

Deadline 2 Submission:

Subject: Application by Highways England for an Order Granting Development Consent for the A303 Stonehenge - Amesbury to Berwick Down (TR010025).

Reference: 20020818 - R P Bartosz

I am a retired landscape and countryside professional of thirty-seven years experience, with over twenty years in the context of landscape assessment, covering the evolution of methodology from landscape evaluation through to landscape character assessment (LCA). This included direct experience of landscape and visual impact assessment (LVIA) on major projects, and local authority policy input, including representation at Examination In Public. I am currently undertaking independent research in archaeoastronomy - since 2006.

This written representation covers aspects of Principal Issues 9 and 10 as at Annex C in the Rule 8 letter dated 11th April 2019. It is based on research in progress and includes unpublished extracts considered material to this application.

My overall conclusion is that the impact on Outstanding Universal Value (OUV) would be significantly negative, and my stand is therefore one of objection to the granting of a Development Consent Order.

1.0 Introduction

1.1 Prior representation

1.1.1 This submission is pursuant to the corresponding Relevant Representation in which the purpose stated was to make more detailed representation in respect of Paragraph 201, and related Paragraphs 195 and 196, of Section 16 of the National Planning Policy Framework. The evidence now presented will focus on,

- i) The extent to which the prehistoric setting of the heritage asset of Stonehenge may be identified and fixed geographically, and**
- ii) The identification of missing astronomical elements at play, considered significant to the understanding of Stonehenge and its setting.**

1.1.2 This formal submission is also pursuant to the non-statutory consultation on route options, held between 12 January to 5 March 2017. A preliminary diagram, inter alia, of the extent of this "fixed" setting revealed a conflict between the extent of the setting and the proposed Tunnel Option, at that time. The subsequent change to the alignment of the tunnel - with respect to the western portal - does not materially mitigate the impact. Both eastern and western portals remain within the primary area of the setting, and the description of "Sacred Space" was used for convenience.

1.2 Condensed objectives

1.2.1 It is argued here that these elements combined, as in 1.1.1 above, would contribute a direct enhancement to the understanding of Stonehenge and its setting, and consequently expand the OUV of the Stonehenge, Avebury and Associated Sites, World Heritage Site (WHS).

1.2.2 If the evidence presented were to be accepted by academia and incorporated into a collaborative research model, it would extend the time frame of the WHS as a repository of knowledge, in particular the relationships between elements in the wider landscape setting, to the early Mesolithic.

1.3 The term "value" and outstanding matters to be considered by UNESCO and the State Party

1.3.1 To distinguish the target "value" i.e. OUV of this representation, it should be noted that argument relating to "value" appears elsewhere in the context of Contingent Valuation Study (CVS) and Value for Money (VfM).

1.3.2 CVS is a matter of representation which I understand is being brought to the attention of the ExA by Jonathan Morris - reference 20020712 - and no further comment here is, nor was, intended in the context of this representation.

1.3.3 VfM is a particularly important issue which remains to be considered at the 43rd session of the World Heritage Committee, Baku, Azerbaijan between 30 June – 10 July 2019, hence during the course of this Examination. The Department for Digital, Culture Media & Sport (DDCM&S) submitted, on 1st February 2019, in accordance with Decision 42 COM 7B.32 a "State of Conservation Report for the Stonehenge, Avebury and Associated Sites World Heritage Site", which may be downloaded here;

<https://whc.unesco.org/en/documents/171631>

1.3.4 DDCM&S has made statements material to this representation as follows:

i) At page 7:

World Heritage Property Setting Study and Boundary Review

The brief for the Setting Study has now been finalised. This has been developed alongside heritage and landscape expert partners. The study is designed to provide guidance on the identification of the setting and the type of development that is likely to have an impact on it and the World Heritage and its OUV. It will also provide advice on the nature of evidence likely to be required from developers. Funding is currently being sought to commission this work.

The study will be informed by the Statement of OUV (SoOUV) and identified attributes as well as Historic England's Guidance on the Setting of Heritage Assets, Historic Environment Good Practice Advice in Planning Note 3 (Second edition) 2017. This sets out guidance against the background of the National Planning Policy Framework and related guidance in the Planning Practice Guide on managing change within the setting of heritage assets. The ICOMOS Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (2011) will also inform the study. These existing documents today form a robust basis for the assessment of impact on the World Heritage property through change in its setting and inform the approach to assessing impact in current development proposals. The boundary review at Stonehenge will be progressed following completion of the setting study.

ii) At page 24:

Value for Money (VfM)

The value for money (VfM) of a road scheme in the UK is classified in accordance with DfT guidance and this in part depends upon the benefits to cost ratio but also on other, broader factors such as environmental impacts.

The VfM of the A303 scheme at preferred route was classed as “Medium” but the additional costs of the heritage mitigations included in the proposed scheme (described above) has reduced the VfM to “Low”. The benefits to cost ratio of the proposed scheme is 1.1:1 which means the cost of the scheme is only just balanced by the expected benefits (including those related to improving the cultural heritage of the WHS).

We have undertaken analysis to assess the value for money of the scheme if the additional cut and cover was added. This indicates that the additional costs of £126m are not balanced by additional quantifiable benefits and the VfM of the scheme would be reduced to “Poor”.

The majority of road schemes that are invested in by the UK government have a VfM of “medium” or “high” to ensure that the return on the investment is maximised. Support for the proposed scheme with a VfM of “low” demonstrates the significant commitment to minimising the impact of the current road on the WHS. Adding additional cost to the scheme with no additional benefit will put the approval of this scheme at significant risk.

1.4 Condensed conclusions

1.4.1 In the light of these outstanding matters I consider the application for development consent is premature. A "Setting Study" is a material consideration, which was at least implied during the non-statutory consultation as at 1.1.2 above.

1.4.2 The details of the brief for the Setting Study are not known, and it has not been opened to scrutiny. This places an unfair burden in the context of the timescale within which the application by Highways England has to be determined.

2.0 Highways England's Response to Relevant Representations

2.1.1 Highways England responded to Representation, R P Bartosz, RR-2294 in two materially relevant sections as follows:

i) At Section 15- 4/5: *The proposal for a tunnel will do damage to sensitive archaeological sites.*

Further information can be found in the Assessment of Alternatives, in the Environmental Statement (ES), at Chapter 3 [APP-041] and in ES Chapter 6, Cultural Heritage [APP-044], Section 6.8, Table 6.9. The cultural heritage assessment, reported in ES Chapter 6, identifies the effects on known archaeological features

ii) At Section 15-16: *The location of the eastern tunnel entrance will adversely impact newly-discovered astronomical elements.*

Archaeoastronomical aspects are considered in the Heritage Impact Assessment, set out in the Environmental Statement, Chapter 6, Cultural Heritage, Appendix 6.1, Section 6.15 [APP-195] and Annex 5 [APP-200], which highlights the astronomical aspects that contribute to the Outstanding Universal Value of the WHS. These are all considered and assessed in the Heritage Impact Assessment with reference to the Scheme, including the location of the eastern portal and its entrance. With regards to Attribute 4 The design of Neolithic and Bronze Age funerary and ceremonial sites and monuments in relation to the skies and astronomy, the Heritage Impact Assessment concludes that the Scheme would result in a Large Beneficial Effect (ES Chapter 6, Cultural Heritage, Appendix 6.1, paragraphs 9.4.24-9.4.28) [APP-195].

2.1.2 Item i) identifies "Asset Groups". The key location relevant to this representation is King Barrow Ridge east of the Stonehenge monument and west of the eastern portal, in a direct sightline for all practical purposes. The barrows here are divided into two cemetery groups, namely Old King Barrows and New King Barrows (AG 26), and the impact on these is considered in general as, "...subject to significant positive changes to setting...". Qualitative differences of "moderate beneficial" to "large beneficial" between them are stated (Pages 6-75 and 6-76 respectively) resulting from the proposed construction works, as per Table 6.11: Summary of significant effects – construction (permanent)

2.1.3 Item ii) identifies more detailed astronomical significances and claims larger benefits, in part. The adopted SoOUV identifies three key criteria, namely i), ii) and iii) of a possible total of ten. A further two potential criteria, namely iv) and vi) are identified within Appendix 6.1, Section 6.15. The most relevant, in the context of this written representation is criterion iv) with the significant assets being the King Barrow Ridge cemetery groups, and the relationship to the sightline from Woodhenge - midwinter sunset (Fig 4.7 as in Annex 5).

