

Brief History of the Bureau des Longitudes

After hearing a report read by the abbé Grégoire, the Bureau des Longitudes was created by a law of the National Convention of the 7 messidor year III (June 25 1795). The purpose was to reassume "the mastery of the seas from the English", through the improvement of the determination of longitudes at sea. Charged with the compilation of Knowledge of the Times and perfecting the astronomical tables, he had responsibility for the Paris observatory, the observatory of the Military school and all the astronomy instruments that belonged to the Nation. The ten founding members had been: Lagrange, Laplace, Lalande, Delambre, Méchain, Cassini, Bougainville, Borda, Buache and Caroché.

It was charged, by the decree of January 30 1854 with a larger mission bringing to it, in addition realization of the ephemerides by its "Calculations Service" created in 1802, to organize several big scientific expeditions: geodetic measurements, observation of solar eclipses, observation of the passage of Venus in front of the Sun, works that were published in the Annals of the Bureau des Longitudes. It participated equally in the foundation of several scientific organisations such as the International Office of Time (1919), the Group of Researches of Spatial Géodésie (1971) and the International Earth Rotation Service (1988).

Law of the year III and Regulations

FOUNDATION OF THE OFFICE OF THE LONGITUDES

Report made to the National Convention in its meeting of the 7 messidor year III (June 25 1795), by the Representative of the People GRÉGOIRE, on the establishment of the Office of the Longitudes.

I come, in the name of your Navy Committees, Finances and of public instruction, to propose to you the establishment of an Office of the Longitudes.

Setting out the reasons that motivate this request, will establish the indispensable necessity of this action for our Navy to flourish.

Themistocles said: "Whoever is master of the sea, is also master of the land."

One of our poets expressed the same idea in his own way by saying:

"The trident of Neptune is the sceptre of the world".

The successes of the English in various eras, and specially in the war of 1761, have proved only too well that the superiority of the navy often decides the results of the war.

One of the more effective measures to stifle British tyranny is to compete in the use of the means by which

this State, that once played only a secondary role in the political order, has become a colossal power.

Now the English, well convinced that without Astronomy there was no commerce or navy, made incredible expenditures to push this science towards the point of perfection.

If I had to recall all the benefits of astronomy, I would say that, without it, men never would have had the true measure of time. Even the ignorant know that the exactness of the calendar results from more profound observations of the state of the sky -

Astronomy unravelled the chaos of earlier ages; without it, several former writers would have been incomprehensible. One knows how useful it was in verifying dates, one of the better works of our century, and by which Pingré clarified history by the chronology of the eclipse, based on the invariable movement of celestial bodies.

Next to the Halle-au-Bled covered market, another monument exists; it testifies to the superstition of a woman who believed in astrology and who did not believe in virtue.

Meteors, the aurora borealis and comets preserved, almost until the present time, the capacity to frighten the earth.

The efforts of Bayle and of other philosophers, to heal these diseases of the human spirit, rendered a not insignificant service to society, if one considers how important it is to growing out of childhood, and how much the astrological events influenced development of nations.

Ultimately, without astronomy, Geography would still be in its infancy; this is because by comparing the celestial observations, made on various degrees of the meridian, one could determine the shape of the Earth and reveal the true system of the world.

But the view point which it is important for us to consider especially is the influence of astronomy on the navy and commerce, which made the glory and the wealth of the Phoenicians, of Rhodes and of Carthage. With its help, the merchant fleets of d'Asiongaber sailed to Ophyr. Hannon, in a journey of twenty-six days, pushed

even towards Senegal, and commanded his voyage in Périple, of which it we only summarise.

An astronomer who was the first to distinguish climates by the different lengths of the days and nights, and who was the boldest navigator of antiquity, had been born among us.

Twenty-two centuries ago Pythéas (of Marseilles) passed the straits of Gibraltar, and sailed as far as Ireland; in a second voyage, he entered the English Channel, passed the Sund and entered the Baltic.

