SECTION 1 - GOVERNING BOARD REPORT

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1.0 INTRODUCTION

The Governing Board (GB) is responsible for the general direction of the service. It defines official ILRS policy and products, determines satellite-tracking priorities, develops standards and procedures, and interacts with other services and organizations. There are 16 members of the Governing Board (GB) - three are ex-officio, seven are appointed, and six are elected by their peer groups (see Table 1.0-1). The current Board members were appointed or elected for a two-year term in the summer of 2000 and were installed in November 2000 at the 12th International Workshop on Laser Ranging in Matera, Italy. Table 1.0-1 lists the current GB membership, their nationality, and special function (if any) on the GB. The new board will be elected in the summer of 2002 and installed at the 13th International Workshop to be held in Washington DC during the week of October 7-11, 2002.

Table 1.0-1. ILRS Governing Board (as of December 2001).

Member	Position	Country
Hermann Drewes	Ex-Officio, CSTG President	Germany
Michael Pearlman	Ex-Officio, Director ILRS Central Bureau	USA
Carey Noll	Ex-Officio, Secretary, ILRS Central Bureau	USA
Werner Gurtner	Appointed, EUROLAS, Networks & Engineering WG Coordinator	Switzerland
Wolfgang Schlueter	Appointed, EUROLAS	Germany
David Carter	Appointed, NASA, Missions WG Deputy Coordinator	USA
John Degnan	Appointed, NASA, Governing Board Chairperson	USA
Yang FuMin	Appointed, WPLTN	PRC
Hiroo Kunimori	Appointed, WPLTN, Missions WG Coordinator	Japan
Bob Schutz	Appointed, IERS Representative to ILRS	USA
Graham Appleby	Elected, Analysis Rep., Signal Processing WG Coordinator	UK
Ron Noomen	Elected, Analysis Rep., Analysis WG Coordinator	Netherlands
Wolfgang Seemueller	Elected, Data Centers Rep., Data Formats & Procedures WG Deputy Coordinator	Germany
Peter Shelus	Elected, Lunar Rep., Analysis WG Deputy Coordinator	USA
Georg Kirchner	Elected, At-Large, Networks and Engineering WG Deputy Coordinator	Austria
John Luck	Elected, At-Large, Data Formats & Procedures WG Coordinator	Australia

Within the GB, permanent (Standing) or temporary (Ad-Hoc) Working Groups (WG's) carry out policy formulation for the ILRS. At its creation, the ILRS GB established four Standing WG's: (1) Missions, (2) Data Formats and Procedures, (3) Networks and Engineering, and (4) Analysis. In 1999, an additional Ad-Hoc Signal Processing WG was organized to provide improved satellite range correction models to the analysts. The Working Groups are intended to provide the expertise necessary to make technical decisions, to plan programmatic courses of action, and are responsible for reviewing and approving the content of technical and scientific databases maintained by the Central Bureau. All GB members serve on at least one of the four Standing Working Groups led by a Coordinator and Deputy Coordinator.

1.1 ILRS NETWORK

The current ILRS Network is shown in Figure 1.1-1. Traditionally the network has been strong in the US, Europe, East Asia, and Australia. Through international partnerships, the global distribution of SLR stations is now improving, especially in the Southern Hemisphere. NASA, working in cooperation with CNES and the University of French Polynesia has established SLR operations on the island of Tahiti with MOBLAS-8. In cooperation with the South African Foundation for Research Development (FDR), NASA has relocated MOBLAS-6 to Hartebeesthoek (which already has VLBI, GPS, and DORIS facilities) to create the first permanent Fundamental Station on the African continent. Both systems are operational. Operations at the new Australian station at Mt. Stromlo, which replaced the older Orroral site near Canberra, are going extremely well in terms of both data quantity and quality.

The NASA TLRS-3 system at Universidad de San Agustin in Arequipa, Peru has carried the total SLR tracking load for South America in recent years. However, in early 2002, BKG (Germany) will began operations of the multi-technique Totally Integrated Geodetic Observatory (TIGO) system in Concepcion, Chile. The TIGO- with SLR, VLBI, GPS and absolute gravimetry techniques will be the only Fundamental Station in South America. In Argentina, NASA has been discussing a possible transfer of TLRS-4 to the University of La Plata. A possible joint Chinese-Argentine SLR station at the San Juan Observatory in western Argentina, with SLR equipment furnished by the Beijing Astronomical Observatory, is also in negotiations.

