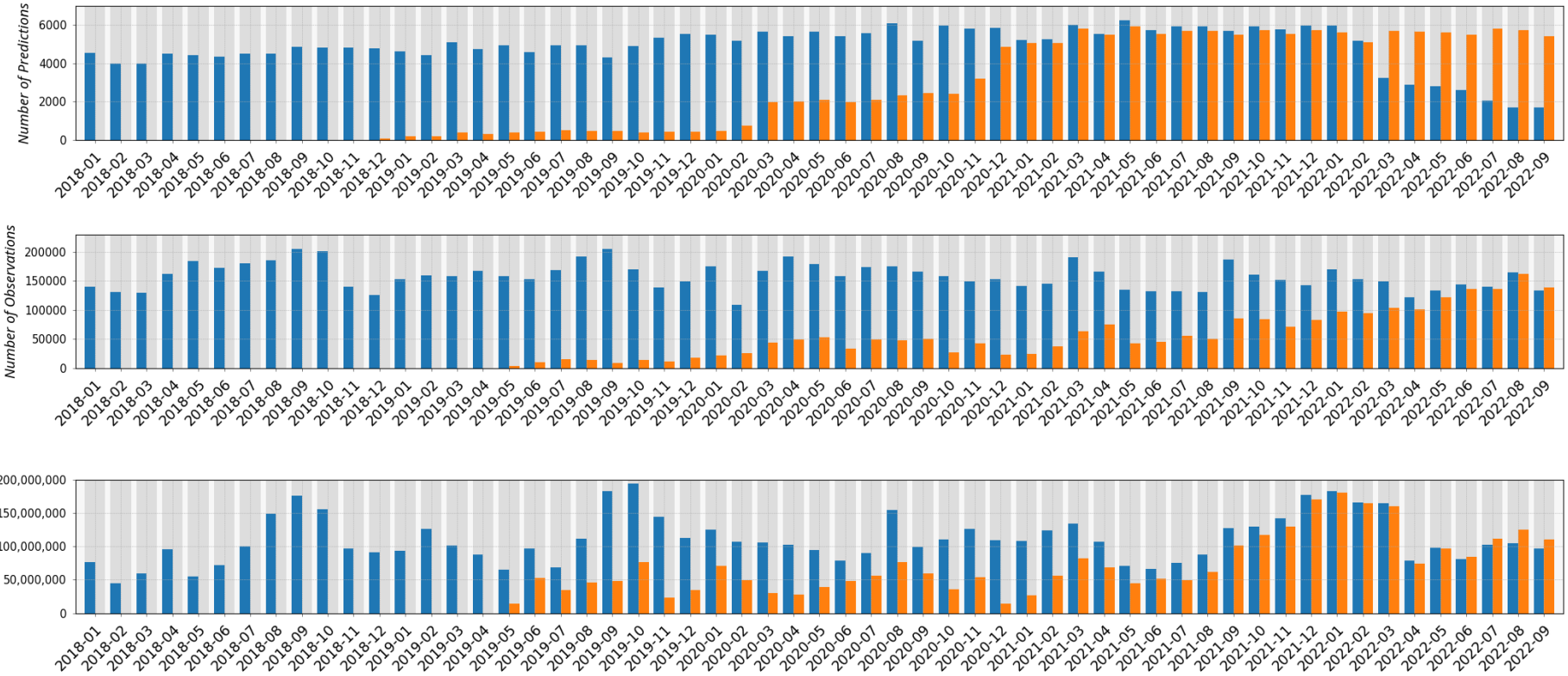
1st January 2023

- Data centers stop processing of CRDv1 data.

  Transition to the new CRDv2 format completed!!!

Monthly Data Holding of CRD/CPF at EDC

- Monthly data holding of CPF (top), NPT (middle) and FRD (bottom) for format version 1 (blue) and format version 2 (orange)



Quality Checks for SINEX products

- Improving format compliance and file consistency of ILRS products
- In the current phase, the new quality checks will be defined and reviewed
- Persons/groups currently involved in the development of quality controls:

  - CDDIS (Justine Woo)
  - EDC (Christian Schwatke)
  - ASC (Erricos Pavlis)
  - ... maybe you? ;-)

Upcoming DFPSC-Meeting

International Laser Ranging Service

Data Formats & Procedures Standing Committee

Monday, November 07, 2022, 17:45 – 19:00 (in person/virtual)
Guadalajara (near Yebes), Spain, Centro San José – Diputación Provincial de Guadalajara

Teams-Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NDdhMDYzYmItNzZkMy00NzQyLTg3OWYtZGM1NzE1ZmI4YTcz%40thread.v2/0?context=%7b%22Tid%22%3a%229dcf2014-d3fc-4a52-a3d3-7376e080f8ad%22%2c%22Oid%22%3a%22e9c7d2a4-43eb-46b5-b9cf-66309174c1dd%22%7d

AGENDA

1.	Welcome and Introduction	*C. Schwatke*
2.	Implementation Status of new CPF/CRD format	*R. Ricklefs (virtual)*
3.	Quality Checks on SINEX Products	*J. Woo*
4.	Status Report of Herstmonceux Normal Point Software	*M. Willkinson*
5.	Other business	All
6.	Next meeting	All

Networks & Engineering SC

Report to the ILRS Governing Board

Matthew Wilkinson

International Workshop On Laser Ranging, Guadalajara, Spain 2022

Networks & Engineering SC

- **Chair**
  - Matthew Wilkinson, NERC Space Geodesy Facility, UK
- **Co-Chairs:**
  - Clément Courde, Observatoire de la Côte d'Azur, France
  - You Zhao, National Astronomical Observatories, China
- Large email list of SC members

Networks & Engineering SC

- The NESC has continued to meet every 2 months virtually via Microsoft Teams.
- Approximately 40 attendees join the online meeting each time.
- The agenda for the meeting is shared in advance and NESC members are invited to contribute by presentation.
- I work with my co-Chairs to find items for the agenda and to invite speakers.

