Recommendations and Action Items

Conventions

CON 1: ACs are encouraged to establish and document conventional procedures and software used to prepare the Technique Center products.
TCs should identify the conventions used by the TC and the dependence of each TC product on the adopted coordinate system conventions, models and software.

CON 2: Conventions Center together with the IERS Analysis Coordinator determine the relative importance of the component conventions to the final IERS combined solution.

CON 3: The IERS Analysis Coordinator and the Conventions Center should clarify which effects should be handled in the internal data reductions of the individual techniques (e.g., tropospheric modelling) and which should be handled a posteriori at the combination level.

CON 4: It is recommended that ACs either implement the new procedure for the transformation between the celestial and terrestrial reference frame or use the classical transformation updated with the IAU 2000 precession / nutation model to represent the position of the Celestial Intermediate Pole in the International Celestial Reference System.

CON 5: All IERS components (TCs, PCs, ...) are urged to implement the IAU 2000 Resolutions as soon as possible.

ICRF

ICRF 1: The IVS ACs are requested to generate coordinate time series for well observed sources to study the stability of radio source coordinates.

ICRF 2: For the maintenance of the ICRF the IVS is requested to secure future observation of the sources found to be stable over 1990–2002.
Observe regularly the sources used for the tie of the optical CRFs (Hipparcos, …).
Continue to extend the southern hemisphere coverage.

ICRF 3: Based on study results, the ICRS Centre & IVS should prepare a brief report for the IERS on how best to maintain the ICRF in the future together with the IAU working group.

ICRF 4: The IVS & CRCs should begin to study how best to form CRF combined solutions and to use these with results from other techniques.

EOP Combinations

EOP 1: A better interaction is required between the TCs and the IERS PCs.

EOP 2: The IERS GGFC SBA is encouraged to provide AAM in near real-time.

EOP Alignement Campaign

ALIGN 1: Create new database with comparable EOP series; reformatting of all series, resample, interpolation (until end of the year 2002).

ALIGN 2: Analysis of OFFSETs + DRIFTs in X_{pol}, Y_{pol}; find relations to the ITRF realization.

ALIGN 3: Develop strategies to combine / compare UT1 and LOD of satellite techniques with VLBI.

ALIGN 4: Final results until end of February 2003.

ALIGN 5: Conclusion and presentation at EGS General Assembly, April 2003.

Technique Centers

IGS

IGS 1: The IGS needs to improve the tracking of equipment changes at GPS stations, especially changes that affect apparent station height. Rigid recommendations are needed for how to accomplish such changes with minimal impact. Particular attention needs to be paid to antenna-related effects and the use / change of radomes. Improved methods for handling the effects of non-ideal GPS satellite and receiver antenna patterns are needed.

IGS 2: The IGS should study the inclusion of LEO satellites into their global solutions in order to help improving the geocentre estimates.

IGS 3: The IGS is encouraged to provide nutation rates series.

ILRS

ILRS 1: The ILRS is encouraged to investigate refinements of the SLR origin to reduce small, but still existing, discrepancies between the ACs and in particular in the Z component and its correlation with the SLR TRF scale.

ILRS 2: The ILRS is encouraged to recommend the installation of GPS receivers at all operational SLR sites.

IVS

IVS 1: The IVS is asked to schedule repeated global ITRF observing sessions with the largest possible number of stations.

IVS 2: It is also highly desirable to develop the capability of observing Earth-orbiting satellites with VLBI.

IVS 3: The IVS is asked to account for mechanical, gravitational, and thermal deformations of the VLBI antennas in results for station coordinates.

IVS 4: There should be redundancy for the future realisation of the ICRS.

IVS 5: ACs are encouraged to analyse past and future VLBI data using the IAU re-commended procedure for the transformation between the celestial and terrestrial reference frames.

IVS 6: ACs are encouraged to implement global CRF-EOP-TRF solutions from the best data (1990 onwards), with appropriate treatment for unstable sources and stations with non-linear motion when necessary.

