Contents of Bulletin 96, January 2008

The participants assembled in the former third class waiting room (now a tea-room) in the Haarlem railway station. After coffee and various cakes, pies, pasties and tarts, the trek began. Leaving the station, we would have seen the Haarlem-6 baluster, had it not been stolen shortly after its restoration in 1982. First stop was the Teyler's Hofje with its twin south-west (just then being painted) and north-east declining verticals on opposite sides of the court. Their setting is somewhat deep, and there is a short period when both dials are in shadow. – The next dial was the wooden west declining vertical dial of the Wilhelm van Heythuysen Hofje. While there, we returned its gnomon into service. – Then on to Angers Lane, where there is a 2m square, 25cm thick, slate horizontal dial remembering the 'twinning' of Haarlem, Angers and Osnabrück. The gnomon is missing. – Assumburg Hall has a vertical dial on the former orangery. Hour lines and numerals are engraved into the white marble, but not coloured, making the sundial difficult to read. – Passing the wooden Bloemendaal-1 on the church, we went to have lunch at Vreeburg's. Over its entrance is a modern, colourful vertical dial, with the motto: the host is to his guests what the sun is to the earth. – Private houses visited were The Three Peats, with a west declining wooden sundial in a carved wooden frame; Under the Beeches, with a vertical dial from glazed tiles; Le Tigre, with a mosaic vertical dial; and "the House with the statues", with a "Haarlem-3" double armillary. We also visited the Franciscan convent Alverna, where a once vertical sundial is now lying in a flowerbed.

Attendance: twenty. Chairman De Groot welcomes a new member. – Bote Holman received a special mention reference at the tenth Shadows of Time contest. – This year is the thirtieth anniversary of the Zonnewijzerkring. – Gemert Castle is about to be renovated. It should be pointed out to the new property developer that the "tacks" equation of time loop is valuable. – The Hagen legacy has found a suitable temporary shelter. Spruyt is looking at museums and universities. Maes notes that transference may be the way to accessibility. – There are also secretarial archives and some boxes of slides to take care of. – Van der Hoeven has some ideas about the Literature section of the Bulletin.

Louwman found photos of the 1996 Rupelmonde excursion. – Coenen visited the Amsterdam Buikslotermeerplein, where once there was a terrace dial. He plans to talk to the district council about placing it back. – Maes composed an Amsterdam sundial walk and placed it on his web site. – Maes is investigating the Paintshop Pro perspective tool, which he finds introduces some proportion error. – De Vries shows photos of a winter sun arc and a take from a TV science quiz (featuring committee member Hooijenga) showing a hâfir taken from the Zonnewijzerkring site. Also one of a granite sundial which he helped design. – Hollander shows the Art Agenda 2008, which has a sundial on the front that *he* helped design; and the Dutch Met Office Christmas gift: a Hollander spider dial.

The self-guided tours of the Tourist Office rarely mention sundials. Some books and internet sites do; *Sundials on the Internet* has a number of *sundial trails*. Maes decided to make one for Amsterdam. It is on his web site. Eight sundials are visible from the public road. Eight more may be seen, sometimes only during office hours, but mostly free of charge. Among these last are the block dial from Oenkerk and the modern sundial by member Taudin Chabot in the Artis planetarium. The Amsterdam Sundial Trail starts and ends at the railway central station, and the description may be conveniently printed for en route use, with or without photographs.

The article is in English.

Miscellanea *Editors* *12*

NASS conference, August 2008; Belgian sundials on the net; Suncycle program.

Winners of the Xth "Shadows of Time" contest *H.J. Hollander* *13*

The article is in English.

Cadran-Info nr. 15 *A. van der Hoeven* *14*

A very detailed description of the contents of this CD-ROM based magazine.

