ILRS
Governing Board Meeting

April 07, 2006
12:00 - 15:00

Austria Center Vienna
Splinter Meeting Room 4 Yellow Level
Vienna, Austria

ILRS Governing Board Meeting

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Friday, April 7, 2006
12:00 – 15:00

Agenda

1.	Opening Remarks (5 min.)	W. Gurtner
2.	ILRS Status/Action Items (15 min.)	M. Pearlman/C. Noll
3.	Reports from Working Groups (5 min. each)	WG Chairs
	Analysis	R. Noomen/G. Appleby
	Data Formats and Procedures	W. Seemueller
	Missions	H. Kunimori/P. Shelus
	Networks and Engineering	G. Kirchner/U. Schreiber
	Signal Processing	G. Appleby
	Transponder Ad hoc Working Group	U. Schreiber
4.	New ILRS Orbit Product (5 min.)	R. Noomen
5.	Restricted Tracking (ICESat, ALOS) (10 min.)	W. Gurtner/H. Kunimori
6.	Galileo Support (5 min.)	W. Gurtner
7.	Laser Retroreflector Meeting Summary (5 min.)	M. Pearlman
8.	Laser Relativity Satellite (LARES) MOU (5 min.)	W. Gurtner
9.	GGOS Activities (10 min.)	M. Pearlman
10.	15th International Laser Ranging Workshop (5 min.)	B. Greene
11.	New Business	W. Gurtner/WG Chairs
12.	Other Business	W. Gurtner

ILRS Governing Board

Ex-Officio Members:

Director, Central Bureau:	Mike Pearlman
Secretary, Central Bureau:	Carey Noll
President of IAG Commission I:	Hermann Drewes

Members Appointed or Elected by Organizations:

EUROLAS Network Representatives:	Giuseppe Bianco Werner Gurtner (Chair)
NASA Network Representatives:	David Carter Jan McGarry
WPLTN Representatives:	Ben Greene Hiroo Kunimori
IERS Representative:	Bob Schutz

Members Elected by their International Peers:

Analysis Representatives:	Graham Appleby Ron Noomen
Data Center Representative:	Wolfgang Seemueller
LLR Representative:	Peter Shelus
At-Large Representatives:	Georg Kirchner Ulrich Schreiber

Former Members:

Francois Barlier (former At-Large Representative, 1998-2000)
Gerhard Beutler (former CSTG President, 1998-1999)
John Bosworth (former Director, ILRS Central Bureau, 1998-2001)
John Degnan (former Chairman and NASA Network Representative, 1998-2002)
Richard Eanes (former Analysis Center Representative, 1998-2000)
Yang Fumin (former WPLTN Network Representative, 1998-2002)
John Luck (former At-Large Representative, 1998-2002)
Wolfgang Schlueter (former EUROLAS Network Representative, 1998-2002)

ILRS Governing Board
ILRS Status Review

Network Items:

- EUROLAS
  - Matera shutdown January 01, 2006 due to funding problems
    - ILRS set letter of support
    - System resumed operations on January 25, 2006
  - Grasse MEO station (7845) down for system modifications 07/2005 for 12-18 months
  - Grasse SLR station (7835) closed 07/2005
  - FTLRS
    - New laboratory to be built at Grasse to house FTLRS for system improvements
    - Announcement of opportunity for future occupations issued
      - No definite proposals received
      - May work with colleagues at Canberra and Hobart universities to collaborate on FTLRS occupation in Tasmania for Jason-1 calibration/validation (decision end of June 2006 for 6 month occupation in early 2007)
- WPLTN
  - SALRO
    - Agreement between NASA and KACST underway
    - Interest in joint activity with IGN to house relocated DORIS beacon and perform site survey
  - San Juan
    - Chinese system began tracking in early 2006; test data now flowing
  - Shanghai
    - Move of station to new location completed 09/2005
    - Test data received starting December 2005
- NASA
  - Maui
    - TLRS-4 operations at GSFC ended March 22, 2006
    - TLRS-4 hardware now being packed for shipment to Hawaii
    - Anticipate operations to commence in fall 2006
    - Survey of new location being scheduled
  - Arequipa
    - HTSI staff visited site in January-February, 2006
    - Refurbishment/upgrade efforts occurring in U.S. and Peru
    - Operations to resume in fall 2006
    - Site survey being scheduled
  - Monument Peak
    - DORIS and seismic instrument installation performed in December 2005
    - Hard weather conditions and subtle laser issue caused reduced tracking during winter
  - Greenbelt
    - Completed ALOS restricted tracking and Go/No Go testing and implementation
    - Shared operations with TLRS-4
  - SLR2000
    - Higher QE PMT on order
    - Shutter developed to prevent laser backscatter on PMT
    - Laser PRF control almost complete
    - Additional optical bench for LRO-LR and Transponder to be added April 2006
    - New star camera being tested
    - New sky camera selected and on order
    - Design to add capability to software for LRO, transponder and new cameras completed March 2006
- CB coordinating with prediction providers and stations on implementation of CPF (see charts)

Modeling:

- Center of mass web pages require updates

ILRS Status Review
(continued)

Analysis and Data Issues:

- Benchmark evaluation on GA and GRGS solutions underway; acceptance imminent
- All reports from CDDIS issue quantity values in passes (not pass segments) and minutes of data (normal points times bin size)
- Update of data archives with older data (BE-B, -C, GEOS-1, -2, -3, PEOLE, DIADEM-1C, -1D) underway
- Update of eccentricity files with new data from ITRF underway

Mission Items:

- TOPEX
  - Satellite maneuvering failure in October 2005
  - SLR tracking ceased as of December 2005
- Cryosat
  - Launch failure on October 8, 2005
- ALOS
  - Launch on January 24, 2006; tracking to commence 90 days after launch
  - Restricted tracking test conducted 02/27-03/03/2006 on Ajisai for individual stations by JAXA
    - Participants: Mt. Stromlo, Zimmerwald, Herstmonceux, Riga, Koganei, Simosato, Greenbelt, Hartebeesthoek, Monument Peak, Yarragadee
- Galileo
  - GIOVE-A (GSTB v2/A) launched December 26, 2005
  - GIOVE-B (GSTB v2/B) launch scheduled for April 16, 2006
  - Prediction generation process being implemented by ESA (both TIRV and CPF)
  - Tentative 3-week tracking campaign on GIOVE-A scheduled to commence on April 24, 2006
- GPS satellites
  - Dialog with various agencies continues on reflectors on GPS-III satellites
  - Study underway at GSFC on hollow cube technology; D. Arnold working on array performance studies
  - INFN-LNF (Istituto Nazionale di Fisica Nucleare-Laboratori Nazionali di Frascati) in Italy also planning to test hollow cubes
  - Meeting on retroreflector array issues held April 6, 2006
- GP-B
  - Liquid helium nearly depleted
  - SLR tracking to continue until June 1, 2006
- ANDE
  - Tracking request approved by Governing Board February 2006
  - Launch from Space Shuttle, earliest would be mission 3 after return to flight (2006+)
- OICETS
  - Tracking request approved by Governing Board February 2006
  - Launched August 23, 2005
  - Start of SLR tracking soon
- MicroSCOPE
  - Tracking request approved by Governing Board March 2006
  - Launch planned for March 2009
  - Additional information on retroreflector array design needed

Reports:

- ILRS 2003-2004 annual report printed and distributed; online version available on ILRS Web site
- Proceedings from 14th International Workshop on Laser Ranging in San Fernando printed and distributed; final versions available on ILRS Web site
- All 2005 ILRS station report cards issued by SGT

ILRS Status Review
(continued)

Site Surveys:

- Analysis of survey data from Hawaii, Arequipa, and GSFC in process
- Closeout survey of Haleakala performed by HTSI in late 2004; analysis underway
- South African survey report completed by IGN
- Shanghai survey report in process
- IERS Co-Location Working Group Meeting to be held at EGU on April 7, 2006

ILRS Web Site:

- New versions of report card charts developed and available through ILRS Web site (linked to report cards); example shown here
- New plots of station performance now fully integrated into ILRS Web site structure (under Stations and linked to report cards); examples shown here
  - Station performance charts since last year and since 2000
- Plot of groundtrack of last seven days of geodetic satellite data available and updated daily (under Stations and What's New)
- Began prototype of new ILRS Satellite section; design shown here

Meetings:

