Tests of Time – Chronometers and Navigation

Sailors relied on the position of the Sun, Moon and stars to calculate their longitudinal position. Thousands of men died in shipwrecks when ships inaccurately mapped their longitudinal position and ran aground on rocks. If ships could carry an accurate timekeeper, then navigation and calculation of longitude would help in reducing fatalities and in mapping countries.

The search for an accurate clock since 1522 was difficult, as the rocking motion of a ship in heavy seas and changes in temperature greatly affected a clock's accuracy. Pendulum swings were interrupted during heavy seas and metal pendulums would expand during the heat slowing the swing, while cold weather caused metal to contract and balance wheels turned more slowly. The oil used to lubricate the mechanisms would become thick in the cold and thin in the heat. Clocks were designed and tried at sea from 1663 up until the late 1700s.

In 1714 a 'Board of Longitude' was established and a reward of £20 000 was on offer to anyone who perfected an accurate and practical method of finding longitude at sea. This was important for preventing loss of life at sea and charting new lands, which could be claimed by Britain. The French were trialling their own version of the chronometer between 1768 to 1771 and were soon producing large numbers of them.

In 1729, John Harrison developed pendulum clocks, which didn't gain or lose a single second in a month by using a 'grid-iron' pendulum. These pendulums had alternate wires of brass and steel and allowed the metal to expand but did not alter the length of the pendulum. His clocks were also revolutionary in that they did not require oil to lubricate the mechanism (except in the H4). Harrison made another two clocks, but the Board of Longitude was not satisfied, as they were large and cumbersome although good in their time keeping ability. Then in 1761, Harrison made his first watch-styled timepiece called the H4. This was tested on a trip between England and Jamaica, losing less than 2 minutes for the round trip (compared to 20 minutes or more error from other clocks). Harrison was gradually granted portions of prize money from the Board of Longitude only after it was tested further and he revealed how the mechanism worked.

Larkum Kendall produced a replica of the H4 chronometer called the K1. This was taken on board HMS *Resolution* I with three other chronometer replicas. Cook was impressed with the quality of K1 and its usefulness in navigation. Kendall needed to make the chronometers for a lower price and also produced the K2 chronometer. This did not keep time as successfully as the K1 and was taken on the HMS *Bounty* voyage.

Astronomy was important for navigation, and was highly valued by the Royal Society. The purpose of HMB *Endeavour's* voyage was to record the transit of Venus. However, HMB *Endeavour* did not carry a chronometer, so Charles Green (who was the official astronomer on board) relied on other methods to observe the transit.

The astronomers William Wales and William Bayly sailed on HMS *Resolution* I and on the sister ship HMS *Adventure* respectively. This was Cook's first voyage with the K1 chronometer, and all three men were greatly impressed with it.

William Bayly also sailed on HMS *Resolution* II which carried a chronometer and was appointed observer on the sister ship HMS *Discovery*. There was no official astronomer on board HMS *Bounty*,

although William Bligh probably performed astronomical measurements with a K2 chronometer as part of his navigation.