IDS

IDS 1: The IDS is asked to consider installing DORIS beacons at SLR and near VLBI sites, starting with sites collocated with GPS in order to augment the number / distribution of 4-technique "primary" sites.

Combined Efforts

COME 1: The IVS, IGS and IDS are encouraged to refine / investigate their various modelling, such as the troposphere and antenna-related effects in order to improve the TRF scale consistency.

COME 2: The ILRS, IDS & IVS should begin to produce combined EOP + TRF solutions using SINEX-2.00.

GGFC / CRCs

GGFC 1: The GGFC should begin to distribute estimates of the time-varying local station displacements due to global fluid changes based on all known effects. Ideally, the results should be made available in a timely way to facilitate use with space geodetic results.

GGFC 2: The GGFC and CRCs need to consider how the joint use of geodetic & geophysical information can be done efficiently and effectively.
A report with recommendations is requested.

Rigorous Combination

The IERS aims at a rigorous combination of ITRF/EOPs/ICRF to produce a fully consistent set of products. After thorough and successful tests these combination products will complement / replace the existing products.

RICOM 1: Development of optimal methods for a consistent combination of ITRF, EOPs and ICRF (SINEX combination campaign, CRCs, others?).

RICOM 2: The IERS PCs should begin to distribute rigorously combined EOP + TRF products, at least in test / evaluation mode.

RICOM 3: The IERS CRCs should critically evaluate the utility of single multi-technique solutions at the observation level (by FFI and others) as a realistic alternative to SINEX combinations.
The results should be documented and reported to the IERS.

RICOM 4: New concepts for TRF combinations concerning non-linear site motions should be developed (e.g. ITRS Center, ITRS CCs, CRCs).

RICOM 5: Study the existing effects (biases) between different solutions / techniques and understand their origin (e.g. IERS PCs, ITRS CCs, ACs, CRCs).

RICOM 6: The TCs are encouraged to provide a unique solution for ITRF coordinates, EOP and ICRF to be combined with the results of other TCs.

RICOM 7: ACs should submit unconstrained normal equations, or solutions with ALL constraints properly reported.

IERS SINEX Combination Campaign

A.I.	Description / Task	Who?	Deadline
1	E-Mail exploder <crc_forum@iers.org> should be used for communications	All participants	ASAP
2	Validation of individual SINEX files regarding format, parameterisation, constraints, rank deficiencies, etc. Generate validation report, feedback to ACs Resubmission of corrected SINEX files (if necessary)	Different groups for different techniques? AC	15.01.2003 ASAP
3	Form concerning modelling and parameterisation Distribution of form to ACs All ACs should return this form to IERS AC	IERS AC ACs	30.11.2002 20.12.2002
4	Consistent modelling and parameterisation define common standards Submission of updated series	IERS AC All ACs	31.01.2003 28.02.2003
5	Scientific studies / combinations: Presentation of first results at the EGS-AGU meeting in Nice	CRCs + others	April 2003

Interaction Between IERS PCs, ITRS CCs, TCs and WGs

INTER 1: The ITRS PCs, ITRS CCs, WG on ITRF Datum and WG on Site Co-location are asked to set up selection criteria and to propose a list of TRF core sites. These sites should be of high geodetic quality so that they can be used in the definition of TRF datum orientation and its time evolution.

INTER 2: The TCs (IVS, ILRS, IGS, IDS) through their respective ACs, CRCs, ITRS CCs and other groups dealing with time series combination are encouraged to investigate non-linear motions of space geodesy observing sites starting with TRF core sites. ACs are urged to adopt a unique list of epochs or events with coordinate discontinuities. The ITRS CCs and TCs are also asked to ensure consistency of epochs in the co-location sites.

Working Group on Site Co-location (WGSC)

The Working Group on Site Co-location (WGSC) should be established by the IERS DB and integrated into the IERS structure (charter, members). The WGSC will work cordially in cooperation with IAG and other IAG WGs. It should involve all the Technique Centres and representatives from potential agencies willing to contribute to this issue.

