
APPENDIX ILRS INFORMATION



APPENDIX

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ILRS Contributing Organizations

Agency	Country
Observatorio Astronómico Félix Aguilar (OFA) of the Facultad de Ciencias Exactas, Físicas y Naturales (FCEFN) of the Universidad Nacional de San Juan (UNSJ)	Argentina
Geoscience Australia (GA)	Australia
EOS Space Systems Pty. Ltd.	Australia
Austrian Academy of Sciences	Austria
National Institute of Geophysics, Geodesy and Geography (NIGGG, formerly CLG/BAS)	Bulgaria
Observatorio Geodetico TIGO, Universidad de Concepción	Chile
Academia Sinica	China
Chinese Academy of Surveying and Mapping (CASM)	China
Institute of Seismology, China Seismological Bureau	China
National Astronomical Observatories of China (NAOC), Chinese Academy of Sciences (CAS)	China
Shanghai Astronomical Observatory (SHAO)	China
State Seismological Bureau	China
Yunnan Observatory	China
Technical University of Prague	Czech Republic
National Research Institute of Astronomy and Geophysics (NRIAG)	Egypt
Finnish Geodetic Institute	Finland
Groupe de Recherche en Geodesie Spatiale (GRGS)	France
Observatoire de la Côte d'Azur/Center d'Etudes et de Recherches Géodynamiques et Astrométrie (OCA/CERGA)	France
Observatoire de Paris	France
Tahiti Geodetic Observatory, University of French Polynesia (UFP)	French Polynesia
Bundesamt für Kartographie und Geodäsie (BKG)	Germany
Deutsches Geodätisches ForschungsInstitut (DGFI)	Germany
European Space Agency/European Space Operation Center (ESA/ESOC)	Germany
Institut fuer Erdmessung/Forschungseinrichtung SatellitenGeodäsie (IFE/FESG)	Germany
Helmholtz Centre Potsdam GeoForschungsZentrum German Research Centre for Geosciences (GFZ)	Germany
Italian Space Agency (ASI)	Italy
Hitotsubashi University	Japan
Hydrographic Department/Japan Coast Guard	Japan

ILRS Contributing Organizations continued

Japan Aerospace Exploration Agency (JAXA)	Japan
National Institute of Information and Communications Technology (NICT)	Japan
Astronomical Observatory, University of Latvia	Latvia
Delft University of Technology (DUT)	The Netherlands
Forsvarets ForskningsInstitutt (FFI)	Norway
Universidad Nacional de San Augustin (UNSA)	Peru
Space Research Center of the Polish Academy of Sciences (PAS)	Poland
Information-Analytical Center (IAC)	Russia
Institute of Applied Astronomy (IAA)	Russia
Institute of Astronomy of the Russian Academy of Sciences (INASAN)	Russia
Institute of Metrology for Time and Space (IMVP)	Russia
Russian Space Agency (RSA)	Russia
Space Research Institute (SRI) for Precision Instrument Engineering	Russia
King Abdulaziz City for Science and Technology (KACST)	Saudi Arabia
Hartebeesthoek Radio Astronomy Observatory (HartRAO)	South Africa
Real Instituto y Observatorio de la Armada	Spain
Astronomical Institute, University of Berne (AIUB)	Switzerland
Astronomical Observatory of the Ivan Franko National University of Lviv	Ukraine
Crimean Astronomical Observatory	Ukraine
Lebedev Physical Institute in the Crimea	Ukraine
Main Astronomical Observatory (MAO) of the National Academy of Sciences of Ukraine (GAOUA)	Ukraine
Natural Environment Research Council (NERC)	United Kingdom
University of Newcastle Upon Tyne	United Kingdom
Harvard-Smithsonian Center for Astrophysics	USA
Jet Propulsion Laboratory (JPL)	USA
Joint Center for Earth System Technology (JCET), University of Maryland, Baltimore County	USA
National Aeronautics and Space Administration Goddard Space Flight Center (NASA GSFC)	USA
Naval Research Laboratory (NRL)	USA
University of Hawaii	USA
University of Texas at Austin	USA
University of Texas, Center for Space Research (CSR)	USA