- EGU 2006, Vienna Austria:
  - April 4: ILRS AWG meeting
  - April 4: GGOS Steering Committee meeting
  - April 5: ILRS DFPWG meeting
  - April 5: IERS combination product meeting
  - April 6: GPS retroreflector array meeting
  - April 6: GGOS Ground Networks and Communication Working Group
  - April 7: ILRS MWG meeting
  - April 7: ILRS GB meeting
  - April 7: IERS WG on Co-Location meeting
- May 8-12, 2006: IGS Workshop in Darmstadt, Germany
- May 23-26, 2006: 2006 Joint Assembly, Baltimore MD, USA
- October 8-9, 2006: GGOS Workshop, Munich Germany
- October 9-13, 2006: IAG Symposium on Geodetic Reference Frames, Munich, Germany
- October 16-20, 2006: 15th International Workshop on Laser Ranging, Canberra, Australia
- December 11-15, 2006: Fall AGU in San Francisco, CA
- April 15-20, 2007: EGU, Vienna Austria
- July 2-13, 2007: IUGG General Assembly, Perugia, Italy

Other Items:

- GGOS
  - Ground Networks and Communications Working Group is actively working on network designs
  - Network design simulations started; status report given at GN&C WG meeting held on April 5, 2006 at EGU
- INDIGO
  - User assessment performed to identify existing commonalities and opportunities in the IAG services (IGS, ILRS, IVS)
  - Survey of IAG service central bureaus and Web sites performed
  - Need AC "logs" for ILRS analysis centers to document analysis strategies, techniques, models, parameters
  - Web site established *http://indigo.nasa.gov*

ILRS Prediction Centers

Satellite	Prediction Provider (3-character code)								
	COD*	**ESA**	**GFZ***	**GSF**	**HTS***	**JAX**	**MCC**	**SGF***	**UTX***
Ajisai					P*	B		B	
ALOS						P			
Apollo##									P*
Beacon-C					P*			B*	
CHAMP			P*						
Envisat		P			B*				
ERS-2		P			B*				
Etalon-1/-2					P*			B*	
GFO-1				P	B*				
GLONASS	P*				B*				
GP-B					P*				
GPS-35/-36	P*				B*				
GRACE-A/-B			P*						
ICESat									P*
Jason-1					P*			B*	
LAGEOS-1/-2					P*	B		B*	
LARETS					P*		B	B*	
Luna 17/21									P*
Meteor-3M				P	B*				
Starlette					P*			B*	
Stella					P*			B*	
Future Satellites									
Galileo		P							
OICETS						P			

Notes: * indicates currently providing predictions in CPF format
P=primary prediction source; B=backup prediction source
HTSI will produce CPF in May
JAXA testing software will produce CPF by May 01
GSFC testing software
ESA testing software; provided initial GIOVE-A file
No response from MCC

ILRS Station CPF Implementation

Randy Ricklefs/CSR

Site Name	Sta. No.	Response?	Not Started	Coding Started	Testing	Prodctn	Use Occas.	Use for Some Target Classes	Use for all Targets	No. of Passes
Yarragadee	7090	Y		X						
Mt. Stromlo	7825	Y			X					
Zimmerwald	7810	Y				X			X	
Wettzell	8834	Y		X						
Graz	7839	Y		X						
Riyadh	7832	N								
Herstmonceux	7840	Y				X			X	>500
Monument Peak	7110	Y		X						
Matera	7941	Y			X	X				
Changchun	7237	N								
Hartebeesthoek	7501	Y		X						
San Fernando	7824	N								
Greenbelt	7105	Y		X						
Potsdam	7841	Y		X						
Simosato	7838	Y			X					
Riga	1884	Y		X						
Beijing	7249	N								
McDonald	7080	Y				X			X	
Borowiec	7811	Y		X	X					
Maidanak	1864	N								
Simeiz	1873	Y			X					
Tahiti	7124	Y		X						
Grasse (MEO)	7845	Y			X					
Lviv	1831	Y		X						
Kiev	1824	N								
Helwan	7831	Y		X	X					
Concepcion	7405	Y		X						
Tanegashima	7358	N								
Metsahovi	7806	N								
Katzively	1893	N								
Urumqi	7355	N								
Greenbelt (T4)	7130	Y		X						
Koganei	7308	N								
Shanghai	7821	N								
Wuhan	7231	N								
FTLRS	-	Y			X					

Comments: **Borowiec**: Should be ready in May

Herstmonceux: The predictions are excellent with 90% of passes within +-20ns and 99% within +-100ns. We have now made ~500 observations using CPFs.

FTLRS, Potsdam: Will be ready by June 30.

McDonald: Moon in testing

MLRS: Testing done, moving into production

Mt. Stromlo: Some testing (tracking) with LLR system; SLR system coding soon.

Mission Recognition of ILRS

Agency	Contact	Mission	Status	Web Site
NASA	Schutz/Shelus	ICESat	No action	
	MacDonnell	Meteor-3M	Done	http://www-sage3.larc.nasa.gov/meteor-3m/
JAXA	Nakamura/Kudoh	ADEOS-1/-2	No resp.	
		ALOS	No resp.	
		ETS-VIII	No resp.	
		OICETS	No resp.	
NRL	?	ANDE	No action	USNO amateur radio Web site, appropriate?
GFZ	Web masters	CHAMP	Done	http://www.gfz-potsdam.de/pb1/op/champ/orbit/orbit_CHAMP.html
		GRACE	Done	http://www.gfz-potsdam.de/pb1/op/grace/general/general.html
ESA	Web masters	CryoSat	Done	http://www.esa.int/SPECIALS/Cryosat/SEMRQ4908BE_0.html
		Envisat	Done	http://envisat.esa.int/instruments/lrr/ http://envisat.esa.int/dataproducts/ra2/CNTR2-8-4.htm http://envisat.esa.int/helpandmail/glossary.html#i
		ERS-1,-2	Done	http://earth.esa.int/ers/eeo3.324/ers_gs_products/er_part3.html#3.1.8
		Galileo	No action	
GFO	Finkelstein	GFO-1	Done	http://gfo.bmpcoe.org/Gfo/Exec_col/exec_col.htm
Stanford	Galal	GP-B	Done	http://einstein.stanford.edu/ (under What is GP-B -> Links)
AVISIO		Jason-1	Done	http://www.jason.oceanobs.com/html/missions/jason/ instruments/lra_uk.html (credit on map)
		TOPEX	Done	http://www.jason.oceanobs.com/html/missions/tp/ satellite_uk.html#LRA (needs improvement)
JPL	Web masters	Jason-1		http://topex-www.jpl.nasa.gov/technology/instrument-lra.html
		TOPEX		

ILRS citations:

- Asked mission contacts to cite ILRS on mission Web sites that referenced SLR tracking or retroreflectors
- Typical citation lists ILRS and links to ILRS home page
- Suggested citation: Pearlman, M.R., Degnan, J.J., and Bosworth, J.M., "The International Laser Ranging Service", Advances in Space Research, Vol. 30, No. 2, pp. 135-143, July 2002.
- ILRS citation on following ILRS Web site pages
  - Home page
  - Data and products main page
  - Bibliography main page
  - Mission support request form
  - Analysis center response form

ILRS Governing Board Meeting
Remaining Action Items

EGU, Vienna Austria (April 26, 2005):

1. CB will contact the IAG Outreach to suggest that the IAG make its participants aware of the issue of service recognition issue in publications, papers, reports, and presentations.
   - Developed similar citation format for posting on service Web sites; added citation to ILRS homepage; IGS and IVS have similar wording on their Web sites. *(Done)*
   - IGS, IVS, ILRS, and IDS continue work a joint activity to:
     - Jointly request that the IAG take positive action (Web site notice, messages to the community, etc) to activate its community;
     - Consider contacting relevant journals and journal referees to help enforce this citation.
2. CB will check if the local ties have been measured for the Riyadh and Changchun SLR stations.
   - Noll contacted both stations in January and September 2005
   - Changchun reports plans made but no survey yet
   - Survey activity under consideration in Riyadh in conjunction with a possible DORIS installation
3. CB should browse all existing mission Web sites and search for references to the service and information about the role of SLR for the mission; if not found, have webmasters add it.
   - Webmasters contacted; summary of results provided separately here
4. A subgroup of technology and science representatives should write a white paper on the future vision for SLR. *(assigned 04/2005)*
   - See ILRS poster and paper presented at IAG meeting, Cairns 08/2005
5. Bianco should make sure Pavlis has looked at the MLRO two-color data. *(assigned 04/2005)*
6. Appleby will provide station signal strength regimes to the CB for placement in the site logs with perhaps a separate table automatically updated/extracted and linked to the CoM pages on the ILRS Web site. The information is not in the site log now so the format will have to be modified. *(assigned 04/2005)*
7. An ILRS orbit product committee should be formed and develop a plan for the new product (Noomen). *(assigned 04/2005)*
8. Review data analysis/station feedback capabilities within the ILRS.
   - Gurtner will look at the existing list of data problems (previously maintained by V. Husson) on the ILRS Web site and see if the webpage can be re-activated and updated on a regular basis.
   - A committee will be formed to work on the specifications and needs for a "Call for Proposal" to handle data analysis and feedback (Gurtner, Pearlman, Noomen). *(assigned 04/2005)*
9. ALOS issues:
   - JAXA will prepare a station test plan for review by the CB. *(assigned 04/2005)*
   - JAXA is managing station qualification activity

