



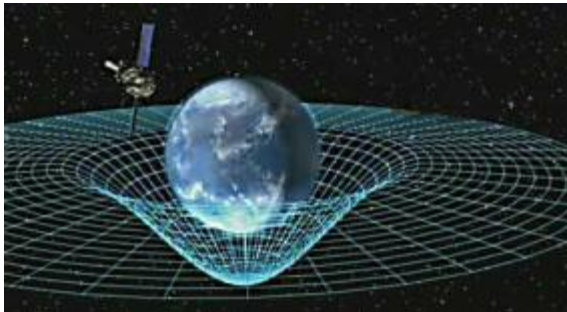
SOFA, an IAU Service Fit for the Future



Standards Of Fundamental Astronomy

Catherine Hohenkerk, Chair

HM Nautical Almanac Office, UK Hydrographic Office



**JD7: Space-time reference systems
for future research**

What is SOFA?

- ❖ IAU Division I activity
 - Providing authoritative astronomy algorithms for space-time reference systems
 - Supporting IAU Resolutions
- 1. The Board of Experts (reporting to C19)
- 2. The Collection of Algorithms → Software
- 3. The Centre – www.iausofa.org

SOFA Board

- John Bangert
- Steve Bell (Webmaster)
- Mark Calabretta
- Nicole Capitaine
- Bill Folkner
- George Hobbs
- Catherine Hohenkerk (Chair)
- Wen-Jing Jin
- Brian Luzum (IERS)
- Zinovy Malkin
- Jeffrey Percival
- Patrick Wallace

Past Members: Skip Newhall, George Kaplan, Wim Brouw, Dennis McCarthy, *Anne-Marie Gontier*

Countries / Institutions

- Australia
- UK
- France
- Russia
- China
- USA
- Australia Telescope National Facility
- HM Nautical Almanac Office (UKHO)
- RAL Space
- Paris Observatory
- Pulkovo Observatory
- Shanghai Observatory
- US Naval Observatory
- University of Wisconsin

IAU Groups

❖ Division I

– Commissions

- C4 Ephemerides
- C8 Astrometry
- C19 Earth Rotation
- C31 Time
- C52 Relativity

– WG NSFA

– WG ASGT

▪ IERS

▪ Division XII C5

– WG FITS

– WGAD

SOFA's Chronology

- 1994 IAU SOFA: Div I Task Group WGAS
- 2001 March: 1st Fortran release
- 2009 February: 1st ANSI C release
- 2010 January: New website www.iausofa.org
- 2012 March 1: 9th (unified) release
updated 2012 July 10



Standards of Fundamental Astronomy



■ Principal Sections ...

Background

Terms & Conditions

Current Software

Register

Cookbooks

Software Archive

Reports & Papers

SOFA Board

■ Related Links ...

Other Implementations

IAU Division I

IAU Commission 19

IERS

↑ Previous page

■ Acknowledge SOFA ...

*If you make use of
SOFA, please include a*

The International Astronomical Union's SOFA service has the task of establishing and maintaining an accessible and authoritative set of algorithms and procedures that implement standard models used in fundamental astronomy. The service is managed by an international panel, the SOFA Board, appointed through IAU Division I. SOFA also works closely with the International Earth Rotation and Reference Systems Service (IERS) and its reporting commission, IAU Commission 19 — "Rotation of the Earth".

■ IAU SOFA Center

This web site provides access to the SOFA Software Collection which is currently available for both Fortran 77 and ANSI C. Information on how to obtain it and instructions for its use are available by following the link to [Current Software](#).

Using SOFA software is free of charge under the terms and conditions of the [SOFA licence](#). [Registration](#) is encouraged as it helps to demonstrate the use being made of the SOFA Libraries and also provides users with e-mail notification of bugs and updates.

■ Quick start ...

■ Download the latest release ...

- Latest [Fortran 77](#) release is available ...
[Released 2012-03-01, Updated 2012-07-10]
- Latest [ANSI C](#) release is available ...
[Released 2012-03-01, Updated 2012-07-10]

