Mason and Dixon Stargazing in Cape Town!

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ABSTRACT

In 1761 the world was abuzz with Transit of Venus fever, because the last time this astronomical phenomenon had occurred was over 100 years prior, and the world's greatest astronomers were planning month-long sea journeys to obtain the best vantage points to observe and record the momentous event. Having only recently been coupled as astro partners, geodetic surveyor/astronomers Charles Mason and Jeremiah Dixon from England had been honoured with the prestige assignment to make recordings of the transit in the southern hemisphere. To enable a more precise

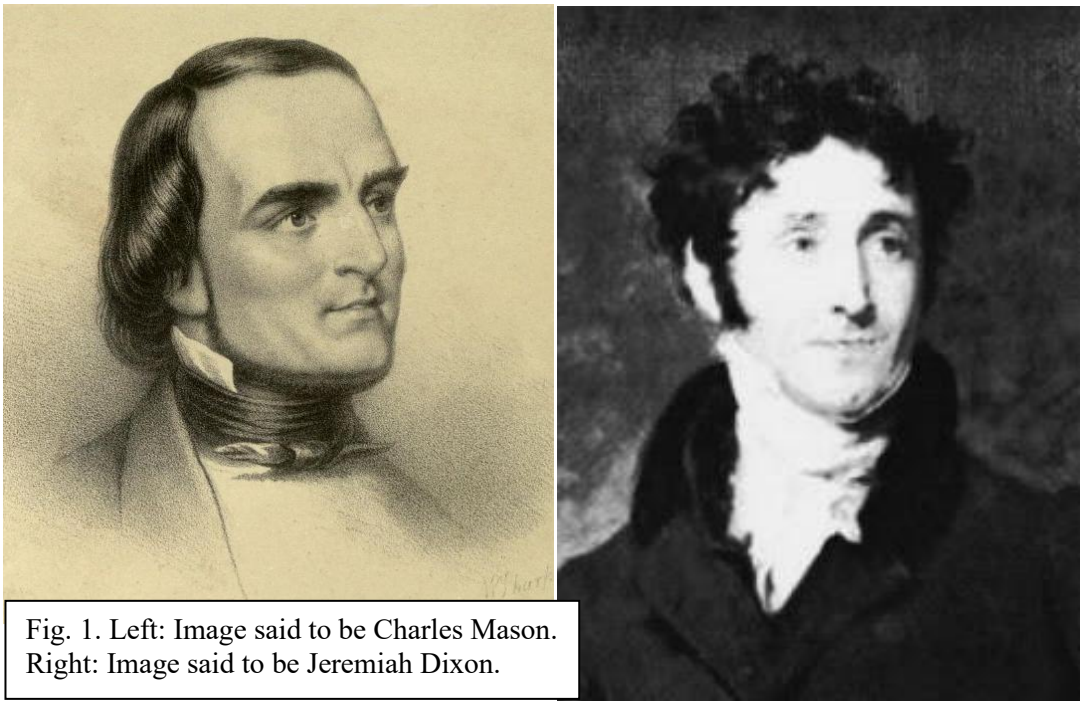

Fig. 1. Left: Image said to be Charles Mason.
Right: Image said to be Jeremiah Dixon.

calculation of the required parameters needed to be made at various selected locations around the globe would not only provide independent cross checks on the data, but also allow for varying climatic conditions which may otherwise prevent sightings in overcast skies. The intrepid pair were on their journey to make the planned observation in Indonesia, but while on their journey were waylaid by a hostile French frigate who delayed their progress before allowing them to proceed on their scientific

mission. Due to this problem and the imminent occurrence of the transit, the duo opted to stop at the Cape of Good Hope and carry out their epic special viewing from Cape Town. As fate would have it the day of the transit was partly overcast at their newly ordained station, but the observations that they were able to make were carried out with great precision and skill.

Such a world-famous scientific achievement brought immediate world-wide recognition to the two relatively youthful surveyors. On their return journey to England they stopped in at St. Helena, a remote island to the west of Africa, where their head man, Astronomer Royal, Nevil Maskelyne, had himself set up in readiness to record the transit. His best plans however were thwarted due to full clod coverage.