Networks & Engineering SC

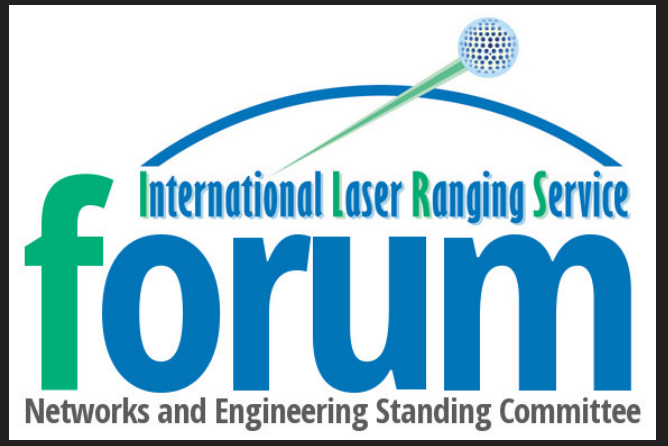
- Here are some example contributions that were made to the NESC over the last year:
  - **Krzysztof Sośnica** presented an elevation dependent tropospheric bias estimation in orbit solutions.
  - **Michael Steindorfer** and **Daniel Kucharski** gave an update on the activities of the Space Debris SG.
  - The new station IZN-1, Tenerife was introduced by **Andrea Di Mira**.
  - **David Antal-Wokes** and **Sharon Sara Saji Mira** from Astroscale were invited to present an update on the ELSA-d space debris recovery demonstration mission.
  - **Ron Sigura**, CEO of GuideTech, was invited to speak to NESC about the available timing technologies from GuideTech that can be used in SLR.
  - **Daniel Hampf** presented the progress of the miniSLR system, which was recently officially accepted as an ILRS Engineering Station.
  - **David Arnold** discussed calculating the centre-of-mass offsets for the newly launched Lares-2 satellite, which are needed in precise orbit SLR analysis.

Networks & Engineering SC

- In addition, the NESC also:
  - Discussed the ILRS position on the Russian invasion of Ukraine. This followed statements for the IAG and ILRS.
  - Discussed the IRNSS tracking campaign in both design and results from the network efforts.
  - Discussed how to design and develop a travelling barometer that will visit every station in the ILRS network.

Networks & Engineering SC

- The NESC continues to operate an online forum. However, this is not very active.
- http://sgf.rgo.ac.uk/forumNESC



Networks & Engineering SC

- **Next NESC meeting:**
  - This will be the first in person meeting since 2019. It will also be accessible via Teams.
  - A number of speakers have agreed to give their perspective on the challenges facing SLR. These include:
    - **Ivan Prochazka** - SLR Technology
    - **Frank Lemoine** - Geodesy and Earth Observation
    - **Graham Appleby** - SLR Analysis, Geodesy and Station Bias
    - **Adrien Bourgouin** - Lunar Laser Ranging
    - **Julien Chabé** - Atmospheric Delays
    - **Michael Steindorfer** - Debris Tracking
    - **Jan Kodet** – Timing and Time Transfer
  - The meeting is on **Tuesday 8th November, 17:45-19:15pm (CET)**.

ILRS Governing Board Transponder SC. Report

Jean-Marie Torre, Université de Nice Sophia-Antipolis, Observatoire de la Côte d'Azur, Géoazur, 2130 route de l'Observatoire, 06460 Caussols, France.

Ulrich Schreiber, Technical University Munchen, Geodetic Observatory, Wettzell, Germany.

ILRS Technical Workshop, November 2022, Guadalajara, Spain

Introductory Remarks

- There are several standing committees established under the ILRS, which are the “Analysis-SC”, the “Missions-SC”, the “Data For-mats & Procedures SC”, the “Network & Engineering SC” and the “Transponder SC”. While the first 4 Standing Committees are in place to organize and improve the services of the ILRS, the “Transponder SC” is looking into the application of novel techniques, based on time-of-flight measurements.

- The main objectives are the extension of the range of the laser ranging application into the deep space regime (MOLA, MLA and GALA), as well as optical time transfer (LRO and T2L2).

Transponder SC activities

- So why is optical time transfer an important aspect for a station network of time-of-flight measurement stations, which rely on a single local clock? To answer this question, we are looking at the latest D-TRF computation of TUM-DGFI and we note that in this solution, the scale of the TRF is jointly defined by VLBI and GNSS and not SLR, which from a technical point of view is curious, because the optical technique has a great advantage over the microwave techniques, since the atmospheric corrections can be established more reliably in the optical domain.

- Upon closer inspection it turns out, that the solution for the scale of the microwave techniques are closer to each other, than to the SLR technique. The cause of this problem are systematic errors in ALL the techniques and it is very likely that none of the solutions for the scale are correct. From GNSS and VLBI clock comparisons we note that the observed clock differences are contaminated by clock-model errors and if the clock estimations are affected, this also means that the coordinates are affected, since both are correlated with each other. SLR might have the better position for the correction of the atmospheric delay, but this advantage is apparently lost over systematic measurement errors, typically in the form of variable range biases.

Optical time transfer

- Optical time transfer and local optical delay compensation provide the means to remove this type of systematic error.
- This has been impressively shown by the T2L2 experiment, where the local delay compensation at some stations for the optical time transfer was introduced during the time transfer calibration process. Discrepancies in the range of 20 - 100 ps became evident, as well as some significant variability. This experience led to the investigation of a closure measurement concept, where delay measurements start off from the clock, pass through the entire measurement system up to the local calibration target and from there the accumulated delay returns back to the clock.
- The next goal is to achieve the same capability for the entire observatory, provided that more than one technique of space geodesy is present. That means the local calibration target must be extended to the point that it offers the same closure measurement capability also to VLBI and GNSS.

