Paper 8. The Date of the Exodus

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8. The Date of the Exodus

Knowledge of the exact date of the Exodus of the Israelites from Egypt is crucial to reconstructing all Bible chronology. With this knowledge, the dates of Adam′s sin to the end of God's 7000-year plan can be accurately determined.

As it is critical to know when the Exodus occurred, we can expect God to provide us with the knowledge to establish a definitive and verifiable date for it. The information must be found in the Bible, because it is the Word of God, as only then will it have the required credibility. ″Paper 6. Chronology″ arrives at the same date by an independent method, so there are two witnesses, as required by Dt 17:6 and Mt 18:16, to the same date for the Exodus.

This Paper examines part of Joshua chapter 10 to arrive at a method for calculating the date of the Exodus using modern-day astronomy, which is part of the increase in knowledge prophesied in **Daniel 12:4 (KJV)**

4 But thou, O Daniel, shut up the words, and seal the book, *even* to the time of the end: many shall run to and fro, and knowledge shall be increased.

The increase in knowledge has made available, to the man in the street, the necessary tools such as astronomical software, and powerful personal computers. Daniel 12:4 identifies this time as the ″time of the end″, which provides comfort in knowing that God′s plan is close to completion.

Brief Summary of Some of the Possible Dates of the Exodus

At present, there are many archaeological theories for determining this date. The earliest date for the Exodus is based upon evidence that the last time Jericho was occupied as a walled city was about 1550 BC. Joshua, chapter 6 describes how Joshua and the Israelites destroyed the walls of the city. The date of the Exodus, therefore, would have been 40 years before this, which is 1590 BC.

https://ancientexodus.com/the-date-of-the-exodus/

Notwithstanding the 1590 BC date, the year 1446 BC is generally considered to be the ″early date″ of the Exodus, which is based on that year being 480 years before the time when Solomon started building the first Temple in Jerusalem.

http://www.biblearchaeology.org/post/2009/10/19/recent-research-on-the-date-and-setting-of-the-exodus.aspx

1 Kings 6:1 (KJV)

1 And it came to pass in the four hundred and eightieth year after the children of Israel were come out of the land of Egypt, in the fourth year of Solomon's reign over Israel, in the month Zif, which *is* the second month, that he began to build the house of the LORD.

Conventional dating for the reign of Solomon is from 970 to 931 BC, which identifies 967/6 BC as the fourth year of his reign and the year in which the building of the Temple commenced.

The ″late date″ for the Exodus is typically 1250 BC, which is based on evidence for battles in Palestine, dating to about 1230 BC, and the reign of Ramses II, 1279 – 1213 BC. The biblical rationale for this comes from Exodus 11: 1, which mentions Pithom and Ramses. It is assumed that the Israelites would only build a city named Ramses when he was Pharaoh.

http://crowlspace.com/?p=2973

Exodus 1:11 (KJV)

11 Therefore they did set over them taskmasters to afflict them with their burdens. Moreover, they built for Pharaoh treasure cities, Pithom and Raamses.

Astronomical Interpretation of Joshua Chapter 10

The following analysis owes nothing to archaeology or any discipline other than the Bible and astronomy. Joshua chapter 10 describes the events which took place at the time that the Israelites defeated the Amorites, which occurred a little more than 40 years after the Exodus. If this defeat can be dated astronomically, then the year of the Exodus will be known from that.

Numbers 32:13 (KJV)

13 And the LORD'S anger was kindled against Israel, and he made them wander in the wilderness forty years, until all the generation, that had done evil in the sight of the LORD, was consumed.

The anniversary of the Exodus is the 15th day of the 1st Hebrew month.

Numbers 33:3 (KJV)

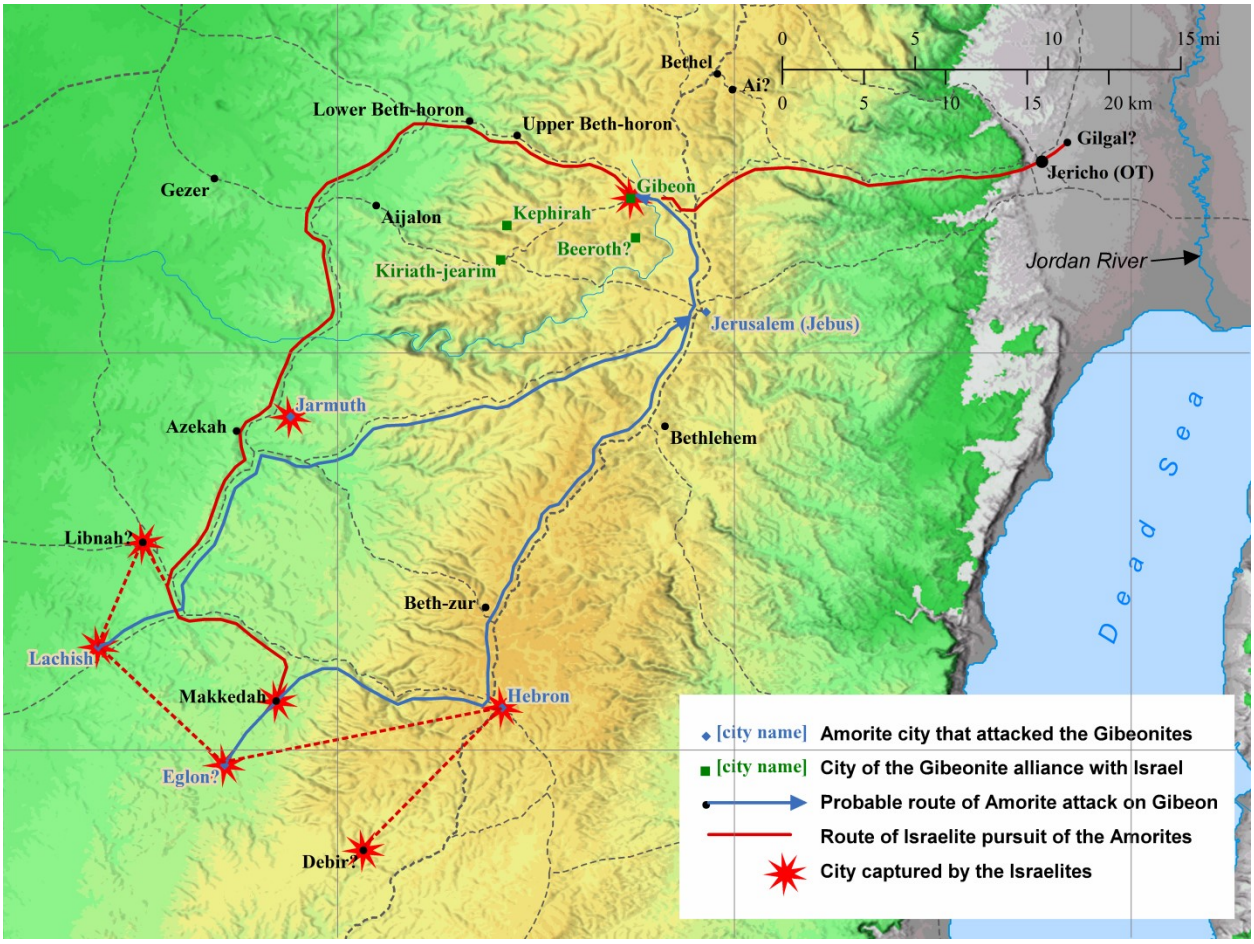
3 And they departed from Rameses in the first month, on the fifteenth day of the first month; on the morrow after the passover the children of Israel went out with an high hand in the sight of all the Egyptians.

The book of Joshua records the events which led to the conquest of Canaan by the Israelites and the subsequent division of the Promised Land among the twelve tribes. It commences just after Moses died, and the leadership of Israel had passed to Joshua. The Israelites were encamped at Shittim on the east of the river Jordan, and God parted the waters of the river so that the Israelites could pass over to Canaan. Here they camped at Gilgal and celebrated the first Passover in the land which God had promised them. The miraculous parting of the river made the Canaanites afraid. Joshua then led the Israelites to Jericho, where, after seven days, the walls fell, and nearly all the people of Jericho were slain. Rahab and her family, who had helped Joshua′s spies, were the only ones saved. Joshua then moved on to Ai and slew all the people of that city too. The

men of the city of Gibeon had seen what the Israelites had done to Jericho and Ai, and by deceiving Joshua, they forged an alliance with him.