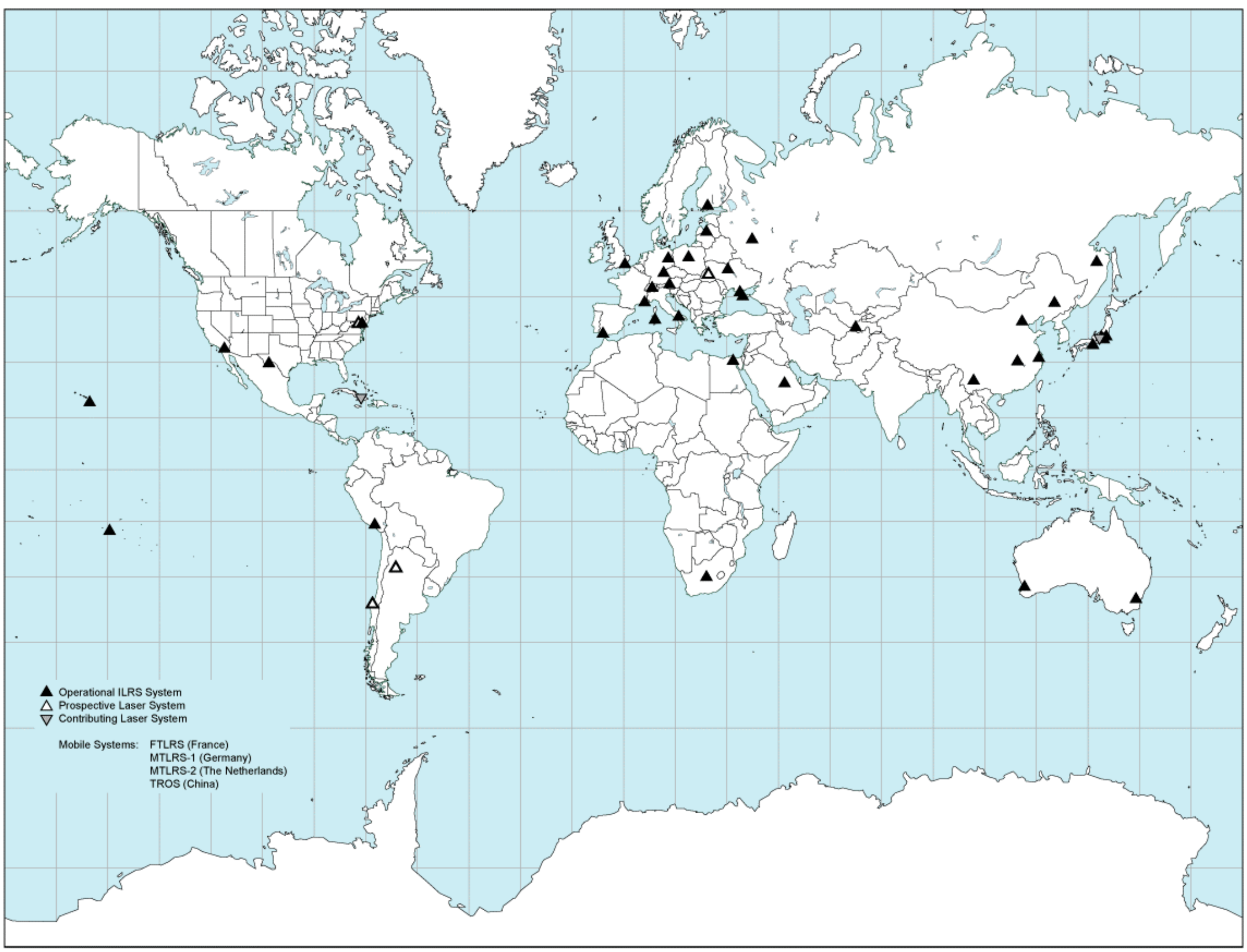

Figure 1.1-1. The ILRS Network.