Nevertheless, the most famous sailors of antiquity were nothing more than excellent coasters, because the ambition of the enterprise was restricted by their limited astronomical knowledge: they did not dare to lose sight the coasts. The waters of the Atlantic Ocean and the Pacific Ocean had not been visited by the floating castles until the era when, by means of the compass and astronomical observations, Pythéas adventuring again into the open sea, rounded the cape of the Storms, and opened the sea lanes to commerce. Then the natural and industrial efforts of all the countries around the globe; then broadening horizons of thought, a big was step made for general civilization. Again branches of the human family aspired to know itself; they began to spread, towards one another, the arms of brotherhood, and in the communications of a reciprocal friendship, draw new happiness.

But the declination of a magnetized needle varies, as everyone knows, at different places and times, and relying on magnetic maps will never be enough. The compass or the log do not show if the progress of the vessel has been accelerated or delayed, if it was diverted by the drift or by some current. With these instruments, the navigator cannot use astronomy; astronomy is absolutely impossible with them. The discovery of the satellites of Jupiter, in perfecting the naval charts, was enough to produce a revolution in the human spirit and in the commercial and diplomatic relations.

The more important discovery, that had first been considered as a chimera, and that greatly exercised the mathematicians of the two last centuries, is the determination of the longitudes at sea. The problem is this: knowing the time on the vessel, find the time on the first suitable meridian, or place of the departure; the difference of the reduced times away from the equator

gives the longitude of the vessel, while retrieving the chosen meridian for terms of comparison. One hour measures fifteen degrees on the equator, and consequently four minutes for a degree.

This problem was the object of the meditations and researches of a celebrated Society, through which the works became the property of all the enlightened peoples, the Académie des Sciences de Paris.

Almost all the nations that used the sea, opened competitions relating to longitude, but nothing equalled that of England in this respect.

In 1714, in London, a committee was formed in which Newton was numbered together with the greatest men of that country. This is where, according to Fleurieu, that the limits of the error were fixed; and according to the deliberation of the committee, Parliament passed a solemn bill to invite the scholars and the artists of all the nations to take care of the problem of the longitudes: a prize of twenty thousand sterling pounds was proposed for whoever would find the longitude to a half degree.

Considerable lesser sums would be assigned for solar and lunar tables, and for less important discoveries.

While horology, mechanics, geometry and astronomy all competed to resolve this problem, each earned rights to the gratitude of the nations. While astronomy perfected its methods to measure the distances of the Moon to the Sun and to the stars, which gives the difference of the meridians, horology produced naval watches, the idea of which was not new, but the application was. The English government awarded exorbitant sums, in order to make an impression of the new methods, to reward Bird, Ramsden and especially Harrison, meeting with success in various trips to Barbados and to Jamaica.

In France, two illustrious rivals entered the competition: one was Leroi, son of Julian Leroi, brother of the man to whom Voltaire said: "Your father and Maurice of Saxe beat the English ", the other was Ferdinand Berthoud, who we must know had adopted France for his second homeland.

On various occasions, the government arranged at great expense corvettes and frigates, to subject to examination, in trips of long duration, the new means presented to determine longitudes at sea. These expeditions recall with interest the names of Courtanveaux, Verdun, Borda, Fleurieu, Pingré, Rochon and

Chappe; the nephew of the latter is inventor of the telegraph of which Amontons had given the idea.

The results from these experiences was that, despite the agitation of the vessel, the variation of friction, the temperature difference and the others accidental causes, these naval watches, especially the one of Ferdinand Berthoud, kept an accuracy that the art had not previously attained.

After a crossing of six weeks, the total deviation did not exceed two minutes of time, or a half degree in longitude. This half degree is equivalent to ten leagues, at the equator; to eight and two thirds leagues, at the parallel of thirty degrees; to seven, at one of forty-five, and to five, at one of sixty. Our colleagues Faure and Tréhouard noted (and it is valuable to record) that, in a final expedition of thirty seven days, the watch of Berthoud gave the longitude to nearly three leagues.