Sundial with spherical gnomon (2) *F.J. de Vries* *16*

De Vries designed a garden tabletop sundial with a spherical gnomon. Starting from the size of the billiard-ball gnomon, the procedure was mainly as follows: Construct all hour lines for which a side of the shadow-ellipse is a reading point; construct solstice date points on the hour lines to find their correct length; calculate the requested special date curve for which the tip of the shadow-ellipse is the reading point; add numerals and text. It was instructive to do this exercise; however, there arose a minor complication: could the pattern be on the bottom of the glass, please.
This would place the ball over the dial instead of on it, and refraction would distort the hour lines and date curve. A new construction should be possible, but finding it would be time-consuming. Fer chose instead to find equations that calculate the lines point by point.
The solution is found in steps.
First, the pattern for the upper surface: Hour planes are chosen so that they tough the spherical gnomon. Where the hour plane intersects the surface is the corresponding hour line for that hour. – The point of contact between hour plane and sphere is regarded as the top of a gnomon. Every hour has its own gnomon. So: for each hour line, determine its gnomon; for every solar declination determine the shadow of its top; check whether the shadow point is real; draw the hour curve through all the real points.
This method automatically gives the correct curve lengths.
Next, the effect of the refracted rays is added: we consider the found points as the tops of so many auxiliary gnomons, standing on the bottom of the glass plate. An additional routine calculates the new direction of the ray in the glass. This will finally give us the corresponding points on the bottom of the glass.
With the glass thickness of 10mm (3/8") the distortion and shift are not all that large, but they are clearly visible in the overlay figure.

A tube of dentifrice and a spectacle-glass *J.A.F. de Rijk* *19*

De Rijk describes his first telescope. It consisted of a 1-meter focus spectacle-glass, held in place on the window ledge in a fold of a squeezed-out toothpaste tube, while the author crawled about the floor with a magnifier by way of eyepiece. It was worth it when he got the moon in view. Later, he would still lean almost-finished objective mirrors against a tree, eyeglass in hand, to look at the moon: another one ground and working! The toothpaste telescope emotion was repeated when De Rijk photographed the hydrogen spectrum of Sirius for the first time: using a large prism, taped in front of the camera lens.

Approximation for the equation of time (part 2) *F.H. Fockens* *20*

Part 1 explained how the non-circularity of the orbit of the earth causes part of the equation of time: 7.64 minutes. There must however be an additional cause, accounting for the remainder of the total of over fifteen minutes that the equation may amount to. Part 2 investigates.
The ecliptic and the celestial equator are great circles on the celestial sphere. One degree of arc along either represents equal lengths. While the mean sun proceeds one degree per day along the equator, so does the real sun along the ecliptic (remember we had divided the year into 360 days).
The ecliptic and equatorial planes intersect at an angle (called the obliquity of the

ecliptic) of 23.5 degrees. So do the tangents to the ecliptic and equator on the equinoxes, where the Sun passes the equator. Away from the equinoxes, this angle is smaller, the tangents being parallel on the solstices.
Fig 7 describes the situation on the vernal equinox. The mean and real suns are in L. One mean solar day later, that is one sidereal day plus four minutes later, the mean sun is again on the same point on the horizon, in B'. It has proceeded one degree along the equator. Meanwhile, the real sun has proceeded one degree along the ecliptic and is now in B. It was, however, over the same spot on the horizon not after one sidereal day plus four minutes, but already after one sidereal day plus (1-COS 23.5 degrees) times four minutes. The apparent solar day on the vernal equinox is therefore 19.9 seconds shorter than the mean solar day. The same goes for the autumnal equinox.
On the solstices, the apparent solar days are longer than the mean solar days; see Fig 8. Using analogue reasoning, we find a difference of 21.7 seconds. Averaging, we say that the obliquity of the ecliptic causes a Δday_s of 20.8 seconds (the suffix s is from *scheefte*, meaning obliquity). The effect is marked in Fig 9a with 'x'-es indicating maximum lengthening and shortening, and the zeroes between solstices and equinoxes. Summing over the first 45 days from 22 December, we arrive at an amplitude of 9.93 minutes for this part of the equation of time, and a formula for E_s, see Fig 9b.
With o for *onrondheid*, non-circularity (see part 1), we get $\Delta day = \Delta day_o + \Delta day_s$, and $E = E_o + E_s$. Adjusting time for the zeroes in both parts of E, we get equations 7 and 8 and Fig 10.
The extremes for E occur when Δday is zero. The apparent solar day is 24.00 hours and the tangent to the figure-of-eight loop is vertical. Maximum E is +16.5 minutes, when lambda is 298 degrees. From Fig 1 we see that this should be 3 November. Checking our simplified formula, replacing 360 degrees by 365.25 days, we get 1 November, only two days off. Our simplified EOT is just under two seconds off.
We may also note that the natural day – from sunrise to sunrise – of 24 December is the longest of the year, with almost half a minute over 24 hours.
Substituting days for degrees, the author finally gives equation 9. A final caveat, he reminds us that he sought to explain the relation between non-circularity and obliquity, and the equation of time, not to calculate it precisely (see literature (3) for precision).
The postscript derives Keplers law of equal areas from the conservation of angular momentum.