The Peoples' Republic of China has made substantial investment in SLR stations and technology over the past several years. The SLR station in Kunming was recently re-established, bringing the total number of Chinese permanent sites to five (Shanghai, Changchun, Wuhan, Beijing, and Kunming). The data quality and quantity from the permanent Chinese stations continue to improve, most notably at Changchun. The Wuhan SLR station has been recently moved to a site outside the city where there is significantly better atmospheric seeing. A Chinese mobile TROS system has occupied sites in Lhasa and Urumqi as part of a national geodetic program. Construction is nearing completion on second Chinese mobile SLR station. The new Russian SLR station started operations near Moscow in 1999, and permission is being requested from the Russian government to integrate it into international SLR operations. A Russian SLR station in Novosobirsk has recently applied for ILRS membership.

In Japan, The Communications Research Laboratory (CRL) in Tokyo has closed its four Keystone sites in the Tokyo area. The Simosato site, operated by the Japanese Hydrographic Institute, continues to provide data in this technically highly interesting region. The Japanese Space Agency, NASDA, is also building a new state-of-the-art SLR station, Global and High Accuracy Trajectory Determination System (GUTS), to be located in Tanagashima at the southern tip of Japan.

Sites in the United States and Europe have been relatively stable over the past several years, with efforts primarily directed at improving overall performance or reducing the cost of SLR operations. After a long period of technical problems and engineering upgrade, the NASA HOLLAS station, operated on Mt. Haleakala by the University of Hawaii, has begun to make a comeback following the installation of a new tracking mount and controller. The data output from this geographically important station is slowly returning to earlier levels. This has been especially important as the output from the joint NASA/CNES partnership station in Tahiti has unexpectedly dropped in the past year due to an unfortunate turnover of station personnel. Both CNES and the University of the Pacific are aggressively addressing the personnel issue in Tahiti, and it is hoped that station performance will soon return to earlier levels. The combined problems in Hawaii and Tahiti have impacted the amount of laser tracking data from the Central Pacific during this reporting period. Fortunately, two of the stations on opposite sides of the Pacific - the Australian site at Mt. Stromlo and the NASA Moblas 4 site in California - continue to rank among the best in the world with regard to both data quality and quantity.

The new state-of-the-art Matera Laser Ranging Observatory (MLRO), which was showcased at the 2000 Matera workshop, has demonstrated a lunar ranging capability and has been equipped with a state-of-the-art two color streak camera receiver. The system is expected to be declared fully operational soon following a rather lengthy period in engineering status. The new French Transportable Laser Ranging System (FTLRS), which was redesigned to operate at the 532 nm wavelength, has established operations on the island of Corsica to support the calibration of the new Joint CNES/NASA JASON altimetric mission as well as other oceanographic missions as they overfly the Mediterranean. In the Ukraine a new SLR site is operating in Kiev, and an additional station is being established in Lviv.

The unmanned SLR2000 prototype is nearing completion at NASA and field tests are expected to begin in Fall 2002. SLR2000 will be showcased at the upcoming Thirteenth International Workshop on Laser Ranging to be held in Washington DC during the week of October 7-11, 2002. The Workshop is jointly hosted by the NASA Goddard Space Flight Center and the Smithsonian Institution.

1.2 ILRS Tracking Priorities and Campaigns

The ILRS is tracking 25 targets, including passive geodetic (geodynamics) satellites, Earth remote sensing satellites, navigation satellites, engineering missions, and lunar reflectors (see Tables 1.2-1 and 1.2-2). Tracking of the South African SUNSAT remote sensing mission was terminated at its end of life. Tracking on Westpac also ceased. Three GLONASS (78, 80, and 84) satellites are being tracked in continuing support of the IGLOS campaign.

The ILRS assigns satellite priorities in an attempt to maximize data yield on the full satellite complex while at the same time placing greatest emphasis on the most immediate data needs. Priorities provide guidelines for the network stations, but stations may occasionally deviate from the priorities to support regional activities or national initiatives and to expand tracking coverage in regions with multiple stations. Tracking priorities are set by the

Governing Board, based on application to the Central Bureau and recommendation of the Missions Working Group.

Table 1.2-1. ILRS Earth Satellite Tracking Priorities (as of December 31, 2001).