Joshua 10 tells the story of the battle of the five Amorite kings:

Having seen the victories of the Israelites, the five Amorite kings of Jerusalem, Hebron, Jarmuth, Lachish, and Eglon became afraid and banded together to smite Gibeon for it was an even greater city than Ai. They attacked Gibeon and the men of that city sent to Joshua, at Gilgal, for help. The following map provides an understanding of the location of the cities involved and also the terrain over which the battle took place:



Joshua led his men to Gibeon and came upon the Amorites at night, and battle commenced. God discomfited the Amorites before Israel and slew many of them at Gibeon and then chased them along the way to Bethhoron, Azekah, and from there to Makkedah. God told Joshua that He would be on his side and hailed meteorites upon the Amorites which killed more of them than the Israelites did with the sword. On this day, Joshua commanded the sun and the moon to stand still in the midst of the heavens.

Israel overcame the Amorites, and the five Kings hid in a cave at Makkedah, but they were found there by Joshua′s men. Later that day, after the battle was complete, Joshua had the kings bought before him and had his captains place their feet on their necks to show the Israelites that the Lord was with them. Joshua then smote the five Kings.

Joshua and the Israelites went on to conquer the southern part of the land that God had promised to Abraham, and this phase of the campaign is shown as a dotted red line in the map above. Please note that the location of some of the cities are not well known and have a ″? ″ after their name. As a result, the red dotted line represents the Biblical order in which the cities were captured by the Israelites rather than an accurate geographical representation of the events. The rest of the book deals with further conquests and the division of the land among the tribes of Israel.

God was with Joshua and the Israelites in this battle because He was keeping His promise to Abraham by giving the Promised Land to his people. God was most keen that the current inhabitants were all slain so that none remained to corrupt His people with their sins.

Joshua 10:8 (KJV)

8 And the LORD said unto Joshua, Fear them not: for I have delivered them into thine hand; there shall not a man of them stand before thee.

And also at this time, because it says *"in the day when the LORD delivered up the Amorites before the children of Israel,"* we have Joshua talking to the Lord where he commanded certain astronomical events to occur, **Joshua 10:12 (KJV)**

12 Then spake Joshua to the LORD in the day when the LORD delivered up the Amorites before the children of Israel, and he said in the sight of Israel, Sun, stand thou still upon Gibeon; and thou, Moon, in the valley of Ajalon.

In this verse, the astronomical events can be interpreted, in conjunction with astronomical computations, such that the year of the entry into the Promised Land can be determined. The Exodus was forty years earlier. However, there is insufficient data in Jos 10:12 to isolate a unique date, and it is necessary to include the data from **Joshua 10:14 (KJV)**

14 And there was no day like that before it or after it, that the LORD hearkened unto the voice of a man: for the LORD fought for Israel.

The reason there was *"no day like that before it or after it*," can be seen from **Joshua 10:9 (KJV)**

9 Joshua therefore came unto them suddenly, *and* went up from Gilgal all night.

When the Israelites arrived at Gibeon, it was night, but that did not prevent them from starting a battle. Why would they do this when the sun was not in the sky? There is only one likely explanation, and that there was a full moon.

The author first completed the mathematics of this concept on September 19th, 2013, which was the night of a Harvest Moon, which is a full moon. I went outside to reflect on my findings and could see just how bright such a moon can be. At that point, my wife returned home and told me that the moon was so bright, she had turned her car lights off for a while to see if she could safely drive by the moon without street lights. She could, and she is not one to take risks while driving.

Using the light of the full moon was included in the planning for the Normandy landings on D Day, which was June 6th, 1944. A full moon is bright enough to conduct a battle, especially when the enemy is fleeing and not putting up much of a fight while being bombarded with meteorites. Why meteorites and not hailstones? The answer is because Joshua needed the moonlight, which would have been obscured by clouds if it was hailing. So a full moon is bright enough to help the Israelites march from Gilgal to Gibeon through the mountains and then fight a battle.

"And hand in hand, on the edge of the sand,
They danced by the light of the moon,
The moon,
The moon,
They danced by the light of the moon."

— Edward Lear

The full text of the astronomical events is found in

Joshua 10:12-14 (KJV)

12 Then spake Joshua to the LORD in the day when the LORD delivered up the Amorites before the children of Israel, and he said in the sight of Israel, Sun, stand thou still upon Gibeon; and thou, Moon, in the valley of Ajalon.

13 And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. *Is* not this written in the book of Jasher? So the sun stood still in the midst of heaven, and hasted not to go down about a whole day.

14 And there was no day like that before it or after it, that the LORD hearkened unto the voice of a man: for the LORD fought for Israel.

Since the Book of Jasher is referenced in verse 13 above, the following verses are relevant:

The Book of Jasher 88:63-65

63 And when they were smiting, the day was declining toward evening, and Joshua said in the sight of all the people, Sun, stand thou still upon Gibeon, and thou moon in the valley of Ajalon, until the nation shall have revenged itself upon its enemies.
64 And the Lord hearkened to the voice of Joshua, and the sun stood still in the midst of the heavens, and it stood still six and thirty moments, and the moon also stood still and hastened not

to go down a whole day.
65 And there was no day like that, before it or after it, that the Lord hearkened to the voice of a man, for the Lord fought for Israel.

It was essential to God that all the inhabitants of the land were destroyed lest they turn the Israelites to false gods; see Deuteronomy 12:29-32 (KJV). At this juncture, the Israelites needed help to complete the task lest any of the enemy escape. However, night was upon them, and it seems that the only way that this help could be given is if light could be provided throughout the coming night.

At first glance, it might seem that Joshua′s command was granted by God, who made the sun and the moon stand still in the midst of the heavens to provide that light. By definition, God is omnipotent, and so it would be possible that He used special power to make this happen. The following are two methods that show how this might have been achieved.

The first possibility is for the Earth to stop rotating about its axis such that the Sun is overhead at Gibeon, and the Moon would have to be motionless over the Valley of Ajalon at that time. The forces associated with the cessation of rotation of the earth would have caused a significant catastrophe to the earth and its inhabitants, a fact which is not recorded in the Bible or history.

Also, because the sun and the moon traverse the heavens at different rates, and with the Earth′s rotation halted, the moon would have had to cease its orbital motion to remain in the same place relative to the Earth. The moon is tied to the earth by the force of gravity between them counter-balanced by the centripetal motion of the moon. If the moon is stopped, the centripetal force goes to zero, and the moon, under the influence of gravity, will start accelerating toward the Earth. Of course, God could have provided the necessary force to counteract this and keep the Earth and the Moon from colliding with each other. However, this method is not likely to have occurred.

The second possibility is for both the Sun and the Moon to alter the rates of their orbits to match the rotational speed of the Earth. They would then appear to remain motionless in the sky, which prevents the catastrophe referred to above. However, the havoc caused to the Solar System by the Sun starting to orbit the earth would have been considerable.

Also, the Moon would have to have orbited the Earth once a day, which is about 30 times its normal speed, and this would have caused it to be flung off into outer space since its centripetal force would be higher. Again God could have provided the necessary forces to stop this from happening, but it is improbable that this method would have been used.

In both cases, it can be argued that God would have been violating His promise to Noah, which is that day and night shall not cease, Genesis 8:22, so, again, it is highly unlikely that he would have chosen either of these two methods.

