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THE IERS, THE LEAP SECOND, AND THE PUBLIC

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Bulletin C with announcements of leap seconds is the most popular of IERS products. A large part of requests from the public received by the IERS Central Bureau concerns the leap second. Although other IERS products may be of more importance, leap-second announcements produce a maximum of attention with a minimum of efforts. IERS has plans for an UT1 time service in case that UTC would be redefined. However, with respect to the public relations of the IERS, a possible abolishment of the leap seconds has to be compensated by other outreach activities which will attract similar public attention.

INTRODUCTION

This paper will discuss the consequences of a redefinition of UTC without leap seconds with respect to the public outreach of the IERS. It reflects mainly the experience and thoughts of the author as a staff member of the IERS Central Bureau, who is responsible also for public relations, and is not an official statement of the IERS. The paper does not intend to argue in favor or against a redefinition of UTC.

The *public* meant here is mainly a technically and scientifically interested audience, like high-school and university students, science teachers, engineers, astronomers, geo-scientists, physicists, etc. This public includes also specialists, who need a more precise time scale than in everyday life, but who are otherwise not involved in Earth rotation matters.

THE INTERNATIONAL EARTH ROTATION AND REFERENCE SYSTEMS SERVICE

The International Earth Rotation and Reference Systems Service (IERS)[1] was established by the International Astronomical Union and the International Union of Geodesy and Geophysics in 1987. Its primary objectives are to serve the astronomical, geodetic and geophysical communities by providing the following:

- the International Celestial Reference System (ICRS) and its realization, the International Celestial Reference Frame (ICRF),
- the International Terrestrial Reference System (ITRS) and its realization, the International Terrestrial Reference Frame (ITRF),
- Earth Orientation Parameters (EOP) required to study Earth orientation variations and to transform between the ICRF and the ITRF,

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- geophysical data to interpret time/space variations in the ICRF, ITRF or Earth Orientation Parameters, and model such variations,

- standards, constants and models (*i.e.* conventions) encouraging international adherence.

In 2003 the IERS, formerly known as the International Earth Rotation Service, got its current name to reflect the equal importance of reference systems besides the Earth Orientation Parameters in its tasks. The IERS is a non-governmental organization, based on voluntary contributions by many institutions around the world, providing personal and financial resources. The IERS does not have its own budget and thus also does not have any staff besides that in the host organizations. This is of certain importance here because it influences how the IERS addresses its users and the public.

The work of the IERS is currently being done by 6 Product Centers (one of them consisting of 4 special bureaus, another supported by 3 ITRS Combination Centers), 4 external Technique Centers (IGS, ILRS, IVS, and IDS), and 4 Working Groups. Its work is coordinated by a Directing Board, an Analysis Coordinator, and the Central Bureau. These components run more than 15 independent web sites and several ftp servers.

The central IERS web site,* maintained by the Central Bureau, provides more detailed information on IERS and gives access to all other IERS web sites. It includes the IERS Data and Information System, providing more general information related to Earth rotation and reference systems, collecting all IERS products from the individual Product Centers, and storing and offering them in different formats together with metadata.[2] Among these products are Bulletins C and D with leap-second announcements and UT1 data.

The IERS web sites include also some information for the public, although their main target groups are scientific and technical users of IERS products. Currently, there are no press releases by the IERS itself, but only by the host organizations of the IERS components.

IERS BULLETINS C AND D

The decision to introduce a leap second in UTC is the responsibility of the IERS, specifically of the IERS Earth Orientation Center, hosted by Paris Observatory, which issues announcements of leap seconds as IERS Bulletin C. This Bulletin is mailed every six months, either to announce a time step in UTC, or to confirm that there will be no time step at the next possible date.†

The decision on the introduction of a leap second is a byproduct of the IERS's work on the determination of Universal Time (UT1) and its prediction for the next months. Hundreds of people all over the world are involved in measurements and calculations of the Earth Orientation Parameters, but once these have been derived for the past and predicted into the future, the estimation of whether a leap second will be necessary or not is an easy task. Probably the most time-consuming task regarding Bulletin C is to maintain its mailing list.

The IERS Earth Orientation Center issues also Bulletin D containing announcements of the value of DUT1 = UT1–UTC to be transmitted with time signals with a precision of 0.1s, which is also being distributed by e-mail and is available for download.

*`http://www.iers.org/`

†See `http://hpiers.obspm.fr/eoppc/bul/bulc/BULLETINC.GUIDE` for more details.

IERS BULLETIN C, THE LEAP SECOND, AND THE PUBLIC

IERS Bulletin C seems to be the most popular of IERS products: there are approximately 1600 subscribers to it, about twice as much as the other IERS bulletins. Although this figure has to be treated with caution because there are no download statistics for other IERS products like reference frames and continuous Earth Orientation Parameter (EOP) series, it shows a tendency. The increased popularity of Bulletin C with the leap-second announcements is feasible because precise time is needed in more applications than reference systems or EOPs. An overview of the fields of activity of the users of Bulletins C and D was gained by the surveys done by the Earth Orientation Center in 2002 and 2011.[3,4]

Also a large part of requests from the public received by the IERS Central Bureau concerns the leap second. There was a climax around the end of the year 2008, when the last leap second was introduced. It is noted that the inquiries did not come immediately after the publication of the corresponding Bulletin C, but rather before or after the end of the year 2008, when many public media published reports about the forthcoming leap second introduction. Also a significantly larger amount of new subscriptions to Bulletin C were observed at that time.