3.0 Points of Agreement and Diversion

3.1 Agreement

3.1.1 With the backing of several decades of professional experience in dealing with landscape matters, including landscape and visual impact assessment (LVIA) there is no argument, in this subject area, with the detailed processes and methodologies employed and/or sought by Highways England to inform regarding the various options to choose from. This was entirely anticipated, and study of the documents became an engrossing, albeit very time consuming, exercise.

3.1.2 In the context of astronomy and archaeoastronomy, the rigid adherence to evidential support in defining valid sightlines and alignments is also expected. Establishing veracity in the face of the plethora of historical and current hypotheses and theories, many appearing quite credible, is a difficult task.

3.2 Diversion

3.2.1 In the context of LVIA, despite the evolution of methodology to the present sophisticated tool it has become, the vast majority of situations to which it is brought to bear revolve around the mitigation of detrimental impact to various degrees from minor to major. So successful has the tool become that it is very tempting to interpret the results of an assessment, particularly in layman's terms, as a "substitute" for the decision making process.

3.2.2 Stonehenge and its landscape setting presents a unique situation of conflict in the face of proposed developments. Any proposal is likely to lead to a vying over "sacred space" - in both evidential and metaphorical senses. Its extent is neither fully understood, nor in place the funding or academic capacity to pursue research in its widest interdisciplinary and multidisciplinary spectrum. The location of the Stonehenge Visitor Centre was informed by LVIA to relative success, albeit still criticised in certain aspects. This application by Highways England lacks significant proactive archaeological and archaeoastronomical research elements, despite the decades of historical tunnel proposals since 1995, and despite extensive non-statutory consultation. The Applicant follows a reactive approach, such as the mutually inclusive setting study and boundary review as in 1.3.4 i) above.

3.3 Condensed Concern: Failure to meet obligations of WHS Inscription.

4.0 The Relevant Obligations of WHS Inscription

4.1 Operational Guidelines for the Implementation of the World Heritage Convention, WHC.17/01 12 July 2017.

4.1.1 Obligations are tied intimately to the three key headings of the Inscription, namely, "Integrity", "Authenticity" and "Protection and Management", and proactive responsibilities are identified within the Operational Guidelines. The key paragraphs in the context of this representation are as follows (key points are emboldened) :

i) Paragraph 96:

*" Protection and management of World Heritage properties should ensure that their Outstanding Universal Value, including the conditions of **integrity and/or authenticity** at the time of inscription, **are sustained or enhanced over time**. A regular review of the general state of conservation of properties, and thus also their Outstanding Universal Value, shall be done within a framework of monitoring processes for World Heritage properties, as specified within the Operational Guidelines⁴ ."*

ii) Paragraph 97:

*"All properties inscribed on the World Heritage List must have adequate long-term legislative, regulatory, institutional and/or traditional protection and management to ensure their safeguarding. **This protection should include adequately delineated boundaries**. Similarly States Parties should demonstrate adequate protection at the national, regional, municipal, and/or traditional level for the nominated property. They should append appropriate texts to the nomination with a clear explanation of the way this protection operates to protect the property."*

iii) Paragraph 99:

"The delineation of boundaries is an essential requirement in the establishment of effective protection of nominated properties. Boundaries should be drawn to incorporate all the attributes that convey the Outstanding Universal Value and to ensure the integrity and/or authenticity of the property."

iv) Paragraph 100:

"For properties nominated under criteria (i) - (vi), boundaries should be drawn to include all those areas and attributes which are a direct tangible expression of the Outstanding Universal Value of the property, as well as those areas which in the light of future research possibilities offer potential to contribute to and enhance such understanding."

v) Paragraph 103:

"Wherever necessary for the proper protection of the property, an adequate buffer zone should be provided."

vi) Paragraph 106:

"Where no buffer zone is proposed, the nomination should include a statement as to why a buffer zone is not required."

4.2 OUV: Obligation Failures

4.2.1 Since "setting" is intimately tied to the issue of boundaries, adequate preparation, in respect of proactive obligations, for consideration as part of the development application has not yet been fulfilled. It is difficult not to interpret this failing as an "afterthought" bearing in mind the forced reactive process currently in hand, as a result of UNESCO requirement. As the details of the brief are not available, it is not explained how adequate scrutiny will be undertaken within the timescale of this application, to deal with any shortcomings and conflicts with respect to the Cultural Heritage Setting Assessment submitted by Highways England (Appendix 6.9 to the Environmental Statement).

4.2.1 It is appreciated that Highways England can only rely on the information tendered during any assessment process. Therefore, it is important to note any potential shortcomings in policy or source information. In the minutes of the A303 Scientific Committee, held on 3rd August 2018 it was reported as follows (key words emboldened as previously):

*"The longevity of the landscape, with activity from the Mesolithic onwards needs to be considered. Attention was drawn to the significance of recent Electro-magnetic Induction (EMI) survey in the WHS – this has identified numbers of previously unknown pit features, excavation of one of these (east of King Barrow Ridge) has indicated a Mesolithic date – this emphasises the long duration of activity in the landscape. It was noted that Paul Garwood had recently presented an overview of this project and its outline findings to members of HMAG and the AmW heritage team. **It was noted, however, that the Mesolithic activity is not what gives the WHS***

Outstanding Universal Value, it is the activity in the Neolithic and Early Bronze Age that provides this.

(<http://a303scientificcommittee.org.uk/>)

4.2.2 The Purpose of the Committee, as stated in its terms of reference is:

"While recognising, and without prejudice to, the particular statutory and advisory roles and responsibilities of their individual organisations throughout the life of the project the Group will advise on and formulate requirements for, guide and monitor the development and delivery of proposals in order to ensure the consistent protection of the OUV, integrity and authenticity of the WHS in particular, and the historic environment in general."

4.3 Condensed conclusions

4.3.1 In the light of the outstanding matter of the Setting Study and Boundary Review, it further appears that the spectrum of elements to be considered as part of the development application is being artificially restricted. The restriction both conflicts with the wider obligations of WHS Inscription and OUV criteria by way of "... **are sustained or enhanced over time...**", and the purpose of the Committee, "...**to ensure...consistent protection...**".

4.3.2 It appears that the application is weighted to one of technical argument, held only to one point in time. In the event of significant evidence accepted as supporting activity extending to the Mesolithic - hence enhancing OUV - this would reduce the VfM, as at 1.3.4 ii) above, to a status of "Poor" due to impact on the "Integrity" of the setting.

5.0 A Potential Model for the Prehistoric Extent of the Stonehenge Setting:

5.1 Considering the extent of physical "Sacred Space" at Stonehenge

5.1.1 Briefly, in terms of methodology, an astronomical quantity (translated into a measure of 2160 metres) was vectorised to produce a geometric diagram (based on square and circle geometry), which was then used to overlay over selected major prehistoric monuments.

5.1.2 In this instance, the objective was to see whether the wider landscape of Stonehenge was based on a geometrical design linked to this particular aspect of astronomical knowledge, namely awareness of a long period cycle which was equated with the cycle known as "precession" (approximately 26,000 years). It was found that the relationship between the circle which cut through Woodhenge, to the circle which cut through a suspected monument at the River Avon end (see Fig 1), was a direct $\sqrt{2}$ ("square-root of two") function between the two diameters (or radii) of the respective circles as measured from the centre of Stonehenge. This results in the area of the outer circle being exactly twice the area of the inner circle, expressing a function of two, and reflecting the largely bilateral symmetry of the Stonehenge architecture.