A more reasonable possibility is to recognize that throughout the ages, mankind has observed that the Sun and the Moon do stand still in the heavens regularly. For the Sun, we call this the solstice. From Wikipedia - Solstice ; the word *solstice* is derived from the Latin *sol* (sun) and *sistere* (to stand still) because, at the solstices, the Sun stands still in declination; that is, the seasonal movement of the Sun′s path (as seen from Earth) comes to a stop before reversing direction. Likewise, because the Moon′s orbit is at a 5.15° angle to the ecliptic, it too stands still in declination and comes to a stop before reversing direction two times every orbit of the earth, which is called a lunistice or lunar stand still. There are two lunistices every sidereal month of 27.3 days. The occurrence of a solstice and then a lunistice, at least a day later, is considered herein to be the correct interpretation of Jos 10:12-14. The concept is simple and does not require the use of any special forces to stop the Moon colliding with the Earth or from flying off and does not violate God′s promise in Genesis 8:22.

So this raised the question as to whether it is astronomically possible to identify a unique time in history when a summer solstice and a lunistice occurred a day apart as indicated by this passage of Joshua? The answer is that there is not unless there was a full moon about the same time.

It is necessary to extract more information from specific verses of Joshua, chapter 10.

The first data to extract is from **Joshua 10:13 (KJV)**

13 And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. *Is* not this written in the book of Jasher? So the sun stood still in the midst of heaven, and hasted not to go down about a whole day.

This verse is structured somewhat like Acts 7:6 and 13:20 in that we have a description of a series of events and at the end of which a period is given, which includes all the tasks. For example **Acts 7:6 (KJV)**

6 And God spake on this wise, That his seed should sojourn in a strange land; and that they should bring them into bondage, and entreat *them* evil four hundred years.

We see here that the sojourning in a strange land and entreating them evil lasted for 400 years. It is not evil alone that lasted 400 years. The same is true of **Acts 13:17-20 (KJV)**

17 The God of this people of Israel chose our fathers, and exalted the people when they dwelt as strangers in the land of Egypt, and with an high arm brought he them out of it.

18 And about the time of forty years suffered he their manners in the wilderness.

19 And when he had destroyed seven nations in the land of Chanaan, he divided their land to them by lot.

20 And after that he gave *unto them* judges about the space of four hundred and fifty years, until Samuel the prophet.

So the 450 years began when Israel was exalted as strangers in the land of Egypt to the time of Samuel, which included the exaltation, the forty years in the wilderness, the conquest of the Promised Land, and the Judges, and not just the judges alone.

So in Joshua 10:13, the ″whole day″ implies that the time from the solstice to the lunistice is at least 24 hours. In this verse, the word ″about″ is not present in the Hebrew text, and Strong′s H8549 defines the meaning of the word ″whole″ means ″complete,″ in other words, an entire day of 24 hours.

So the solstice occurred while the Israelites were at Gibeon. A day later, the lunistice occurred when the Israelites were at Ajalon, and from the description of the battle, we can see that there is at least a day between the Israelites being at Gibeon and Ajalon. The map above shows this distance to be about 15 miles, so it would have been possible to cover that distance, downhill, in one day, even with an enemy fleeing before one.

The phrase ″*and hasted not to go down*″ confirms that the day was long, and so this was a summer solstice. The Bible confirms this since we can see from the earlier chapters of Joshua that after crossing the river Jordan, they observed the Passover, which is a spring event. The events recorded in Joshua, which took place after this, would have put the battle against the Amorites at the beginning of summer or earlier.

We can also see from this verse that ″the Sun stood still in the midst of heaven″, which we can take to mean that the solstice occurred as the Sun crossed the local meridian plus 180°. Based on the data above, it would have occurred when the sun was on the other side of the Earth from Gibeon, i.e., at night. The Hebrew word used in Joshua 10:13 for ″midst″ is Strong′s H2677, which can be translated as ″midnight″. As the book of Jasher says in chapter 88:63, the day was declining towards evening, so Joshua was asking for the solstice to occur at night, which would make it the shortest night of the year. The fact that the solstice occurred at midnight helps to isolate a specific solstice.

However, the occurrence of the solstice at midnight and the lunistice a day later does not provide light during the night for Joshua and the Israelites when they arrived at Gibeon. If the sun had stood still, as suggested by Joshua 10: 11 – 14, then this would have provided the light necessary to continue the battle. However, as discussed above, it is considered unreasonable that God used this method. The only real method of providing the most light at night, in a natural way, is for there to have been a full moon at this time. From the description in Joshua 10, the moon had to have been visible; otherwise, the lunistice could not have been observed. On this basis, it is concluded that there was a full moon to provide the maximum luminance to the Israelites, not just for the night of the solstice, but for the nights surrounding the solstice as the battle lasted several days. So though it is not explicitly stated in the account in Joshua chapter 10, it can be concluded that there had to have been a full moon. The closer the occurrence of the full moon to

the solstice, the better it would be for the Israelites. However, we are not given any means of determining how close this would have to be.

From Wikipedia ″Full Moon″:

″All full moons rise around the time of sunset. Because the moon moves eastward among the stars faster than the sun, its meridian passage is delayed, causing it to rise later each day – on average by about 50.47 minutes.

Finally, to reiterate, Joshua 10:14 shows that this day was unique because *″there was no day like it before or after it″*, which is an important selection criterion.

The following information is used to find a unique date for this battle. To summarize:

1. Find a summer solstice within God′s 7000-year plan
2. Find a lunistice which occurs at least 24 hours after the solstice, but it would have been less than one and a half days; otherwise, it would have been written that it was two days.
3. The solstice must occur at local midnight, and specifically, this is the time when the Sun transited the local ante-meridian 180° on the other side of the Earth, which is midnight
4. There had to have been a full moon before or after the solstice and quite close to it
5. The day must be unique because *″there was no day like that before it or after it.″*

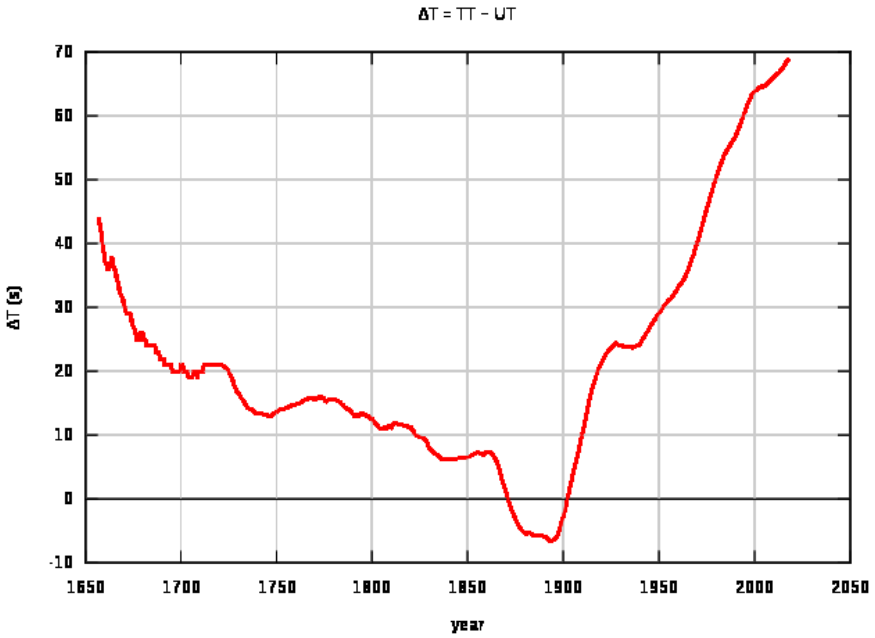
It is possible to conduct a search using astronomical software and a spreadsheet to eliminate all occurrences of solstices that do not match the above criteria. Version 12 of Solex astronomical software was used. It was written by Aldo Vitagliano Federico II and is free. His software can search for times at which minimum and maximum angles of solar system bodies like the Sun and the Moon occur. These are the times when the Sun and Moon appear to stand still. This information can then be transferred to a spreadsheet, and a search can be conducted to identify solstices that occur at, or very near, the crossing of the local meridian at night, followed by a lunistice at least one to one and one-half days later. There is no information in Joshua 10 to identify whether the standing still of the moon was a minimum or maximum lunistice, so both have been included in the search.