Eastbourne UK (October 10, 2005):

1. Examine the issue of the internal SLR reference frame. (Noomen) *(assigned 11/2005)*
2. Examine the eccentricity files to see if they could serve as a source for the list of key information. (Noomen) *(assigned 11/2005)*
3. CB will contact both the Prediction Centers and the Stations to begin the Consolidated Prediction Format (CPF) process. *(assigned 11/2005) (Done)*
   - Message sent to prediction providers (12/7/2005)
     - CPF predictions now provided by UTX, CODE, NSGF, HTSI, GFZ
     - GSFC currently working on format
     - Received no feedback from MCC, ESA, JAXA
   - Message sent to stations (12/9/2005)
4. Gurtner will write a letter to Hiroo Kunimori to ascertain the ALOS status and planned procedures. *(assigned 11/2005) (Done)*
   - JAXA contacted stations directly to arrange and validate tracking procedures
   - JAXA conducted test campaign 02/27-03/03/2006
5. Pearlman will circulate a copy of VLBI 2010 to the GB members. *(assigned 11/2005; done 12/2005)*
6. Consolidate the presentations to AUSLIG into a 1 hour talk *(assigned 11/2005)*

ILRS Satellite Tracking Priorities
December 2005

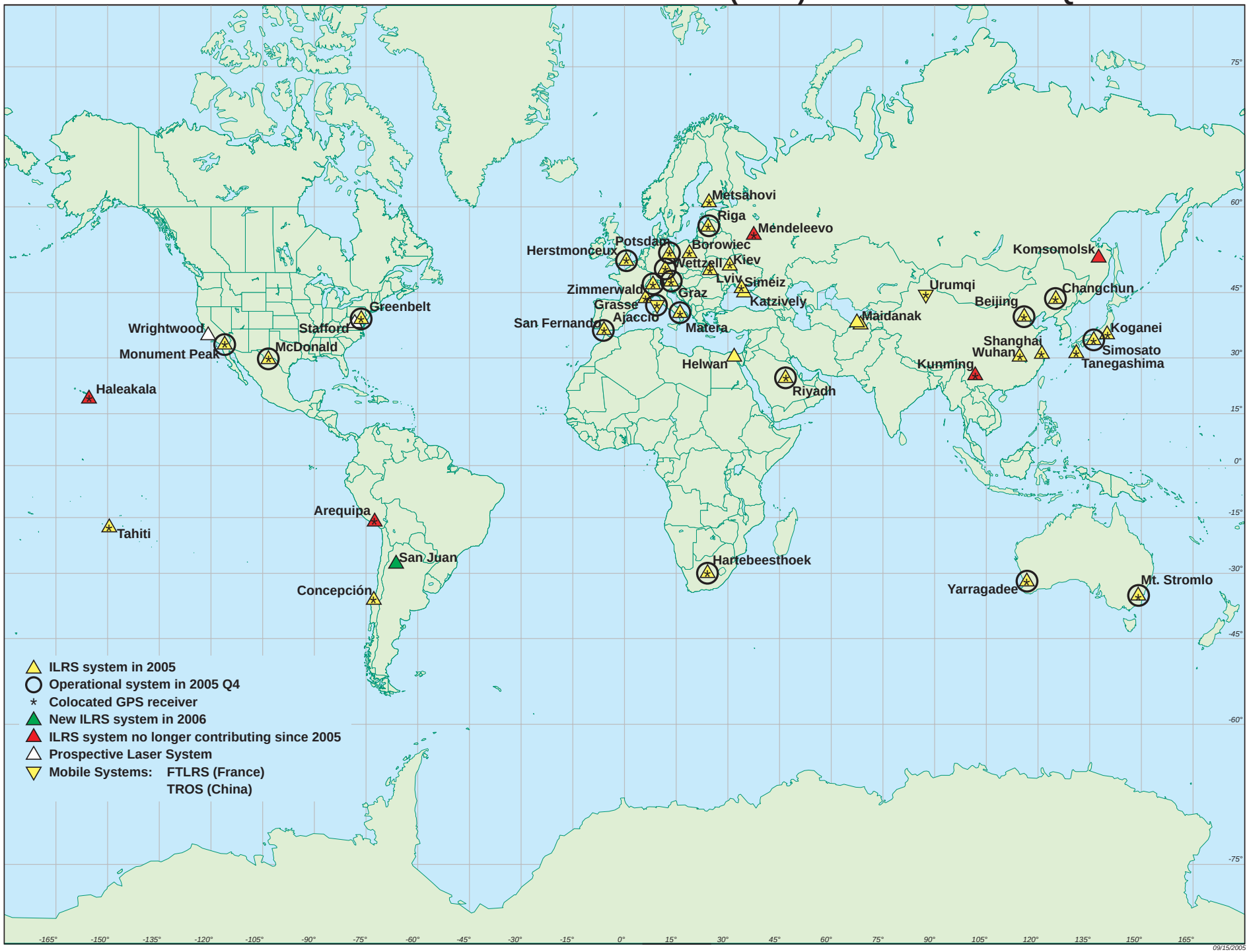
1. Priorities decrease with:
   a. increasing orbital altitude; and
   b. increasing orbital inclination (at a given altitude).
2. Priority of some satellites may then be increased to intensify support for:
   a. active missions (such as altimetry);
   b. special campaigns (such as IGLOS); or
   c. post-launch intensive tracking phases; and
3. Some slight reordering may be done to give higher priority missions with increased importance to the analysis community.

Priority	Mission	Sponsor	Altitude (km)	Inclination (degrees)	Comments
1	GP-B	NASA/Stanford U.	652	90	New mission
2	GRACE-A, -B	GFZ/JPL	485-500	89	Tandem mission
3	CHAMP	GFZ	429-474	87.3	
4	GFO-1	US Navy	790	108.0	Altimetry/no other tracking technique
5	Envisat	ESA	796	98.6	Tandem with ERS-2 tracking to commence 40 days after launch
6	ERS-2	ESA	800	98.6	Tandem with Envisat
7	Jason	NASA/CNES	1,350	66.0	Tandem with TOPEX
8	Larets	IPIE	691	98.2	
9	Starlette	CNES	815-1,100	49.8	
10	Stella	CNES	815	98.6	
11	Meteor-3M	IPIE	1000	99.6	
12	Ajisai	NASDA	1,485	50	
13	LAGEOS-2	ASI/NASA	5625	52.6	
14	LAGEOS-1	NASA	5850	109.8	
15	Beacon-C	NASA	950-1300	41	Upgraded from campaign to ongoing mission (Jan-02)
16	Etalon-1	Russian Federation	19,100	65.3	Campaign extended to 01-Oct-02
17	Etalon-2	Russian Federation	19,100	65.2	Campaign extended to 01-Oct-02
18	GLONASS-89	Russian Federation	19,100	65	Replaced GLONASS-86 as of 20-Mar-03
19	GLONASS-87	Russian Federation	19,100	65	Replaced GLONASS-88 as of 20-Feb-02
20	GLONASS-95	Russian Federation	19,100	65	Replaced GLONASS-84 as of 26-Aug-05
21	GPS-35	US DoD	20,100	54.2	
22	GPS-36	US DoD	20,100	55.0	

Lunar Tracking Priorities

Priority	Retroreflector Array	Sponsor	Altitude (km)
1	Apollo 15	NASA	356,400
2	Apollo 11	NASA	356,400
3	Apollo 14	NASA	356,400
4	Luna 21	Russian Federation	356,400
5	Luna 17	Russian Federation	356,400

INTERNATIONAL LASER RANGING SERVICE (ILRS) NETWORK IN 2005 Q4



ILRS Quarterly Report Card (Table 1a, 01/01/2005-12/31/2005)