List of Acronyms

AAC	Associate Analysis Center
AC	Analysis Center
ACES	Atomic Clock Ensemble in Space
ACT	Australian Capital Territory
ADEOS	Advanced Earth Observing Satellite
AG	Absolute Gravimeter
AGU	American Geophysical Union
AIUB	Astronomical Institute of Berne (Switzerland)
AltiKa	Altimeter Ka-band
ANDE	Atmospheric Neutral Density Experiment (USA)
ANDE-RR	Atmospheric Neutral Density Experiment Risk Reduction (USA)
AOLC	Altay Optic-Laser Center
AOPOD	Atmospheric Occultation and Precision Orbit Determination
APD	Avalanche Photodiodes
APOLLO	Apache Point Observatory Lunar Laser-ranging Operation (USA)
ARB	Average Range Bias
ARTEMIS	Advanced Relay And Technology Mission
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
AVISO	Archiving, Validation and Interpretation of Satellite Oceanographic
AWG	Analysis Working Group
Az-El	Azimuth-Elevation



BAS	Bulgarian Academy of Sciences
BE-C	Beacon Explorer C
BELA	BepiColombo Laser Altimeter
BIPM	International Bureau of Weights and Measures
BLITS	Ball Lens In The Space
BKG	Bundesamt für Kartographie und Geodäsie (Germany)
BSW	Bernese Software



Cal/Val	Calibration/Validation
CAS	Chinese Academy of Sciences
CASM	Chinese Academy of Surveying and Mapping
CB	Central Bureau
CC	Combination Center
CCD	Charge-Coupled Device
CCR	Corner Cube Reflector
CCTV	Close Circuit Television
CDDIS	Crustal Dynamics Data Information System (USA)
CERGA	Centre d'Etudes et de Recherches Géodynamiques et Astrométrie (France)
CfA	Center for Astrophysics (USA)
CFD	Constant Fraction Discriminator
CGS	Centro di Geodesia Spaziale (Italy)
CHAMP	CHALLENGING Mini-Satellite Payload
CLG	Central Laboratory for Geodesy (Bulgaria)

CLS	Collecte, Localisation, Satellites (France)
CNES	Centre National d'Etudes Spatiales (France)
CODE	Center for Orbit Determination in Europe
CoM	Center of Mass
CONGO	Cooperative Network for GIOVE Observation
COPs	Control Operation Planning Subsystem (Japan)
COSI	COrea SAR Instrument
COSPAR	Committee on Space Research
COTS	Commercial Off The Shelf
CPF	Consolidated Prediction Format
CPP	Combination Pilot Project
CRD	Consolidated Laser Ranging Data format
CRDF	Civilian Research and Development Foundation
CRL	Communications Research Laboratory (Japan)
Cr:YAG	Crystal Yttrium Aluminum Garnet
C-SPAD	Compensated Single Photoelectron Avalanche Detector
CSR	Center for Space Research (USA)
CSRIFS	Combined Square Root Information Filter and Smoother (Finland)
CSTG	International Coordination of Space Techniques for Geodesy and Geodynamics
CTU	Czech Technical University (Czech Republic)



DEM	Digital Elevation Model
DEOS	Department of Earth Observation (The Netherlands)
DFPWG	Data Formats and Procedures Working Group
DGFI	Deutsches Geodätisches Forschungsinstitut (Germany)
DAO	Dihedral Angle Offsets
DLR	German Aerospace Center
DoD	Department of Defense (USA)
DOGS	DGFI software
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
DPSSL	Diode Pumped Solid State Laser
DTOF	Differential Time of Flight
DUT	Delft University of Technology (The Netherlands)