The bodies in the solar system move in their orbits through the force of gravity, and to a lesser or greater extent, each one influences the orbits of the others. When computing the position of the bodies at any given time, Terrestrial Time (TT) is used since it is a theoretical ideal and hence free of the irregularities that occur in Universal Time (UT). The earth′s rotational parameters are irregular and introduce small uncertainties in the observation of the time at which planetary events occur at the surface of the earth. TT is based on the SI second, which is approximated, quite accurately, by atomic clocks. When using TT to compute the position of a body, the result defines where the center of that body is in space at a specific time. This is its geocentric position. According to Meeus, ″Astronomical Algorithms″ pp 177, 337, and 367, geocentric coordinates should be used to calculate solstices, full Moons, and lunistices, respectively.

To calculate the time at Gibeon, at which a specific astronomical event occurred, it is necessary to compute Universal Time (UT) and then add an offset. UT is the modern equivalent of Greenwich Mean Time (GMT). UT is related to TT by the following equation

UT = TT – Delta Time (ΔT)

Delta Time accounts for the known variations of the position of the earth′s surface versus time. The chart below shows these variations from 1657 to 2018. Time variations outside this range were estimated by scientists using historical records relating to eclipses.



Musashiaharon - Own work

An ancient astronomer would record that an eclipse occurred at, say noon, which is in terms of UT plus an offset. Knowing the city from which he was reporting, and by calculating when that particular eclipse occurred in TT, it is possible to calculate ΔT for that time in history.

Calculating sufficient values of ΔT overtime allowed modern astronomers to define mathematical curves that can be used to predict ΔT at any given moment in history. A description of a set of polynomial expressions for ΔT can be found at https://eclipse.gsfc.nasa.gov/SEcat5/deltatpoly.html . These polynomials are used in this analysis and are embedded in a spreadsheet.

The issue mentioned above is that uncertainties are introduced by ΔT when converting from TT to UT. These are not constant but increase with increasing time before or after the modern era.

For example in

6000 BC the uncertainty was ±37049 seconds (10.3 hours)
2070 BC the uncertainty was ±4033 seconds (1.1 hours)
67 BC the uncertainty was ±285 seconds (0.1 hours)
AD 2005 the uncertainty was ±0 seconds (0.0 hours)
AD 3933 the uncertainty will be ±5724 seconds (1.6 hours)

When computing selection criteria, such as the lunistice being 1 to 1.5 days after the solstice, it is possible to calculate the difference by keeping the times of the occurrence of both events in TT, and the uncertainties above are avoided. Also, this is true when determining the relationship between the solstice and the following full moon. However, when determining the relationship between midnight and the solstice, we have to convert to UT, and the uncertainty then comes into play. For example, the selection criteria are that the solstice occurred at midnight, but in 6000 BC, the uncertainty is ±10.3 hours for a total of 20.6 hours, which allows the solstice, in that year, to occupy almost an entire day which makes it almost useless as a selection criterion.

Taking note of this issue is then used to determine the order in which the selection criteria are applied so that as many ″early″ candidates, i.e., occurring before 2000 BC, are rejected using TT based criteria before applying the UT selection criteria. In other words, the time between the solstice and lunistice is applied first, then the time between the solstice and full moon, and finally the time of the solstice.

The Analysis

The analysis was carried out as follows:

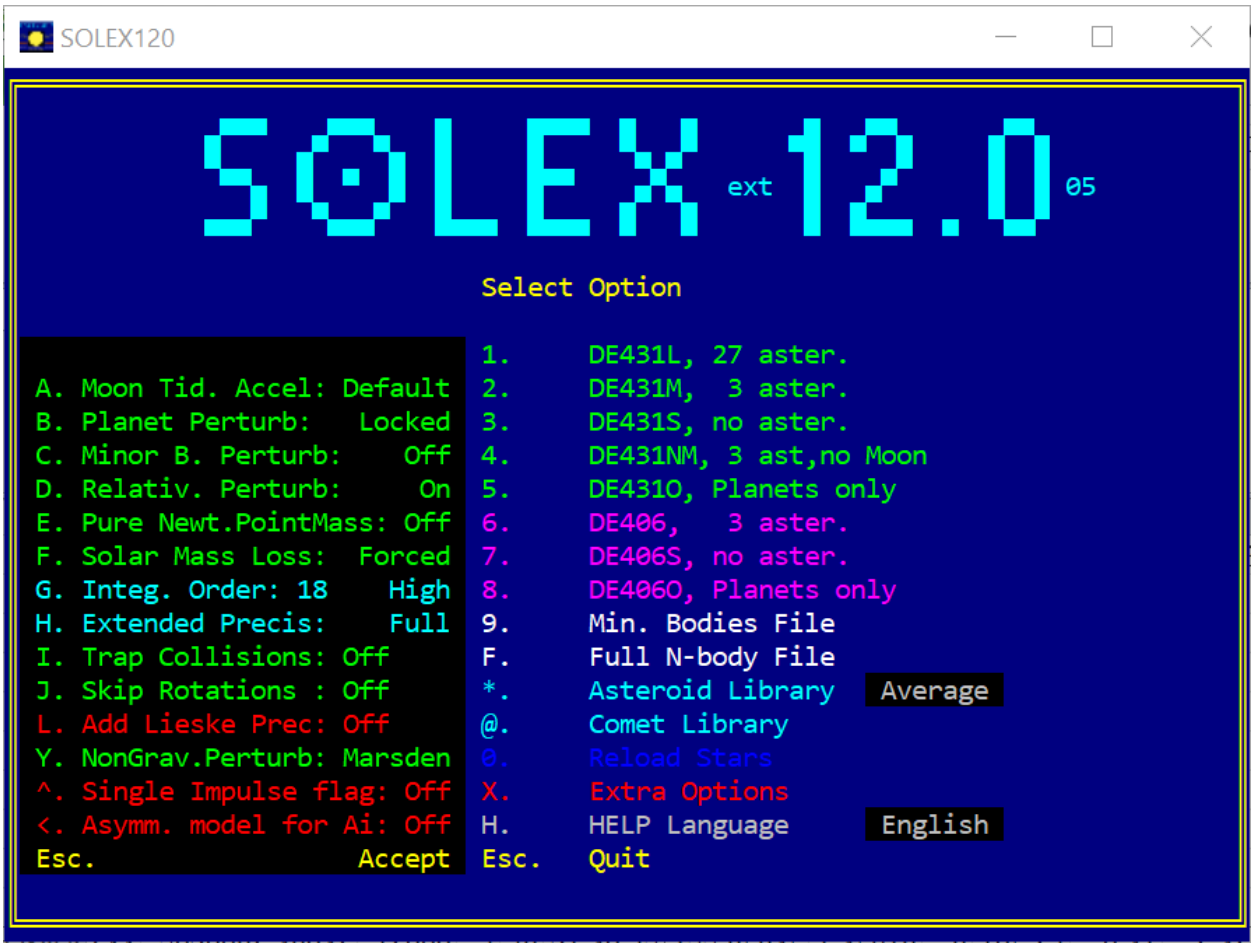
Solex 12.0 was used as it is more accurate over the required time range because it uses JPL DE431 rather than the earlier DE406. JPL DExxx stands for Jet Propulsion Laboratory Development Ephemeris, followed by a number.

As Wikipedia says, *″The models consist of computer representations of positions, velocities and accelerations of major Solar System bodies, tabulated at equally spaced intervals of time, covering a specified span of years.″*DE406 was released in 1998 and covered the years 3000 BC to AD 3000. DE431 was released in 2013 and covered the years 13201 BC to AD 17191.