Upon their arrival back home they had the fortuitous coincidence to land around the same time that Lord Baltimore, owner of the US colony of Maryland, arrived to negotiate some business with his associates. Seeing as there had been an ongoing 80 year often violent dispute over the location of the boundary between Maryland and the adjoining colony to the north, Pennsylvania, founded by William Penn and still owned by his descendants, he quickly sought a meeting with the most famous surveyors on the planet! Following acceptable discussions, the pair signed a contract to lay out the boundary separating the two US colonies, which ultimately started in 1763 and was nearly completed by 1767, at which time the disgruntled Lord told the pair that their services were no longer required, some 36 miles short of the western terminus of the line. This final piece of the boundary was laid out by surveyors David Rittenhouse and Andrew Ellicott in 1784.

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INTRODUCTION

Nothing sets the world abuzz more than a rare astronomical event. Whether that be a solar eclipse, a vision of Halley's comet or any one of such momentous visions of space from the aspect of our tiny planet amongst all of the excitement. However, there has been a singular event in space which conjures up anxious fervour when for a few fleeting moments the planet Venus makes a cameo transit across the face of the Sun. The problem with this albeit brief phenomenon is that it makes two appearances 8 years apart, but then does not repeat the double for another 105-122 years! This makes it all the more precious for those alive during any of its transits, especially hopeful for clear skies overhead when the visions are presented.

The very first such transit observed by human beings occurred one Sunday late in 1639 in a small English country hamlet called Much Hoole near Liverpool. Jeremiah Horrocks mounted his telescope so that the Sun's image projected onto a piece of paper in a dark room. This image was only 6 inches (0.15 metre) wide, and on the piece of paper he divided the circumference into degrees and the diameter into 30 equal parts to facilitate recording of the path of the transit of Venus.

Leading up to this 1639 transit most of Europe was engaged in battle during the Thirty Years' War from 1618 to 1648. It had been in 1609 that poor old Galileo had invented the telescope, discovering four moons orbiting Jupiter, which caused great dissention amongst the religious zealots, mainly Catholics, who had him convicted of heresy in 1633. No longer was the Pope's infallibility sacrosanct with the flat earth policy well disproven and earth no longer the centre of the Universe.

The famous astronomer Johannes Kepler had predicted the 1631 transit, but had not realised that they happened in pairs eight years apart. It was Horrocks who was the one who predicted the 1639 transit, only a month before the event, in addition to being the first observer of the cosmic exposition at the small English village of Much Hoole, which is nearby to Liverpool, with little pageantry or hooha in celebration.

Figure 2. The stained glass window in the church in the little English village of Much Hoole (near Liverpool) displays a commemoration of Jeremy Horrocks and the first observation of a Transit of Venus in 1639.

Another 122 years would elapse before the next opportunities would be available to record this iconic outer-space occurrence in the year 1761, and the astronomical elite would be set to mobilise legendary expeditions to all possible vantage points around the globe to maximise the windows of visibility as well as increasing the geometric coverage of the observations. There would indeed be over 100 teams of adventurous willing astronomers who would journey to many often remote destinations in order to get the best viewing perspective of the Transit of Venus which was happening 122 years since its previous appearance.

Figure 3. Astronomer Royal The Reverend Nevil Maskelyne.

Two such intrepid cosmic observers were selected by the Astronomer Royal, Nevil Maskelyne (see Figure 3.), astronomer Charles Mason and surveyor Jeremiah Dixon for the privileged task of recording the 1761 Transit of Venus from the Southern Hemisphere, initially planned to be done in Sumatra. Maskelyne and Robert Waddington were designated to observe the transit from the South Atlantic island of St. Helena, from whence Edmond Halley had recorded the transit of Mercury a century beforehand. Unfortunately, despite careful and thorough preparation for the event, the skies were cloudy for the duration of the phenomena denying them the opportunity to view and document the transit. Thus the ultimate results bestowed upon Mason and Dixon the proud distinction of making the only observations of the Transit in the South Atlantic region.

Mason had been born in April 1728 at Gloucestershire, England, the only son of a banker and miller, while Dixon's birth was at County Durham, England on 27 July 1733 to a wealthy family with his father owning a coal mine. Mason was an assistant astronomer to Maskelyne at Greenwich while Dixon's training as a surveyor is believed to have been self-taught as nothing is known of any formal training in that field. It is said that the well-regarded instrument maker John Bird recommended Dixon to fulfil the role as Mason's assistant for the proposed TOV observations.