SOFA Web Site Statistics

Availability 24/7

Registered Users 619

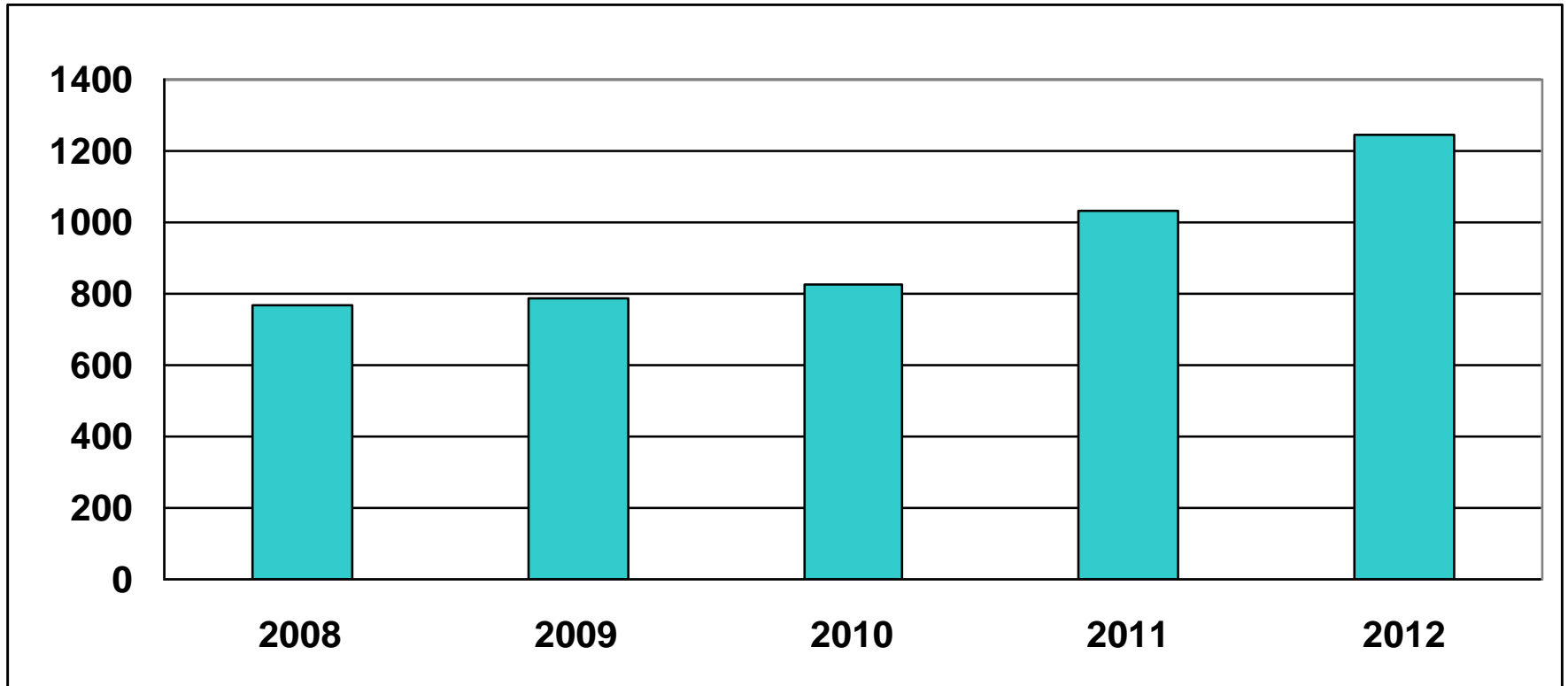
Web site size
(+ archive) 0.5 Gb

Releases 3 major 7, 8, 9

Downloads	Number of	Fortran : ANSI C
Release 8 (15 mths)	2836	44:56
Release 9 (5 mths)	1205	40:60

