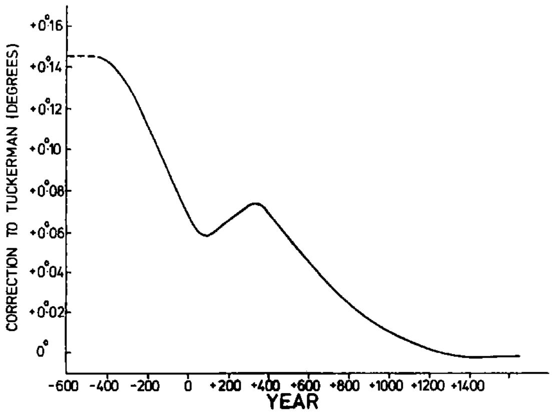

Fig 3. Mean corrections to Tuckerman's tabular longitudes of Saturn in order to obtain best agreement with longitudes computed from DE 102.

tudes to be corrected with errors as small as 0.03 deg at any time since about 300 BC. In earlier centuries the scatter of individual values becomes rather larger—approaching 0.1 deg—so that at this period only comparatively rough, but still useful estimates of the longitude of Saturn can be made from the tables.

OUTLINE OF THE PRESENT TABLES

In producing the present tables we have two main objectives—to make available revised positions for Mars throughout the period 601 BC to AD 1649 and to enable the apparent magnitude of each planet to be estimated at any time during this period.

Using the integrated ephemeris DE 102, we have computed the longitude and latitude of Mars to the nearest 0.01 deg at 10 day intervals for the same time of day as selected by Tuckerman (16 h UT). As a check on accuracy, we have compared a series of our calculated longitudes for the planet with those based on an orbital theory for Mars which until very recently was used in generating positions for the Astronomical Almanac. This is the theory of Newcomb (1898), with corrections derived by Ross (1917). Co-ordinates of Mars deduced from the Newcomb-Ross theory were kindly supplied by B. Emerson of the Royal Greenwich Observatory. The agreement between these and the equivalent DE 102 data is close to 0.01 deg as far back as 601 BC, sound evidence in favour of the reliability of our tabular data.

Brief remarks are needed on the question of the clock error ΔT. This arises from a gradual increase in the length of the day due to a combination of lunar and solar tides and other causes. From an extensive study of historical observations, mainly of eclipses and occultations, Stephenson and Morrison (1984) deduced revised expressions for ΔT. The difference between values calculated from these formulas and figures based on equation (1) above is less than one hour at all periods back to 601 BC, which is negligible for the present purpose. For consistency, in producing the present tables we have used equation (1) to calculate ΔT values.

We have taken the opportunity to increase the versatility of the present volume by including—at 10-day intervals—the apparent magnitudes of each of the five bright planets Mercury, Venus, Mars, Jupiter and Saturn. We ourselves have often felt the need for readily accessible data of this kind. The values tabulated here should be especially useful in the case of Mercury and Mars, both of which fluctuate in brightness to a considerable degree. In not much more than a month, the magnitude of Mercury can vary from about -1.5 at superior conjunction to fainter than $+3$ at inferior conjunction. Changes in the brightness of Mars are much slower, but between opposition and conjunction the magnitude varies from about -2 to $+2$. Both planets revolve in rather elliptical orbits. As a result, the actual range in magnitude for Mercury at superior conjunction is from -0.8 to -1.6 whereas for Mars at opposition the range is between -1.2 and -2.6. At a close opposition, Mars can thus briefly outshine Jupiter. The brightness of Venus, Jupiter and Saturn is relatively steady, seldom varying over a range of much more than about one magnitude. The main factor in the case of Saturn is the visibility of the ring system; due to the changes in the aspect of the rings, the opposition magnitude of this planet varies between about $+0.7$ and -0.3. In the tables we have computed the apparent magnitudes of the planets from the formulae derived by Müller (1893). These formulae, which are based on numerous observations, formed the basis of the data in the Astronomical Almanac until 1983. The differences between these and the newer formulae employed—due to Harris (1961)—are trivial for all practical purposes.

USE OF TABLES

The accompanying pages of tables normally carry four years of data, the only exception being for the first page, covering -600 and -599 (i.e. 601 and 600 BC). This format has been chosen for convenience so that a typical single page of the present volume will correspond to an open double page of Tuckerman. Our tables actually extend to A. D. 1651, rather than 1649. Column by column for each year we have: (i) the ecliptical longitude of Mars; (ii) the latitude of the planet; (iii) the apparent magnitude of Mars; (iv) the longitude of the Sun – given for reference; (v) the Julian Calendar date; (vi) to (ix) the apparent magnitudes of Mercury, Venus, Jupiter and Saturn.

Interpolation of the magnitude data should be accurate except in the rare instances for Mercury and Venus when these planets pass very close to the Sun at inferior conjunction – a transit across the solar disc being an extreme example.

The planetary symbols appearing at the top of the tables are:

♂ Mars	♀ Venus
☉ Sun	♃ Jupiter
☿ Mercury	♄ Saturn

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