5.1.3 Logically, if these two locations were ritually, or otherwise connected, then there should have been a physical monument present at the River Avon end of the

Avenue. This monument, namely Bluestonehenge, was indeed found by the Riverside Project team, led by Professor Mike Parker Pearson, and reported in 2009.

5.1.4 This relationship may be fundamental to the understanding of the extent and ritual use of the Stonehenge wider landscape, as an evolutionary process across the various phases of Stonehenge construction. In short, ritual and funerary archaeology linking geometry to astronomy, and indicating a strong cultural cosmology at play.

5.1.5 Briefly, the conclusions as they now stand as the basis for future research, are:

- The areas of the two circles represent “sacred space” which can be categorised as ‘primary’ and ‘secondary’, but not necessarily functionally, in relation to the inner and outer circles, respectively.
- The locations of the monuments of Woodhenge and Bluestonehenge on the perimeters of the circles, least strongly supports, if not confirms the theory proposed by Prof Mike Parker Pearson, to paraphrase “wood is for the living, and stone is for the dead (ancestors)”. There is therefore a coincidence of purpose between the design “geometry” and the “ceremonial”, utilising the link between, i.e. navigating the River Avon.
- The disposition of barrows and barrow cemeteries within the respective “sacred spaces” suggest reserved space for the elite members of the community, and probably their families.
- The location of Blick Mead, within the defined sacred space, suggests recognition of use and contribution to developments, including probably the observation of astronomical phenomena, over a long period - extending into the early Mesolithic - and the importance of water for life, as presented in academic papers and lectures by lead researcher, Professor David Jacques.

5.1.5 In terms of defining the future boundary of the WHS, the above geometry contributes to a potential new theoretical model of use of Stonehenge and its wider landscape in prehistory. This provides a strong case for reviewing the extent of the existing “pragmatic boundary” to consider an extended primary boundary and buffer zones.

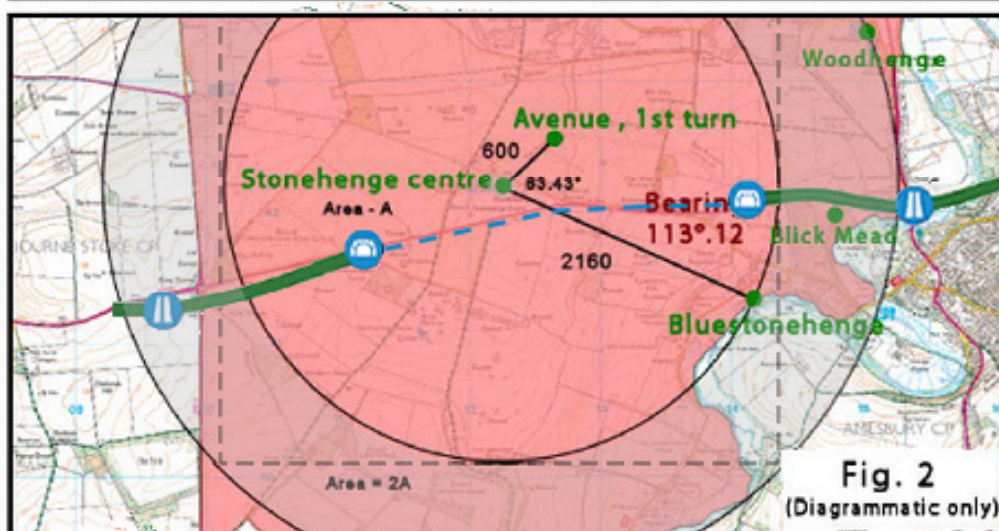
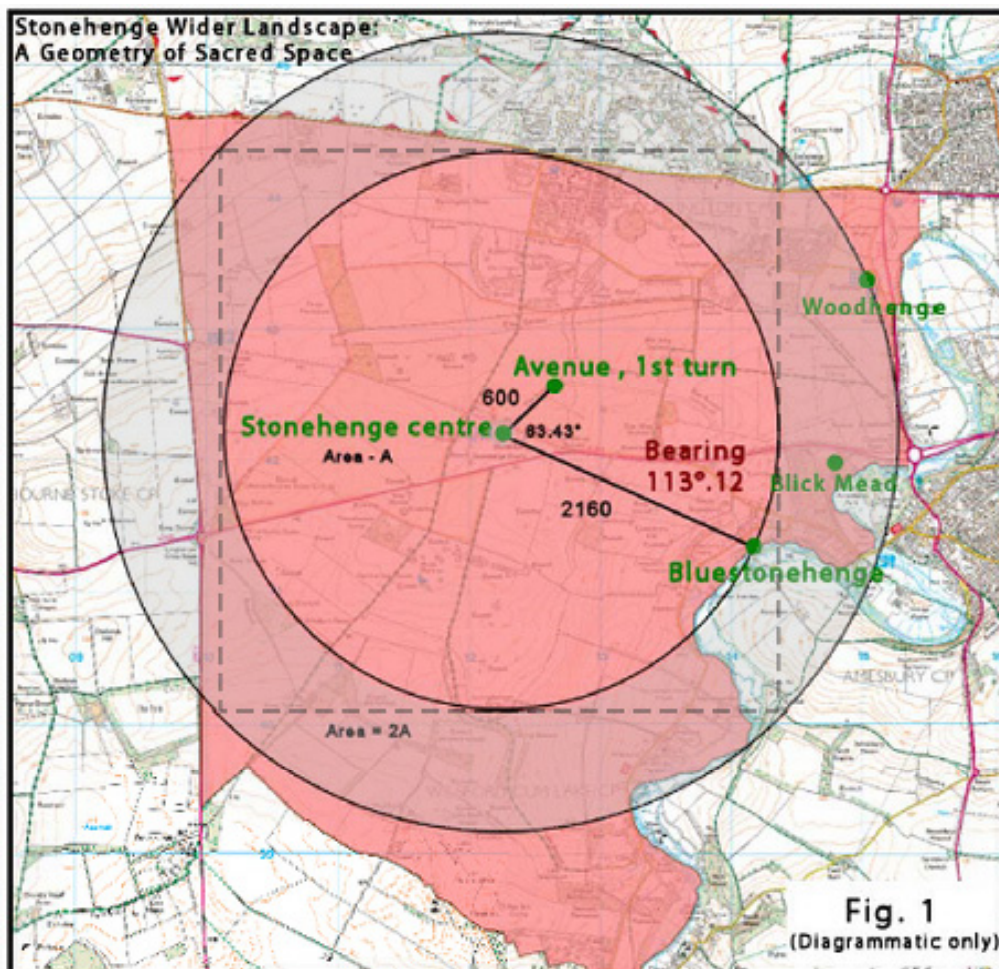
5.2 The impact of the Preferred Short Tunnel Option

5.2.1 The tunnel and proposed location of the portals is illustrated in Fig.2. There are two key issues to consider. Firstly, whereas the tunnel itself is “hidden” from the landscape, the traffic entry and exit portals will not be. Furthermore, the scale of the construction of the portals is significant and this introduces, in the context of EIA and LVIA, the issue of “dominance”. Dominance of structures is a subject that has been given considerable attention in power transmission-line development proposals, namely the impact of pylons. Whereas the tunnel construction concept is largely “perceived” as below ground there is a significant “trade-off” involving “above ground” construction. For example, the requirement for extensive embankments for the carriageways, in strategically sensitive locations.

5.2.2 It is not clear, whether or how issues of ‘dominance’ have been considered and integrated into current LVIA practise, and its relation to EIA, in general, yet alone in respect of WHS designation. To emphasise, the acceptance of Stonehenge was based

on a statement of OUV and its protection and enhancement. The "dominance" of the modern portal constructions will fundamentally relegate prehistoric "engineering" to lesser status. It is not clear how this conflict can be reconciled, if at all.

5.2.3 Secondly, it is not challenged that the engineering expertise required for such a tunnel project, is capable of resulting in the construction of a feature of "outstanding" architectural and engineering merit. However, the intention is to achieve this wholly within an existing designated area and a definable historic "sacred space", in geometric/astronomical terms, if accepted. Visitors to the area will be challenged with the task of decoupling one objective of experiencing its original landscape setting, as close as is possible, at the same time as having to accept a modern development, of considerable dominance, both psychologically and visually during the course of exploration of the area.



