



NETWORKS AND ENGINEERING STANDING COMMITTEE

ILRS TECHNICAL WORKSHOP 2019

STUTT GART, GERMANY

Chair: *Matthew Wilkinson*

Co-Chair: *Georg Kirchner*





AGENDA

- The new way in which the NESC will operate
 - Presentation (M. Wilkinson)
 - Discussion
- A discussion on what NESC priorities require a working panel
 - Who could lead these panels?
- Other suggestions for NESC focus



NESC WORKING

Presently, the NESC meets once a year at the ILRS workshops to discuss topical issues.

This is usually for an hour, at the end of a busy day. While these meetings are valuable, how much can be achieved and the level of detail that can be discussed is limited by the time available.

Also, if enough time was allowed to address a potentially high number of issues then this could lead to drawn-out and demanding meetings.

Earlier this year I sent out proposals on email to set out how I would like to change the operations of the NESC.



NESC AIMS

The NESC aims to identify technical challenges in SLR and approach them in a collaborative way. It can provide a network perspective and use the resource of knowledge and experience in the community.

The NESC doesn't have to control or direct all of the work in the community. But it should be aware of what is going on and try to facilitate work that could benefit SLR.

Where there are issues the NESC should bring together individuals that could work the problem through and find resolution.

I want to:

- Increase the activity in the NESC and open it up.
- Make the NESC a route through which to explore, to question and to change how we do things
- Enable the NESC to be able to take decisions.



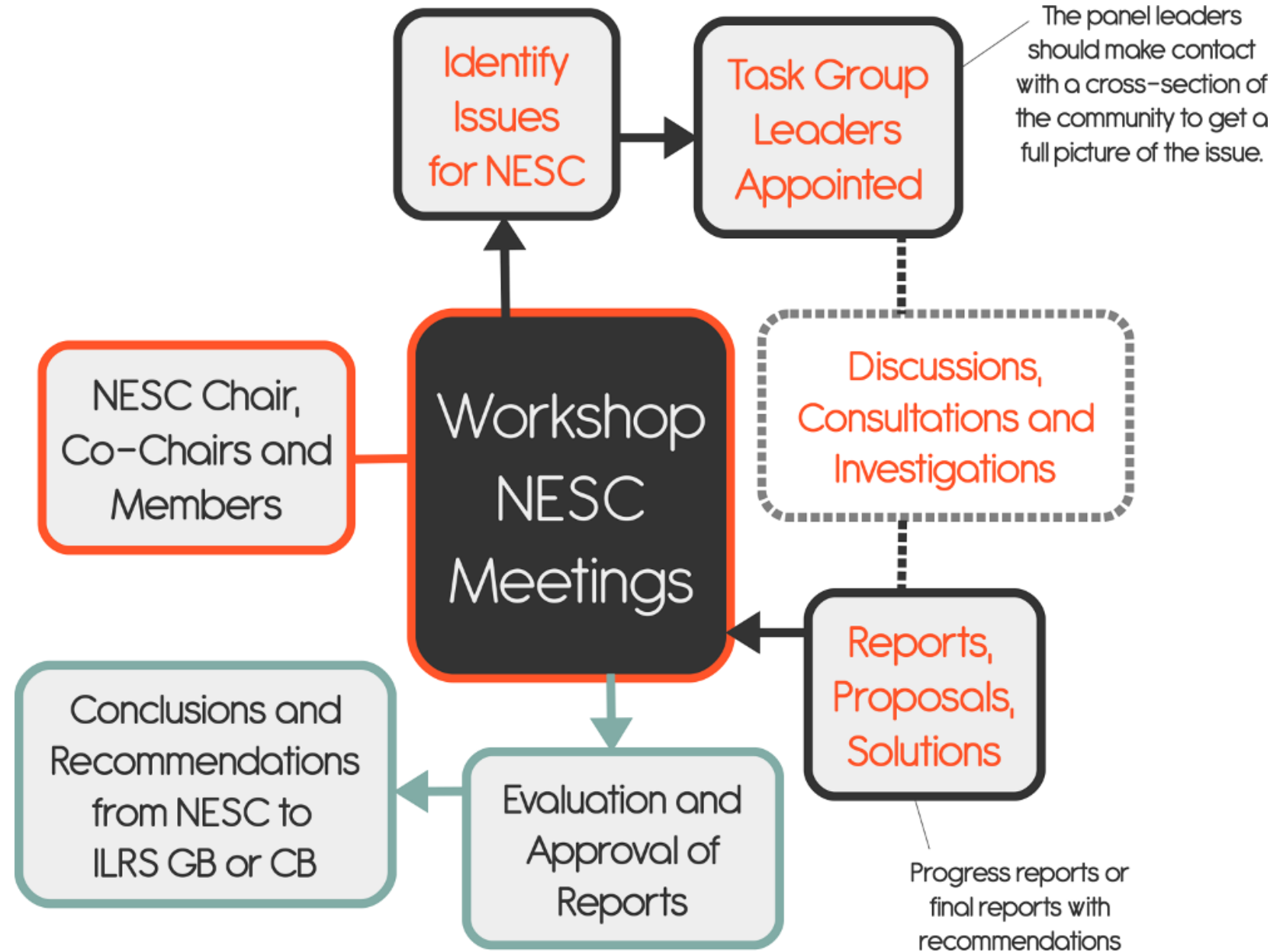
NESC MEMBERS

As a member of the NESC, you are needed to attend the meetings to discuss the progress of the NESC working panels.