Site Information		Data Volume									Data Quality		
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Location	Station Number	LEO pass Tot	LAGEOS pass Tot	High pass Tot	Total passes	LEO NP Total	LAGEOS NP Total	High NP Total	Total NP	Minutes of Data	Cal. RMS	Star RMS	LAG RMS
Baseline		1000	400	100	1500								
Yarragadee	7090	9745	1552	1227	12524	183528	19655	13664	216847	159711	4.9	8.3	9.3
Mount_Stromlo_2	7825	5286	1631	693	7610	83870	22642	5514	112026	101173	3.4	6.6	9.1
Zimmerwald_423 Zimmerwald_846	7810	5454 5614	1074 1117	884 884	7412 7615	81830 82970	15093 16949	7478 7199	104401 107118	91572 94273	10.0 19.1	15.0 19.8	17.6 21.5
Wettzell	8834	5655	952	433	7040	75310	6822	1962	84094	47559	3.3	10.6	16.6
Graz	7839	5554	768	507	6829	112966	9747	4119	126832	70700	2.3	4.4	8.1
Riyadh	7832	4896	1126	761	6783	68086	10065	4330	82481	63216	9.6	12.8	15.3
Herstmonceux	7840	4551	1014	436	6001	70105	12923	2086	85114	56302	7.8	12.4	15.4
Monument_Peak	7110	4440	712	239	5391	68817	5722	1670	76209	39599	5.8	11.7	13.2
Matera_MLRO	7941	2768	612	102	3482	38383	5622	590	44595	26997	1.5	4.4	6.5
Changchun	7237	2746	471	114	3331	30686	4053	572	35311	20653	12.3	13.9	14.1
Hartebeesthoek	7501	2205	390	121	2716	29889	3583	1158	34630	22839	5.6	7.8	10.1
San_Fernando	7824	2180	432		2612	31681	3214		34895	16331	7.2	11.3	18.8
Greenbelt	7105	2059	305	125	2489	45510	3413	757	49680	23512	5.3	10.2	10.1
Potsdam_3	7841	2010	322	12	2344	40459	3911	72	44442	19232	12.7	7.9	10.1
Simosato	7838	1845	456	4	2305	36804	6821	49	43674	25612	10.3	13.0	14.8
Riga	1884	1565	196	7	1768	30535	2541	30	33106	12759	7.1	15.4	14.2
Beijing	7249	1378	296	68	1742	19861	3025	470	23356	14668	14.3	91.5	32.9
Ajaccio	7848	1610	81		1691	29034	306		29340	9685	5.6	10.6	18.5
McDonald	7080	1000	344	198	1542	12860	3245	906	17011	14680	14.1	12.0	13.5
Borowiec	7811	839	190		1029	13785	2121		15906	8239	16.2	19.3	21.9
Maidanak_1	1864	621	257	144	1022	6847	2155	503	9505	9018		55.5	55.3
Simeiz	1873	526	200	12	738	6602	1767	74	8443	6151		40.4	53.2
Papeete	7124	573	89	1	663	9810	649	2	10461	4114	5.2	8.5	9.3
Grasse	7835	540	70		610	11638	629		12267	4466			
Shanghai	7837	430	66	3	499	6272	712	30	7014	3440			
Lviv	1831	361	135		496	6230	1142		7372	4233	14.1	48.8	53.9
Kiev	1824	319	49		368	3157	291		3448	1541	62.9	79.2	93.7
Helwan	7831	360			360	3778			3778	1170	6.0	24.7	
Concepcion_423 Concepcion_847	7405	297 288	56 207	9	353 504	2561 3147	264 1953	31	2825 5131	1469 5284	7.5 11.1	14.5 54.9	13.1 93.0
Tanegashima	7358	269	33	35	337	3224	236	171	3631	2367	2.6	4.5	8.2
Metsahovi	7806	220	1		221	3173	2		3175	776			
Katzively	1893	172	17	4	193	2684	124	15	2823	1179	72.7		68.7
Urumqi	7355	135	56		191	1614	576		2190	1645			
GrnBlt_TLRS4	7130	105	35		140	1575	380		1955	1220	5.8	7.8	9.7
Koganei	7308	95	24	16	135	1373	219	111	1703	1581			
Shanghai_2	7821	95	13		108	1189	158		1347	642	12.2	20.2	27.6
Wuhan_2	7231	83	18		101	883	110		993	531	14.2	23.3	27.8

ILRS Quarterly Report Card (Table 1b Lunar, 01/01/2005-12/31/2005)

(continued)

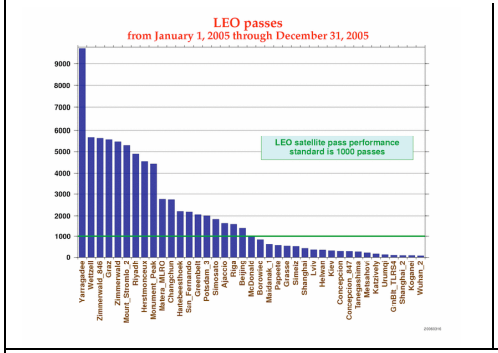
Site Information		Data Information			
Column L1	L2	L3	L4	L5	L6
Location	Station Number	num nights tracking last 12 mon	num npt last 12 mon	num npts last 3 mon	ave npt rms last 3 mon
McDonald	7080	43	77	26	45.1

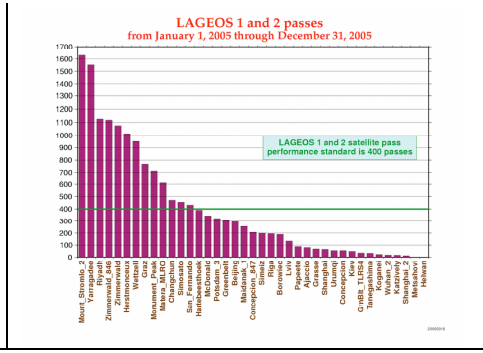
ILRS Quarterly Report Card (Table 2, 01/01/2005-12/31/2005)

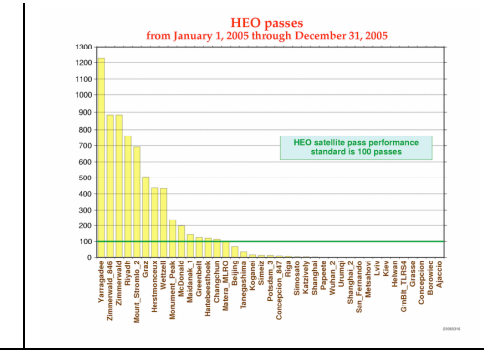
Site Information		CSR Orbital Analysis				Delft Orbital Analysis				NICT Orbital Analysis				MCC Orbital Analysis				SHAO Orbital Analysis			
Station Location	Station Number	LAG NP RMS (mm)	short term (mm)	long term (mm)	% good LAG. NP	LAG NP RMS (mm)	short term (mm)	long term (mm)	% good LAG. NP	LAG NP RMS (mm)	short term (mm)	long term (mm)	% good LAG. NP	LAG NP RMS (mm)	short term (mm)	long term (mm)	% good LAG. NP	LAG NP RMS (mm)	short term (mm)	long term (mm)	% good LAG. NP
Baseline		10.0	20.0	20.0	95	10.0	20.0	20.0	95	10.0	20.0	20.0	95	10.0	20.0	20.0	95	10.0	20.0	20.0	95
Yarragadee	7090	2.5	7.2		99.3	2.2	8.0	1.8	99.9	2.0	12.6	6.9	100.0	2.5	15.7	3.5	97.8	1.7	11.8	2.5	94.7
Mount_Stromlo_2	7825	4.3	8.8		97.3	4.3	10.9	1.6	97.6	4.8	18.0	4.3	99.2	4.1	10.7	4.0	90.7	3.3	13.8	3.4	92.8
Zimmerwald_423 Zimmerwald_846	7810	3.1 3.2	5.4 5.1		99.2 99.2	3.0 3.5	7.9 7.4	3.9 4.1	100.0 100.0	2.9 3.2	8.3 11.0	4.2 4.6	100.0 100.0	4.2 4.0	7.4 7.5	2.5 3.0	93.5 92.3	2.3 2.8	7.3 8.6	3.2 4.9	94.3 95.5
Wettzell	8834	3.1	9.8		99.8	3.3	12.9	3.2	100.0	3.3	14.3	4.6	100.0	2.8	11.5	1.3	97.4	3.1	16.4	4.2	96.3
Graz	7839	1.6	4.5		99.8	0.8	8.8	1.7	100.0	1.4	7.2	3.0	100.0	2.2	7.4	1.8	100.0	1.2	8.4	2.6	95.9
Riyadh	7832	2.9	12.0		99.4	3.2	12.5	1.4	99.9	2.9	13.6	5.5	99.8	3.5	23.6	16.4	96.8	2.7	18.4	8.0	95.9
Herstmonceux	7840	2.1	6.1		99.8	2.0	13.3	1.9	100.0	1.8	8.9	3.2	100.0	2.9	6.4	1.8	98.4	1.5	6.5	3.3	95.1
Monument_Peak	7110	2.5	5.7		99.0	2.1	9.9	3.5	99.8	2.1	12.0	7.8	99.9	2.2	12.4	3.2	97.7	1.6	11.1	3.0	95.4
Matera_MLRO	7941	2.2	9.5		98.8	2.6	11.7	3.2	100.0	2.1	14.9	4.9	100.0	2.4	13.7	2.4	98.5				
Changchun	7237	6.0	14.2		90.1	6.4	28.7	12.1	97.3	6.9	22.2	14.0	99.7	5.5	22.0	12.9	84.6	5.5	21.1	16.9	94.6
Hartebeesthoek	7501	1.6	9.1		100.0					1.6	12.7	3.8	99.4	1.7	11.3	4.8	99.0	1.6	18.5	6.9	97.6
San_Fernando	7824	2.8	14.6		97.3	3.4	21.8	15.8	100.0	3.2	16.8	18.0	99.9	5.6	17.8	6.5	96.1	3.8	23.1	12.2	95.2
Greenbelt	7105	2.0	6.0		99.7	1.9	13.8	2.9	100.0	1.7	12.8	7.9	100.0	2.1	13.6	2.9	98.8	1.4	12.1	4.8	94.9
Potsdam_3	7841	3.9	11.7		97.8	3.6	9.2	1.6	99.8	3.2	10.8	11.6	99.6	3.4	12.7	5.2	91.6				
Simosato	7838	4.9	9.9		98.3	5.1	14.9	3.7	100.0	3.6	12.5	5.5	99.8	5.3	17.2	6.8	84.3	4.7	14.8	8.3	96.4
Riga	1884	3.5	23.7		86.6	5.8	27.3	21.6	100.0	3.1	25.2	22.3	100.0	4.7	26.9	24.9	87.6	5.1	24.2	11.8	94.9
Beijing	7249	7.2	15.5		86.8	12.3	25.4	4.2	97.3	10.5	20.9	15.7	96.9	9.0	44.3	16.9	77.2	8.6	20.1	11.3	90.5
McDonald	7080	3.5	9.9		98.6	2.9	19.1	6.2	100.0	3.0	16.6	12.6	100.0	3.4	13.2	6.0	95.5	2.4	11.5	4.2	94.6
Borowiec	7811	7.3	8.9		96.5	8.1	16.8	6.6	100.0	9.0	14.5	4.9	99.8	6.0	11.1	8.8	81.1	6.6	11.1	4.1	93.4
Maidanak_1	1864	9.3	16.6		82.1	15.4	37.4	21.5	100.0	13.4	32.9	21.7	98.9	9.2	24.9	13.8	80.3	14.1	27.0	17.3	87.0
Simeiz	1873	10.0	14.5		71.0	1.5	23.1	11.2	100.0	18.5	35.1	23.8	94.1	13.0	29.5	22.1	74.7	17.8	22.5	12.5	88.8
Papeete	7124	2.0	17.8		100.0	1.8	15.2	11.2	100.0	1.6	12.3	7.6	100.0	1.6	25.6	6.0	97.7	1.2	15.9	16.4	97.9
Lviv	1831	5.9	24.1		34.2	14.1	32.4	24.9	100.0	16.7	37.0	23.7	100.0								
Kiev	1824	8.4	15.9		33.3	33.0	40.8		98.1												
Concepcion_423 Concepcion_847	7405	4.1	24.4		81.5					5.5	21.8	20.2	99.9	4.6	25.4	9.4	90.9				
Tanegashima	7358					1.2	32.6		100.0	3.2	28.2		100.0								
Shanghai_2	7821																	6.7	11.1		94.0