5.3 Additional evidence

5.3.1 A forceful argument can be made that knowledge of geometry and related mathematical skills was a cultural phenomenon in prehistory. It is beyond the scope of this representation to identify the researchers, past and present, who have contributed to theories seeking to establish the importance of this phenomenon to cultural heritage. Pertinent evidence, however, is provided by;

i) The enigmatic Scottish stone balls. It is well known that the construction of Stonehenge was a "nationwide" enterprise with contribution from as far as Orkney.



Three Scottish examples, in Kelvingrove Art Gallery and Museum, Glasgow (Creative Commons Attribution at Wikipedia - "Carved stone balls")

and,

ii) More recently, a joint paper (published December 2018) by Professors Andrew Chamberlain and Mike Parker Pearson, and Dr Anne Teather, speculates metrological significance in the equally enigmatic Folkton and Lavant Drums:

"Following recent research, we propose that there is a direct link between the design of the monument of Stonehenge and the chalk artefacts known as the Folkton and Lavant Drums, in which the Drums represent measurement standards that were essential for accurate and reproducible monument construction."

(Reference: <https://www.tandfonline.com/doi/full/10.1080/17498430.2018.1555927>)



(Reference: <https://www.ucl.ac.uk/news/2018/dec/folkton-drums-could-have-been-measuring-devices-used-build-stonehenge>)

In the context of geometry at Stonehenge, it is also significant that these "drums" display the square and circle geometry as in Figures 1 & 2, and as illustrated in the fig below.



Figure 3: Folkton Drums - geometry
 © R P Bartosz, January 2019

The third drum is not illustrated here as a high resolution orthogonal image could not be found. From what was available it does, however, show similar geometric proportions.



Folkton Drums:

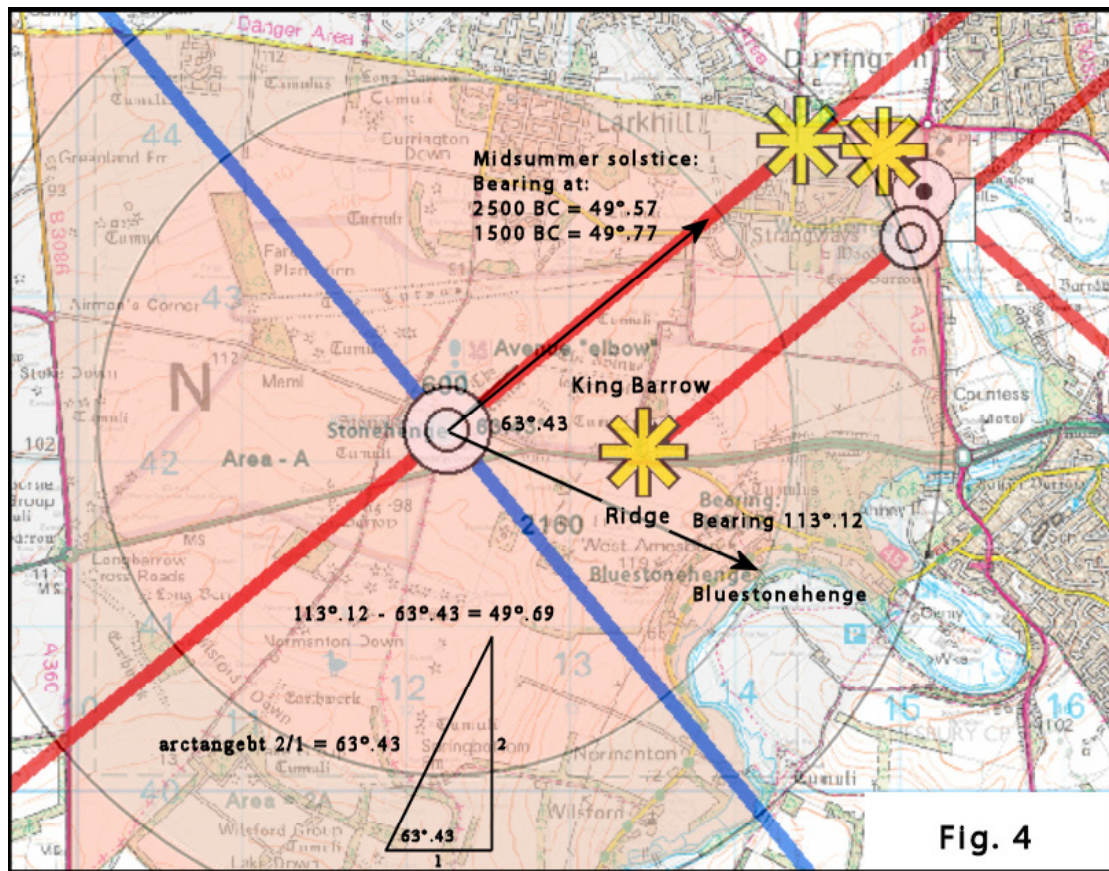
6.0 Adding the Missing Stellar Astronomy to the Model

The following provides a tailored step-by-step illustrated explanation which will, hopefully, make some relatively complicated astronomy and mathematics easier to understand for the purposes of this Application.

6.1 Confirming the Solstitial Alignment through site Geometry

6.1.1 The astronomical element of OUV is well established in terms of the solstitial alignments, namely midsummer sunrise to the north east and midwinter sunset to the south west (as per source as at 2.1 ii) above). It is accepted that this aspect of cultural cosmology was included intentionally within the extent of "sacred space". Therefore, if the geometric model, as above, holds credibility then the parameters of either distances or angles as shown in Figures 1 and 2 (or both) need to be investigated in order to establish if the solstitial alignment is represented.

6.1.2 In Figure 4, the geometric model is overlaid onto the diagram of alignments as presented in Highways England's Environmental Statement, Appendix 6.1, Annex 5. (Note: The lines do not match precisely as the sightline diagram is only "indicative", and the overlay also is "diagrammatic". The angles shown are, however, accurate.) Between 2500 BCE and 1500 BCE, which roughly equates with the period that Stonehenge monument remained active, the summer solstice sunrise bearing from the centre of Stonehenge changed over time from approximately $49^{\circ}.57$ to $49^{\circ}.77$. Simple arithmetic by way of $113^{\circ}.12 - 63^{\circ}.43 = 49^{\circ}.69$. This is a very strong indication that the geometry from Bluestonehenge via the Avenue to the centre of Stonehenge, is both intentional and related to the solar alignment, for whatever "sacred" objective was intended.