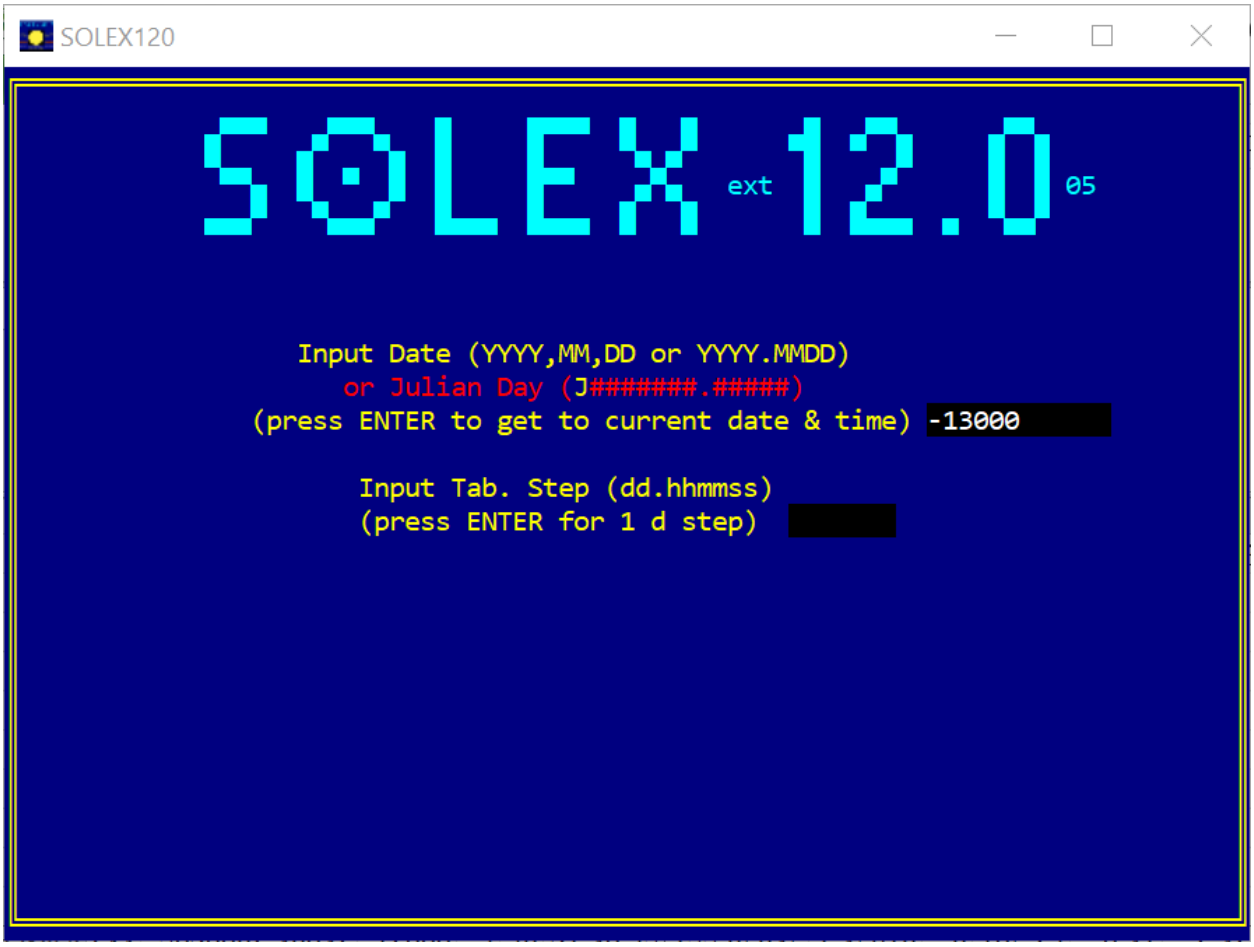
Solex was configured to generate dates for summer and winter solstices, lunistices, maximum and minimum, and full moons for the years -13000 to 17000. The reason for such a wide range of dates, 30000 years, was to evaluate search parameter number 5 which is *″there was no day like that before it or after it*,″ There is no specific detail in the Bible which allows this statement to be evaluated. After trial and error, it was decided that widening the period over which the first four search parameters are evaluated results in a visual method of understanding *″there was no day like that before it or after it.″*

Solex is the only PC software available that would compute lunistices over the 30000-year range.

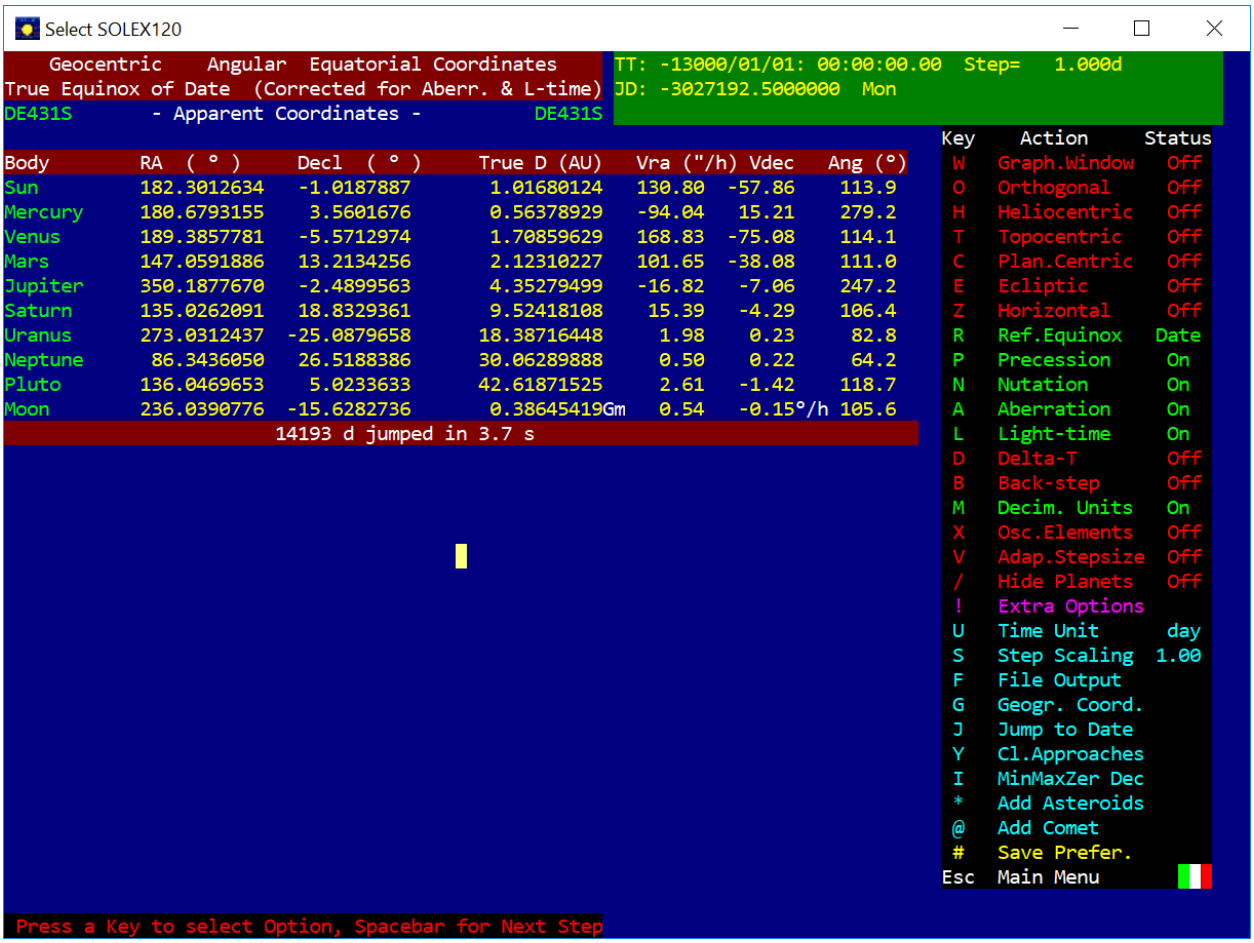
Under the X menu, Solex was configured with options A through J, and Y set green. Options L, ^ and < were set red. ″Option 3, DE 431S, no aster.″ was selected, and then the start date, -13000, was set with the default step size of one day. Keys R, P, N, A, L, and M were set to green, and the rest above ″Extra Options″ were set red. See the control panel as follows:



Then



Then



Solstices were generated using option I ″MinMaxZer Dec″ then press M, then 0 for the Sun and then enter the end date, ″17000″. The dates are stored in the file ″MAXMILAT″ in the Solex directory. Sixty thousand solstices were computed. These were saved and then input to Excel. The Winter Solstices were rejected, leaving 30000 Summer Solstices labeled SS.