EDC	EUROLAS Data Center (Germany)
EGU	European Geophysical Union
ELT	European Laser Time Transfer Experiment
ENSO	El Niño-Southern Oscillation
EO	Earth Observation
EOP	Earth Orientation Parameter
EOS	Earth Observing System (USA)
EOS	Electro Optical Systems (USA)
EOST	EOS Technologies, Inc. (Australia)
ERP	Earth Rotation Parameter
ERS	European Remote Sensing Satellite
Er:YAG	Erbium Yttrium Aluminum Garnet
ESA	European Space Agency

ESOC	ESA Space Operations Center
ET	Event Timer
ETS	Engineering Test Satellite
EU	European Union
EUREF	IAG Reference Frame Sub-Commission for Europe
EUROLAS	European Laser Consortium



FAA	Federal Aviation Administration (USA)
FCEFN	Facultad de Ciencias Exactas, Físicas y Naturales (Argentina)
FDF	Flight Dynamics Facility (USA)
FESG	Forschungseinrichtung Satellitengeodäsie (Research Facility for Space Geodesy, Germany)
FFDP	Far Field Diffraction Pattern
FFI	Forsvarets ForskningsInstitutt (Norwegian Defense Research Establishment)
FOV	Field Of View
FPGA	Field Programmable Gate Array
FR	Full-Rate
FRD	Full-Rate Data
FTLRS	French Transportable Laser Ranging System
FTP	File Transfer Protocol



GA	Geoscience Australia
GAOUA	Main Astronomical Observatory of the National Academy of Sciences of Ukraine
GB	Gigabyte
GeoDAF	Geodetical Data Archive Facility (Italy)
GEO	Group on Earth Observations
GEOS	Geodetic and Earth Orbiting Satellite
GEOSS	Global Earth Observation System of Systems
GEST	Goddard Earth Sciences and Technology Center (USA)
GETEMME	Gravity, Einstein's Theory, and Exploration of the Martian Moons' Environment
GFO	GEOSAT Follow-On (USA)
GFZ	GeoForschungsZentrum (Germany)
GGAO	Goddard Geophysical and Astronomical Observatory (USA)
GGOS	Global Geodetic Observing System
GIA	Glacial Isostatic Adjustment
GIOVE	Galileo in Orbit Validation Experiment
GIS	Geographic Information System
GLAS	Geoscience Laser Altimeter System (USA)
GLONASS	Global Navigation Satellite System
GLONASS	Global'naya Navigatsionnaya Sputnikovaya Sistema
GM	Gravitational Constant
GNSS	Global Navigation Satellite System
GOCE	Gravity Field and Steady-state Ocean Circulation Explorer
GOLDEN	GIS, Ocean and Land management, Disaster and Environmental monitoring
GP-B	Gravity Probe B
GPS	Global Positioning System
GRACE	Gravity Recovery And Climate Experiment
GRGS	Groupe de Recherches de Geodesie Speciale (France)

GSFC Goddard Space Flight Center (USA)
GSOC German Space Operations Center
GSTB Galileo System Test Bed
GUTS Global and High Accuracy Trajectory Determination System



H2A/LRE Laser Ranging Experiment
HAC High Accuracy Clock
HartRAO Hartebeesthoek Radio Astronomy Observatory (South Africa)
HDD Hard Disk Drive
HEO High Earth Orbiter
Hit-U Hitotsubashi University (Japan)
HOLLAS Haleakala Laser Station (USA)
HP Hewlett-Packard
HPWREN High Performance Wireless Research and Educational Network (USA)
HTSI Honeywell Technology Solutions, Inc. (USA)
HV High Voltage
HVAC Heating, Ventilation, and Air Conditioning
HxET Herstmonceux Event Timer