On the third day of their proposed trip on the ship *Seahorse* to Bencoolen (now the city of Bengkulu), on the Indonesian island of Sumatra, they were beset by an assault at the end of the cannons from a French warship, *Le Grand*, on 8 January 1760, as England and France were engaged in the Seven Years War at this time with 11 killed

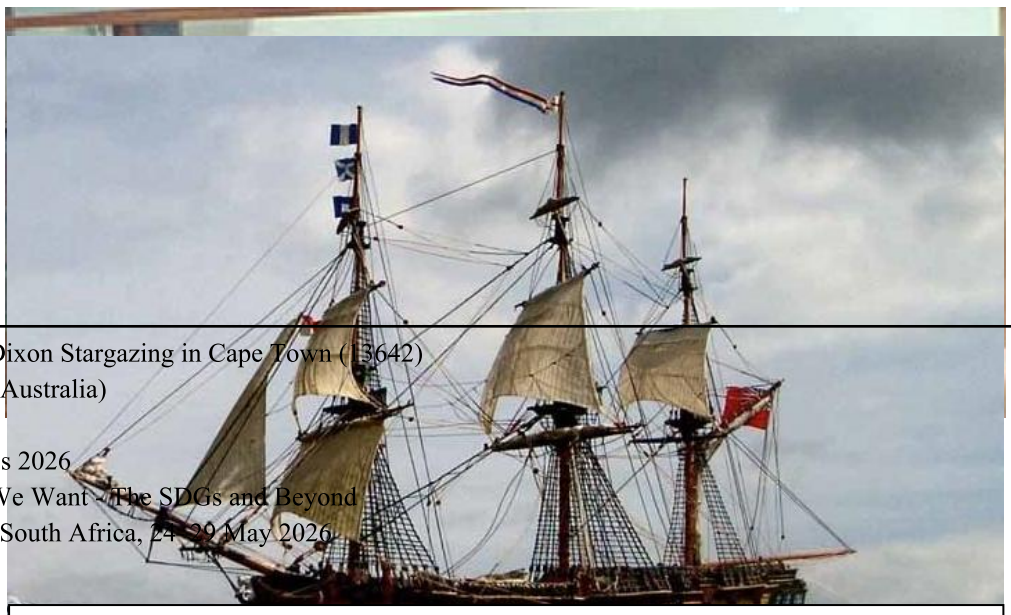

Figure 4. Top: Model of the *Seahorse.* Bottom: Artistic image of the vessel.

and 38 wounded, so the enthusiasm of the daring pair had turned into refusal to set forth on the same ship, under a different commander. However, under extreme coercion from the British Admiralty they ultimately agreed, but because of this unanticipated delay, the new destination for the TOV observations was to be the Dutch colony of Cape Town. Arriving at Table Bay on 27 April, 1761, great assistance was rendered to the two starmen to set up their observatory in the centre of Cape Town between St. Johns Road and Hope Street behind the later St. Mary's Cathedral. This building was circular with a diameter of 4 metres and a conical roof at a height of 1.7 metres which would house their accurate instrumentation to carry out the task including a pendulum clock secured to two solid timber posts sunk a metre into the ground for precise time keeping to determine their longitude, connecting them to Greenwich. Armed with two reflecting telescopes each two feet (0.61 metre) long from renowned Scottish instrument manufacturer James Short with an astronomical quadrant made by another famous instrument maker John Bird (see Figure 5), the only thing out of their control was the weather?

Observing the Transit in Cape Town

LX. *Observations made at the Cape of* Good Hope; *by Mr.* Charles Maſon *and Mr.* Dixon; *reduced to apparent Time by Mr.* Maſon. *With an Appendix.*

Read April 22, 1762.

TABLE for the object-glaſs micrometer, applied to the object-end of the tube of a reflecting teleſcope of two feet focal length, its focal length being 495.48 inches.

