TRIGONOMETRICAL SURVEY.

Ανυ survey of a country, which is carried on from a single base by the computation of observed angular dis­tances, may be properly called a trigonometrical survey ; but the term is usually confined to measurements on a large scale, embracing a considerable extent of country, and requiring a combination of astronomical and geodetical ope­rations.

There are two principal objects for which a trigonome­trical survey may be undertaken ; the first being to ascer­tain the exact situation of the different points of a country relatively to each other, and to the equator and meridians of the terrestrial spheroid, for the puη>ose of constructing an accurate map ; and the second to determine the dimen­sions and form of the earth, by ascertaining the curvature of a given portion of its surface. Having already, in the article Figure of τηε Earth, given a general account of the principal operations, which, in different ages and coun­tries, have been undertaken with a view to the second of these objects, and also explained the methods by which the elements of the earth’s form and dimensions are computed from the geodetical measurements, and stated the results which are deducible from those measurements taken col­lectively, we shall not, in the present article, enter into the general subject of Geodesy, but shall confine ourselves to a more particular account than could have been properly given in the article cited, of the great survey which during the last half-century has been carrying on in our own country under the direction of the Board of Ordnance. We accordingly propose to give, in the first place, a brief abstract of the history of that operation, so far as it may be collected from the accounts published in the Transactions of the Royal Society, and in the three volumes of the work entitled “ The Trigonometrical Survey of England and Wales and, in the second place, to explain the me­thods by which the distances, latitudes, longitudes, bear­ings, and relative heights of the several positions are com­puted from the observations. The subject, though some­what technical, is important both in a scientific and national point of view ; and few persons, perhaps, have any just notions of the extremely refined nature of the operations to be executed, or of the difficulties to be surmounted, when the question is to determine terrestrial distances and posi­tions with the extreme precision which alone can be tole­rated in the present advanced state of mathematical and as­tronomical science.

From the account given by General Roy, it appears that the origin of the British trigonometrical survey goes back to the middle of the last century. The rise and progress of the rebellion which broke out in the Highlands of Scotland in the year 1745, convinced government of the importance of establishing military posts, and opening roads of commu­nication in the remotest parts of the country ; and a body of infantry having been encamped at Fort Augustus in 1747 with a view to these objects, Lieutenant-general Watson, who was then officially employed at that place as deputy quartermaster-general, conceived the idea of mak­ing a map of the Highlands. The proposal having met with the approval of the Duke of Cumberland, the survey necessary for the purpose was forthwith commenced under the direction of General Roy ; and although it was origi­nally intended to confine the operation to the Highlands, it was nevertheless extended to the Lowlands, and at length included the whole of the mainland of Scotland. The breaking out of the war in 1755 prevented the survey from being completed, and accordingly the projected map was

never published. General Roy states, that although the work, which exists in manuscript, possesses considerable merit, and perfectly answered the purpose for which it was intended, yet, having been carried on with instruments of a common or even inferior kind, it is rather to be consider­ed as a magnificent military sketch than a very accurate map of a country.

On the conclusion of the peace of 1763, the question of making a general survey of the whole island came for the first time under the consideration of the government ; but although the utility of such a measure was acknowledged, no steps were taken to carry it into effect until after the termina­tion of the American war in 1783. During this year a memo­rial, drawn up by Cassini de Thury, was transmitted by the French ambassador to Mr Fox, then Secretary of State for the Foreign Department, setting forth the advantages that would accrue to astronomy by carrying a chain of triangles from the neighbourhood of London to Dover, to be connected with those of the French arc of meridian, which had now been extended from Collioure to Dunkirk, and thereby determin­ing, by actual measurement, the relative positions of the Observatories of Greenwich and Paris. Cassini’s proposal having been referred to the Royal Society, was warmly ap­proved by that body ; in consequence of which the govern­ment undertook to give the requisite assistance, and the execution of the operation was committed to General Roy, who was then employing himself in the measurement of a base for a projected survey of London, which he had under­taken with a view to connect the different private observa­tories in and about the capital with tiιat of Greenwich, and, as he states, “ that it might possibly serve as a hint to the public for the now almost forgotten scheme of 1763.”

Although the operation which was thus resolved upon did not embrace a general survey of the kingdom, but was confined to the particular object of effecting a junction of the Greenwich Observatory with the French triangulation, it was still an object of great astronomical interest; and ac­cordingly it was determined that the measurement should be conducted with the utmost possible care in all its details, and with the best instruments which could be provided by the celebrated Ramsden, at that time acknowledged to be the first artist in the world.

The first step in the operation was the accurate measurement of a base, from which the sides of a chain of triangles might be successively computed. For this purpose Gene­ral Roy selected a line on Hounslow Heath, a situation which presented the advantages of proximity to the capital and the Observatory of Greenwich ; of great extent and levelness of surface ; of being free from local obstructions, and commodiously situate for any future operations of a similar nature. The line extended from a place culled King’s Arbour, at the north-west extremity of the Heath, and terminated at Hampton poor-house, near Bushy Park, at the south-east extremity, the whole length being upwards of five miles.

The preliminary operations having been completed, and the terminal points having been marked by sinking wooden pipes into the ground, the measurement was commenced about the middle of July 1784. The measuring apparatus consisted of three deal rods, on which lengths of twenty feet were laid off by Ramsden, and a standard rod, with which the former were from time to time to be compared. The measur­ing rods were formed out of an old mast of Riga timber, their dimensions being 20 feet 3 inches in length (including the tippings, which were of bell-metal), about 2 inches deep, and