The adoption of a Prime Meridian and the International Meridian Conference of 1884

In the beginning

Although latitude has always been measured from the Equator, there is no equivalent point from which to measure longitude. Over the years, it has been measured from many different places, including national observatories, the island of Hierro in the Canaries and St Paul's Cathedral in London – each country having chosen for itself where to measure from.

Calls for unification

The start of the nineteenth saw calls for unification and the adoption of a single common meridian. But the problem was not one of geographical location alone; it was also linked to the measurement of time. To rationalise one, would require the rationalisation of the other.

The first rationalisation of time

The introduction of the Nautical Almanac in 1767 had required sailors to make use of astronomical time, where the day was reckoned from noon, beginning twelve hours after the start of the civil day. Until then, sailors had used the civil day along with the nautical day. The nautical day also began at noon, but started twelve hours earlier than the civil day. The potential for confusion because of the similarity between astronomical and nautical days was much reduced when on 11 October 1805; the British Admiralty issued an order to end the use of the nautical day. A similar change was made in America in 1848.

The coming of the trains

It was the emergence of new technologies, in particular the railways in the 1830s, that forced a wider reform of the time system, and with it the adoption of a single Prime Meridian. Whilst local time had sufficed in the age of the horse drawn carriage, it was inappropriate for the railways.

When it was midday local time in Bristol for example, it was already ten past twelve in London some 100 miles to the east. In order to make the timetable workable, instead of using local times, the railway companies introduced a single standard time across their network. In mainland Britain, this was Greenwich Mean Time – a time that was chosen because time signals were available directly from the Royal Observatory at Greenwich via the electric telegraph. In mainland Britain however, the time difference between the most easterly and westerly points is only about 30 minutes – significantly less than the four hours on mainland USA.

Reform in North America

It was the large number of different time systems that had evolved on the North American railways that lead to further reform and the adoption of time zones on that continent. The need for change was first mooted by Charles Dowd in 1870 and taken up in earnest by the railway engineer Sandford Fleming. Cleveland Abbe, a sometime astronomer and government meteorologist and geophysicist also became a keen advocate for reform when he discovered a large set of observations of the northern lights could not be reconciled due not only to the multiplicity of times being used by those who had observed them, but also the inconsistency in their application. It was William F Allen, editor of the *Traveller's Official Guide* and secretary of the railroad industry's General Time Convention (a group set up to harmonise train schedules), who turned talk into action, and brokered the move to a simplified time system. On 18 November 1883, at noon on the 75th Meridian, the North American railways switched over. Many cities quickly followed suit, leading to the rapid establishment of five, one-hour wide time zones across the continent.

The first scientific study

Meanwhile, back in 1870, Otto Struve, the Director of the Pulkova Observatory had presented a study of five meridians to the Geographical Society of Russia – three that were in common use Greenwich, Paris and Hierro (defined as 20° W of the meridian of Paris) along with Greenwich + 30° (W) and the Greenwich antemeridian (Greenwich + 180°). Struve's study looked not only at the needs of geographers but also of navigators and astronomers. His preferred meridian was Greenwich, but he was only too aware of the likely objections from those in other countries unable or unwilling to relinquish their national meridians. As Ian Bartky puts it in his book One Time Fits All, Struve's study 'can be considered the first salvo in what turned out to be a half century of skirmishes aimed at having the world adopt Greenwich as the common meridian for longitudes'.

Greenwich – a pragmatic choice?

By 1879, little had changed in either Europe or North America. It was in that year, that Fleming published his paper: *Time-Reckoning and the selection of a prime meridian to be common to all nations*. In it, he presented a table 'prepared from the latest authorities within reach', in which he gave 'an estimate of the number and tonnage of steamers and sailing ships belonging to the several nations of the world' along with the meridians which they used for determining their longitude. 95.5% of the World's ships (97.5% by tonnage) were found to be using eleven main meridians (illustrated right). Of the top three, the Greenwich meridian was being used by 65% of ships (72% by tonnage), Paris by 10% (8% by tonnage) and Cadiz by 5% (3% by tonnage). In terms of economics, alone, the case for Greenwich was compelling.

Fleming retired from the railways in 1880 and began to devote more of his time to timekeeping issues. He was present at the Third International Geographical Congress which took place in Venice in 1881, where he presented a further paper on the matter.