The requests received by the IERS Central Bureau came from journalists, who asked for interviews or more information for writing articles, and from the readers of these articles, drawing attention to errors in them or asking questions like the following ones:

- ”Why would the leap second have an impact on the accuracy of GPS satellites?”
- ”I understand 24 seconds have been added since 1972 but I see other web sites that state only 2.2 seconds need to be added in 100,000 years. Will you be adding about 1 second every 1 1/2 years in the future as you have in the past?”
- ”Is there a similar ’slowing’ of the earth in orbit around the sun each year? I realize there are leap years but was there a time when a year was shorter and will this too require an adjustment in the future?”
- ”When will the next leap second occur?”

Very often these questions are not easy to answer, but in any case they show the attention of the public.

In December 2010 the Bundesamt für Kartographie und Geodäsie (BKG) in Frankfurt am Main, Germany, which is the host organization of the IERS Central Bureau, issued a press release stating that there would be no leap second at the end of 2010, noting that the leap second was overdue compared with past years when they were introduced more often, giving a geophysical explanation for this, and drawing attention to the work of the IERS. A science writer of a large German news agency wrote a well researched article on the basis of this press release. The article was reprinted in many national and local German newspapers between Christmas and New Year’s Eve, and several inquiries from readers were received after this.

Generally, press releases and articles about leap seconds and their background seem to gain rather good attention. There are several reasons for this: civil time concerns many more people than other data related to Earth rotation and reference systems. Leap seconds are an integrated effect of the

deceleration of Earth rotation, for which mainly the Moon is responsible – a very interesting astronomical, geophysical, and physical phenomenon which can be used nicely in science popularization. The introduction of a leap second is a single event, and it occur mostly at New Year's Eve (at least during the last years), i.e., at a rather distinguished moment. At that time of the year other news is rare, such that mass media readily include news about a forthcoming leap second. Partially, discussions about the future of UTC also caused public interest.

The situation described above applies to the last decade, and to future years, when the introduction of a leap second is perceived as a rather rare event. This will eventually change in the future as Earth's rotation slows down and leap seconds will be needed more routinely like in the 1970s (Figure 1). Therefore, one might expect less attention from the public in this situation.

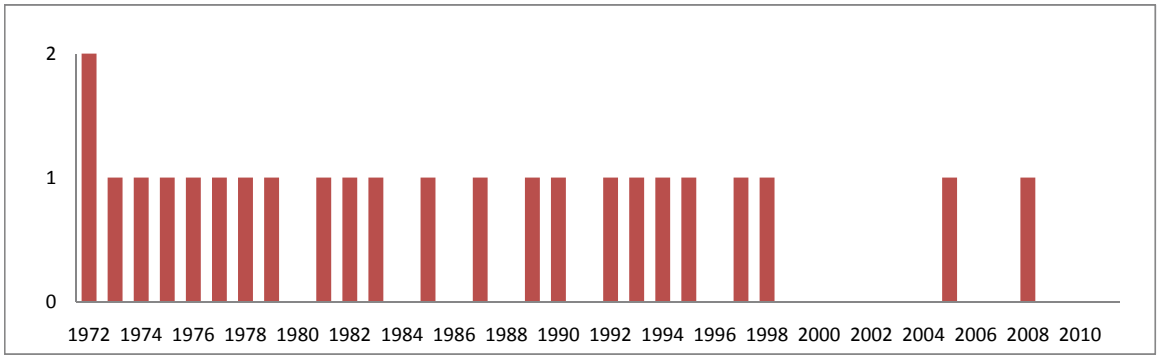

Figure 1. Leap seconds per year between 1972 and 2011

CONCLUSION: THE IERS WITHOUT LEAP SECONDS

Leap seconds are a byproduct of other IERS activities; thus, even without leap seconds the IERS will have an important and continuing role with its other products.

The IERS has plans for a UT1 time service should UTC be redefined to no longer be an approximation to UT1, e.g., through the use of the Virtual Observatory[5] or by other means.[6] This will be a task in addition to the existing ones and will probably demand more efforts than the current Bulletins C and D.

However, such a UT1 service is of interest mainly for those who really need it in practice, and not so much for a broader audience. As a permanent service, it would not be useful for public outreach. Although other IERS products may be of more scientific importance, the current leap-second announcements, especially in combination with press releases, produce maximum attention with minimal effort.

Thus, an abolishment of leap seconds (but equally the expected higher frequency of leap seconds in the future) would result in an loss of publicity for the IERS and geo-sciences. This would have to be compensated by other activity attracting similar public attention – a not so easy task for the IERS doing mainly routine service work. However, IERS might still increase and improve its public outreach activities, e.g., by the following:

- include more information for non-specialists in the web sites;
- publicize more strongly the scientific research relating to global climate change and sea level rise, which are popular topics in the media;
- issue IERS press releases;
- define a policy for public relations and public outreach, which currently does not exist.

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