Time transfer between observatories

- So far we have seen, that the 2-way comparison of time is the key for the removal of systematic offsets. Time in this context is not necessarily the UTC timescale. Any sufficiently stable clock, close enough to the length of the SI second is adequate for the purpose (We only measure around in a circle, locally). How-ever, if we link several observatories (fundamental stations) by 2-way time transfer, this concept has the potential to mature to the point that we can experimentally set up a common network clock for at least a sub-network of collocated (fundamental) stations, which promises two things, a) a higher measurement resolution and b) a significantly enhanced instrumental stability. This is possible because we can perform a closure measurement again, this time between fundamental stations. In other words, we are substituting local ties alone by a consistent realization of a combination of local ties plus electronic delay compensation.

Time transfer between observatories

- **ACES** is currently the only upcoming mission that provides this basic optical time transfer functionality.
- Within the activities of the Transponder SC, we have explored optical time transfer from diffuse target reflections.
- Although very successful, it did not provide the necessary range resolution, caused by an unfavorable target structure. There is currently another experiment between Grasse and Wettzell under way, which seeks to utilize geodetic satellites in low orbit for this purpose.
- Over the last two years, we have submitted a large research unit application to the national science foundation (DFG) in Germany in order to develop this concept of a widely distributed accurate common clock for space geodesy further. The scientific review was very favorable and we hope to obtain funding, starting in January 2023.

Deep space optical transponder operations

- An experiment has been carried out for the Hayabusa-2 mission upon launch and as an experiment of opportunity during a fly-by at the Earth in December 2021. In this latter experiment successful 2-way transponder ranging has been achieved by the Grasse observatory. Another such experiment is in preparation between the GALA (Ganymede Laser Altimeter) of the JUICE (Jupiter's Icy Moons Explorer) mission for the late spring in 2023. It will require stations with lunar capability to perform these transponder measurements.

- Grasse LLR station continue to range on LRO. Successful 2-Way ranging were obtained two weeks ago.

ILRS Space Debris Study Group current status and directions

Chair, Dr. Michael Steindorfer, Graz SLR Station, IWF, AAS
Co-Chair, Dr. Daniel Kucharski, The Aerospace Corporation

ILRS Governing Board Meeting, Guadalajara, Spain, November 6, 2022

Space Debris Laser Ranging – the big picture

- July 2022: the White House Office of Science and Technology Policy released the National Orbital Debris Mitigation Plan defining a US national effort to mitigate, track, and remediate orbital debris for space sustainability. The specific actions for the gov. agencies are defined across three pillars:
  - Debris Mitigation
  - Tracking and Characterization of Debris
  - Remediation of Debris
- Sept 2022: NASA has announced it will be funding new research projects to better understand the dynamics of congested orbital environment and identify options to mitigate the impact of orbital debris population on space sustainability.
- May 2022: the U.S. Space Force has awarded 125 R&D teams (academia & commercial) with up to $250k each (Orbital Prime, 1st stage) in an effort to accelerate the development of technologies for orbital debris cleanup and other services needed for long-term space sustainability.

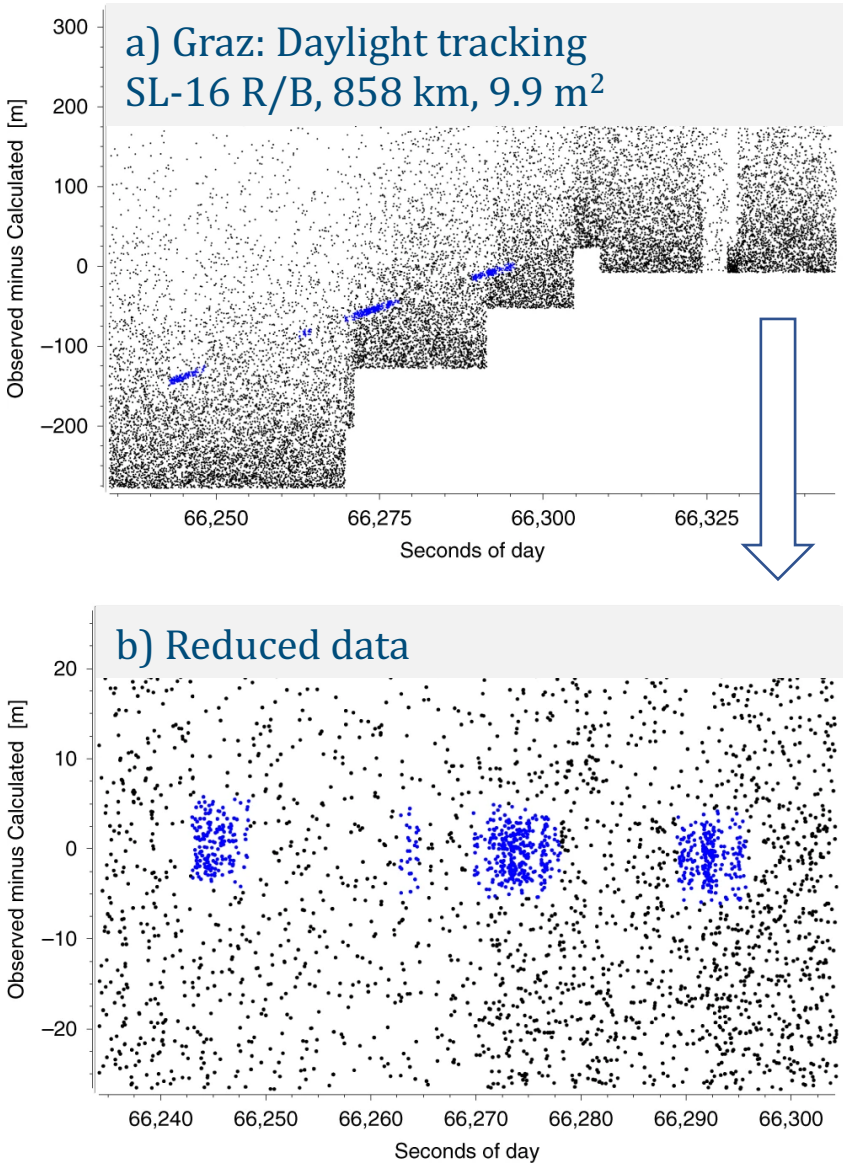
Space Debris Laser Ranging – the big picture