Restoration of the Snellegem sundial *E. Daled* *27*

Although the Snellegem Enigma (what did this dial look like when it was in one piece?) was solved in 2002, restoration had to wait for a long time. Now, it is finally completed. Pieter Boudens, an accomplished sculptor, did the work. The sundial is on display in Jabbeke City Hall. Check www.gnomonica.be for a recent photograph of the Snellegem dial.

Vanished sundials *F.W. Maes* *28*

The Dutch Sundial Society religiously keeps track of which sundials are discovered or newly made, but – so far – not of which ones have disappeared for whatever reason. This new section proposes to remedy that. To start with, the sundials mentioned here have vanished. They are not stored, or being repaired – they are missing.

What was the intention of Vitruvius' Analemma? *A.M. Griffiths* *30*

All known manuscripts on Vitruvius' Analemma are, to some extent, imperfect. Texts have frequently been adapted and interpreted, possibly to the point of changing the original intentions. A striking example is the fact that most commentators have concluded that Vitruvius mistakenly transposed the winter and summer parts of his Analemma. In the present paper, Griffiths intends to prove that there was no mistake; Vitruvius' description did reflect his intentions and modern authors simply did not understand him. He uses the Latin text from Soubiran's 'consensus of all, or most, codices'.
The four main points are: letter placement in the figure; transposition of summer and

winter parts; location and meaning of the *locothomus;* construction of the *maneus*. Soubiran thinks that the upper diameter should represent the summer part, the lower the winter part. Apparently, he sees the Analemma as an image of the paths of the Sun on the celestial sphere, and also as a template, an *épure*, for various kinds of sundials, including horizontal dials. Griffiths feels that Vitruvius' description was in fact correct, and that the Analemma is not a general sundial construction template, nor an orthographic projection of the solar path in the sky, nor a mathematical instrument to indicate the altitude of the sun. It *is* a template, but for a specific sundial: the well-known hemispherical *polos*, or *skaphe*. He demonstrates this idea in Fig 7.
Soubiran himself said that Vitruvius' definition of the Analemma most closely matches the polos sundial, but he did not accept the idea that is was restricted to it.
The *manaeus*, or circle of months, would actually have been drawn on the bottom of the hemisphere. Its size would then be correct: in reality, not in the drawing.
Griffith sums up: Vitruvius' Analemma was a template for the construction of one specific sundial, a *polos*; it was not an abstract depiction of the sun's path on the celestial sphere, to be used in the construction of various types of sundial. That interpretation was added later.

The Frans Loenen Hofje Sundial *'Hofjeskrant'* *40*

The Frans Loenen 'hofje' (court) is four hundred years old (1607-2007). On this occasion, the governors had a sundial made. The sundial is on the neighbouring church.
On the dial is the hofje's emblem, a beheaded lion, and a motto: Bene Vixit Qui Bene Latuit, meaning: One who lives unnoticed, lives well (Ovid).
There is a date curve for 24 October, the dying day of Frans van Loenen, after whom the hofje is named. A 'K' is the sponsor's initial.
Hendrik Hollander made this dial from satin-finish granite, after a 1984 sketch by Maarten Poldermans. The lines and numerals are gilt; so is the pole style, but by Gerrit Sasbrink. Surveyor Wim Kleinhout helped determine the wall declination.

