

You Want Us To Do What?

The Evolution of SLR/LLR in Response to Mission Needs

Peter J. Shelus

Center for Space Research and McDonald Observatory
University of Texas at Austin, Austin, TX, USA

pjs@astro.as.utexas.edu

15th International Laser Ranging Workshop
15-20 October 2006
Canberra, Australia
Network Performance and Results

The “spirit” of this talk ...

- The ILRS and the laser ranging network
- A continuing evolution in laser ranging
- New experiments keep us young and excited
- Seeing and solving the laser ranging problems
- How well are we doing?
- What will we be doing tomorrow?

The ILRS SLR Network



In the beginning ...

- Just get us the data ...
- Building a better mousetrap ...
 - Lasers, clocks, mirrors, mounts, PMT's, MCP's
- Can we do it in software (and hardware)?
 - Automation is the key ingredient
 - Observation logs
 - Reception of predicts
 - Setting of priorities
 - Data transmission

Learning the ropes ...

- Do we know where to look?
 - Tarot cards and crystal balls don't seem to work too well
 - Bootstrapping the predicts
 - better orbits and gravity fields were the answer
- Is less better? (but let's be smart about it)
 - Ameliorating the data glut
 - What about normal pointing
 - But, sometimes full-rate is good, too

Getting more data ...

(... but, can we do it cheaper?)

- Are you lonesome tonight?
 - Radars and diligence reduce manpower needs
 - Safety still reigns supreme
- Who do you think we are? (Kilo) Hertz?
 - The same power
 - Smaller pieces, more often

More than data...can we do science?

- Can you get the data to me quicker?
 - Real and near-time automated data transfers
- What time is it?
 - Earth rotation and polar motion
- Are these things really moving?
 - Coordinate/reference frames
- You mean the Moon is not made of green cheese?
 - Core and mantle
- It's all relative!
 - Einstein still has it right.
- (Scotch and) water, on the rocks...
 - Melting ice and rising sea level

An early time transfer experiment

- This is the early 1990's!
- Let's use the LLR-capable stations at OCA and Texas
 - We need simultaneous visibility of a common target
 - We need the epoch at the ns level (ouch!)
 - Can we correlate and coordinate laser firing times?
 - We “ask” the laser to fire, we do not “tell” it to fire
 - Meteosat MP-3 is the geo-stationary intermediary
- Excellent results at the nanosecond level (cf. C. Veillet)

Increasing the challenge (this is a real drag!)

- Duck! (...and it is really going fast !)
 - Not quite a perfect vacuum
 - Going to 5 degrees...
- People at prediction centers do it several times a day...
 - Integrating state vectors or generating ephemerides?

Maybe two is better than one...

- The interspersing of data
 - Interrupting a long pass for a short one
- The challenges of priorities and scheduling
 - The Honeymooners (...remember Ralph and Norton?)
 - Just a follow-up (Jason/TOPEX, then GRACE)
 - Can we tell the difference?
 - We did with TIPS
 - Can we do it with ANDE?

Here's looking at you, kid...

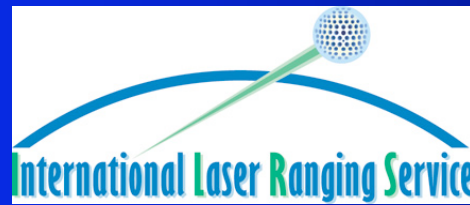
- Do you feel that someone is watching us?
- Here come the altimeters and the photographers!
 - elevation restrictions
 - “go/no-go” restrictions
 - pass-segment restrictions
- Some targets require none, one, two or all three of the above.
- The present challenges of ICESat, ALOS, and other targets

What's next?

- Your guess is as good as mine
- The ILRS has a good record
- It'll do whatever has to be done

Summary Remarks

- Nothing really new under the sun ...
- As scientific experiments become more complicated, greater pressures are placed upon operational logistics in order to perform necessary operations, and yet retain personnel safety and instrumental integrity
- Thorny logistical problems have been solved by a combination of computer power, internet communications, orbital dynamics and precisely defined inter-relationships among several reference frames.
- The results
 - More and better “science”
 - And



Summary Remarks (con't)

- YES! Job Security
- Thank you!