

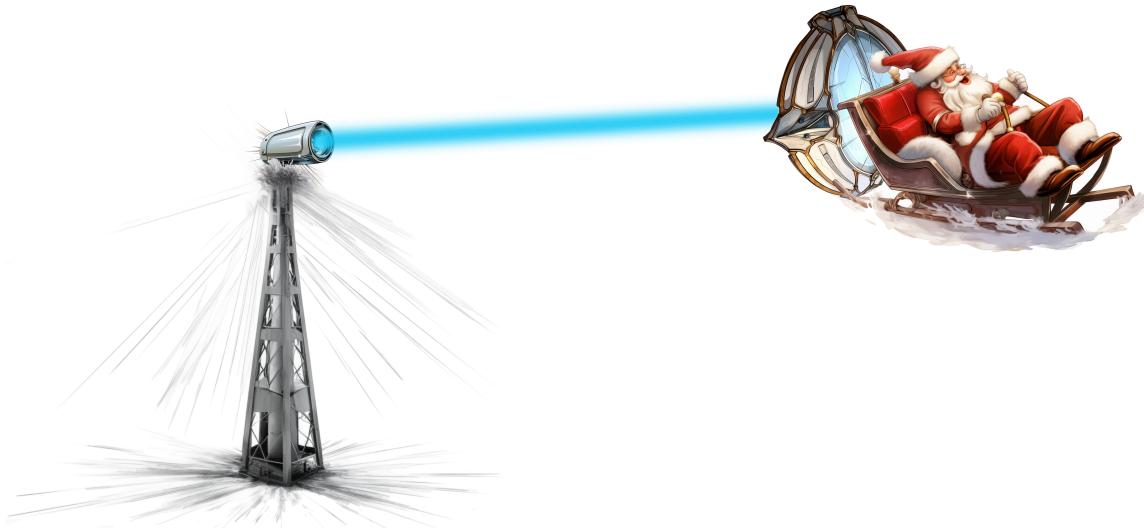
New Santa's Sleigh

Enigma n°7

14th December 2023

Santa's magical reindeer are getting old. In order to have no disruption in the distribution of presents when the reindeer can no longer fly, Santa is testing a new model of sleigh from the future: a laser-powered sleigh.

The concept is simple: Santa Clause needs to ask the elves to construct towers at regular intervals. They will take it in turns to propel the sleigh via ultra-powerful lasers. To prevent the sled from disintegrating, it is fitted with a shield at the rear.



Santa Clause trying his new high-tech sleigh.

If D is the distance between the sleigh and the tower, the energy transmitted by the tower is proportional to $1/D$ (due to interaction of the laser with the atmosphere). The speed of the sleigh is proportional to the energy it receives from the tower.

In fact, we have $V = \frac{\beta}{D}$ ¹, with $\beta = 4000\,000\text{s}^{-1}$.

Despite the shield, being too close to the tower is dangerous. The sleigh must be at least 8km away from the tower.

The sleigh is launched via a big spring canon. The canon is configured so that the sleigh arrives with a speed of 900km/h (250m/s) at 8km from the tower (at $t = 0\text{s}$).

The sleigh can not fly at a speed below 144km/h (40m/s).

What is the maximal possible distance (in meters) between two towers?

¹With V in m/s and D in m (meters).