IAU Standards of Fundamental Astronomy (SOFA)
Annual Report 2021

SOFA Board/Working Group Members

John Bangert	United States Naval Observatory, retired
Steven Bell	HM Nautical Almanac Office, UKHO (Webmaster)
Nicole Capitaine	Paris Observatory
Maria Davis	US Naval Observatory (IERS)
Mickaël Gastineau	Paris Observatory, IMCCE
Catherine Hohenkerk	HM Nautical Almanac Office, retired (Chair)
Li Jinling	Shanghai Astronomical Observatory
Zinovy Malkin	Pulkovo Observatory, St Petersburg
Jeffrey Percival	University of Wisconsin
Wendy Puatua	United States Naval Observatory
Scott Ransom	National Radio Astronomy Observatory
Nicholas Stamatakos	US Naval Observatory
Patrick Wallace	RAL Space, retired
Toni Wilmot	HM Nautical Almanac Office (Trainee)

SOFA is a Functional Working Group of Division A. The IAU SOFA service continues its task of establishing and maintaining an accessible and authoritative set of algorithms and procedures that implement standard models used in fundamental astronomy. This is achieved via the expertise of Board members and the SOFA website (www.iausofa.org).

Currently SOFA is in a "maintenance" mode. However, during 2021 there were two major releases and one minor release. The latest release, on 2021 May 12, was the unified eighteenth release, a major release that added three new routines, two in the astrometry category, and an approximate lunar ephemeris routine to the ephemerides category. Currently the collection consists of an ANSI C and a Fortran library made up of 192 astronomy routines of which 59 are canonical that realise IAU standards. There are also 55 utility routines dealing with vectors, matrices, and angles, making a total of 247 routines.

The previous major release, the unified seventeenth release (2021 January 25), added extra defensive precautions when computing astronomical refraction at low altitudes, and µarcsecond-level improvements to the handling of polar motion, which is now rigorous. A very rare problem, which to some extent was dependent on compiler behaviour and rounding was found with the routine dealing with leap seconds during the period 1960 to 1971 before leap seconds were introduced. This issue was corrected in the minor release 17a. SOFA is grateful to the Astropy group for reporting this issue and to all users for their comments and suggestions. Many miscellaneous typographical corrections and improvements to the Cookbooks and other documents were also made. Technical queries from users still occur, which were answered by Patrick Wallace.

Statistics concerning the use of SOFA has been missing in recent years due to system changes at SOFA's host organisation. However, we now have some access to some data. For the current release 936 users had registered and were informed of the 18th release. These libraries have been downloaded 3639 times, 63% ANSI C and 37% Fortran. This is an increase on the 2018 figures. It is both individual users and system managers who are installing either or both libraries on their computers. These figures do not give a measure of those who use the SOFA website to download a particular Cookbook or study an individual routine to better understand the algorithms and processes involved. There are also many users of the SOFA software via other implementations, Java from Jodrell Bank Centre for Astrophysics and C# available from the World Wide Astronomy library, and the Essential Routines for Fundamental Astronomy (ERFA) version that is bundled with Astropy in Python. We encourage all our users to acknowledge their use of SOFA.

The International Earth Rotation and Reference Systems Service (IERS) representative, Brian Luzum, has stepped down from the Board. We thank Brian for some 14 years of service to SOFA. We welcome Maria Davis of US Naval Observatory, who replaces Brian as the IERS representative. The SOFA Board also needs a new Chair to take SOFA forward.

Finally, we acknowledge and thank the members of the Board and their institutes. The Board thanks the United Kingdom Hydrographic Office for hosting the SOFA website. We also thank our users; in particular for reporting issues and making suggestions.

Catherine Hohenkerk
Chair IAU SOFA Board
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