Inches.	Angle. ′ ″	Decimals of an inch.	Angle. ′ ″	Diviſions of Vernier.	Angle. ″
1	7 5.9	.05	0 21.3	1	0.852
2	14 11.9	.10	0 42.6	2	1.7
3	21 17.8	.15	1 3.9	3	2.6
4	28 23.8	.20	1 25.2	4	3.4
5	35 29.7	.25	1 46.5	5	4.3
		.30	2 7.8	6	5.1
		.35	2 29.1	7	6.0
		.40	2 50.4	8	6.8
		.45	3 11.7	9	7.7
		.50	3 33.0	10	8.5
		.55	3 54.3	11	9.4
		.60	4 15.6	12	10.2
		.65	4 36.9	13	11.1
		.70	4 58.2	14	11.9
		.75	5 19.5	15	12.8
		.80	5 40.8	16	13.6
		.85	6 2.0	17	14.5
		.90	6 23.3	18	15.3
		.95	6 44.6	19	16.2
		1.00	7 5.9	20	17.0
				21	17.9
				22	18.7
				23	19.6
				24	20.4
				25	21.3

MEMO-

Figure 5. Left: James Short reflecting telesco
Bird astronomical quadrant. Figure 6. Below

To ensure precise timings to true solar time the first duty was to work out the pendulum clock rate, subsequently finding it to be losing 2 minutes 17 seconds per day. With an overcast sky on the day of the transit, the outlook for clear passages to allow measurements was not promising. However, the clouds lifted for a sufficient period to

enable a series of measurements of the position of the planet on the Sun's disc and the ratio of apparent sizes of the two bodies. The most important instant when Venus was about to move off the Sun could be seen, such internal contact moment known as at the egress. To produce a complete set of accurate calculations it was necessary for the pair to establish the geographic coordinates of their observing site, staying there for nearly 4 months to do star sightings with the Bird quadrant coupled with recording the moons of Jupiter.

Contracted by Lord Baltimore to Lay Out the Mason-Dixon Line

With the reputation of their international profile elevated to the status of eighteenth century superstar surveyors after their successful astronomical mission in Cape Town, the names of Mason and Dixon held world acclaim as the most accurate surveyors of their time. Shortly after they made their return to England in late 1761 they would meet up with Lord Baltimore, the owner of the US colony of Maryland, who had been at war with his northern neighbour, William Penn and his family, the holder of the title to the colony of Pennsylvania, with often violent exchanges between the two disagreeing parties. His lordship engaged the pair on an 18 month contract to set out

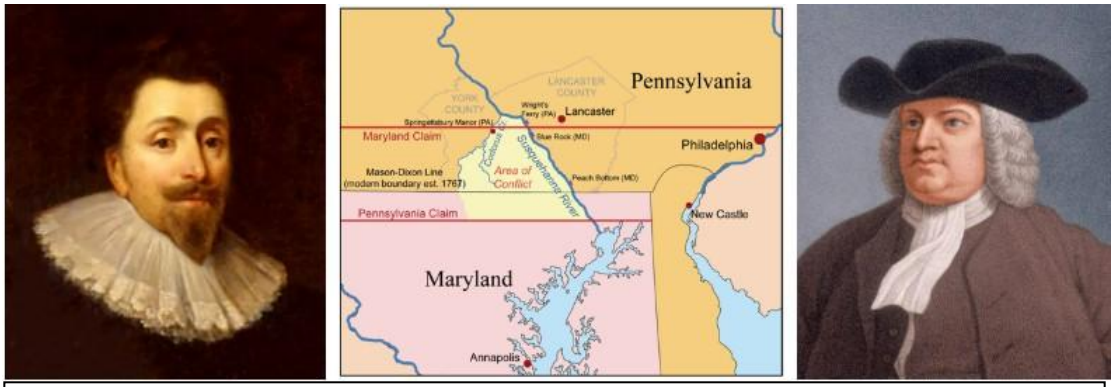

Figure 7. Left: Lord Baltimore (Calvert) Centre: Map of disputed areas and final Mason-Dixon Line Right: William Penn

the true position of the borderline between Pennsylvania and Maryland which they duly set about doing in 1763. Finally, after four years, the unhappy Lord sent the two experts packing in 1767 with still 36 miles (58 kms) left to mark. They were paid 3,516 pounds 9 shillings for their services to that date. The remaining segment of the