IAA Institute of Applied Astronomy (Russia)
IAC Information-Analytical Center (Russia)
IAG International Association of Geodesy
IAPG/TUM Institute of Astronomical and Physical Geodesy of the Technische Universität München (Germany)
IAPSO International Association for the Physical Sciences of the Oceans
IA/RAS Institute of Astronomy/Russian Academy of Sciences
IAU International Astronomical Union
ICCD Intensified Charged Coupled Device
ICESat Ice Cloud and Land Elevation Satellite
ICET International Center for Earth Tides
ICRF International Celestial Reference Frame
ICRS International Celestial Reference System
IDS International DORIS Service
IEEE Institute of Electrical and Electronics Engineers
IERS International Earth Rotation and Reference Systems Service
IFE Institut für Erdmessung (Germany)
IGeS International Geoid Service
IGFS International Gravity Field Service
IGGOS Integrated Global Geodetic Observing System
IGLOS International GLONASS Service
IGN Institut Geographique National (France)
IGNE Instituto Geografico Nacional de España (Spain)
IGOS Integrated Global Observing Strategy
IGS International GNSS Service
ILRS International Laser Ranging Service
ILRSA ILRS A solution
ILRSB ILRS B solution
IMVP Institute of Metrology for Time and Space (Russia)

INASAN	Institute of Astronomy of the Russian Academy of Sciences
INFN	Istituto Nazionale di Fisica Nucleare (Italy)
INGV	Istituto Nazionale di Geofisica (Italy)
InSAR	Interferometric Synthetic Aperture Radar
IOV	In Orbit Validation
IPIE	Science Research Institute for Precision Instrument Engineering (Russia)
IR	Infrared
IRS	Indian Research Satellite
IRV	Inter-Range Vector
ISGN	Integrated Space Geodetic Network
ISRO	Indian Space Research Organization
ISS	International Space Station
ISTRAC	ISRO Telemetry Tracking and Command Network (India)
ITRF	International Terrestrial Reference Frame
ITRS	International Terrestrial Reference System
IUGG	International Union of Geodesy and Geophysics
IVS	International VLBI Service for Geodesy and Astrometry



JAXA	Japan Aerospace Exploration Agency
JCET	Joint Center for Earth Systems Technology (USA)
JGM	Joint Gravity Model
JGR	Journal of Geophysical Research
JPL	Jet Propulsion Laboratory (USA)



KACST	King Abdulaziz City for Science and Technology (Saudi Arabia)
KARI	Korea Aerospace Research Institute
kHz	Kilohertz
KOMPSAT	Korea Multi-Purpose Satellite



LAGEOS	LAser GEOdynamics Satellite
LAREG	Laboratoire de Recherches en Géodésie (France)
LARES	Laser Relativity Satellite
LEO	Low Earth Orbit
LLR	Lunar Laser Ranging
LNF	Laboratori Nazionali di Frascati (Italy)
LNU	Lviv National University (Ukraine)
LOD	Length Of Day
LOLA	Lunar Orbiter Laser Altimeter
LR	Laser Ranging
LRC	Laser Radar Control
LRA	Laser Retroreflector Array
LRE	Laser Retroreflector Experiment
LRO	Lunar Reconnaissance Orbiter
LRO-LR	Lunar Reconnaissance Orbiter Laser Ranging
LRRA	Laser Retro Reflector Array

LTT Laser Time Transfer
LURE LUnar Ranging Experiment



MAO Main Astronomical Observatory (Ukraine)
MCC Mission Control Center (Russia)
MCP Micro Channel Plate
MeO Meteorology and Optics (France)
MEO Medium Earth Orbit
MESSENGER MErcury Surface, Space ENvironment, GEOchemistry, and Ranging
MGS Mars Global Surveyor
MHz Megahertz
MLA Mars Laser Altimeter
MLRO Matera Laser Ranging Observatory (Italy)
MLRS McDonald Laser Ranging System (USA)
MOBLAS MOBile LASer Ranging System
MOLA Mars Orbiter Laser Altimeter
MoonLIGHT Moon Laser Instrumentation for General relativity High- Accuracy Tests
MPACS Mount Positioning and Control Subsystem
MSTA Ministry of Science and Technology of Argentina
MSTC Ministry of Science and Technology of China
MWG Missions Working Group