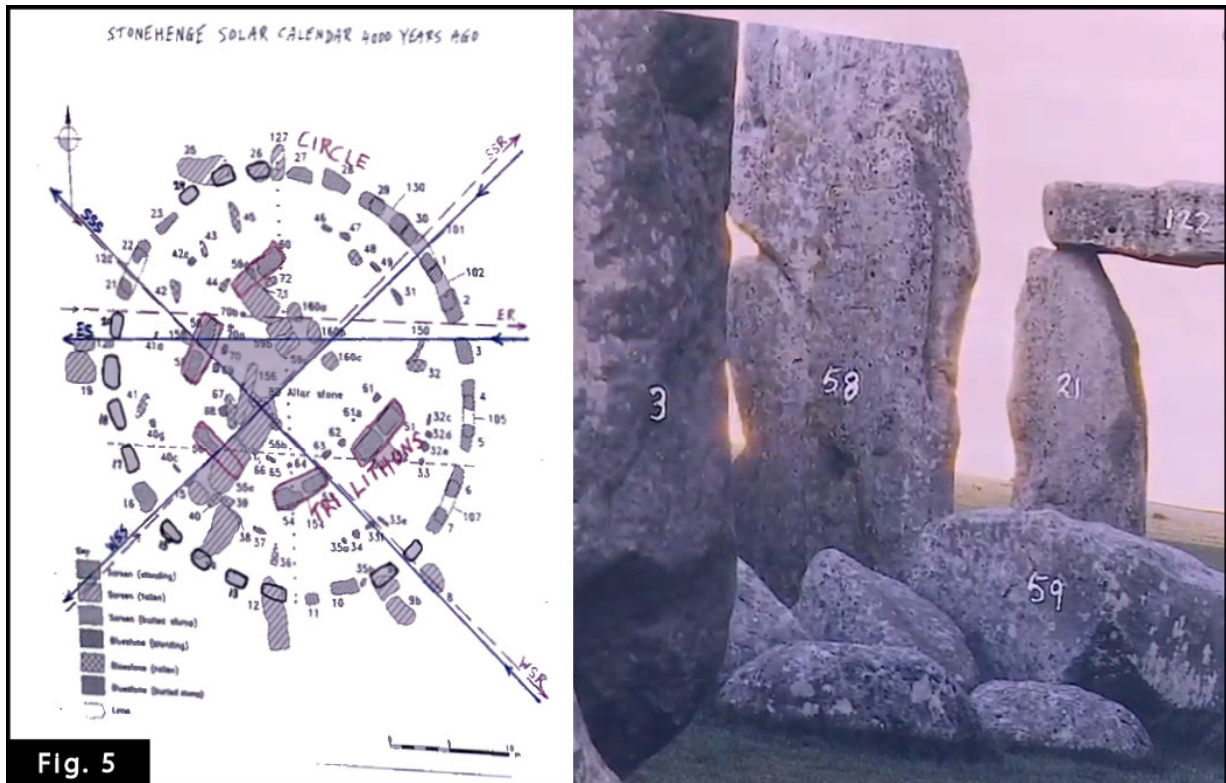
6.1.3 The angle of $63^{\circ}.43$ is fixed because it represents the angle opposite the long side of a right-angled triangle, and where the long side is twice the length of the short side. Hence $\arctangent\ 2/1 = 63^{\circ}.43$. This, in turn, is important in the context of the number 2 and its square root, and clearly the $\sqrt{2}$ function in the geometry of the Stonehenge "Setting".

6.2 Invoking Stellar Astronomy to discover a putative Stonehenge Date Stamp

6.2.1 Whereas the solstitial alignments are accepted, neither theorised cardinal equinoctial alignments nor any stellar elements currently share equivalent status. However, independent researcher Gordon Freeman identified a potential Stonehenge calendar and has detailed this in both a book

(Ref: <http://canadastonehenge.com/2017/01/how-stonehenges-solar-calendar-works/>)

and YouTube video (Ref: <https://www.youtube.com/watch?v=0k9Piwbg6Q4>). Fig.5 is a combination of snapshots from the video illustrating the autumnal equinox sunset alignment through the lower notch on Stone 58 as observed from between Stones 2 and 3 of the Sarsen Circle.



6.2.2 Intrigued by this potential evidence I mused over the possibility that if the upper notch were intentional, then a date stamp could have been constructed on Stone 58, if the notch was intended to be a viewing port, at night, to an asterism of approximately solar proportions. Confirmation of solar proportion was provided by an image taken during a guided walk around Stonehenge by Heather Sabire for former President Barack Obama. The most obvious astronomical candidate was the Open Cluster of Pleiades, probably the most famous of naked eye observable asterisms, both currently and likely throughout history. Fig.6 is a combination of images illustrating the result for the purposes of this representation.

6.2.3 Whereas the result is intriguing, it has firstly to be confirmed through on-site theodolite survey, and secondly, if validated, it does not necessarily mean that the date was an intentional Stonehenge completion marker. It may have represented the time of an inauguration ceremony, but it could equally have been subsequently created to mark a specific significant event. Nevertheless, the calculated date does suggest the former - stressing again, the need for on-site survey of this feature for assessing astronomical significance.

Fig.6 Putative Date stamp at Stonehenge



Alcyone
 Magnitude: 2.85 (extincted to: 4.82)
 Absolute Magnitude: +2.61
 RA/Dec (on date): 23h45m58.26s/+2°24'22.3"
 Az./Alt.: +270°24'04.9"/+3°00'04.6" (apparent)
 Ecl. long./lat. (on date): +357°46'21.2"/+3°37'24.0"
 Ecliptic obliquity (on date): +23°58'27.9"
 IAU Constellation: Tau

The Pleiades

An Astronomical Date Stamp for Stonehenge?

The angle between the two observation ports was estimated, and the date when the dominant asterism of the Pleiades crossed the equinoctial azimuth was found (centered on the brightest star - Alcyone).

If this course estimation is supported by more accurate survey, the margin of error could potentially be within 20 years either side of the observed date.

Vernal Equinox Sunset: 2500 BC

(Reverse view of Stone 58 using a higher resolution image)

Date and time			Julian Day		
-2499	- 11	- 12	3	: 39	: 13

As observed from between Stones 2 & 3.
 Ref: Gordon R Freeman, A Stonehenge Solar Calendar.

© R P Bartosz Stellarium Version 0.18.2 April 2019

6.2.4 Why the Pleiades? The astronomical phenomenon of stars, and their respective asterisms, travelling north and south along local visible horizons - whatever they may have been envisioned as at the specific time - offers a situation of "coupling" alignments to the predominantly fixed positions of the solstices and equinoxes. In a word, stars and asterisms can act as a "proxy" for the cardinal solar (and, indeed, lunar) alignments. The table below illustrates a sequence of "proxies" 3800 - 1400 BCE.

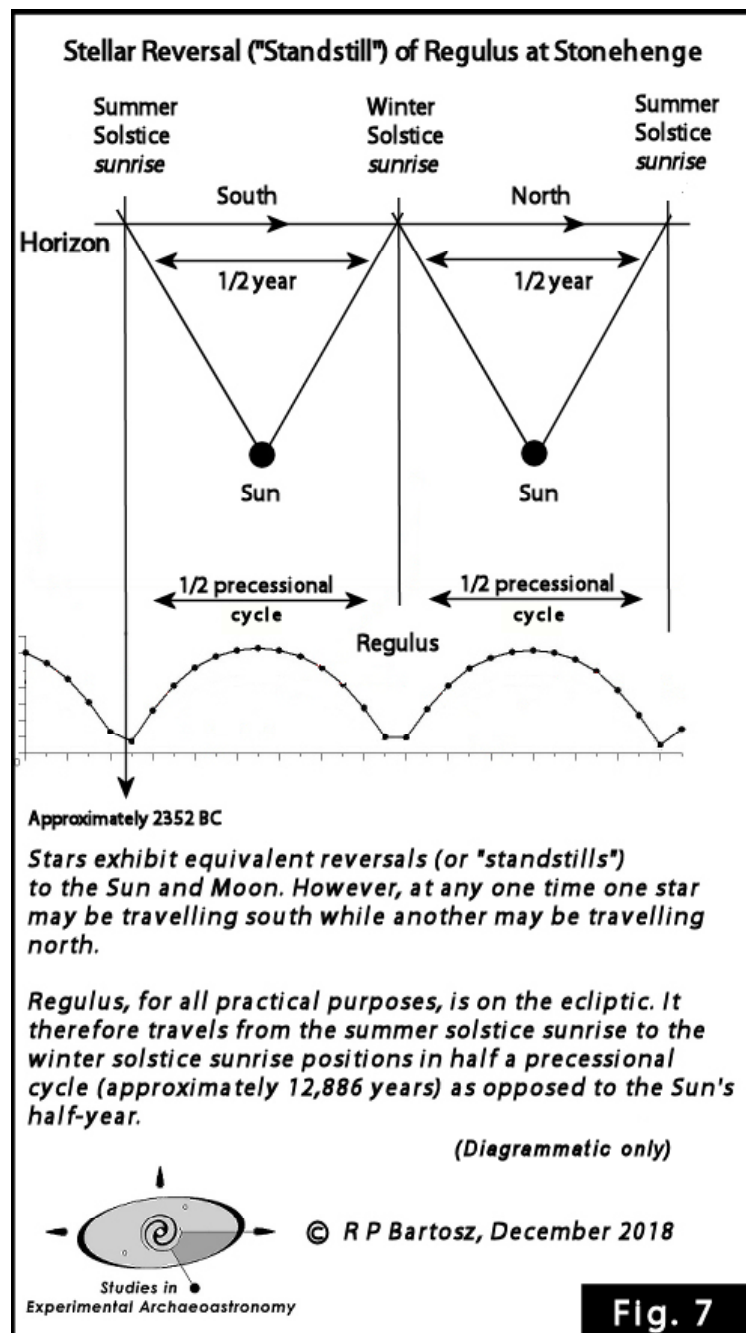
Star	Constellation/Asterism	Proxy for	Date BCE	Magnitude
Procyon	Canis Minor	Equinox	3800	0.40
Alcyone	Pleiades	- ditto -	2900	2.85
Aldebaran	Taurus	- ditto -	2100	0.85
Betelgeuse	Orion	- ditto -	1400	0.45