- The EU and ESA stand on the long-term commitment to efficiently detect and characterize the space debris population for safety and sustainability of space environment
  - Programs: ESA Expert Centre, EU Space Surveillance and Tracking (SST) Support Framework
  - ESA says: “The Izaña station is a technology test bed and a vital step in making debris mitigation widely accessible for the future of space environment.”
- Australia: has recently deployed two new Laser Ranging systems (1m) for space debris tracking, characterization and cataloguing (Western Australia, EOS Space Systems).
- China: committed to the space environment laser tracking for years now; multiple laser stations operate with the debris ranging capabilities.
- Japan: officially interested in tracking, modelling and mitigating the risk of orbital debris. In 2023 JAXA will be testing technologies for removing large-scale debris from orbit.
- ILRS network members experienced in space debris tracking include (15+):
  - Graz, Mt. Stromlo, Zimmerwald, Izaña, Wettzell, San Fernando, Matera, Kunming, Shanghai, Stuttgart, Potsdam, Herstmonceux, Borowiec, Riga, Geochang…

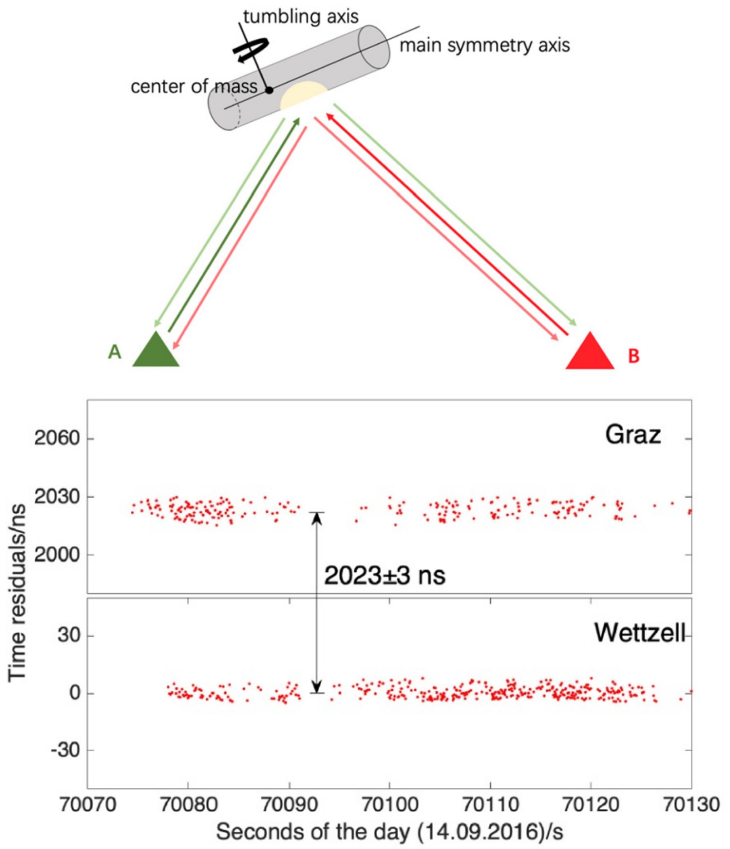
Space Debris Study Group
- Laser ranging for space environment sustainability-

- SDSG supports SLR stations in their effort to attract funding for development and operation of additional observation systems and capabilities for space debris tracking.
- To us, the space debris objects are free-falling passive sensors of physical interactions with the environmental forces and torques (orb. perturbations, tumbling motion).
- Space Debris Laser Ranging supports physical research to better understand the space debris behavioral characteristics needed for accurate interaction models – especially for long term orbit determination, conjunction analyses, reentry prediction (and impact footprint) etc.
- Possible technologies to benefit from space debris laser ranging data (day/night) are:
  - Rendezvous and Proximity Operations (RPO) for satellite servicing, refueling and mission extension (including geoscientific missions)
  - Active Debris Removal (ADR) services for safety and sustainability of space operations (including geoscientific missions), human flight.
- Please consider establishing SDSC for more effective support of the stations that direct resources to the development and operation of new laser tracking technologies. We want stations to do well because they provide unique observational capabilities.

Space debris state vectors

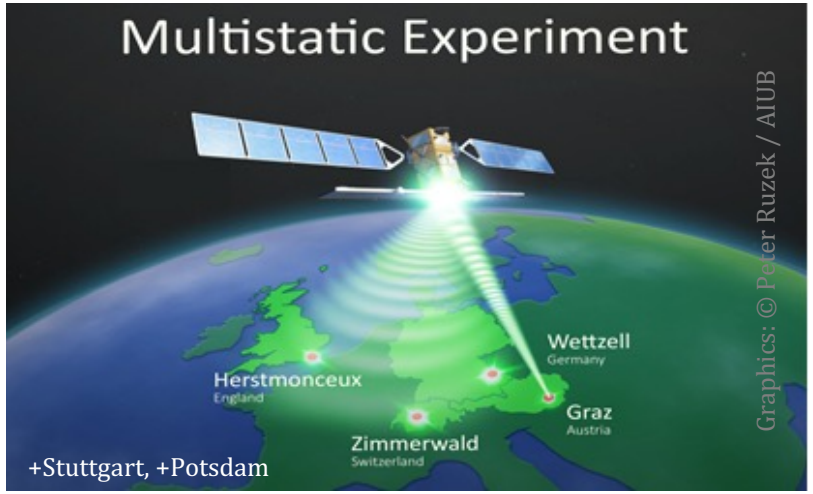


M.A. Steindorfer, G. Kirchner, F. Koidl, et al. Daylight space debris laser ranging. Nat Commun 11, 3735 (2020).