Lunistices were also generated using option I ″MinMaxZer Dec″ then press M, and then 10 for the Moon and then enter the end date, ″17000″. The dates are stored in the same file ″MAXMILAT″ in the Solex directory, so make sure to save the solstice data first. In all 802104 lunistices were computed. These were input to Excel.

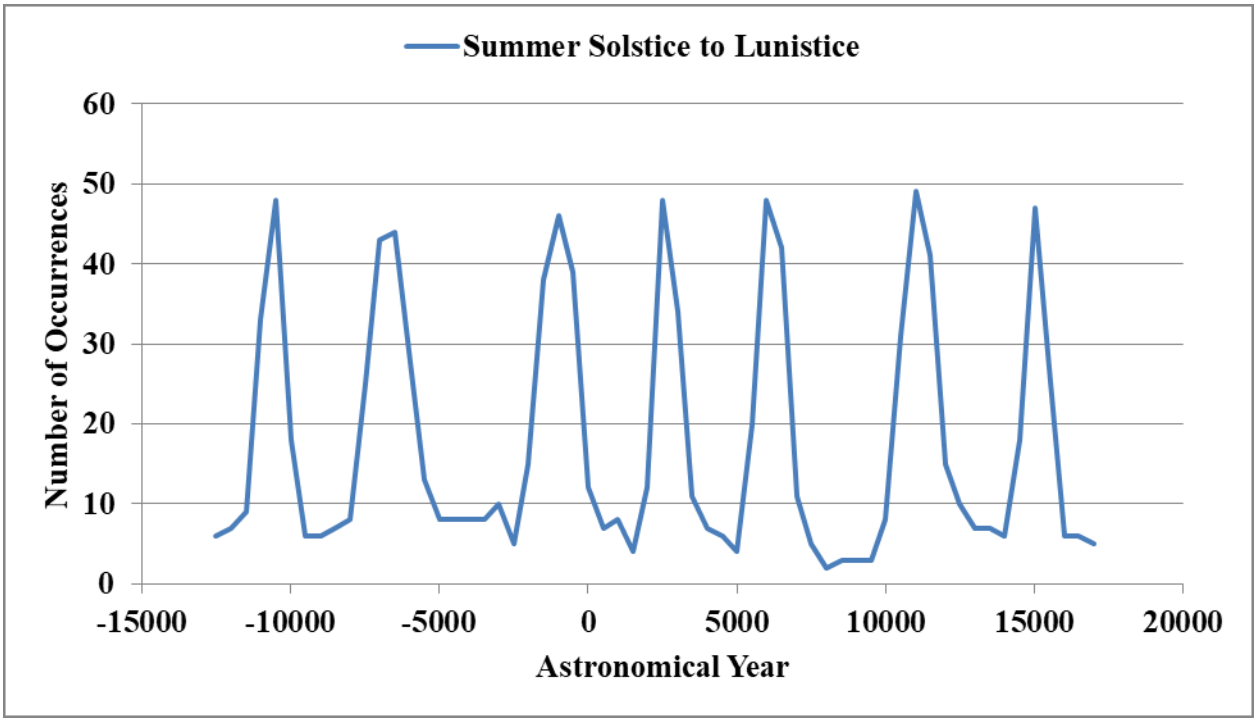
The proximity of the solstice to midnight was calculated in Excel, taking into account the uncertainties that occur when converting TT to UT.

Full moons were generated using the ″Cl. Approaches″ option ″Y,″ followed by ″E″ for Moon-Sun, then 2 for the Max Angle, see Solex 11.0 ″Help file″ for why, and ″/O″ for oppositions which are full Moons. Follow this with the end date, ″17000″. The times of 371052 full moons were calculated and stored in the file ″MINDIST, but make sure the solstice and lunistice data are safely stored in another file first.

For each of the above events, Solex calculated the decimal Julian day number. The solstices, lunistices, and full Moons were then transferred to the spreadsheet and sorted into chronological order by using their Julian Day value. The results were processed by Excel to generate charts that show how each of the selection criteria, individually and in combination, reduce the pool of available dates to one.

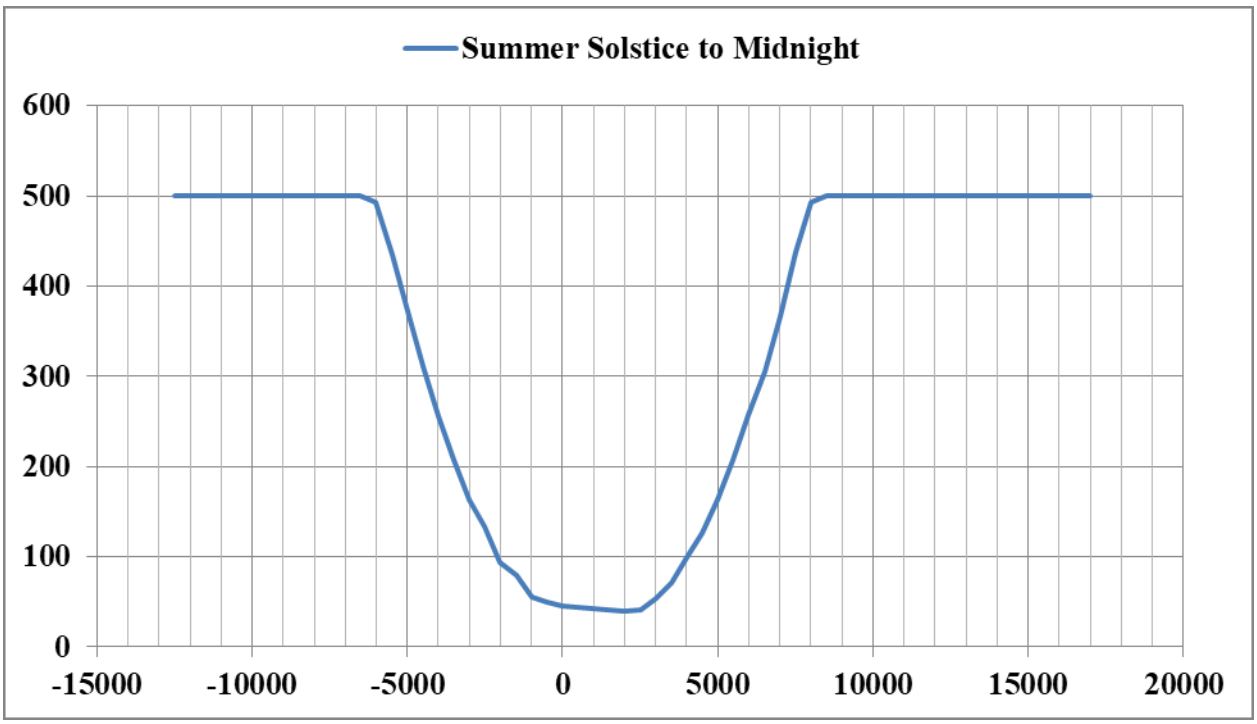
God′s plan occupies 7000 of the 30000 years, and to determine the very earliest date for the start of God′s plan, let us assume that at this time, it is just a few years from completion. Backing up 7000 years from, say, 2000, takes us to -5000. It can also be said that in the year 2000, we knew the entry into the Promised Land has already occurred, so we can confidently say, grossly, that any event that indicates this entry, between -5000 and 2000, is acceptable.

The data for 30000 years was divided into 60 bins of five hundred years each and then plotted along the X-axis. The following chart shows the years where there are no more than 1.5 days, between the summer solstice and the next Lunistice. The total number of years remaining is 1060, and the range for the 500-year bins is from 2 to 49 years. The retention ratio is 1 to 28.3.