6.2.5 Whereas solstices (once annually), equinoxes (twice annually) and lunar standstills (every 9.3 years) can only be observed at the respective times, celestial objects as proxies can be observed on any clear night in the appropriate seasons, extending over many weeks and even months. This offers a means of establishing alignments at proposed new sites quickly, and to a high degree of accuracy, whatever the profile of the local horizon. In the case of the Pleiades, the prominent asterism makes up for the lower brightness of the reference star - Alcyone - and its observation would have been well established prior to the putative "Date Stamp" suggested.

6.3 Observing Stellar Phenomena at the Horizon

6.3.1 The phenomenon of the Sun and Moon travelling north and south along the horizons is generally well known. The eastern horizon is the "rising" horizon and the western horizon is the "setting" horizon. The Sun's travel, with reversal points (solstices) lasting roughly five to ten days in terms of apparent "standstill" at north and south extremes, is celebrated annually world wide. The Moon's "Standstill" is more complicated, completing a full cycle of phases, for example successive New Moons from north to south extremes every 29.53 days. An informative leaflet "*Stonehenge and Ancient Astronomy*" produced by the Royal Astronomical Society may be downloaded from, https://www3.cliveruggles.com/images/cliveruggles.com/documents/ras_stonehenge_factsheet.pdf

6.3.2 What is generally not known is that both individual stars and their respective constellations/asterisms, which both rise and set at horizons - *with the exception of "circumpolar" stars and constellations which are always visible above the horizon* - do exactly the same but over considerably longer timescales. Whereas, the position of the solstices, as observed on a local horizon, move very slowly backwards and forwards, covering an angle of approximately three degrees (dominated by the obliquity cycle of some 41,000 years), the movement of other potential celestial reference objects is largely governed by the precessional timescale of approximately 26,000 years (25,772 years referenced at year 2000). This is illustrated in Fig.7 below with reference to the star Regulus (the "King's Star") in the constellation of Leo (the Lion).



6.3.3 It is important to note, as stated in Fig.7, that stars, and therefore the corresponding asterisms of which they are a part,

- i) May be travelling along the horizon in opposite directions, and
- ii) May not be visible because their maximum elevation is below the local horizon, but will eventually become visible as time progresses, depending on latitude.

In the case of ii) and in the context of communities resident at different latitudes, this leads to a community being able to anticipate the arrival of a celestial object, and a state of "waiting for" followed by celebration on first observation. To illustrate the importance of this for Stonehenge and its OUV in the context of the Mesolithic, I will

focus on the constellation of Orion (the Hunter) alongside that of Leo (which for the purposes of adding a "mythological" flavour to this representation, I will call the "Beast", and use the descriptions interchangeably with formal nomenclature)

6.4 The Beast, The Hunter and the Mesolithic - but "never the twain shall meet" in battle - not in the Neolithic, the Bronze Age and nor at any time in the future.

(The astronomy graphics are taken from Stellarium, Version 0.18.2)

6.4.1 The Mesolithic of Western Europe, namely "Great Britain" and Ireland is defined as having a time span of approximately 9000 BCE to 3500 BCE. Until such time as this period is thoroughly researched it will be difficult, if not impossible, to identify all the elements contributing to OUV. Activity within the Stonehenge landscape can be dated back archaeologically to around 8000 BC, evidenced by the three pits in the former car park north west of the post holes. Blick Mead potentially adds, if it has not already done so, a significant Mesolithic component to OUV and integrity of the wider setting. As indicated at Section 4.2.1 above, new information from cemetery features east of King Barrow Ridge will be forthcoming. The following sections will look at potential astronomical evidence that may help cement a more holistic picture from the relatively more limited sources of archaeological Mesolithic evidence.

6.4.2 Figure 8 is the "master graphic" showing the situation beginning 8900 BCE. In Fig.9 the situation at 8900 BCE is shown. Regulus and Leo are observable rising over the King Barrow Ridge. For a traveller from the west (at night), Blick Mead is "...in the direction of the rising Beast..." (and the equinoctial direction to the east). The Hunter's "belt" is still well below the local horizon and never becomes visible at this latitude, at this time. The rising points on the horizon of both the Beast and the visible part of the Hunter are slowly moving to the north. The residents of Blick Mead, if they constituted a permanent community, must "wait for" Orion's belt to appear.