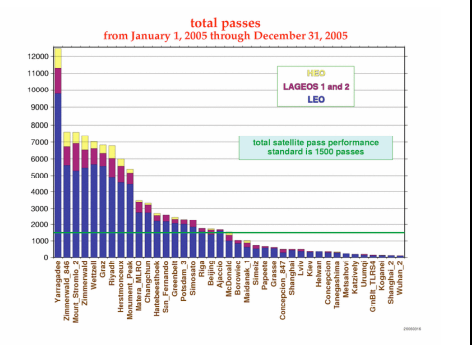
ILRS Quarterly Report Card Charts (01/01/2005-12/31/2005)

Number of Passes:

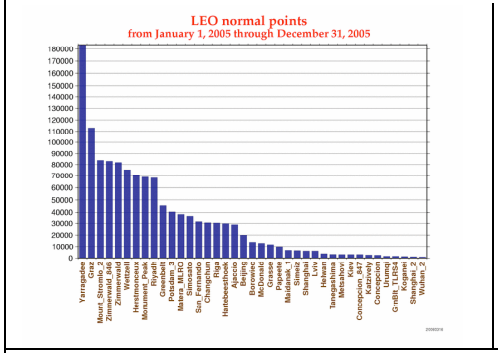


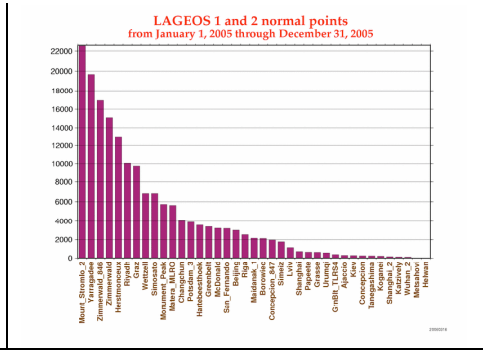


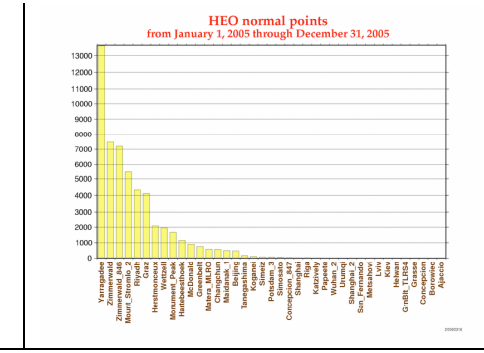


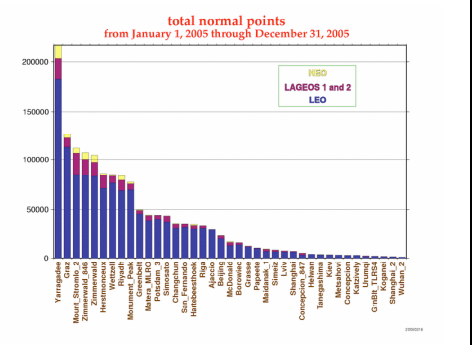


Normal Point Yield:

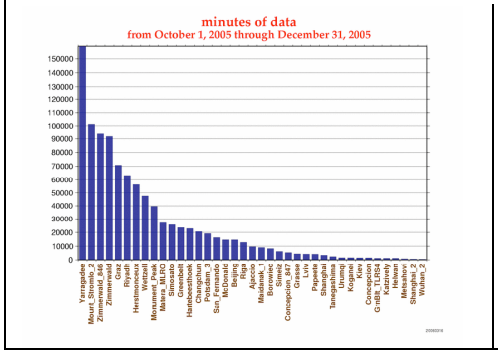


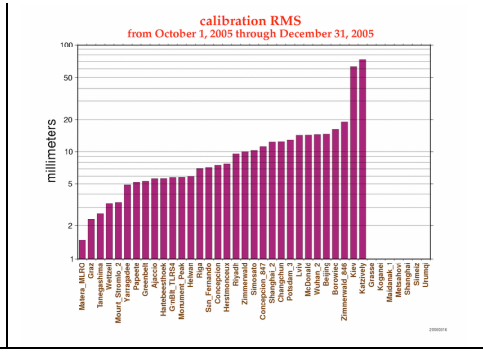


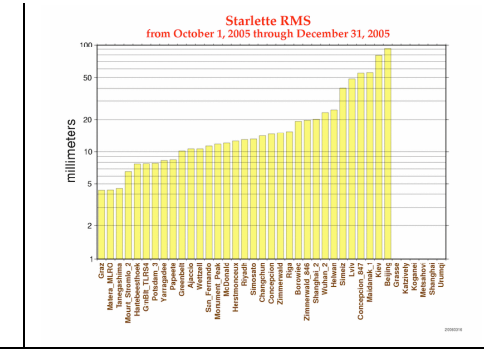


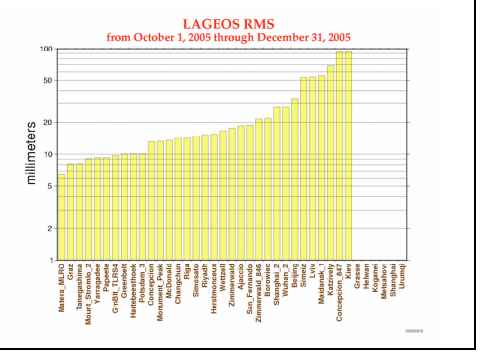


Minutes of Data and Data Quality:

