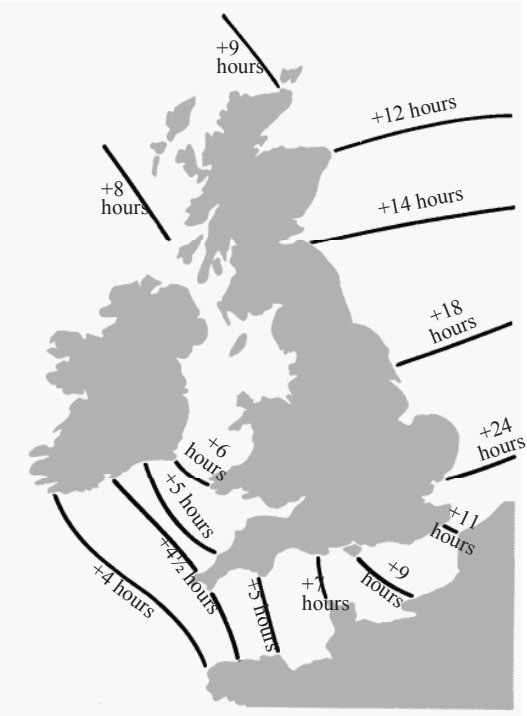
WHAT CONTROLS THE TIMINGS OF HIGH AND LOW TIDES?

Every month, Bosham Life publishes the times of high tides for Bosham Quay, usually on page 23. Both the Sailing Club 'Red Book' and the 'Village News' give the timings at the harbour entrance. The widely available white booklet gives the timings at Portsmouth. Although the differences are not great enough to matter, these times are not exactly the same, high tide at Bosham being later that at Portsmouth by between 5 and 20 minutes. If high tide occurred when the moon was directly overhead (as you might expect), the speed at which the tide moved around the coastline should equal the rotation speed of the earth—around 1,000 km/hour at the latitude of Bosham. Since Portsmouth is only about 20km from Bosham, and the earth rotates west-to-east, high tide in Bosham should be about one minute earlier than in Portsmouth, not 5-20 minutes later! Thus, it is clear that something else is going on!

That something else is 'tide waves'—not to be confused with 'tidal waves', which are destructive tsunamis! The moon's 'tidal force' is the difference between the moon's gravity on the side of the earth facing the moon and the moon's gravity on the opposite side of the earth. The tidal force moves around the world at the speed of the earth's rotation, but the water itself cannot move at the same speed. There is thus a lag between the cause and the effect. And that lag can be substantial—up to 24 hours around the English coast!

The previous two articles have described how the tidal force of the moon, and to a lesser extent that of the sun, pulls the water into a bulge, which causes a high tide. Although this effect applies to any body of water (even to a glass of beer, if you had equipment sensitive enough to measure it), it only produces a noticeable effect on large bodies of water, such as the Atlantic Ocean. The piling up of water in the Atlantic produces a 'wave', which then radiates out in all directions.



It is well known that as waves reach shallower water, they slow down, allowing the following water to pile up and increase the wave height. Thus, the tide wave in the Atlantic may be only a few centimetres in height, but when it arrives at the coast, it produces the 3-5 metre rise and fall of the tide, with which we are all familiar.

The tide wave reaches the coast of Portugal about two hours after the moon has passed overhead. It reaches western France after three hours, and Lands End after 4½ hours. Having encountered the obstruction of the British Isles, the wave splits, and goes around the island in two

directions. Since it takes a finite time to move large quantities of water, the wave gets later and later as it progresses, as shown in the figure. One part of the wave travels around the north of Scotland, then down the North Sea to East Anglia, by which time it has been delayed 24 hours. There it joins up with the wave which has passed up the English Channel, and accumulated a 12 hour delay.

The high tide over the Atlantic occurs when the moon is at its highest in the sky, and again 12 hours later. At the time of the full moon and new moon, spring tides occur, around noon and midnight. It takes about 9 hours for the tide wave to reach Bosham. There is also a two-hour time difference between Bosham and the area in the Atlantic where the wave is generated, so at full moon and new moon, the spring tides occur at around 11am and 11pm GMT. When summer time is in force, the corresponding times are noon and midnight. Neap tides occur at 5am and 5pm GMT, or 6am and 6pm in summer time. You should be able to confirm this from the tide tables in this magazine!

Lastly, I have been very casual up to now, in saying that there are 12 hours between one high tide and the next. There are not, of course. Although the time between high tides varies a little, it averages out at 12 hours 25 minutes. The extra 25 minutes per 12 hours, or 50 minutes per day, is due to the changing position of the moon in the sky. If you buy a 'tide clock', it uses this interval to give the current state of the tide, which can be quite useful information if you live in Bosham!

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