If this not the ultimate in perfection, it is so far the best effort of the wisdom of the scholars and artists; and of course, they are the benefactors of the enterprise. They saved humanity from sorrows and tears, while diminishing by far unfortunate luck of the maritime expeditions.

On a return trip to South America, in 1735, Don Ulloa published in Madrid, that the difference of two and even three degrees of longitude at sea, did not represent a considerable error; and, better than the expeditions of Le Peyrouse and of d'Entrecasteaux, the corvettes dispatched in 1789, returned recently to the harbors of Spain, become our enemy. It is perhaps the French genius which gives the advantage; for the genius is, by its kind deeds, a cosmopolitan one; it is found in the inheritance of mankind, and the efforts of these men working to clear the paths of the science, to take the works of nature, following the expression of Fontenelle, prepare in silence, and assure the destiny of nations. The sending of an escort vessel in time of war, can compromise the success of a battle and the survival of a colony, if the ignorance of the pilot gives an incorrect course and delays its arrival. It is for lack of enlightenment that several vessels going to land on the island Rodrigues to win the wind, instead of to carry itself directly to the l'ile de France or Reunion, were captured by English cruisers. As a result of a similar ignorance, a vessel, destined for the l'ile de France island came close to the Malabar Coast -

One remembers the trials of admiral Anson, during which the uncertainty in the position of the island Juan-Fernandez, required him to remain at sea for a long time, and ended the lives of seventy or eighty men of his crew.

The success of commerce, the safety of our vessels is of interest to you; the life of the sailors is precious for you, and you do not want to leave them to fallible men who, incapable of knowing the position of the vessel at every instant of the day and night, the longitude and the latitude of ports, the bearings of coasts, will become wrecked on the rocks

There are some officers, some very enlightened pilots: it is necessary to increase their number in order to avoid the shipwrecks that afflicted the French navy.

It is necessary to give to them sure and applicable rules for all circumstances. It is necessary, in some way, to popularize the science communicating to them prompt and easy methods, to simplify the calculations, and in this way to master the furies of the sea, and cheat the whims of this element.

The English have published their Nautical Almanac Since 1767, the idea for which was French; for when Maskelyne, returned from St. Helena, he adopted the idea presented in 1755, by Caille. This work, which became the Manual of their sailors, appears five and even six years in advance, while at home, nowadays, the *Connaissance des Temps* is printed only for the current year, and it is impossible to give this essential work to sailors, if at the same time a long voyage was being undertaken.

But also the compiling of the Nautical Almanac is confided in an establishment for which the English nothing is spared, to a Board of Longitudes, such as the one which your Committees propose should be formed.

This Office will make each year, a public course of astronomy; it will verify all the nautical instruments destined for our navy, it will be in charge of composing the *Connaissance des Temps*, in a way that is always several years in advance; it will perfect the astronomical Tables and the methods of longitudes, the magnetic charts and especially the hydrographic charts, a large number of which are very incorrect, above all that of the Mediterranean which is essential for commerce to the Levant.

Such is their imperfection, that for l'Anacharsis de Barthélémy, the charts were made after the plans based on the compass. The Caspian Sea, with the adjacent country, again if little known, that some geographers varied five degrees in position. Citizen Beauchamps, who left his Observatory in Baghdad, and who is named consul to Muscat, hopes to rectify these errors in the course of a journey, from which big advantages in commerce and astronomy are promised.

The Bureau des Longitudes will equally take care of Meteorology, a science not very advanced, but nevertheless the results of this branch of the human knowledge are uniquely import to farming. One knows with what success they were applied by Duhamel to Botany, by Malouin to Medicine, by Deluc to measure the height of the mountains.

The Paris observatory, the most beautiful high monument to astronomy, is close to being in chaos. Several of the members are in Belgium to measure triangulation, to complete the arc of nine and half degrees, for which the measurement was begun, Delambre will resume the geodesic operations from Orléans, while continuing towards the Pyrénées; and from the Pyrénées, Méchain will advance continuing work of the same kind. By establishing of the Bureau des Longitudes, the observatory is being reorganized.