You can bring ideas for the NESC to look in to and you are encouraged to contribute to the discussions in the panels.



NESC OPERATION





NESC OPERATION

- This will mean some work between meetings
- Panels should have a clear purpose:
 - To answer a question
 - Resolve an issue that has conflicting views
 - Pull together ideas
 - Perform a task
- Panels should be focussed with achievable tasks
- The time frame should not be open-ended
- Each panel would be required to report back to the NESC meetings. On the conclusion of the panel a short write up would be appropriate.
- NESC would consider and take forward any recommendations





NESC EXAMPLE

- **NESC review of the new CRD testing criteria.** The ILRS Operations Centers have implemented standard screening criteria for data acceptance. Each CRD data entry is checked in order to determine if invalid information was being reported by a station. The NESC was asked to provide its input.
- *Matthew Wilkinson* asked *Chris Moore, Jens Steinberg and Jean-Marie Torre* to form a small group to provide NESC input. The individuals had a range of SLR and LLR experience, using different hardware. This was carried out on email and this group provided feedback and was eventually able to approve these values on behalf of the NESC.



FIRST NESC WORKING PANELS

- **Alternative normal point methods to reduce systematic errors for single photon SLR systems.** On-site data screening can be done in different ways but the normal point calculation is well defined applying the mean residual at a central epoch.
- **Stefan Reipl** has agreed to form a working panel to explore the advantages of using other methods to form normal points.



FIRST NESC WORKING PANELS

- **Assessing the automation levels of ILRS stations.** Jens Steinborn proposed a survey looking in to the automation levels at stations.
- I invited him to do this with NESC support



PROPOSED NESC WORKING PANELS

- **How can stations demonstrate their high achieving performance to funding bodies?** Every SLR station has to justify its continued funding and operations. How could this be best argued and communicated in ways that apply to many stations? Could the ILRS better demonstrate the importance of the work at SLR stations?
 - *I think we do need a good brochure that explains what we do and why it is important. Some nice pictures and diagrams so people can understand, Pearlman*
 - *It is - and always was - difficult for us to argue (for getting money) with routine tracking of ILRS targets, Our Academy just does not acknowledge continuous routine data collection (although it is - and always has been - a major task to keep everything operational). It has proven (for us) to be much more efficient to start activities like space debris laser ranging (most of our present project-oriented money comes from space debris related experiments / tasks / research & developments), or quantum key distribution via satellite, or developing high-tech detection packages etc. etc. Kirchner*



PROPOSED NESC WORKING PANELS

- **Meteorological measurements at SLR stations.** Meteorological devices are used to make critical atmospheric delay corrections to SLR measurements. Therefore, the choice of the equipment, the installed location, height corrections and calibration are important. Are all stations carrying out this task as best as they can? Should a calibration campaign between stations be repeated?
 - *This is very important. Maybe even redundancy. It is terrible to spend large sums on equipment and operations, and then have the measurements corrupted by biased met data. Pearlman*



PROPOSED NESC WORKING PANELS

- **Monitoring the invariant point and the impact of temperature change.** It is difficult to determine exactly the invariant reference point and even more difficult to monitor it for change. Are stations using the best methods and what accuracy can be expected? How do stations monitor the eccentricities of the reference points of all space-geodetic instruments?



PROPOSED NESC WORKING PANELS

- **Catalogue of recommended equipment.** Lots of different timers, detectors, lasers and telescopes are in use in the ILRS network. Could these be better catalogued and characterised for those looking to upgrade?
 - Toshi asked Georg in the session on Monday where he finds the instruments he uses.
 - Toshi also expressed interest in low cost COTS components



PROPOSED NESC WORKING PANELS

- **Accurate site surveys.** Independent measurements of the calibration distance and the site- ties to other geodetic techniques are of great importance and should be repeated every few years. What are the best, most reliable, methods? Can stations perform their own surveys?
 - *I agree that the periodic measurement are very important. I also believe that the biggest problem may be the connection with the instrument reference point. My guess is that many groups do not do the best job at this. This is crucial for the reference frame.*
Pearlman



PROPOSED NESC WORKING PANELS

- **How accurate are the timing references at SLR stations?** Stations report epochs in their SLR data. These must take in to account electronic delays from the frequency source, the 1pps tick source, detector rise times and event timer stability. Are stations able to calibrate and monitor timing errors?
 - *As we have seen through T2L2, a number of the stations are working outside (some well outside) the 100 ns epoch timing criteria. We should understand the behaviour of the timing systems components, but we really need routine clock synchronization from space also with better understanding of how epoch reference propagates through the systems. May there are some procedures that could monitor this. Fundamental issue.*
Pearlman



OTHER POSSIBLE TASKS FOR THE NESC

- In-sky safety
- Ground calibration best practice
- Systematic bias
- Getting the best mount model
- Effects of polarisation on SLR
- How to SLR reference manual
- Synergy applications with SLR
- Two-colour ranging
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OTHER TASKS??





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THANK YOU



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