Hora Naturalis: Antique Hour or Planetary Hour? *F.J. de Vries* *42*

Around 1230, Sacrobosco wrote: the natural hour, *Hora Naturalis*, is the space of time wherein half of a sign [of the ecliptic] rises. The impression exists that not all writers who used the term knew what it meant. The oldest image of a sundial using the system is one from 1925 by Drecker. – The figures in the present paper explain this hour system, using an astrolabe. We find that the natural hour varies in length, not just through the year, but also through the day. Even so, a sundial pattern is possible; here, it is split in two; one for lengthening days, the other for shortening days. It is unlikely that the system found practical use, but it is found in literature. Finé (1555) gives a correct table.
Antique hours were based on the division of the sun's diurnal arc. They were also often referred to as *Planetary* hours. Drecker protested against this, saying that planetary hours were in fact natural hours. His argument was that there are two natural great circles that are suitable for use in a time system: the equator and the ecliptic. The first gives us the modern solar hour, the second the Sacrobosco natural hour. In contrast to this, the diurnal arc of the antique hours is not a great circle, and therefore not natural. In addition, all the planets are quite close to the ecliptic, but have nothing to do with the diurnal arc of the sun. Therefore, according to Drecker, a planetary hour should be identified with the *hora naturalis*. De Vries says in conclusion that he tends to side with Drecker: planetary hours are not natural hours.

Computer analysis of the Vijversburg sundial *F.W. Maes* *48*

A common puzzle is to find the originally intended location for a sundial. Its solution (which is that the tangent of the angle between the noon and three-o-clock lines equals the cosine or sine of the latitude, for a direct south vertical or a horizontal sundial, respectively) supposes that the dial pattern is exact – but in practice, this need not always be the case. The Vijversburg dial is an example.
Presumably, it came from Toutenburg House, which was built around 1525 and torn down around 1860. Its motto, "Time is brief and irreversible", and the top and side

ornaments are newer. The style triangle was quite thin and far too large. On the left half of the dial there were seven date curves, on the right half six. They were rather irregularly done, and the same was true of the rest of the pattern. Maes wished to check the entire pattern and find out to what extent and for what latitude it was correct.
He scanned a conventional photograph, and traced the hour lines and date curves in *Paintshop Pro*. Then, he generated sundial patterns for several latitudes, using François Blateryron's *Shadows* package, for comparison against the traced pattern.
Reference points were the intersection of the noon line and the 6-18 hours line, and that of the noon line and the equinox line, both being reasonably well defined.
Fig 4 shows the patterns. The best fit occurred at 51 degrees latitude for the hour lines, but at 53 degrees for the date curves. Now, Georg Schenk, the builder of Toutenburg, which is at about 53 degrees latitude, originally came from Tautenburg, Thüringen, which is at about 51 degrees latitude. One wonders if the sundial, or its recipe, came from Thüringen and was adapted somewhat maladroitly to its new location.
Based on the above findings, a new gnomon was made for its actual location, and the date curves for Capricorn, Sagittarius and Aquarius adjusted. Subsequently the dial was handsomely repainted and gilt.
Not only should one always be aware of the possibility of errors in one or more hour lines, but digital image processing is not without its own perils, either. The author's scanner had a 1.7% difference between vertical and horizontal. Then again, a digital camera checked square; however, that may not be guaranteed in a specific case.

Sundials in The Netherlands *A.G.M. Bron* *52*

All the sundials in this instalment are in the province of Friesland.
Marssum 01, Popta Hall. English bronze horizontal dial, 256 mm (10") diameter, on a pillar with floral designs on the square top. Height: 1.27 m (4'). Apparent solar time, Roman numerals IIII to VIII. Good condition.
Heerenveen 01, Voormeer House. Armillary sphere, 'Haarlem' type; 57 cm (22") diameter, total height 1.58 m (5'). Roman numerals and quarter hour marks. North and south arctic circles, solstices, ecliptic. Pathetic condition, probably beyond repair.
Joure 01. Vertical nodus dial, 47 cm x 120 cm (1.5' x 4'). Roman numerals XI to VII for standard time MET*, Arabic 12 to 8 for summer time MEST*. Date curves per month. By Hans Noordman of Sneek. From 2002, excellent condition.
Langweer 01, Osinga Hall. Bluestone vertical dial, 65 cm x 60 cm (2' x 2'). Roman numerals, VI to XVI. Shorter half-hour lines. By Th. Van Rhijn. From 1994, excellent condition. The ball on the end of the gnomon is for ornamental purposes only.
Koufurderrige 01. Trespa® vertical nearly-east node dial, 50 cm x 64 cm (1.5' x 2'). Stainless steel gnomon with round top. Arabic numerals, 4 to 9 for standard time MET*, 5 to 13 for summer time MEST*. Solstices, equinox, horizon. By Th. Van Rhijn. Well-maintained, and no signs of wear.