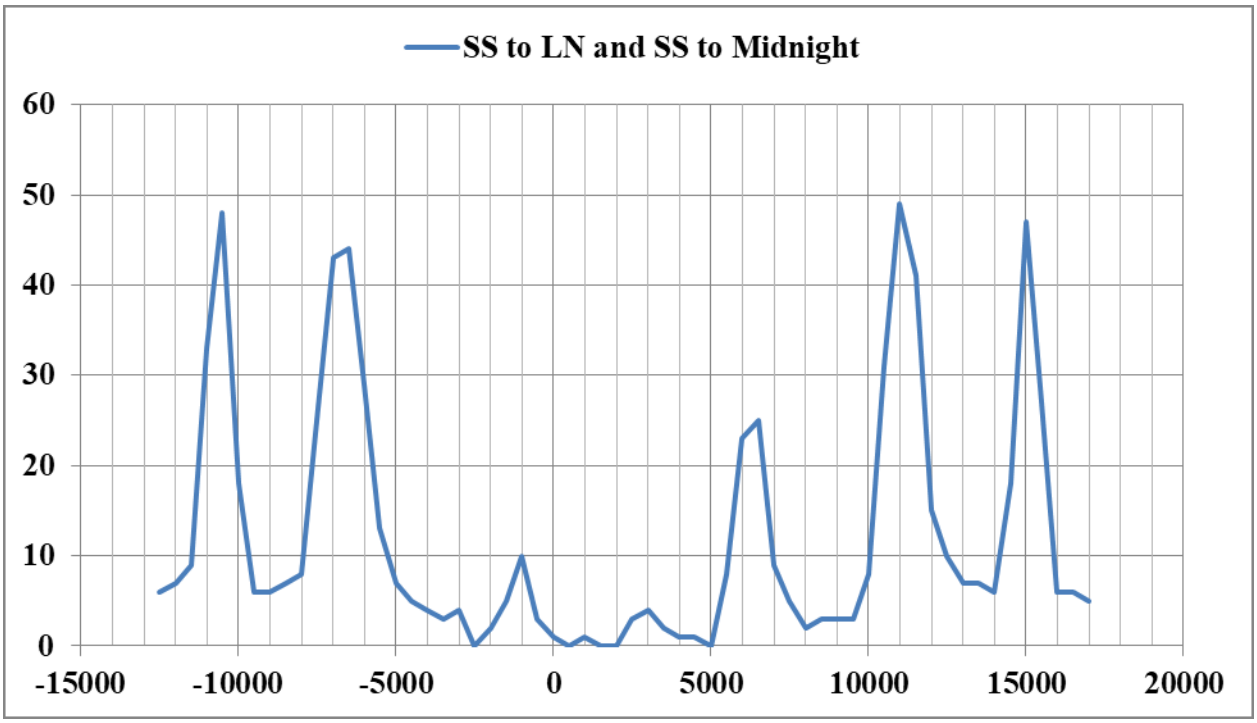


The next chart shows the number of years remaining in each 500-year bin after the summer solstice is restricted to being within 1 hour from midnight. The chart shows how the uncertainties in converting time from the TT domain to the UT domain limit the attenuation of this filter. From the years -13000 up to -6500, there is no filtering at all. After -6500, the ability to reject years increases so that by the year -2500 less than 100 years remain in each bin. There is a gradual improvement up to the year 2000 when the number of years per bin is 40. From there up to the year 4000, the ability to reject years diminishes to 100. After this, up to the year 8500, the ability

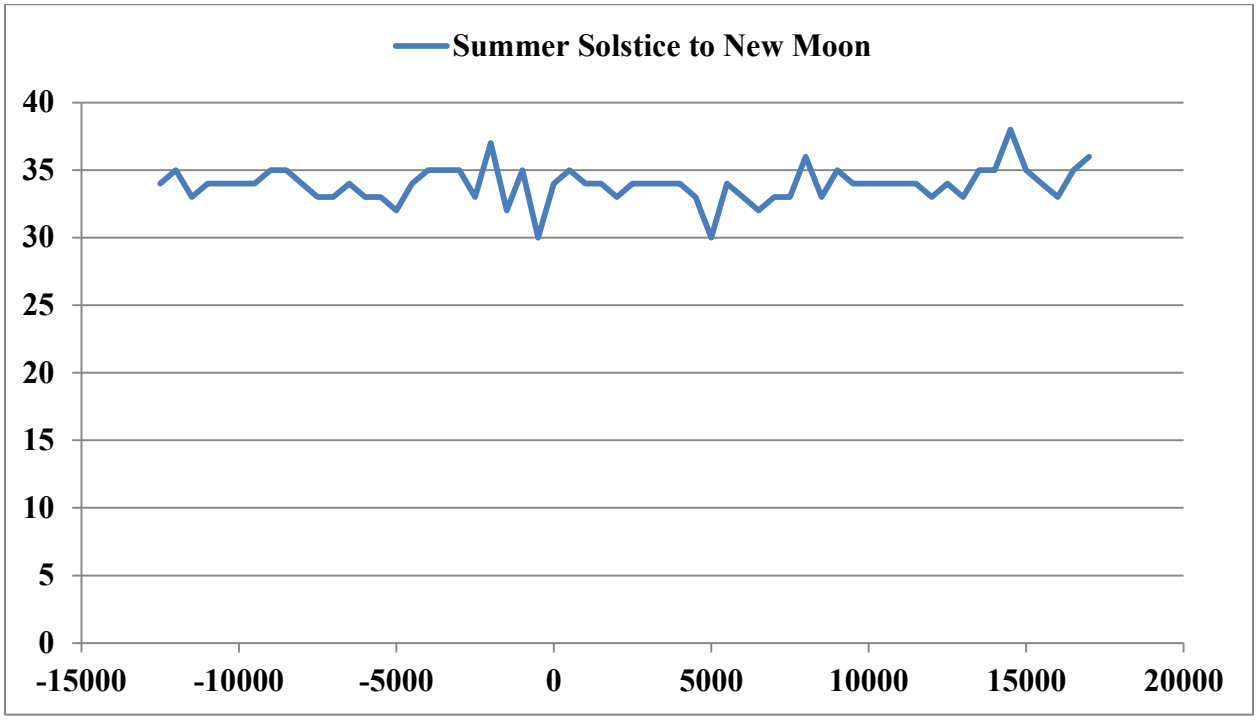
to reject years decreases to zero. Then, up to the year 17000, no filtering takes place at all. While this may seem limited, it does filter where needed, which is from -2000 to 4000.



If the two filters above are combined, the chart below shows that the third and fourth peaks in the summer solstice to Lunistice chart are significantly attenuated. The fifth peak is somewhat attenuated while the first two and last two peaks are not attenuated at all.



The chart above demonstrates that between the years -5000 and 5000, the maximum number of occurrences of a possible entry into the Promised Land is a maximum of ten per 500-year period. So it can be seen, as stated earlier, that an additional filter is required, which is where the overlay of the Full Moon on the summer solstice comes in. By itself, this filter attenuates, as shown in the following chart:



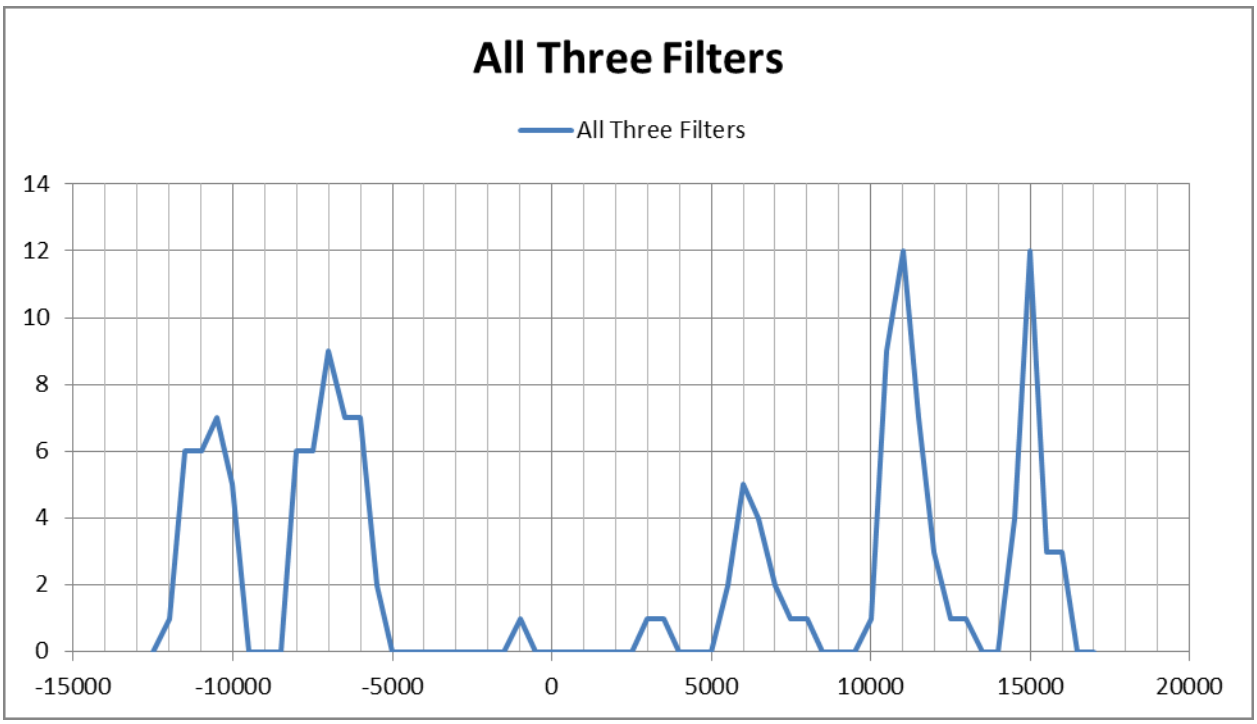
The above chart shows that restricting the time between the summer solstice and the closest new Moon to 1 day reduces the number of occurrences to about 35 per 500 years. The range is 30 to 38 possible events per 500 years, and the retention ratio is 1 in 14.7.

When added to the attenuation achieved by the combination of the summer solstice to the next lunistice and the summer solstice closeness to midnight filters, the following chart shows that there is only one possible event between the years -5000 to 2000 which is the year that the Israelites entered the Promised Land.

Excel reveals that this is the astronomical year -1441. The date of the summer solstice that year was 23:43, Saturday, 6th July 1442 BC, with an uncertainty of ±1718 seconds. The anniversary of the Exodus that year occurred during the 24 hours preceding 18:28, Saturday, 11th May 1442 BC.

Therefore, the Exodus occurred 40 years earlier in 1482 BC. The day of the Exodus, and hence its anniversaries, occur on the 15th day of the 1st month of the Hebrew year. In this case, the author′s calendar shows that the end of the Julian Day of the Exodus, i.e., sunset, is JD 1180244.2665, which is 18:23, Wednesday, 2nd May 1482 BC. By this Biblical/Astronomical

method, the day of the Exodus, therefore, began at the previous sunset on Tuesday, 1st May 1482 BC.



The above chart shows how the selection criteria filter possible dates of the entry of the Israelites into the Promised Land. The impact of **Joshua 10:14 (KJV)** can be seen from the above chart.

14 And there was no day like that before it or after it, that the LORD hearkened unto the voice of a man: for the LORD fought for Israel.

In gross terms, the year of the entry into the Promised Land was shown to be somewhere in the period -5000 to 2000. The chart shows only one possibility, which is the peak between -1500 and -1000, and there is no other between -5500 and 2500, which completely encompasses the somewhat gross estimate above.

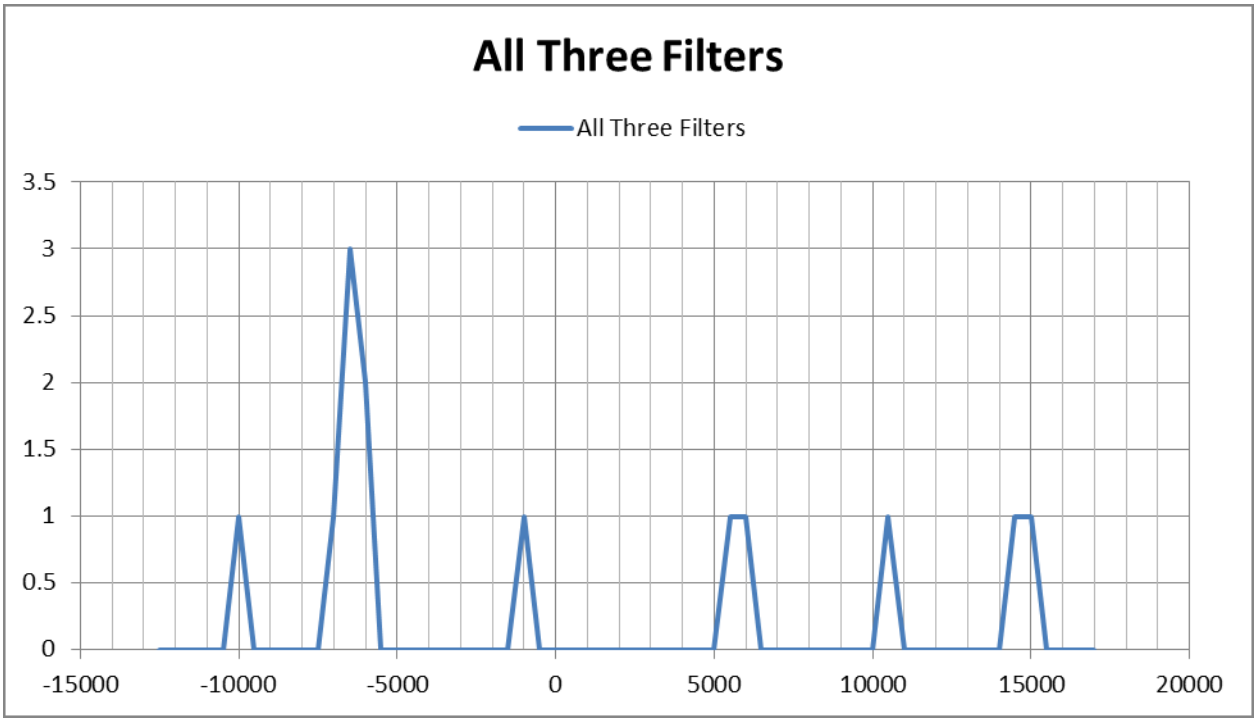
It is worth adjusting the selection criteria to determine if it is possible to eliminate the need for the full Moon filter. The ranges of the selection criteria over which the associated filters provide a single result is as shown by the following Table:

Filter	Current Setting	Min. (Days)	Max. (Days)
SS to Lunistice	**1.5**	1.1	11.8
SS to Full Moon	**1**	0.26	1.4
SS to Midnight	**0.042**	-0.005	0.047

This table shows the initial settings of the selection criteria. The ranges were adjusted individually until either there was no event shown in the period of interest or until there was

more than one. No reasonable settings within the ranges caused the need for the full Moon filter to be eliminated. With all settings at a minimum, the following chart was the result.

Filter	Current Setting	Min. (Days)	Max. (Days)
SS to Lunistice	**1.1**	1.1	11.8
SS to Full Moon	**0.26**	0.26	1.4
SS to Midnight	**-0.005**	-0.005	0.0417



In the above chart, there are only a total of 13 possible events during 30000 years. The year -1441 is still the only one in the original range -5000 to 2000. However, the range has widened out to -6000 to 5000, which is a total of 11000 years. It can, therefore, be concluded that the selection criteria *"And there was no day like that before it or after it"* is met, using this Biblical/Astronomical method with a significant margin.

Conclusion

The Biblical/Astronomical method using filters, as described herein, results in only one possible year for the entry of the Israelites into the Promised Land, which was 1442 BC. The date and time of the summer solstice that year was 23:43, Saturday, 6th July 1442 BC, with an uncertainty of ±1718 seconds. **Based on this, it is concluded that the day of the Exodus ended at sunset, JD 1180244.2665, which was 18:23, Wednesday, 2nd May 1482 BC ± 1843 seconds.**