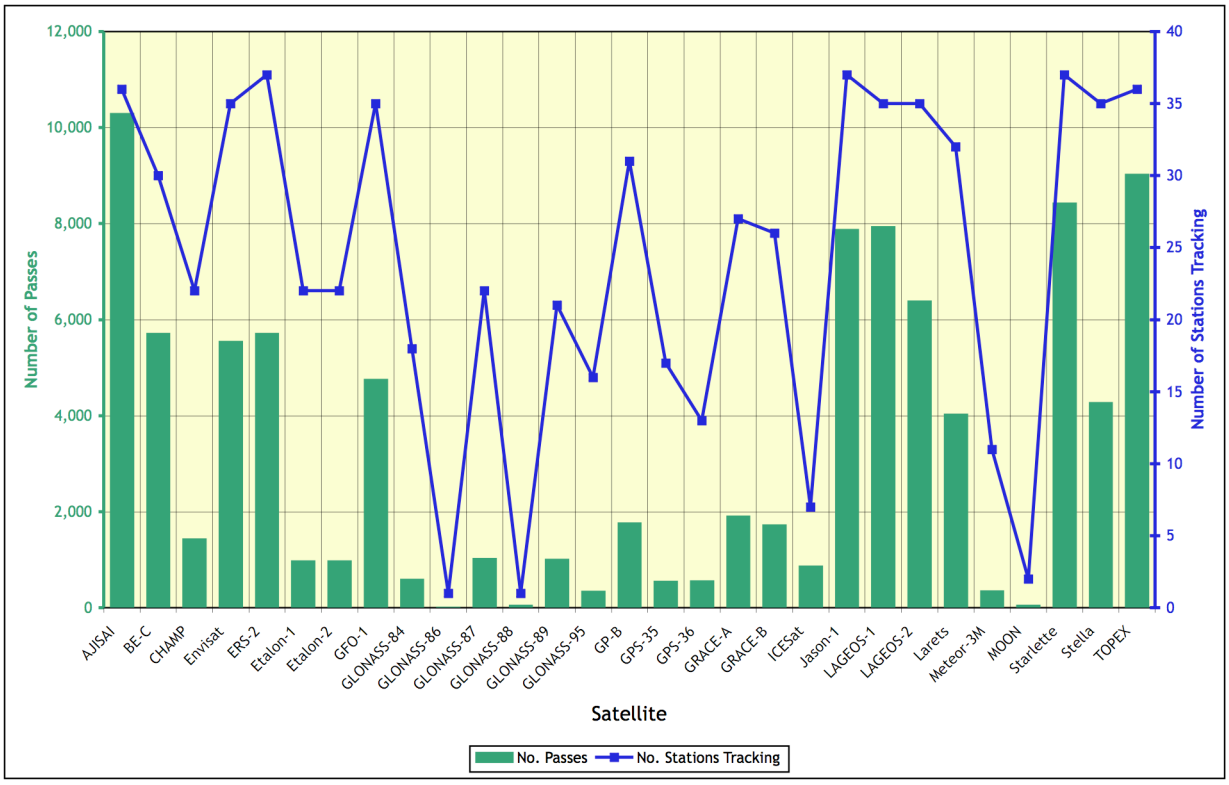




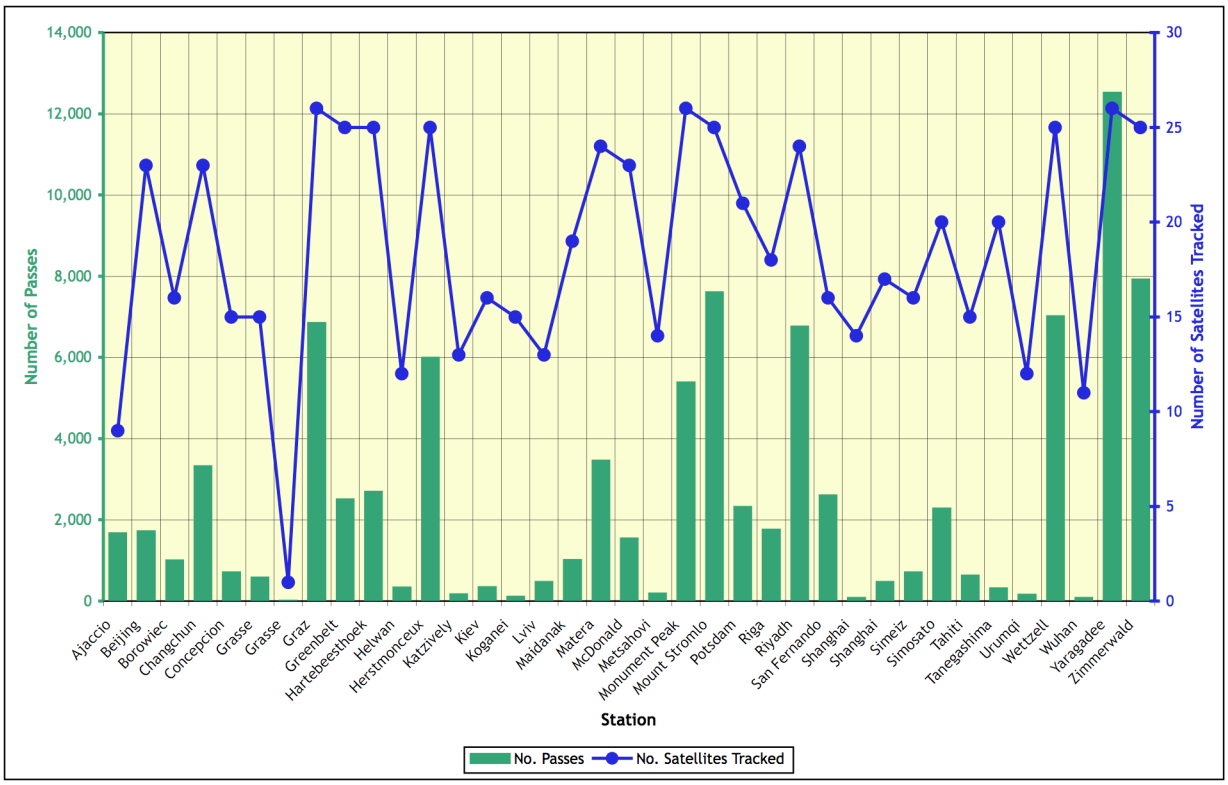




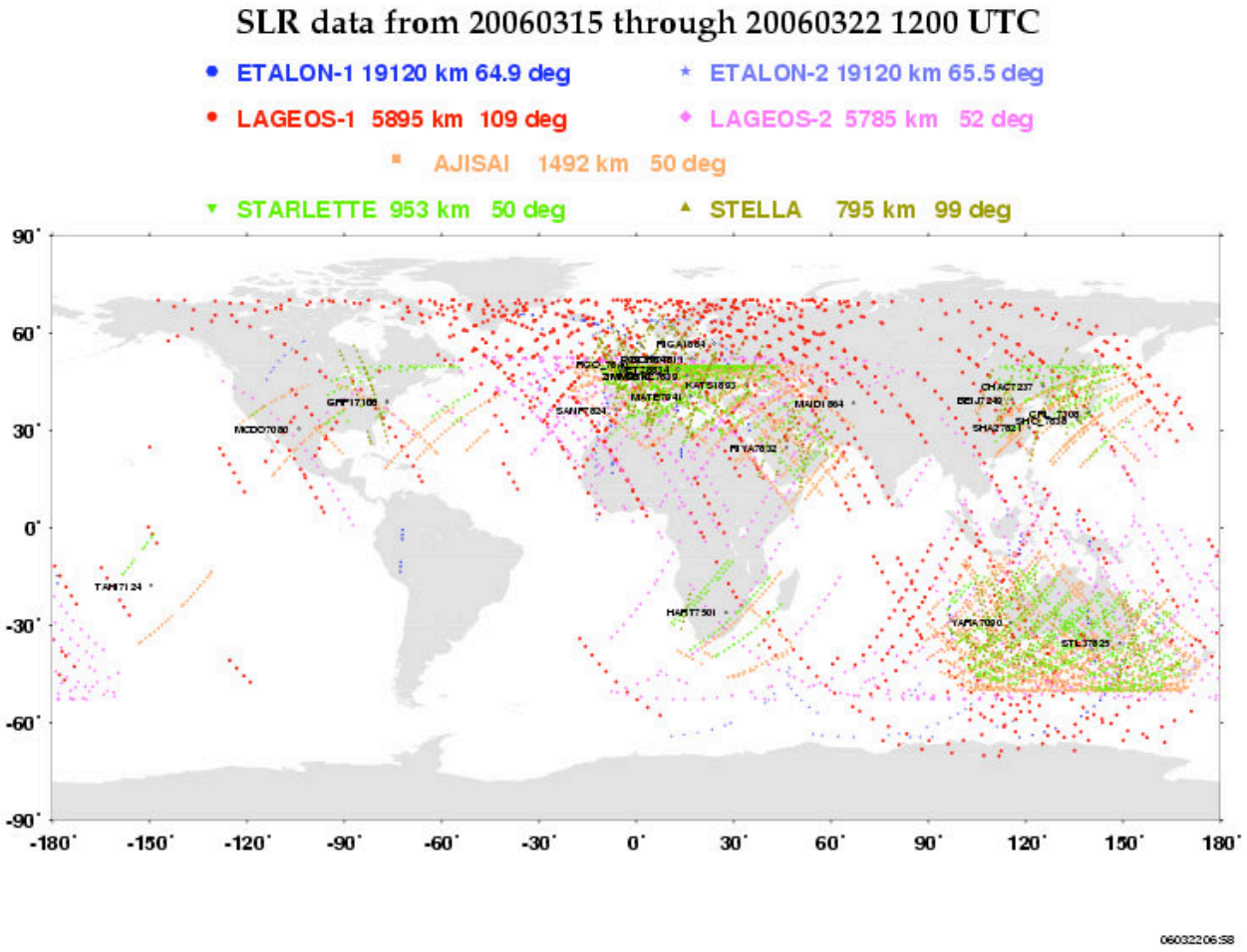
Total Passes by Satellite (01/01-12/31/2005)