NAO National Astronomical Observatories (China)
NAOC National Astronomical Observatories of Chinese Academy of Sciences
NAS National Academy of Sciences (Ukraine)
NASA National Aeronautics and Space Administration (USA)
NASDA National Space Development Agency (Japan)
NASU National Academy of Sciences of Ukraine
NCEP National Centers for Environmental Prediction (USA)
NCL University of Newcastle Upon Tyne (UK)
NCST Naval Center for Space Technology (USA)
Nd:YAG Neodymium Yttrium Aluminum Garnet
Nd:YLF Neodymium: Yttrium Lithium Fluoride
Nd:YVO Neodymium-doped yttrium orthovanadate
NEAR Near Earth Asteroid Rendezvous
NEOS National Earth Orientation Service (USA)
NERC Natural Environment Research Council (UK)
NEWG Networks and Engineering Working Group
NGA National Geospatial-Intelligence Agency (USA)
NGSLR Next Generation Satellite Laser Ranging system (USA)
NICT National Institute of Information and Communications Technology (Japan)
NIGGG National Institute of Geophysics, Geodesy and Geography
NIM Nuclear Instrumentation Measurement
NOAA National Oceanic and Atmospheric Administration (USA)
NP Normal Point
NPOESS National Polar-orbiting Operational Environmental Satellite System
NPT Normal Point

NRC	National Research Council (USA)
NRIAG	National Research Institute of Astronomy and Geophysics (Egypt)
NRL	Naval Research Laboratory (USA)
NSF	National Science Foundation (USA)
NSGF	NERC Space Geodesy Facility (UK)
NTUA	National Technical University of Athens (Greece)
NUSJA	National University of San Juan of Argentina



OAFA	Observatorio Astronómico Félix Aguilar (Argentina)
OC	Operations Center
OCA	Observatoire de la Côte d'Azur (France)
OGT	Observatoire Géodésique de Tahiti (French Polynesia)
OICETS	Optical Inter-orbit Communications Engineering Test Satellite (Japan)
OSTM	Ocean Surface Topography Mission



PALSAR	Phased Array L-band Synthetic Aperture Radar (Japan)
PAS	Polish Academy of Sciences
PCA	Point of Closest Approach
PCIe	Peripheral Component Interconnect Express
PDF	Portable Document Format
PHARAO	Projet d'Horloge Atomique par Refroidissement d'Atome en Orbite (France)
PMSL	Permanent Service for Mean Sea Level
PMT	Photo Multiplier Tube
POD	Precision Orbit Determination
POE	Precise Orbit Ephemerides
POLAC	Paris Observatory Lunar Analysis Center (France)
PP	Pilot Project
PPET	Portable Pico-Second Event Timer
PPS	Part Per Second
PRARE	Precise Range and Range-rate Equipment
PROBA	Project for On-Board Autonomy



QC	Quality Control
Q/C	Quality Control
QLNP	Quick-Look Normal Point
QUEST	Quantum Engineering and Space-Time Research (Germany)
QZS	Quasi-Zenith Satellite (Japan)
QZSS	Quasi-Zenith Satellite System (Japan)



R&D	Research and Development
RAS	Russian Academy of Sciences
REAPER	Reprocessing of Altimeter Products for ERS (Germany)
RG	Red-Green laser

RINEX	Receiver Independent Exchange format
RIS	Reflector In Space
RLEP	Robotic Lunar Exploration Program (USA)
RMS	Root Mean Square
RNAAC	Regional Network Associate Analysis Center
ROA	Real Instituto y Observatorio de la Armada (Spain)
RRA	Retro Reflector Array
RSA	Russian Space Agency
RSG	Refraction Study Group