Wettzell-Graz: common view laser time transfer between two stations by diffuse reflections off of a R/B.

T. Liu, J.J. Eckl, M. Steindorfer, P. Wang and K.U. Schreiber. Accurate ground-to-ground laser time transfer by diffuse reflections from tumbling space debris objects. Metrologia 58, 025009 (2021).



- Graz debris laser „offset to pps“ communicated
- Target + time bias communication via time bias exchange
- Tests with: Herstmonceux, Wettzell, Zimmerwald, Stuttgart, Potsdam, Graz
- Multistatic / multicolor space debris laser ranging

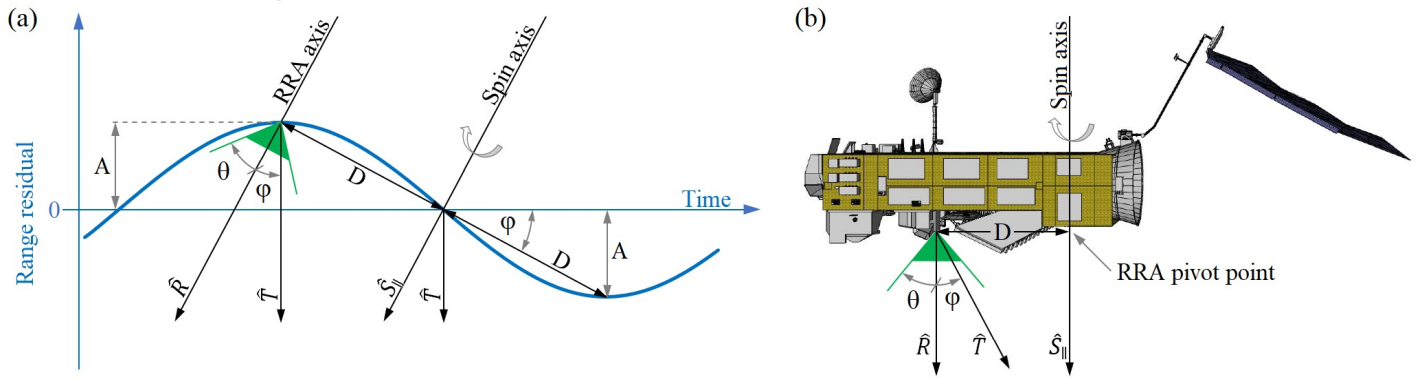
Riepl, Eckl, Kirchner, Sproll, Hampf, Wagner, Riede, Schreiber, Koidl, Steindorfer, Bamann, Hugentobler, Wang, Flohrer, Funke
First results from an ESA study on accurate orbit determination with laser tracking of uncooperative targets. 7th European Conference on Space Debris.

Space debris tumbling motion

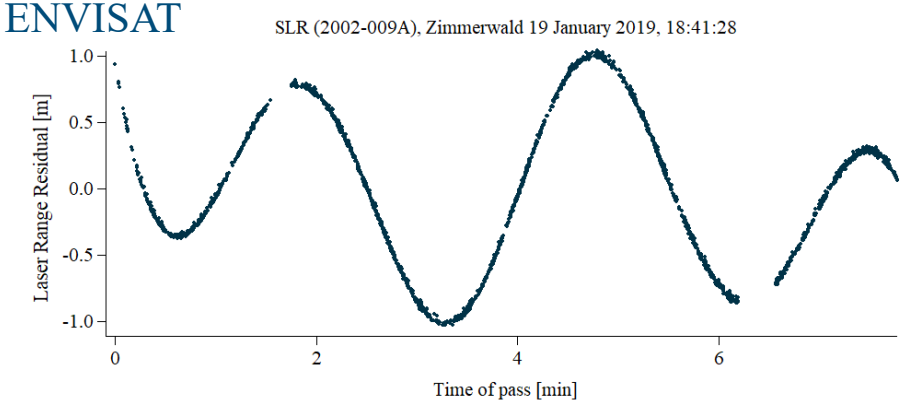
Tumbling motion of passive objects as a result of the environmental interactions.

SLR provides observational ground truth as an input to scientific analysis, space physics model development and validation.

Range inversion methods for space object attitude determination



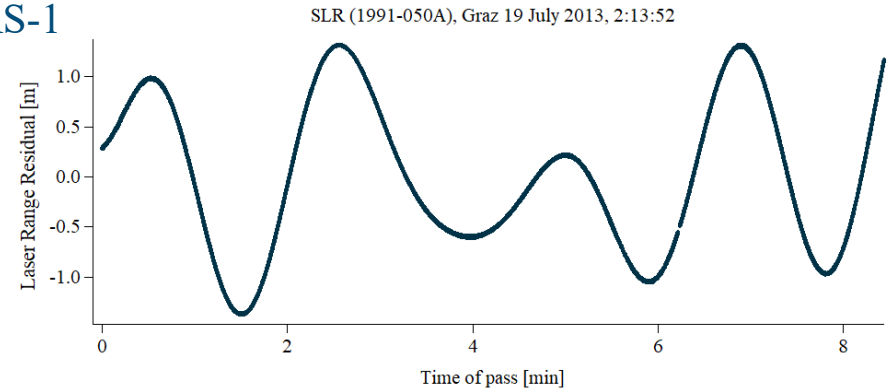
ENVISAT



Pass information
Duration: 7m:46s
Data points: 2936
Data rate: 16.6 Hz

Object: ENVISAT
NORAD: 27386
Cospar: 2002-009A
Launch: 1 March, 2002
Apogee alt.: 766 km
Perigee alt.: 764 km
Inclination: 98.2°
Orb. period: 1.7 h
RCS: 18.6 m2