Fig. 8 Adding the Missing Stellar Astronomy

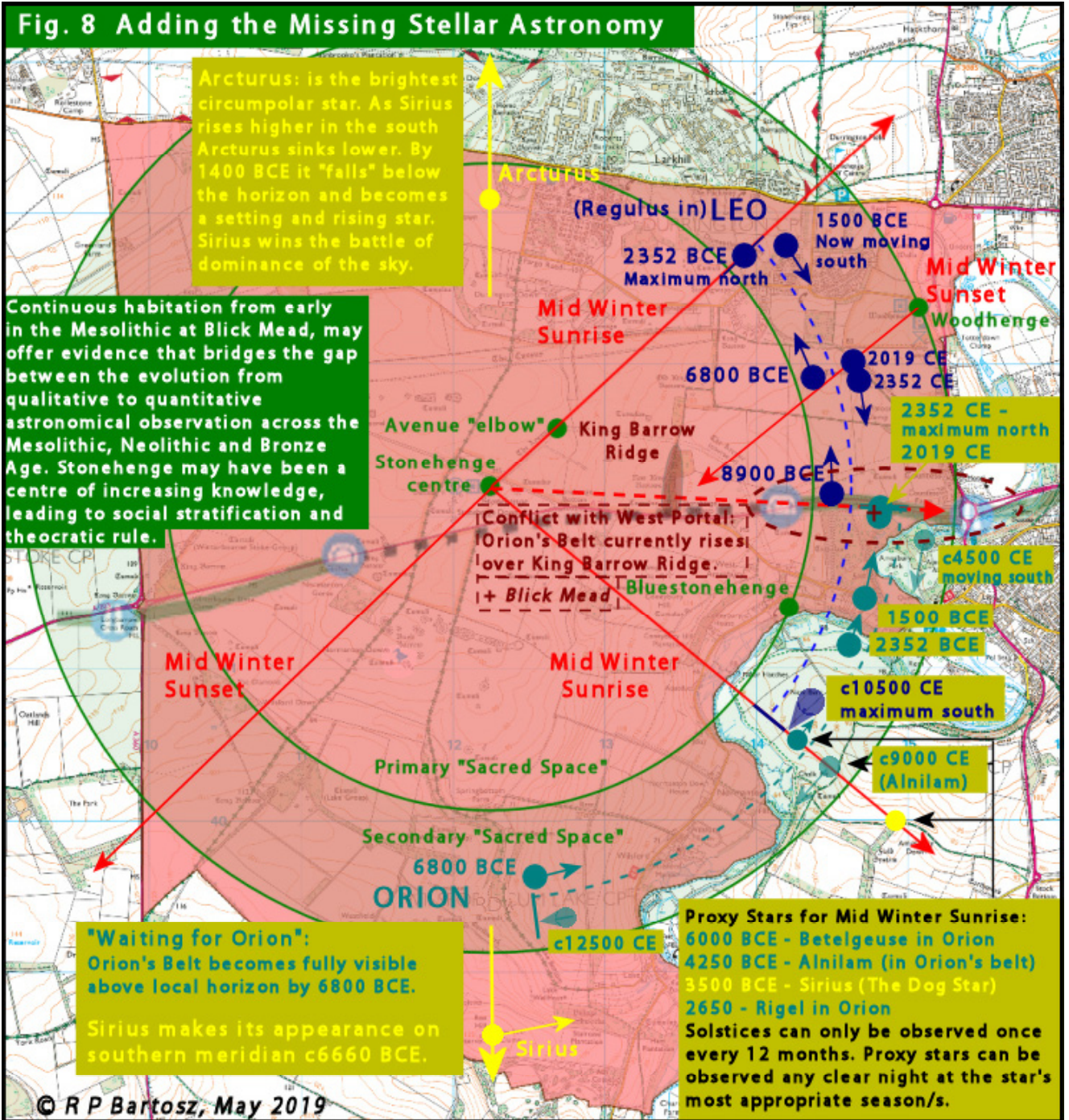
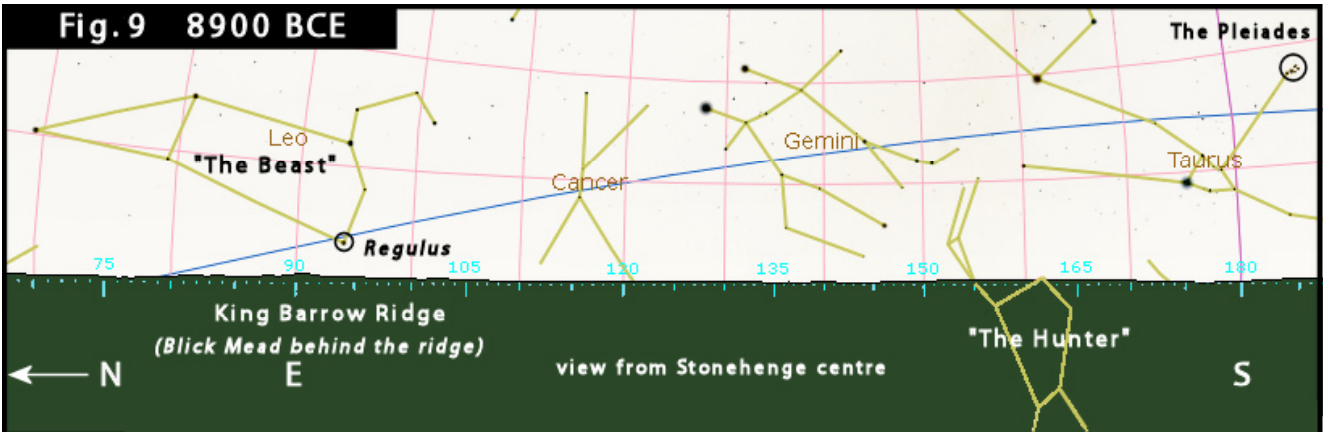
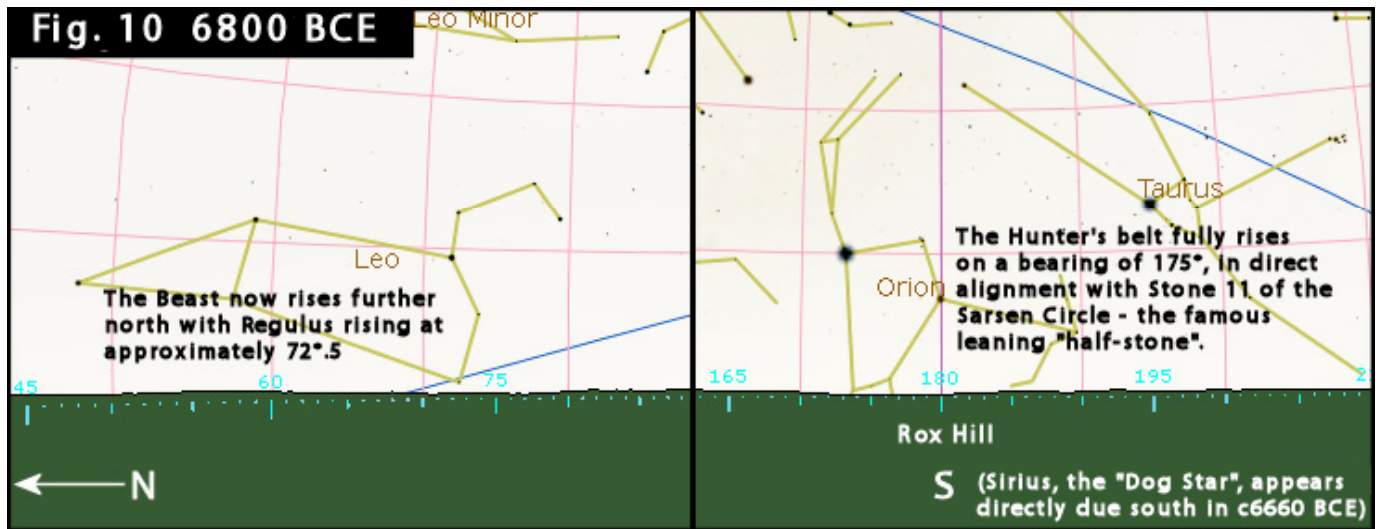


Fig. 9 8900 BCE

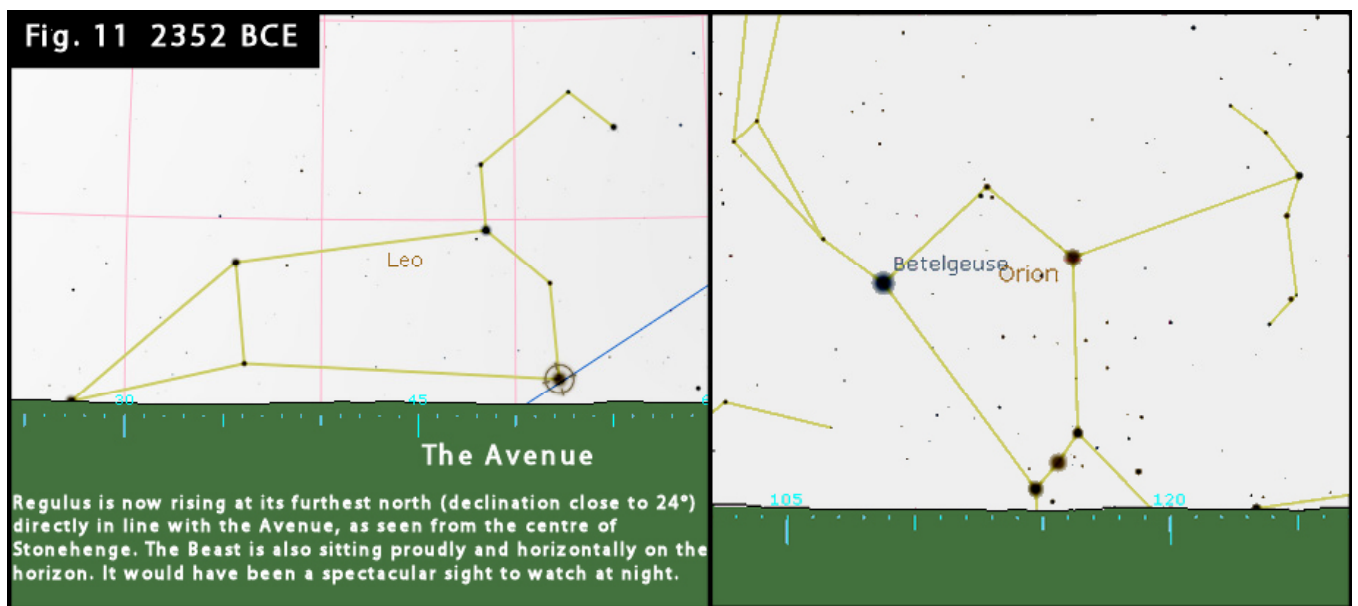


6.4.3 Figure 10 shows the situation at 6800 BCE. The "waiting for Orion" is over. The full belt is visible and rises at approximately 175°. Sirius, the Hunter's companion rises directly due south a few generations later c 6660 BCE. From here on these will be key sky objects to muse over and make up tales. "Perhaps he's come to hunt the Beast", which appears to be running away, as it now rises some 17°.5 further north.