WGSC 1: The WGSC is asked to evaluate the number and distribution of inter-technique co-location sites, as well as problems with ties.

WGSC 2: The WGSC is asked to organize repeated local surveys at the co-location sites.

WGSC 3: Per-site local tie components (at the survey epoch) and their time variations should be provided in SINEX format with full variance-covariance matrix.

WGSC 4: The WGSC should make specific recommendations designed to improve the global reference system.

WGSC 5: The situation concerning co-location sites and local ties needs urgently to be improved (e.g. IERS, TC, CSTG, subcommission ISGN + others)

WGSC 6: In order to improve co-location site distribution and observing networks an international effort is needed to improve VLBI-SLR co-locations by installing new SLR systems (e.g. SLR2000) at VLBI sites. These are very critical for the long term TRF scale maintenance.

Working Group on the ITRF Datum (WGID)

The Working Group on the ITRF Datum (WGID) should be "integrated" into the IERS structure with an updated charter and member list.

WGID 1: The IERS Working Group on the ITRF Datum is asked to work with the Technique Centres to clarify the current quality of geocentre results and to report recommendations on future geocentre combinations and products.

Special Bureau for the Atmosphere

SBA 1: Explore atmospheric data from more data sources, especially new reanalyses are needed (e.g. higher vertical extent and higher temporal resolution).

SBA 2: Create combined atmospheric data sets. Problem: errors in atmospheric excitations are not known, so it is difficult to create optimal solution.

SBA 3: Understand the relationship between the torque and angular momentum approach.

SBA 3: Explore new formulations and constants for excitation terms.

SBA 4: Model link with oceans should be improved.

SBA 5: Atmospheric mass terms: recalculation based on more accurate coordinate approach and gravity field

- for earth rotation/polar motion
- for loading
- for gravity missions

SBA 6: Assess forecasts as well as analyses of atmospheric forecasts of AAM.

SBA 7: Relationship of AAM to climate and weather signature:

- El Nino/Southern Oscillation
- North Atlantic Oscillation
- Moving weather systems over continents
- Understanding the atmosphere with AAM as a diagnostic: model intercomparison projects, century-long simulations and projections.

SBA 8: Other needs of atmosphere in geodetic missions. Can we help?

General Discussion

GEN 1: **Rigorous Combination**: The IERS aims at a rigorous combination of ITRF/EOPs/ICRF to produce a fully consistent set of products. After thorough and successful tests these combination products should replace/complement the existing products.

GEN 2: **Interactions** between GGFC and IERS PCs, CRCs and TCs:

- What would PCs, TCs, CRCs, like to have from GGFC? (e.g. SBs provide "best" estimates of seasonal terms of degree 1 for geocentre motion).
- What would GGFCs like to have from PCs?
- Contributions of GGFCs, PCs, TCs to conventions, consistency of conventions (GGFC work with Convention Centre by recommending new geophysical models or improvements to existing models for inclusion in future versions of the IERS Conventions.)

GEN 3: **Role of altimetry** in the IERS.

GEN 4: **Role of IERS** in new satellite missions, mission-independent source for GGFs ?

GEN 5: **All IERS components** should be proactive in promoting IERS products and GGF sciences to wider scientific community as well as to public.

GEN 6: **General goals of IGGOS:**

- IGGOS brings different techniques, different models, different approaches together, in order to achieve a better understanding of geodetic, geophysical, geodynamical processes.
- IGGOS provides geodesy's contribution (products and discoveries) to Earth sciences.
- IGGOS integrates the three pillars of geodesy – *geometry and kinematics*, *Earth orientation and rotation*, and *gravity field and dynamics* – to achieve maximum benefit for the scientific community and society in general.
- IGGOS aims at ensuring the stability and ready access to the geometric and gravimetric reference frames by establishing uninterrupted time series of state-of-the-art global observations related to the three pillars of geodesy.
- IGGOS views the Earth system as a whole by including the solid Earth as well as the fluid components, the static and time-varying gravity field in its products.