In various departments, you have seen Observatories. At Lyon, Dijon, Montauban, Marseilles, Toulouse, etc. ..; and good observers, such as Jacques, Darquier, Duke-it-Chapel, le Roy and other. The Office will propose the Observatories that must be preserved.

And of course, in this number, the harbours of Brest and of Toulon will not be forgotten, which are the principal arsenals of the maritime forces of the Republic, where the naval command urgently needs the establishment of observatories. At Brest, the local observatory and the instruments need only a small expenditure for the buildings, and there you have for astronomer a man whose name gives confidence, the citizen Rochon.

Doubtless you will favor equally the establishment of a workshop for the manufacture of lenses at Brest, where the flint-glass necessary for their production can almost always be obtained from English prizes. Besides the Paris lenses, although excellent and made by very skillful artists, are not always suitable for the navy,

because those used on land do not have to fear the inconvenience that results from the rolling and pitching of ships, and that the horizon at sea presents a different aspect from that on land.

If one grants to Ferdinand Berthoud a lodging at the Louvre, where this artist can deploy his workshop, he has himself proposed to return services to the fatherland, while giving free education to students in the construction of marine clocks; then the means to perfect the science will be met and while opening canals will provide internal navigation, the Bureau des Longitudes, by its own work, its observations and correspondence with scholars, national as well as foreigners, will gather in one beam all the bright lights to illuminate and direct exterior navigation.

It is important to repair the gnomon of the Tonnerre, this can be done with very little expense.

You will realize the project of a telescope in the Herschel manner, being 60 feet long, and 6 feet diameter.

The royalty had spoiled everything, the Republic will purify all. Since the end of the sixteenth century, all the nations borrowed from French the practice of using a Fleur de Lys to mark the direction of north, on navigational compasses, on all the hydrographic charts and even on the geographic maps that contained too little space for meridians and the parallels to be drawn. One knows only of a few exceptions to this practice in the new charts of the Kattegat, Baltic and Gulf of Finland, by Nordenankars. More suitable symbols of liberty will replace the emblems of despotism.

The moment has not yet arrived, doubtless, where all the nations, renouncing childish pride, will adopt for a common meridian, the one that Ptolemy had set up at the westernmost of the Canary Islands.

The Board of Longitudes, in London, is composed at least of eighteen members, of which six are the Lords of Admiralty; the one of Paris will be less numerous: ten members and four assistants; your Committees suggest to you that Europe envies us, who are the benefactors of posterity, and whose choice will be a sudden reparation for the outrages of the barbarians, the counter-revolutionaries who account for foreigners for the sciences which they cultivate.

As for the expenditures, we will not recall those which were made by other people, and even the Chinese, for the erection of a magnificent Observatory; which made two tyrants of France for the advancement of astronomy. Under Louis XIV, the meridian and the perpendicular were traced. Under Louis XV, teams of scholars distributed themselves around globe to observe the passage of Venus and to measure terrestrial degrees; to the island of Rodrigues, to the Cape of Good Hope, in California, others in Lapland, and to Peru.

It is necessary to deduct on the new expenditures that will cause this establishment, those which are incurred by the observatory, since it will be henceforth inside its authority.

Finally we will say to you that it is an economy to spend appropriate to this saving. One will object maybe that, in the organic laws relating to the party of the Constitution that has the aim of public instruction, this item will find its place; it will without doubt be found, and our project is conceived in a manner to be put in this plan; but the moment when, on the basis of the constitutional, the Bureau des Longitudes could be organized, is a long way off, while it becomes an urgent choice. If you think that postponement is necessary to the discussion, then at least let it be next. Do not postpone indefinitely the means of prosperity of the Republic; you will increase these proper means to hasten the happiness of the human race, and you will bequeath this to the generations who will follow us and who will judge us.

We will finish by these words of a scholar, who, after having sat among the legislators was murdered under the system of tyranny. "In astronomy, there remains, said Bailly, a large number of questions to be answered; this will be the work of time and the harvest of prosperity"