The community at Blick Mead is by now well established and growing. It has a reputation for astronomical knowledge.

6.4.4 Figure 11 fast-forwards to 2352 BCE. It is now the Neolithic. Avebury is constructed. Stonehenge has also been built. Silbury Hill is built, or close to built. The solstitial alignments are important, but the stone monument is also potentially a celebration of the Beast coming to rest. Regulus has stopped moving north and it will rise more or less exactly at the point of the mid summer solstice for decades,



stretching into centuries. In astronomical terms, its declination will remain effectively stationary for many dozens of generations. Regulus has become a proxy for the position of the solstice, because it rises at that bearing from whatever location it is

observed, and at any time that it can be observed doing so throughout the year, not just in midsummer. Orion is now rising some 60° further north along the horizon, now well past the midwinter solstice sunrise bearing of 129°.5, and heading towards the equinoctial bearing. The Hunter's belt is also now rising increasingly more vertically as time proceeds.

6.5 The battle for "dominance" of the night sky - Sirius v Arcturus.

6.5.1 Fig. 8 illustrates the appearance of Sirius, the main star in the constellation of Canis Major (the Greater Dog) and the brightest star in the night sky (magnitude - 1.45), in approximately 6660 BCE. Its brightness, as today, cannot have been missed. It would have been a spectacle to watch it appear, and as time passed through the generations, its position at culmination (passage across the meridian at an observer's location) increasingly rise in the sky.

6.5.2 In the northern sky there were two stars vying for dominance - in terms of brightness. These are the circumpolar stars of Arcturus in the constellation of Boötes (the Herdsman) and Vega in the constellation of Lyra (the Lyre). Both are close to zero magnitude. In 6660 BCE, at lowest culmination, both were some twenty-one degrees above the horizon. By 1400 BCE, when Stonehenge was at the point of abandonment, Vega and Arcturus were now close to the local horizon at lowest culmination, roughly one-degree above. But, Sirius by then was dominating the night sky at an elevation of some twenty-one degrees at the southern meridian.

6.5.3 From here the situation changes significantly. Whereas Vega remains more or less at the local northern horizon (to this day) Arcturus sinks below steadily further. It is now at some twenty degrees below the horizon at lowest, and is firmly a setting and rising star. Eventually, albeit in millions of years time, it will disappear from our sky altogether. Sirius is now close to its maximum culmination and will remain the dominant night star for thousands of years to come. It has won the "battle of the sky".

6.5.4 This factual stellar phenomenon is tied to the cycle of precession. But it is also potentially the stuff of Arthurian legend. Arcturus, in Arthurian research circles is regarded by many as being the epithet for King Arthur. What we have here is the mortal wounding of Arcturus (sinking below the horizon) while its companion Vega (Sir Lancelot) remains weakened. In short the legend or myth of King Arthur could have roots dating back to prehistory. Whether or not folk lore at the time of Stonehenge's abandonment may have been a contributory factor, bearing in mind that Leo also was moving away from the solar alignment, is an intriguing consideration.

6.6 Brief Supporting Comments and Sources

6.6.1 *"As for what attracted these crowds to the site, Blick Mead lies within what would have been excellent prehistoric hunting grounds. Since the mid-1990s, it has been known that, during the 9th-7th millennia BC, the Stonehenge landscape was an area of open and lightly wooded country, with vegetation kept low – perhaps thanks to the regular presence of the large herbivores, notably aurochs, which we now know to have been present here at the time. The environment's plentiful natural vantage points would also have been invaluable to Mesolithic hunters. Given this*

bounty of advantages, it is therefore not surprising that human activity at Blick Mead seems to have been strikingly long-lived."

Kathryn Krakowka - Current Archaeology, 1 February 2017.

<https://www.archaeology.co.uk/articles/blick-mead.htm>

6.6.2 *"We shouldn't assume mesolithic people didn't innovate, didn't change their ideas about their world or didn't engage with other communities in ways that might have affected how they lived. Our default hypothesis – learning from Star Carr, as well as a wider understanding of hunter-gatherers in general – should be that the people at Blick Mead, over 4,000 years, had a complex history."*

Mike Pitts - "A-close-look-at-Blick-Mead-and-Star-Car"

<https://mikepitts.wordpress.com/tag/blick-mead/>

<https://mikepitts.wordpress.com/2018/06/06/a-close-look-at-blick-mead-and-star-car/>

6.6.3 *"Beaker pottery is found widely in Britain from around 2450 BC. Here it forms part of a "cultural package" characterised by single inhumation burials, archery equipment, and objects of gold and copper...the Beaker phenomenon represents a major cultural disjunction in British prehistory...a large scale analysis of ancient DNA recently published in the journal Nature...shows that it was principally the idea of making Beakers that spread between Iberia and the rest of Europe rather than people. But the situation in north-west Europe is very different...in Britain where our study reports whole genomes from 155 individuals from the beginning of the neolithic to the end of the bronze age it is possible to examine what happened at high resolution. Here, the arrival of Beakers was accompanied by a massive genetic turnover, suggesting a substantial influx of new people."*

Ian Armit & David Reich - Beakers: How ancient DNA is changing the way we think about prehistoric Britain.

British Archaeology, May/June, 2018.

7.0 Concluding Comments

7.0.1 I have tried to illustrate how the "skies" may have inspired the construction of the Stonehenge monument, and the function of its wider landscape. The contribution that the local resident communities made as a result of the advantageous conditions for habitation that may have existed from as far back as the early Mesolithic, currently remains under researched. Blick Mead, provides a significant focus, which along with other local sites, may return material evidence in the future.

7.0.2 It is unlikely that the true breadth and depth, in understanding of the World Heritage Site will happen without wider multidisciplinary and interdisciplinary input. The discipline of archaeoastronomy offers untapped expertise. This is currently being promoted under the umbrella title of "Skyscape Archaeology", both within academia and by independent researchers contributing a range of background expertise coupled

with passionate desire. Many have skills, as in my case, entirely pertinent to the circumstances of this application by Highways England.

7.0.3 Engaging in this application process offers an opportunity to change the paradigm that capability of people in those times was restricted to simple observation with little sophistication. Attitudes are changing but perhaps too slowly. Wide ranging skills, need to be brought to bear to fill the gaps. Bridges to understanding the journey in the evolution of qualitative to quantitative astronomical observation across the Mesolithic, Neolithic and Bronze Ages, need to be built. Bridges to understanding the impact on the design and purpose of Stonehenge's "sacred" setting.

7.0.4 I am convinced that this proposal to build within the "sacred setting" of Stonehenge, will significantly damage the integrity of OUV, and not enhance it any way. I believe future generations will judge the scale of the proposal as unjustified. The monetary value of the scheme is already "low" as stated. The engineering difficulties, and cost, of future decommissioning is a burden which should not be passed on to those future generations.

7.0.5 It may also be that evidence materialises to support construction of the stone monument as being to celebrate the "meeting" of the solar cycle with the "Long cycle" (precession as we know it) represented by the star Regulus, and coincident with the mid summer sunrise alignment. I believe we underestimate the skills and sophistication of the people of those times, and the barrows at King Barrow Ridge may have been placed there, in knowledge of the eventual "standstill" of Orion in the future - a meeting of the Long cycle with the equinox. It should be left to future generations to decide if they wish to build a suitable monument, in 2352 CE or other appropriate close "astrological date", in honour of our ancestors and the enjoyment their hard work has given so many in our era. The "sacred" setting of Stonehenge, should remain "sacred". It is our legacy to those future generations.

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