Priority	Satellite	Sponsor	Altitude (Km)	Inclination	Comments
1	CHAMP	GFZ	470	87.3	Gravity research
2	GFO-1	US Navy	790	108.0	Altimeter POD/calibration no other tracking technique, Upgraded to ILRS Mission Apr 2001
3	ERS-2	ESA	800	98.6	Altimeter calibration, PRARE backup
4	TOPEX/Poseidon	NASA.CNES	1,350	66.0	Altimeter calibration, DORIS and GPS backup
5	Starlette	CNES	815 — 1,100	49.8	Geodetic, no other tracking technique available
6	Stella	CNES	815	98	Geodetic, no other tracking technique available
7	Meteor-3M	NASA/IPIE, Russia	1020	99.64	Retroreflector research, tracking by only 2 NASA sites
9	Beacon-C	NASA	950 — 1,300	41	Upgraded to ILRS Mission 1 Jan 2001
9	Reflector	ROSAVIA/COS	1020	99.6	Launch 10 Dec 2001 9 month campaign
10	Ajisai	NASDA	1,485	50.0	Geodetic, no other tracking technique available
11	LAGEOS-2	ASI/NASA	5,625	52.6	Geodetic, no other tracking technique available
12	LAGEOS-1	NASA	5,850	109.8	Geodetic, no other tracking technique available
13	Etalon 1	RSA	19,100	65.3	Geodetic, no other tracking technique available, Etalon campaign began 1 Apr 2001
14	Etalon 2	RSA	19,100	65.2	Geodetic, no other tracking technique available
15	GLONASS 78	RSA/IGLOS	19,100	65	Positioning POD enhancement, replaced G72 6/29/00
16	GLONASS 80	RSA/IGLOS	19,100	65	Positioning POD enhancement, replaced G70 10/20/99
17	GLONASS 84	RSA/IGLOS	19,100	65	Positioning POD enhancement, replaced G7a 2/22/01
18	GPS 35	US Air Force	20,100	54.2	Positioning POD enhancement
19	GPS 36	US Air Force	20,100	55.0	Positioning POD enhancement

Table 1.2-2. ILRS Lunar Reflector Tracking Priorities (as of December 31, 2001).

Priority	Lunar Targets	Sponsor
1	Apollo 15	NASA
2	Apollo 11	NASA
3	Apollo 14	NASA
4	Luna 21	RSA

The ILRS conducted a number of campaigns during 2001. Tracking on Beacon-C continued to support gravity field improvements in preparation for the upcoming Gravity and Climate Experiment (GRACE). The US Navy's GFO-1 oceanographic satellite was approved by the GB for intense tracking due to a failure in the four redundant GPS receivers and is now totally reliant on SLR for its orbit. The highly elliptical orbit of the Japanese LRE mission presented new technical challenges to the ILRS network. At the request of the ILRS Analysis Working Group, Etalon 1 and 2 were elevated in tracking priority above the other high altitude satellites, GPS and GLONASS, to better understand the ultimate capabilities of SLR in measuring Earth Orientation Parameters (EOP). Another campaign was scheduled to test two new retroreflector packages onboard the Russian Meteor-3M and companion Reflector satellite. Meteor-3M carries an experimental retroreflector, which is the optical equivalent of the Luneberg lens used in microwave systems. It consists of two concentric glass balls of different index of refraction with one half coated with a reflective coating. Although originally intended as a six week campaign experiment, the immediate failure of the onboard GPS/GLONASS receiver following launch resulted in a request to the ILRS for routine tracking status in support of the NASA SAGE mission. The Reflector satellite consists of several small arrays placed at different positions and orientations to allow the measurement of spacecraft attitude. Tests were also conducted to verify the tracking capability on STARSHINE 3.

Since several remote sensing missions have suffered failures in their active tracking systems or have required in-flight recalibration, the ILRS has encouraged new missions with high precision orbit requirements to include retroreflectors as a fail-safe backup tracking system, to improve or strengthen overall orbit precision, and to provide important intercomparison and calibration data with onboard microwave navigation systems.

1.3 Upcoming Missions

At one time, the main task of the international SLR Network was the tracking of dedicated geodetic satellites (LAGEOS, Starlette, etc.). Although we have had requests to revive tracking on older satellites already in orbit (e.g. Beacon-C) to further refine the gravity field with improved accuracy laser data, new requests for tracking are now coming mainly from active satellite missions. The tracking approval process begins with the submission of a Missions Support Request Form, which is accessible through the ILRS web site. The form provides the ILRS with the following information: a description of the mission objectives; mission requirements; responsible individuals, organizations, and contact information; timeline; satellite subsystems; and details of the retroreflector array and its placement on the satellite. This form also outlines the early stages of intensive support that may be required during the initial orbital acquisition and stabilization and spacecraft checkout phases. A list of upcoming space missions that have requested ILRS tracking support (as of 22 January 2002) is summarized in Table 1.3-1 along with their sponsors, intended application, projected launch dates, mission duration, and ILRS status.