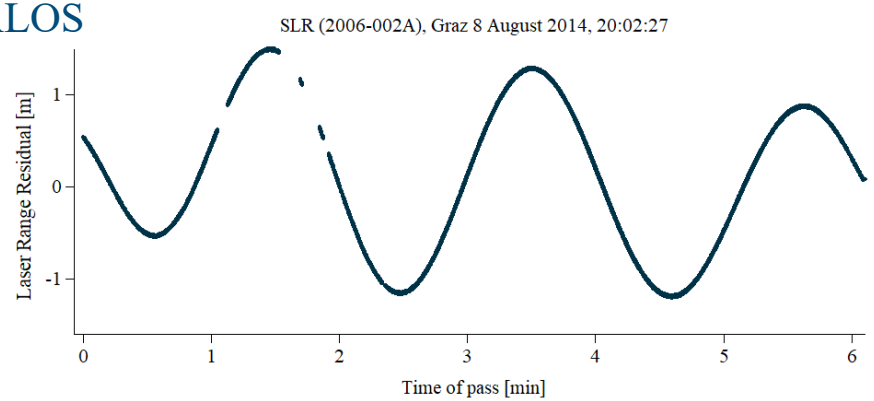
ERS-1



Pass information
Duration: 8m:27s
Data points: 583059
Data rate: 1716.8 Hz

Object: ERS-1
NORAD: 21574
Cospar: 1991-050A
Launch: 17 July, 1991
Apogee alt.: 789 km
Perigee alt.: 742 km
Inclination: 98.7°
Orb. period: 1.7 h
RCS: 10.3 m2

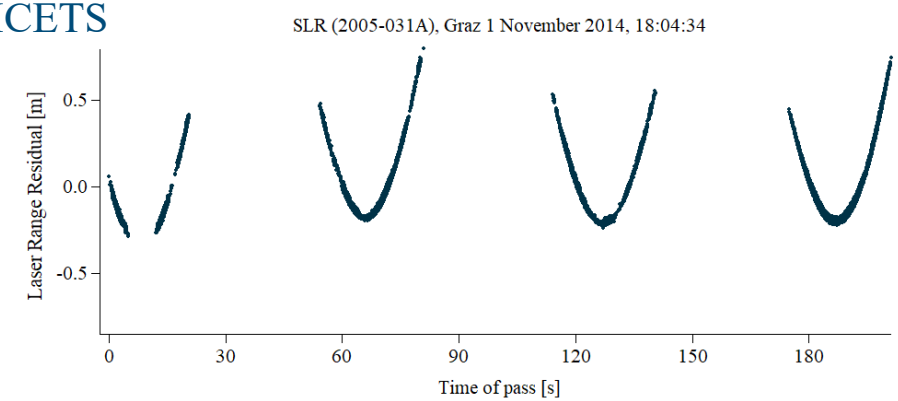
ALOS



Pass information
Duration: 6m:07s
Data points: 357903
Data rate: 1742.5 Hz

Object: ALOS (DAICHI)
NORAD: 28931
Cospar: 2006-002A
Launch: 24 January, 2006
Apogee alt.: 685 km
Perigee alt.: 682 km
Inclination: 97.9°
Orb. period: 1.6 h
RCS: 13.6 m2

OICETS



Pass information
Duration: 3m:21s
Data points: 30941
Data rate: 1019.0 Hz

Object: KIRARI (OICETS)
NORAD: 28809
Cospar: 2005-031A
Launch: 23 August, 2005
Apogee alt.: 577 km
Perigee alt.: 551 km
Inclination: 98.1°
Orb. period: 1.6 h
RCS: 1.6 m2

Space Debris Study Group
- Conclusions-

- Space geodesy is fundamental to ILRS, but additional activities supporting space environment research are needed too.

- Space debris laser ranging delivers observational data to feed dynamic physics-based models of the orbital environment
  - Space object orbital state vectors, attitude parameters
  - Low-cost, day/night, multiple sites worldwide

- Space safety and sustainability is important for science and “LEO economy”:
  - Laser ranging can efficiently monitor and characterize a large subset of space debris population
  - Funding opportunities are growing rapidly, scientific applications of space debris laser ranging need to be promoted

ILRS Governing Board
LLR Report

Jean-Marie Torre, Université de Nice Sophia-Antipolis, Observatoire de la Côte d'Azur, Géoazur, 2130 route de l'Observatoire, 06460 Caussols, France.

Ulrich Schreiber, Technical University Munchen, Geodetic Observatory, Wettzell, Germany.

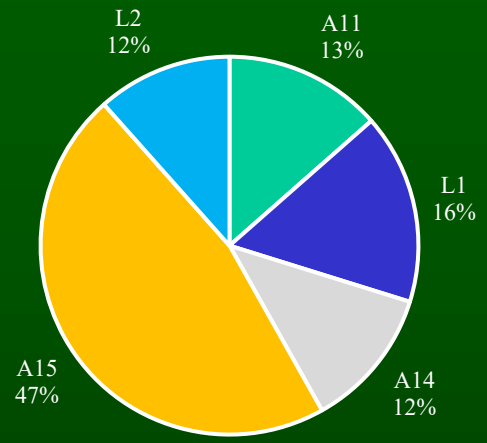
ILRS Technical Workshop, November 2022, Guadalajara, Spain

Lunar Laser Ranging Network

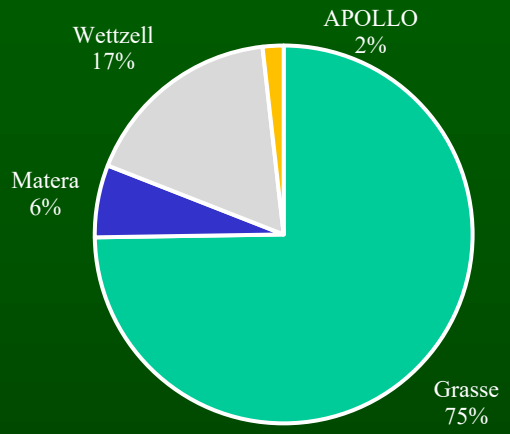
- **APOLLO**, (USA): Both Evan and Stephen Merkowitz are very much involved in LLR. NASA is now responsible for APOLLO. Stephen is also involved in next generation lunar retroreflectors, Lunar Pathfinder, as well as the new LLR analysis center..
- **Grasse**, (France): Observations stopped for 2 months during the installation of a new high-rate laser and detectors.
- **Matera**, (Italy): No change / no news.
- **Wettzell**, (Germany): Due to the very bad seeing in Wettzell, they explore if they can improve LLR by introducing a tip/tilt correction.
- **Kunming**, (China): no news.
- **Altay Optical-Laser**, (Russia): no news.