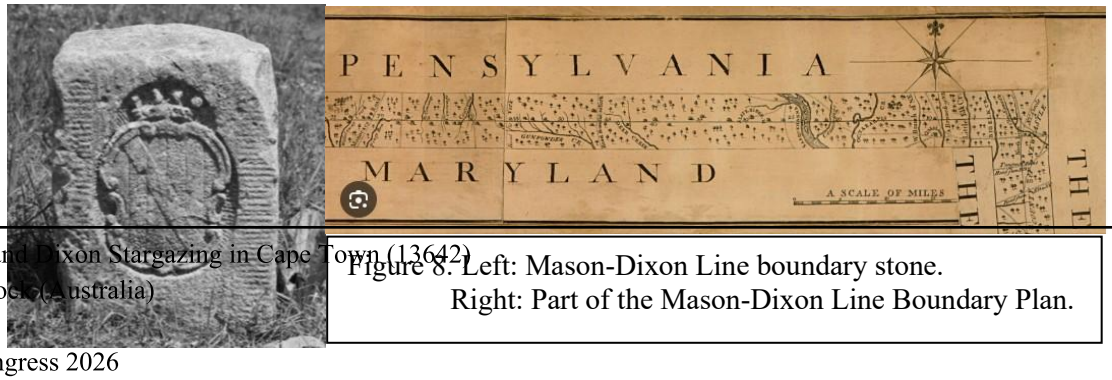

Figure 8. Left: Mason-Dixon Line boundary stone.
Right: Part of the Mason-Dixon Line Boundary Plan.

boundary line would be finally set out by US surveyors Andrew Ellicott and David Rittenhouse in 1784. Many of the original boundary monuments still can be found today, displaying a most creditable precision in their installations as a lasting testament to the fine and professional work (albeit longer than predicted?) by the two after whom the line has become immortalised.

Mason and Dixon After Cape Town and the USA

After their initial triumph in Cape Town in 1761, and their expert intervention into the boundary dispute between the independent states of Maryland and Pennsylvania in the northern American territory between 1763 and 1767 these two space explorers were not finished yet! After spending a brief time back home in England, Jeremiah travelled to Norway to carry our observations of the 1769 Transit of Venus, eventually passing away in 1779. Charles also participated in the 1769 TOV, collecting his information in Ireland, while continuing to collate his tables of the Moon and working on the Nautical Almanac. Returning back to Philadelphia with his family, he died just a few months after his arrival on 25th October 1786.

Conclusion

On the occasion of the 1769 TOV another world-renowned surveyor, James Cook, was sent on a scientific discovery mission to take observations of the event in the Southern Hemisphere at Matavai Bay in the Pacific island of Tahiti on 3rd June, 1769. After this successful venture at Point Venus the ship HMB *Endeavour* sailed westerly to make the first accurate charts of the east coast of New Holland, which Cook was to name the eastern side, New South Wales, claiming it on behalf of Great Britain at Possession Island in northern Queensland on 22/8/1770. Having taken photographs of the 2004 TOV through the telescope of the firm's total station from the rear yard of our office in Harris Park, New South Wales on 8th June, I seized the rare opportunity eight years later to travel to Tahiti to make my own observations of the 2012 TOV from the elevated area just 20 metres from where James Cook had made his 1769 set of obs. I made some amazing shots of the TOV on 6th June through my astro telescope, which I bought at the Sydney telescope shop shortly before my departure. It was the last one left, due to the frenzy of interest for this phenomenon. The

Figure 9. My astro telescope set up at Fort Venus ready for action on 6/6/2012 at Tahiti.

weather was clear and I was the ONLY ONE occupying this position, and I also let the local school children and their teachers view the transit through my telescope with much excitement.

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BIOGRAPHY

Private land surveyor since 1973, **Bachelor of Surveying** (UNSW 1978), **MA** (Egyptology) from Macquarie Uni., Sydney (2000), **Registered Surveyor NSW** 1981. Now Director of Brock Surveys at Parramatta (near Sydney). Papers presented on six continents including Brunei, Nigeria, Morocco, Papua New Guinea, Hawaii, Bulgaria, Finland, Colombia and all states/territories of Australia as well as Norfolk Island. Director of FIG International Institution for the History of Surveying & Measurement awarded **FIG Article of the Month March 2005**, **January 2012**, **June 2014, April 2017 and April 2023.** Institution of Surveyors NSW Awards – **Halloran Award 1996** for Contributions to Surveying History, **Fellow ISNSW 1999 & 2002 Professional Surveyor of the Year**. First international **Life Member** of the Surveyors Historical Society (USA), Rundle Foundation for Egyptian Archaeology, Parramatta & District Historical Society, Friends of Linnwood (House), **Foundation Member** Australian National Maritime Museum & Friends of National Museum of Australia. **Member** of Bradman Crest, International Map Collectors Society, Royal Australian Historical Society, National Trust of Australia, Hills District Historical Society.

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