Preparing the ground

With reform in the air, an enabling act was passed in the United States in August 1882 that authorised the President 'to call an International Conference to fix on and recommend for universal

adoption a common prime meridian, to be used in the reckoning of longitude and in the regulation of time throughout the world'. But the time was not yet right for the Conference itself to be called.

The Rome Conference of 1883

Instead, the various arguments were ventilated once again at the International Geodetic Association conference in Rome in October 1883. Of the various resolutions passed, two are cited below:

'The conference proposes to the Governments to select for the initial meridian that of Greenwich ... for the reason that that meridian fulfils ... all the conditions wished for by science and because being at present the best known of all, it offers the most chances of being generally accepted'.

'The Conference hopes that if the entire world ... [accepts] the meridian of Greenwich ... Great Britain will find in this fact ... a new step in favour of the unification of weights and measures, by acceding to the Convention du Mètre of the 20th [of] May, 1875'.

Chester Arthur and the beginning of the end

It was just a few weeks after the Rome Conference that the North American railways enacted their switch to standard time. By the end of the next fortnight, Chester Arthur, the 21st president of the United States had decided that the time was right to issue the invitations to what is now known as the International Meridian conference. The conference took place in October 1884 and was attended by 41 delegates from 25 nations. The write up of the proceedings was published in three different versions – separate English and French versions (links below) and a version in both languages that was produced for the House of Representatives.

The Resolutions of the International Meridian Conference

In all, seven resolutions were passed:

1. That it is the opinion of this Congress that it is desirable to adopt a single prime meridian for all nations, in place of the multiplicity of initial meridians which now exist.

2. That the Conference proposes to the Governments here represented the adoption of the meridian passing through the centre of the transit instrument at the Observatory of Greenwich as the initial meridian for longitude.

3. That from this meridian longitude shall be counted in two directions up to 180 degrees, east longitude being plus and west longitude minus.

4. That the Conference proposes the adoption of a universal day for all purposes for which it may be found convenient, and which shall not interfere with the use of local or other standard time where desirable.

5. That this universal day is to be a mean solar day; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that meridian; and is to be counted from zero up to twenty-four hours.

6. That the Conference expresses the hope that as soon as may be practicable the astronomical and nautical days will be arranged everywhere to begin at mean midnight.

7. That the Conference expresses the hope that the technical studies designed to regulate and extend the application of the decimal system to the division of angular space and of time shall be resumed, so as to permit the extension of this application to all cases in which it presents real advantages.

What the conference did not do was recommend a global system of time zones. The American journal Science commented ‘It seems unfortunate that Mr. Allen’s resolution for local times, differing by whole hours from the universal time, was not recommended; for this would seem by all odds the simplest way of connecting local and universal times. It is already in almost universal use in this country’. Our global system of time zones emerged largely by default as one by one different countries chose to adopt a standard time based not on their capital city or national observatory, but one that was generally a whole number of hours ahead or behind Universal Time.

The International Meridian Conference delegates. Image courtesy of Architekturmuseum der Technischen Universität Berlin Inv. Nr. F 8253 (see below)

Enacting the resolutions

The resolutions from the conference were only proposals – it was up to the respective governments to show political will and implement them ... and progress was slow ... very slow. Resolution six was particularly problematic – not because of the nautical day (which had been dealt with before and was easy to change), but because of the implications of changing the astronomical day. Changing it would take a great deal of coordination if confusion and misunderstandings were to be avoided as Samuel Franklin the man in charge of the Naval Observatory in the United States was soon to discover. The order he issued on 4 December 1884 for the changes to be introduced from 1 January had to be rapidly rescinded, following his failure to properly anticipate the practical implications of so sudden a change. William Christie his opposite number at Greenwich was rather more circumspect. He made only a symbolic gesture, which included altering the Observatory’s public clock with its 24-hour dial. From 1 January 1885, instead of showing astronomical time as it had in the past, it was set to show civil time – a change that involved moving the hour hand half way around the dial. The two pictures below were both taken in the hour before midday. The one on the left dates from about 1870 and shows a time on the clock of 23.20. The one on the right was taken soon after the changeover and shows a time of 11.50.