Results: 2022 - October 2022

2022: NPs by reflector



2022: NPs by station



Analysis Centers

- **New contact at IAARAS:** Dr. Eleonora Yagudina

- **New Analysis Center**:

  Center name: University of Maryland Baltimore County (UMBC)/NASA Goddard Space Flight Center (GSFC).

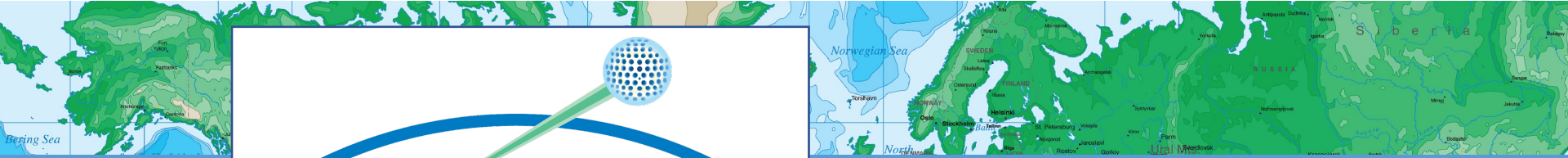
  Primary contact: Vishnu Viswanathan

New Lunar Reflectors

- Shanghai develop a single large solid laser ranging retro-reflector on a new lunar orbit spacecraft.
- Doug Currie: The University of Maryland Next Generation Laser Retroreflector (NGLR) is to go to Mare Crisium at 61.75º E, 18.50º N, R=1733.8±0.2 km. This is about 1/3 of the way from the center of the 550 km Crisium basin to the edge toward the ENE. The time is Sept 2023….
- Natalia Parkhomento: In the period up to October 19, 2022, it is planned to launch the Luna 25 mission, which will deliver to the surface of the Moon in the near–polar region near the south pole of the Moon – the main area – north of the Boguslavsky crater, the reserve area - southwest of the Manzinus crater a LRA designed and manufactured by JC RPC PSI.

Future

- New ILRS LLR representative: Clément Courde.
- Ully and I, propose to merge the LLR Standing Committee Meeting with the Transponder S.C. meeting on this round of the ILRS meeting.
- It is a need to update the LLR ILRS website.
- Lunar Laser Ranging Meeting: The goal is to organize a novel type of community meeting in order to reorganize the LLR activities more coherently and close the loop between the observation and the analysis side.
- …



ILRS Governing Board Election Process

Claudia Carabajal
Michael Pearlman
ILRS Central Bureau

2022 ILRS Technical Workshop
November 6th, 2022
Guadalajara (near Yebes), Spain

Outline

- Terms of Reference
- Recommendations
- Questions?

ILRS Governing Board: 2021-2022

- Elected positions:
  - EUROLAS Network Representatives:
    José Rodriguez*, Sven Bauer
  - NASA Network Representatives:
    Evan Hoffman, Stephen Merkowitz*
  - WPLTN Representatives:
    James Bennett, Zhang Zhongping*
  - Data Center Representative:
    Christian Schwatke*
  - LLR Representative:
    Jean-Marie Torre*
  - Analysis Representatives:
    Cinzia Luceri*, Erricos Pavlis*
  - At-Large Representatives:
    Toshi Otsubo* (Chair), Matt Wilkinson*

- Ex-officio/appointed positions:
  - Director of the Central Bureau:
    Mike Pearlman
  - Secretary of the Central Bureau:
    Claudia Carabajal
  - Representative of IAG Commission 1:
    Urs Hugentobler
  - IERS Representative:
    Daniela Thaller
- Appointed by the Governing Board:
  - **Ulli Schreiber***
  - **Randall Carman**

*Note: * SC/SG chair/co-chair*

Elections: from ILRS Terms of Reference

- Call for Nominations and GB Elections conducted bi-annually by the Central Bureau using official email lists
- Board members serve two-year terms starting on January 1
- For lunar, data center and analysis representatives:
  - GB nominees must be associated with that ILRS component
  - Only ILRS associates officially participating in that component, as determined by the official email lists maintained by the CB, may participate in the election of their representatives
- Full ILRS membership can nominate and vote for At-Large Representatives
- Election is by majority of votes received
- GB elects Chairperson from among its members for term of two years, renewable for one additional term (total of 4 years)

Election process:

- Table (1)

Step	Position	#	Contact
Ex-officio/appointed positions			
1	Director of the Central Bureau	1	N/A
	Secretary of the Central Bureau	1	N/A
	Representative of IAG Commission 1	1	https://www.iers.org/IERS/EN/Organization/DirectingBoard/IERSDirectingBoard.html
	IERS Representative	1	https://www.iag-aig.org/commissions/5
Elected positions			
2	EUROLAS Network Representatives	2	Current EUROLAS representatives on the Board
	NASA Network Representatives	2	Current NASA representatives on the Board
	WPLTN Network Representatives	2	Current WPLTN representatives on the Board
3	Data Center Representative	1	ilrs-dc@lists.nasa.gov
	LLR Representative	1	ilrs-laac@lists.nasa.gov
4	Analysis Representatives	2	ilrs_ac@lists.nasa.gov ilrs-aac@lists.nasa.gov
5	At-Large Representatives	2	ilrs-a@lists.nasa.gov
At-Large Appointed by the Governing Board		2	N/A
Total:		18	

Members of ILRS components are considered ILRS Associates; other contacts are Correspondents. **Only ILRS Associates may participate in the ILRS Governing Board and the election process.** The table below lists the classification of ILRS contacts.