Total Passes by Station (01/01-12/31/2005)

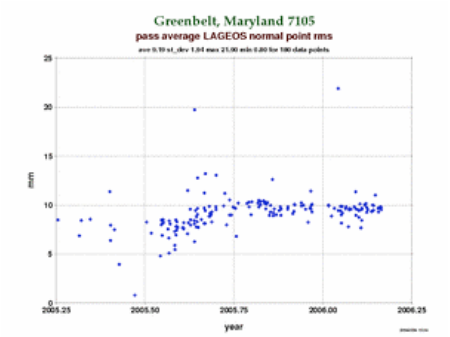


Groundtrack of Last Seven Days of Geodetic Satellite Data

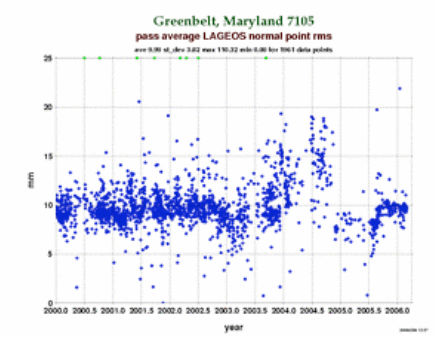


ILRS Station Performance Charts

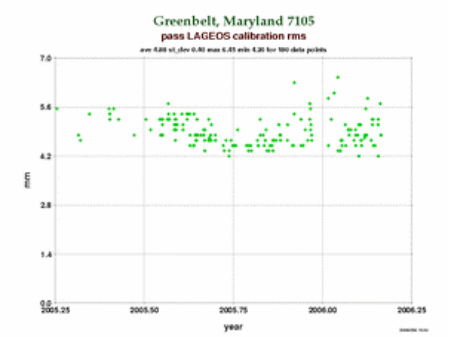
RMS (past year)



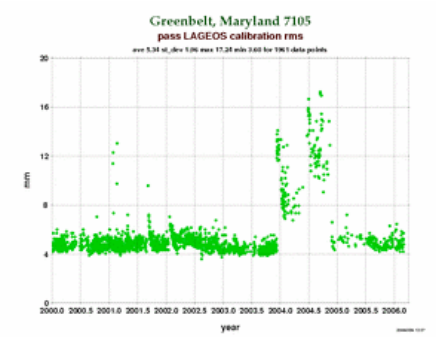
RMS (since 2000)



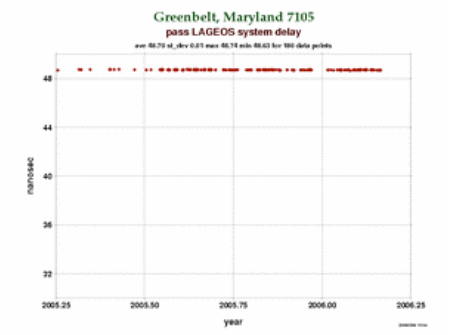
Calibration RMS (past year)



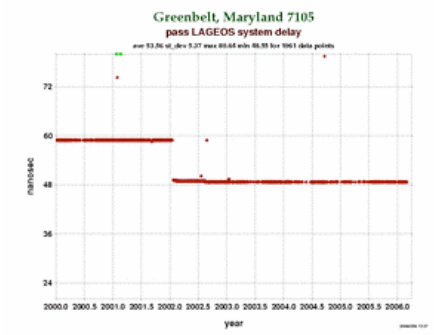
Calibration RMS (since 2000)



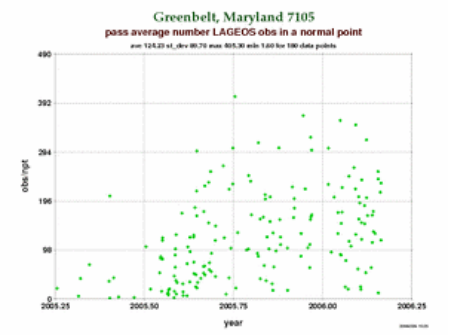
System Delay (past year)



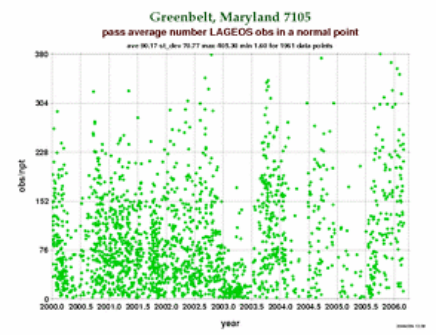
System Delay



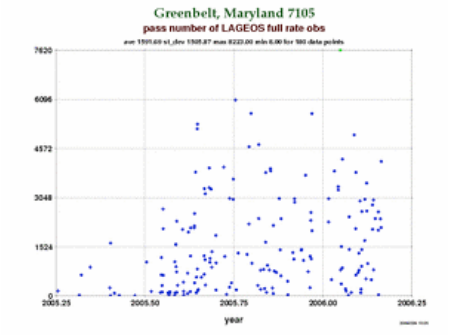
Observations per Normal Point (past year)



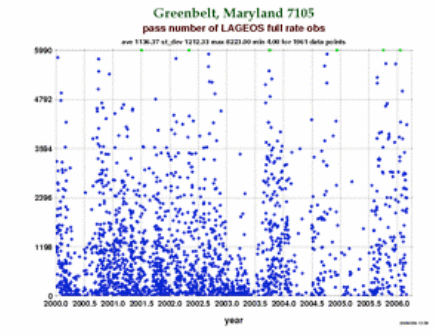
Observations per Normal Point (since 2000)



Full-Rate Observations per Pass (past year)

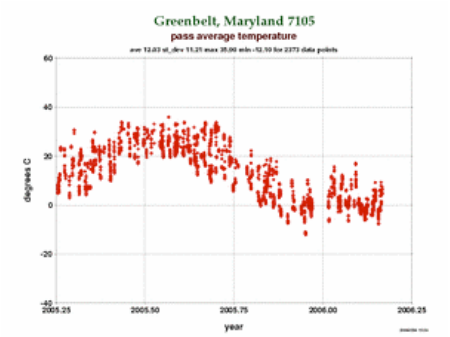


Full-Rate Observations per Pass (since 2000)

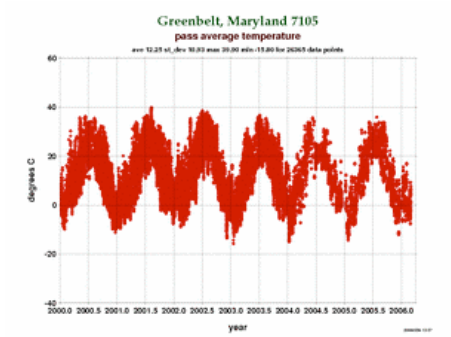


ILRS Station Meteorological Data Charts

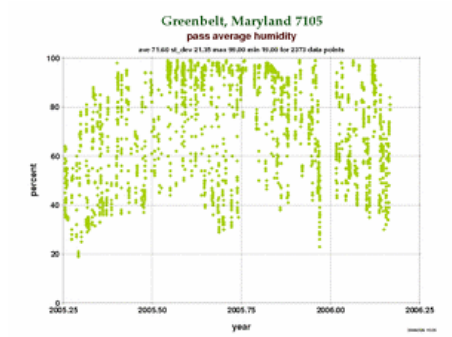
Temperature (past year)