Once tracking support is approved by the Governing Board, the Central Bureau works with the new missions to develop a Mission Support Plan detailing the level of tracking, the schedule, the points of contact, and the channels of communication. New missions normally receive very high priority during the acquisition and checkout phases and are then placed at a routine priority based on the satellite category and orbital parameters. After launch, New Mission Reports with network tracking statistics and operational comments are issued weekly. The Central Bureau monitors progress to determine if adequate support is being provided. New mission sponsors (users) are requested to report at the ILRS Plenary meetings on the status of ongoing campaigns, including the responsiveness of the ILRS to their needs and on progress towards achieving the desired science or engineering results.

Table 1.3-1. New Missions and Campaigns Planned for 2001-2002).

Mission Name	Support Requester	Application	Planned Launch Date	Mission Duration	Received Mission Request Form	Received ILRS GB approval
STARSHINE 2	NASA, NRL, etc.	Atomspheric Drag, Educational outreach	Nov. 2001	5 mon.	Yes	Approved conditionally for limited testing only.
Jason-1	CNES/NASA France/USA	Environmental change	Dec. 2001	5 yrs	Yes	Yes
ENVISAT-1	ESA Europe	Environmental change	Mar. 2002	5 yrs	Yes	No
GRACE	NASA GFZ	Gravity field modeling	Mar. 2002	5 yrs	Yes	Yes
ICESat (GLAS)	NASA USA	ice level and ocean surface topography	Dec. 2002	3-5 yrs	Yes	Yes
ADEOS-II	NASDA Japan	Ocean circulation; atmosphere-ocean interaction	Dec. 2002	3 yrs	Yes	Yes
Gravity Probe B (GP-B)	NASA-JPL USA	Relativity	Apr. 2003	1-2 yrs	Yes	Yes
IRS-P5	ISRO	Experimental	Late 2003	5 yrs	No	No
ALOS	NASDA	Altimeter calibration	Jul/Aug 2003	3 yrs	No	No
ETS-VIII	NASDA	Time transfer	Jul/Aug 2003	3 yrs	No	No
CryoSat	ESA	Sea Ice, Ice Cap	Apr/May 2004	3.5 yrs	Yes	Awaiting MWG recommendation
VCL	NASA	Laser Altimeter	TBD	18 mon.	Yes	No

1.4 Meetings and Reports

The ILRS organizes semiannual meetings of the Governing Board and General Assembly, which is open to all ILRS Associates and Correspondents. The 6th ILRS General assembly was held on 28 March 2001 in Nice, France, in conjunction with the EGS Symposium. Detailed reports from past meetings can be found at the ILRS web site.

The 7th ILRS General Assembly was scheduled to be held at the Centre de Congres Pierre Baudis in Toulouse, France, on Friday morning, 21 September 2001, in conjunction with the SPIE/Europto Symposium on Remote Sensing (September 17-21, 2001). Open ILRS-sponsored Working Group sessions and a calibration workshop were also scheduled. Unfortunately, the events of 9/11 caused all of these ILRS meetings to be cancelled at the last minute. A special Joint ILRS/WPLTN symposium in Riyadh, Saudi Arabia, on the following Sunday and Monday (September 23-24) was also cancelled. As a result, the 7th ILRS General Assembly was postponed until the next EGS Symposium during the week of 22 April 2002. The 8th ILRS General Assembly will be held in conjunction with the 13th International Workshop on Laser Ranging to be held in October 2002 in Washington DC.

ILRS Analysis Center reports and inputs are used by the Central Bureau for weekly review of station performance and to provide feedback to the stations when necessary. Special weekly reports on on-going campaigns are issued by email. The CB also generates Quarterly Performance Report Cards and posts them on the ILRS web site. The Report Cards evaluate data quantity, data quality, and operational compliance for each tracking station relative to ILRS minimum performance standards. A catalogue of diagnostic methods, for use along the entire data chain starting with data collection at the stations, has emerged from this process and will be made available on the ILRS web site. The evaluation process has been helpful in comparing results from different Analysis and Associate Analysis Centers, a role soon to be assumed by the Analysis Working Group.