SALRO	Saudi Arabian Laser Ranging Observatory
SARAL	Satellite with ARGos and ALtiKa
SAO	Shanghai Astronomical Observatory (China)
SAO	Smithsonian Astrophysical Observatory (USA)
SAR	Synthetic Aperture Radar
SCF	Satellite/lunar laser ranging Characterization Facility (Italy)
SCF	System Configuration File
SELENE	Selenological and Engineering Explorer
SGF	Space Geodesy Facility (UK)
SGT	Stinger Ghaffarian Technologies, Inc. (USA)
SHAO	Shanghai Astronomical Observatory (China)
SHM	Space Hydrogen Maser
SINEX	Software Independent Exchange Format
SIRAL	SAR/Inteferometric Radar Altimeter
SIRGAS	Sistema de Referencia Geocéntrico para las Américas (Geocentric Reference System for the Americas)
SK	Statens Kartverk
SLR	Satellite Laser Ranging
SLRP	Satellite Laser Ranging Processor
SMS	Satellite Monitor Station (Japan)
SNPI	STandard Normal Point Interval
SNR	Signal-to-Noise Ratio
SOD	Site Occupation Designator
SOS-W	Satellite Observing System-Wetzell (Germany)
SP3	Standard Product 3 (satellite orbit format)
SPAD	Single Photoelectron Avalanche Detector
SPIE	International Society for Optical Engineering
SPWG	Signal Processing Working Group
SRI	Space Research Institute (Russia)
SRIF	Square Root Information Filter
SSC	Set of Station Coordinates
SSV	Set of Station Velocities
SSN	Space Surveillance Network (USA)
SST	Satellite-to-Satellite Tracking



T2L2	Time Transfer by Laser Link
TanDEM	TerraSAR-X add-on for Digital Elevation Measurement
TC	Timer and Counter
TCE	Time Compare Equipment
TDC	Time-to-Digital Converter
TIGO	Transportable Integrated Geodetic Observatory
TIRV	Tuned Inter-Range Vector
Ti:Sap	Titanium Sapphire
Ti:Sapphire	Titanium Sapphire
TIU	Time Interval Unit
TKSC	Tskuba Space Center (Japan)
TLE	Two Line Element
TLRS	Transportable Laser Ranging System
TOF	Time-Of-Flight
TOPEX	Ocean TOPography Experiment
ToR	Terms of Reference
TOR	Tracking, Occultation and Ranging
T/P	TOPEX/Poseidon
T/R	Transmit/Receive
TRF	Terrestrial Reference Frame
TROS	TRansportable Observation Station
TROS	Transportable Range Observation System
TTS	Triple Threshold Screening
TUM	Technische Universität München (Germany)
TUP	Technical University of Prague (Czech Republic)
TWG	Transponder Working Group
TWSTFT	Two-Way Satellite Time and Frequency Transfer



UCSD	University of California San Diego (USA)
UFP	Université de la Polynésie Française (French Polynesia)
UK	United Kingdom
UMBC	University of Maryland Baltimore County (USA)
UNAVCO	University NAVSTAR Consortium
UNESCO	United Nations Education, Scientific and Cultural Organization
UNSA	Universidad Nacional de San Augustin (Peru)
UNSJ	Universidad Nacional de San Juan (Argentina)
UPF	University of French Polynesia
UPS	Uninterruptible Power Supply
URL	Uniform Resource Locator
USA	United States of America
USB	Universal Serial Bus
USNO	U.S. Naval Observatory
UT	University of Texas
UTC	Universal Coordinated Time
UTX	University of Texas
UV	Ultraviolet

VLBI Very Long Baseline Interferometry



WESTPAC Western Pacific Laser Tracking Network Satellite

WG Working Group

WLRS Wettzell Laser Ranging System (Germany)

WPLTN Western Pacific Laser Tracking Network

YAG Yttrium Aluminum Garnet

Yt:YAG Ytterbium Yttrium Aluminum Garnet



ZD Zenith Delay