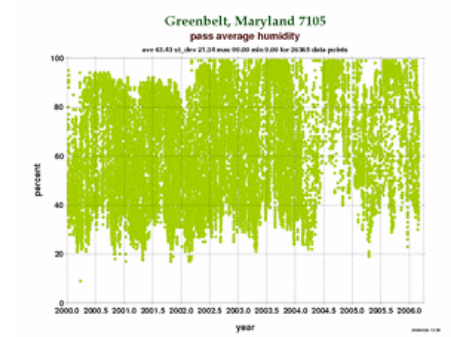
Temperature (since 2000)



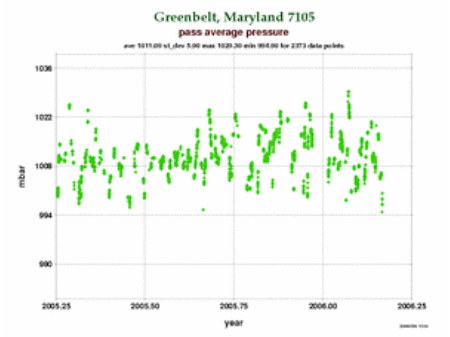
Humidity (past year)



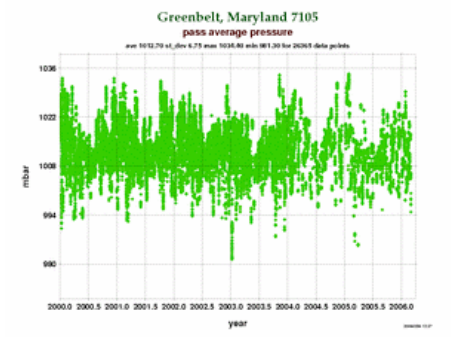
Humidity (since 2000)



Pressure (past year)



Pressure (since 2000)



New Format for ILRS Mission Pages

Follows design of station section of ILRS Web site

Proposed sections:

1. General information
   - Picture (links to high-resolution pictures?)
   - Mission objectives
   - Instrumentation
   - Mission parameters table
   - Links
   - News
2. Reflector information
   - Picture
   - Characteristics
3. ILRS mission support
   - What ILRS brings to the mission
   - Mission support request
   - Campaign summaries
4. Center of mass information
   - Table and/or references
5. Applications/References (not currently tracked within mission pages)

Global Geodetic Observing System (GGOS)

Ground Networks and Communications Working Group
Status Update - April 2006

Mike Pearlman/CfA

Goals and Objectives

The Ground Networks and Communications Working Group is working toward the implementation of properly designed and structured ground-based geodetic networks to materialize the reference systems to support sub-mm global change measurements over space, time and evolving technologies. The WG is working with the IAG measurement services (the IGS, ILRS, IVS, IDS and IGFS) to develop a strategy for building, integrating, and maintaining the fundamental network of instruments and supporting infrastructure in a sustainable way to satisfy the long-term (10-20 year) requirements identified by the GGOS Science Council. At the moment, the Working Group is examining options for 1 mm and 0.1 mm/yr reference frame stabilities.

Activities Planned and Underway

Activities of the Working Group include the investigation of the status quo and the development of a plan for full network integration to support improvements in terrestrial reference frame establishment and maintenance, Earth orientation and gravity field monitoring, precision orbit determination, local deformation monitoring, and other geodetic and gravimetric applications required for the long-term observation of global change. This integration process includes the development of a network of fundamental stations with as many colocated techniques as possible, with precisely determined intersystem vectors. This network would exploit the strengths of each technique and minimize the weaknesses where possible.

The final design of the GGOS network must take into consideration all of the applications including the geometric and gravimetric reference frames, EOP, POD, geophysics, oceanography, etc. We will first consider the TRF, since its accuracy influences all other GGOS products. Early steps in the process are:

1. Define the critical contributions that each technique provides to the TRF, POD, EOP, etc;
2. Characterize the improvements that could be anticipated over the next ten years with each technique;
3. Understand the present error sources for each technique (instrument and modeling) and how these errors sources propagate into the analysis products;
4. Using simulation techniques, quantify the improvement in the TRF, Earth orientation and other key products as stations are added and station capabilities (co-location, data quantity and quality) are improved;

The Working Group is assuming that the GNSS and the DORIS Networks will be at least as robust as they are presently and that planned upgrades in the ground systems and the satellites will come to fruition. Some augmentation is also assumed where the present networks would be significantly enhanced with additional stations.

SLR and VLBI are presently investigating the size and density of the networks that will be required to satisfy their individual requirements.

We are still in the process of integrating the role of gravity field measurements within the context of the integrated network.

In a next step, we will examine the current infrastructure in-place, for the analysis of the network-collected data, investigate their adequacy to meet the envisioned future network realizations and the product quality and latency vis-à-vis the GGOS goals, and suggest appropriate actions.

Global Geodetic Observing System (GGOS)
Ground Networks and Communications Working Group
Status Update - April 2006
(continued)

Related to the above, is the question of data and product communications. This needs to be examined once we have a firm idea of the networks of the next decade and the product availability requirements. Our detailed investigation will ensure that the data will reach the analysis centers with minimal delays, and the products will be expeditiously disseminated to the public and the users. In addition to these questions, we will examine the need and possible improvements of communication links between geodetic and other GEOSS-related networks, e.g. oceanographic, atmospheric, seismic, etc., to make sure that data and results from each of these can be made available to all users with minimal effort and delays.

A preliminary discussion of items 1 and 2 above is included in our Poster paper from the IAG Cairns meeting:

M. Pearlman, et al, "GGOS Working Group on Networks, Communication, and Infrastructure" (http://cddis.gsfc.nasa.gov/docs/GGOS_IAG_0508.pdf)

Meetings

During 2005, the Working Group met at EGU in April, IAG in August, and AGU in December.

The next meeting is scheduled for EGU on April 6, 2006. The progress of the SLR and VLBI simulations will be reviewed along with the long term plans for the GNSS and DORIS networks, and the role and scope of the gravity field and tide gauge measurements in the integrated network. The agenda for the meeting is attached.

Member List of the Working Group

- IGS: Angelyn Moore, Norman Beck
- ILRS: Mike Pearlman, Werner Gurtner
- IVS: Chopo Ma, Zinovy Malkin
- IDS: Pascal Willis
- IGFS: Rene Forsberg, Steve Kenyon
- ITRF and Local Survey: Zuheir Altamimi, Jinling Li
- IERS Technique Combination Research Centers: Marcus Rothacher
- IAS (future International Altimetry Service): Wolfgang Bosch
- Data Centers: Carey Noll
- Data Analysis: Erricos Pavlis, Frank Lemoine, Frank Webb, John Ries, Dirk Behrend

Global Geodetic Observing System (GGOS)

Ground Networks and Communications Working Group Meeting
Austria Center Vienna, Room SM3
April 6, 2006, 17:30 – 20:00

Agenda

Review of Working Group Charter

Status of Network

Satellite Laser Ranging
- What should the technology and infrastructure look like in 10 years?
- What TRF requirements does the technique satisfy?
- What network is required to satisfy the TRF requirements?

Very Long Baseline Interferometry
- What should the technology and infrastructure look like in 10 years?
- What TRF requirements does the technique satisfy?
- What network is required to satisfy the TRF requirements?

GNSS
- What should the technology and infrastructure look like in 10 years?
- What TRF requirements does the technique satisfy?
- What changes in the network are anticipated over the next 10 years?

DORIS
- What should the technology and infrastructure look like in 10 years?
- What TRF requirements does the technique satisfy?
- What changes in the network are anticipated the next 10 years?

Gravity Field
- What type of gravity data are available now, where and with what coverage (spatial+temporal)?
- Who controls the data archival and dissemination?
- Which data level is freely available, L0, L1, L2,... define what these levels of processing.
- Which gravity-measuring efforts are in-place and how and who runs them?
- What do the current permanent gravity networks look like now (describe all types)?
- How many absolute gravimeters are there, who owns them and controls them, what are the end-product, and what is the deployment plan?
- How many super-conducting gravimeters are there, who owns them and controls them, what are the end-product, and what is (if any) the enhancement/expansion plan?
- How best could we incorporate these gravity networks into our overall activity on a "Global Geodetic Observing System" network design?
- What are expected to be the future requirements and how did you arrive at these?
- Describe on-going or planned, global and regional programs for each type of gravity measurements: surface, airborne, shipborne, space missions.
- Should all fiducial reference geodetic observatories have a gravimeter or a program of gravimeter occupations at regular intervals?
- What is the mechanism (if any) that coordinates gravity measuring campaigns of any type, and how and who initiates them?

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Agenda
(continued)

Tide Gauge Network

- What the network looks like?
- What does the data look like?
- Where are the data stored?
- How do people get access?
- What kinds of products are generated from the data?
- Is the technology changing?

Site Metadata Effort

Communications