Associates	
	Analysis Center
	Associate Analysis Center
	Lunar Associate Analysis Center
	Station
	Central Bureau
	Data Center
	Operations Center
Correspondents	
	Mission
	Correspondent

Election process:

- Send email to ILRS associates (ilrs-a@lists.nasa.gov) requesting review of membership to ILRS components.
- Make modifications to ILRS personnel database and related ILRS mailing lists based on associate feedback.
- Send emails to contacts in table (1) in order listed requesting nominations; follow-up email reminders may be required.
- Validate that each nominee is an ILRS associate.
- For each valid nominee, send email to nominee requesting confirmation that they agree to stand for election
- If there is more than one nominee, send ballot of candidates; if there is only one nominee, that nominee is elected.
- Accept votes and determine elected candidate based on majority of votes.
- Notify all candidates individually of election results.
- Notify new ILRS Governing Board of results (following At-Large election) and solicit nominees for ILRS GB Chairperson
  - If more than two candidates, ask each candidate for a 250-word CV that includes their ideas for the ILRS
  - Conduct election within the GB for the chairperson
- Notify new ILRS Governing Board to submit candidates for two appointed positions
  - If more than two candidates, ask each candidate for a 250-word CV that includes their ideas for the ILRS
  - Conduct election within the GB for these two candidates
- Once all elections are completed, notify community of results
- GB for 2023 - 2024 term (16 members) must be in place prior to 22nd International Workshop on Laser Ranging in Guadalajara (November, 2022)

Proposed schedule: 2023-2024 election

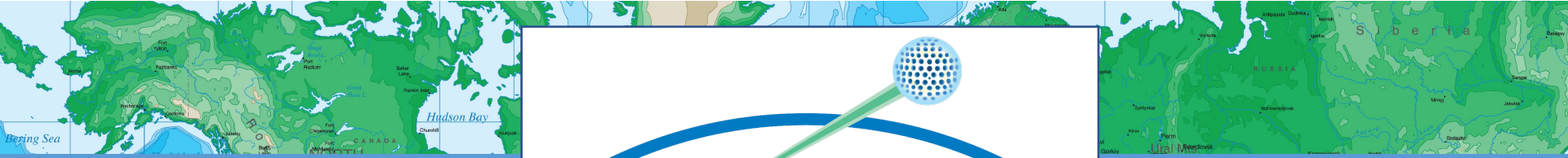
1. Call for ILRS associates review of organization's membership — July 2022
2. Call for appointed and network representatives: — July 2022
   - Appointed: IERS (1), IAG Commission 1 (1)
   - Networks (conduct their own elections): NASA (2), WPLTN (2), EUROLAS (2)
3. Conduct (concurrent) elections for other positions: — July-September 2022
   - Representatives for Lunar (1), Data Center (1), Analysis (2) — Through September 2022
   - Nominations and voting limited to ILRS associates within these communities
4. Conduct elections for At-Large Representatives (2): — October 4th-21st, 2022
   - Voting on these positions from all ILRS associates
5. Following appointment/election of above 16 members:
   - Call for nominations for GB chairperson — Late October 2022
   - Call for nominations of GB appointed members (2) — Late October 2022
   - Elect chairperson (at GB meeting) — November 6th, 2022
   - Elect GB appointed members (by email) — By December 15th, 2022

ILRS Governing Board: 2023-2024

- Elected positions:
  - EUROLAS Network Representatives:
    José Rodriguez*, Sven Bauer
  - NASA Network Representatives:
    Evan Hoffman, Stephen Merkowitz*
  - WPLTN Representatives:
    James Bennett, Zhang Zhongping*
  - Data Center Representative:
    Justine Woo*
  - LLR Representative:
    Clément Courde*
  - Analysis Representatives:
    Cinzia Luceri*, Mathis Blossfeld*
  - At-Large Representatives:
    Christian Schwatke*, Matt Wilkinson*
  - **Chair Elected by new ILRS GB: XXXX**

- Ex-officio/appointed positions:
  - Director of the Central Bureau:
    Mike Pearlman
  - Secretary of the Central Bureau:
    Claudia Carabajal
  - Representative of IAG Commission 1:
    Urs Hugentobler
  - IERS Representative:
    Daniela Thaller
- Appointed by the Governing Board:
  (Decided by December 15th, 2022)
  - XXXX
  - XXXX

*Note: *SC/SG chair/co-chair*



International Laser Ranging Service

ILRS Governing Board Other issues

Claudia Carabajal
Michael Pearlman
ILRS Central Bureau

2022 ILRS Technical Workshop
November 6th, 2022
Guadalajara (near Yebes), Spain

Questions

- 2-year term too short?
- Need to choose the SC Chairs only from the GB members?
- Election procedures to be simplified?
- Network representatives: 20+ year-old “3 Network” system to be reviewed?
- To stimulate more active changes? More geographical, career-level distributions?
- More?

Election process: what steps could be improved

- Institute a more formal process, investigate utilizing process similar to IGS, IDS
- Appoint election committee (chair+2)
- Start election process 6 months (minimum) prior to workshop and establish a clear schedule (schedule needed several modifications due to people's availability)
- Continue to conduct elections by "category" (lunar, analysis, data center, at-large)
- For each received nomination:
  - Confirm nomination with nominee before the election can start (already being done)
  - Request CV + statement from all candidates (those nominees that confirmed that are willing to serve; this was only requested from LLR Representative candidates at this time)
- Distribute (and then count) ballots through email (election committee)
- Communicate results to nominees/elected candidates/community (already being done)
- ILRS CB can continue assist in election process
- GB for 2023-2024 term (16 members) must be in place prior to 22nd International Workshop on Laser Ranging in Guadalajara, Spain (November 6th, 2022)