Unique Visitors to SOFA

Average Monthly: 2008 – 2012 July



SOFA's Astronomy Routines

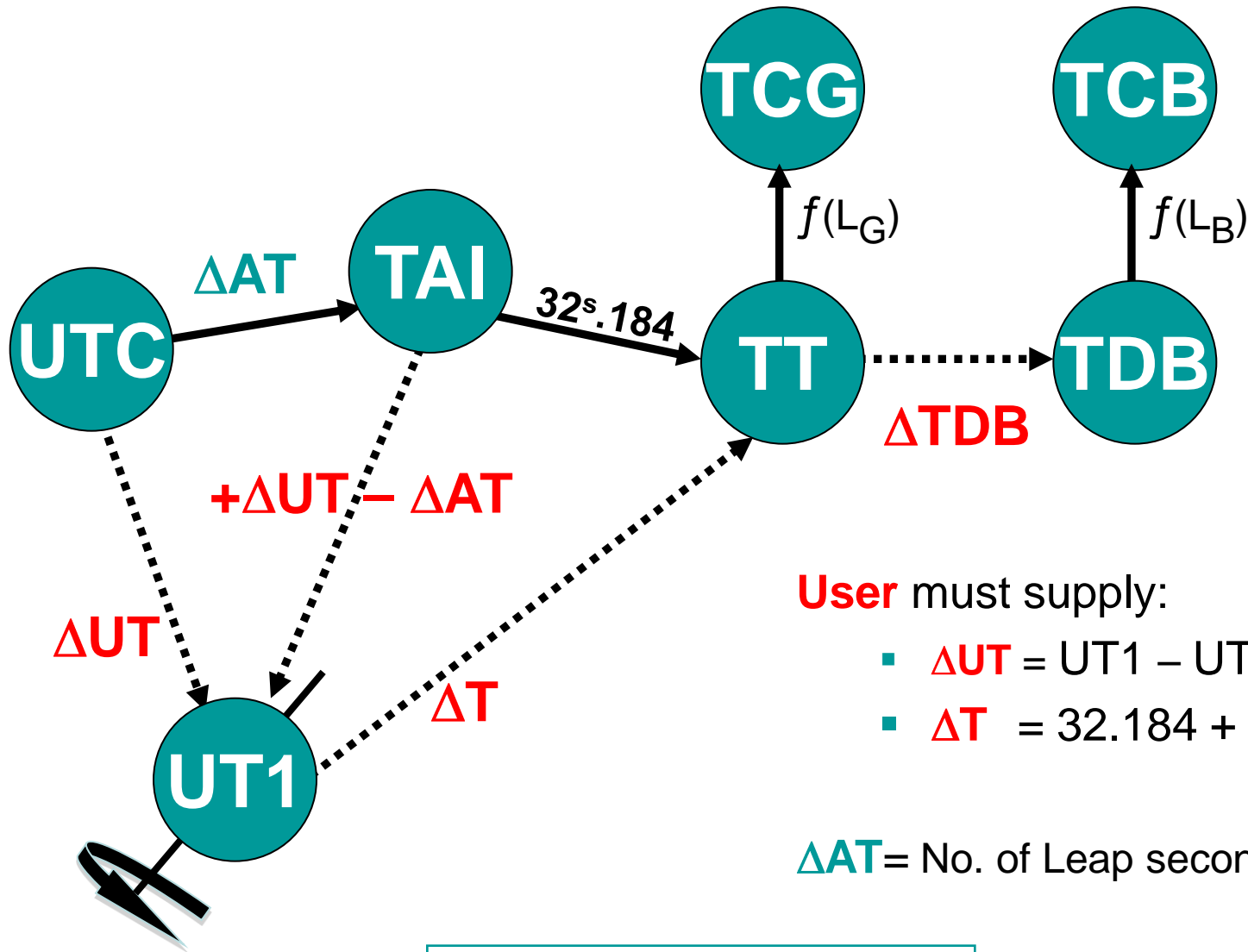
Canonical Total

- 0 : 7 Calendars
 - 16 : 20 **Timescales**
 - 10 : 15 Earth Rotation and Sidereal Time
 - 0 : 2 Ephemerides
 - 14 : 14 Fundamental Arguments
 - 3 : 5 **Geocentric/Geodetic Transformations**
 - 16 : 60 Precession/Nutation/Polar Motion
 - 0 : 8 Star Cat. Conversions & Space Motion
-
- 59 Canonical, 72 support Astronomy routines
 - 55 Vector/matrix & utility routines

SOFA: Geodetic ↔ Geocentric

- Standard reference ellipsoids
 - WGS 84
 - GRS 80
 - WGS 72
- User defined ellipsoid
- Geodetic \Rightarrow Geocentric
- Geocentric \Rightarrow Geodetic

SOFA's Time Scale Conversions



User must supply:

- $\Delta UT = UT1 - UTC$ (IERS)
- $\Delta T = 32.184 + \Delta AT - \Delta UT$

ΔAT = No. of Leap seconds

SOFA's Documentation

- **Manual** – ASCII & PDF
- **CookBooks**
 - *SOFA Tools for Earth Attitude*
 - CIO, CIP, X , Y , s , s'
 - Precession, Nutation, Polar motion
 - Earth Rotation Angle & Sidereal time
 - ***SOFA Time Scale & Calendar Tools***
 - TAI, UT1, UTC, TT, TCG, TCB, TDB
 - Civil Date, JD, h, m, s and Leap seconds
 - Versions for both Fortran and ANSI C



New

SOFA's Tools

- Build procedure
 - **make** file to install the library and for C the include files as well
- Validation programs
 - Fortran `t_sofa_f.for`
 - ANSI C `t_sofa_c.c`

Continuing Service for the Future

- Position within Division I
- Transformations:
 - BCRS to GCRS: aberration, light-deflection
 - Ecliptic/galactic coordinates
- Other algorithms?
- Maintaining SOFA
 - people, standards, technology, ...

Thank You

- Host institutions of the Board members
- The UKHO for hosting the SOFA website
- SOFA Board members
 - John Bangert
 - Steve Bell (Webmaster)
 - Mark Calabretta
 - Nicole Capitaine
 - Bill Folkner
 - George Hobbs
 - Jin Wen-Jing
 - Brian Luzum (IERS)
 - Zinovy Malkin
 - Jeffrey Percival
 - Patrick Wallace

And Finally

- Please tell your colleagues about SOFA
- If you use SOFA, please acknowledge your use
- Contact SOFA? Then contact me at:

sofa@ukho.gov.uk

❖ THANK YOU