Throughout the 1880s, the only country to do anything really concrete was Japan, which legislated in 1886 and formally adopted the Greenwich Meridian and a standard time nine hours in advance of Greenwich at the start of 1888. At the Fifth International Geographical Congress in 1891, the Indian Government delegate lamented the lack of progress stating:

The meridian question ... has certainly advanced far enough that all English maps should possess a common origin for longitude. At present this is not so, for maps of India ... are published with a different longitude ... from the true Greenwich value ... a continuance of the present system is a grave disadvantage if we wish to persuade other nations to adopt Greenwich as the longitude of origin.

A new technology signals change

Attempts to get agreement on changing the astronomical day continued to go nowhere. But in the same way that the coming of the railways had heralded changes to national timekeeping, it was the arrival of wireless telegraphy with its potential to widely disseminate time signals that gave the impetus that was to lead to global uniformity. And France was in the vanguard of change, establishing a transmitter on the Eiffel Tower and a leadership role for itself from the first. And if it wanted to lead, it had to conform and transmit time signals in Greenwich time rather than Paris time. With neither fanfare nor ceremony, France adopted Greenwich Mean Time as its civil time on 11 March 1911, referring to it as ‘the mean time of Paris retarded nine minutes and 21 seconds’. At this point, although France still declined to adopt the Greenwich Meridian; the seeds for change had already been sown. The Bureau des Longitudes had expressed a desire to find a way of increasing the number of stars covered in its annual publications without increasing the cost. This it was thought might best be done by a change in working practices. Instead of different observatories around the world producing their own sets of what were often similar if not identical tables, something that involved extensive duplication of time consuming calculations, could the work load not be spread between them and the results shared? But to do this, the astronomers would need to work to a common set of standards, which included the calculations being based on just a single meridian using a single time system. When the International Congress on Astronomical Ephemeredes met for the first time in Paris on 23 October 1911, the use of the Greenwich Meridian was unanimously agreed. However, the French astronomers had no jurisdiction over the publication of France’s hydrographic charts and could not themselves order a change in the meridian on which they were based.

The sinking or the *Titanic*

Within months of the Congress in Paris, the *Titanic* had struck an iceberg, and sunk with enormous loss of life. At the subsequent enquiry, the potential for confusion became apparent for all to see, when it was revealed that the telegram sent from the French vessel *La Touraine* to the *Titanic* giving the locations of various ice fields and icebergs gave the times in terms of the Greenwich Meridian, but the longitudes in terms of the Paris one. Although there was no suggestion that this was why the *Titanic* had struck the iceberg, it undoubtedly struck a chord. The Portuguese adopted the Greenwich Meridian in 1913 and the French on all their nautical documents with effect from 1 January 1914. Finally the point had been reached where all the maritime nations of Europe were using the same meridian.

The final abolition of the astronomical day

The problem of the astronomical day was eventually resolved as well. Its fate was effectively sealed in 1918, when the Council of the Royal Astronomical Society reported in favour of change, recommending that it should be introduced into the Nautical Almanac with effect from

1 January 1925. The strict meaning of Greenwich Mean Time changed with it, for up until then, it had been reckoned in terms of astronomical rather than civil time.

The anniversaries and myth making

Despite the fact that it was only a milestone on the way, the conference of 1884 has become regarded as the moment when the Prime Meridian came into being. As such, its centenary was celebrated in 1984 and its 125th anniversary in 2009. How this myth came about is unclear, but it may have its origins in an article published in the 1890s by E Walter Maunder, a much-respected member of the Observatory's staff. Meanwhile, the National Maritime Museum – the present custodian of the Observatory, continues to spin it.

Further Reading and links

The 1884 Conference

The proceedings – English edition (text file)
The proceedings – English edition (non searchable pdf)
The proceedings – French Edition (various formats)

Contemporary news reports (pdfs)

Interview with delegates (7 Oct)
Delegates pay respects to President (16 Oct)

Others

Convention du Mètre
Unification of the astronomical, civil and nautical days (1894)
Notes on wireless time (1912)
The Beginning of the Astronomical Day (1918 report)

Books

Bartky, Ian R. *One Time Fits All: The Campaigns for Global Uniformity*. Stanford, Calif: Stanford University Press, 2007.

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The image of the delegates at the International Meridian Conference is reproduced courtesy of Architekturmuseum der Technischen Universität Berlin. It has been cropped and compressed from the original jpeg file. The orginal can be accessed via the link below:

Architekturmuseum der Technischen Universität Berlin Inv. Nr. F 8253.