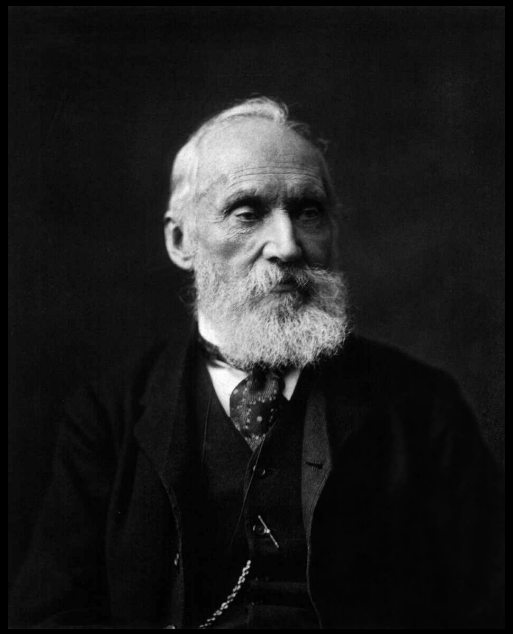
A Brief History of Unit Systems – Or Why Units Do Not Always Mean Unity

Frédéric GALLIANO

DAp, CEA Paris-Saclay, France

December 16, 2022

Foreword by Lord Kelvin



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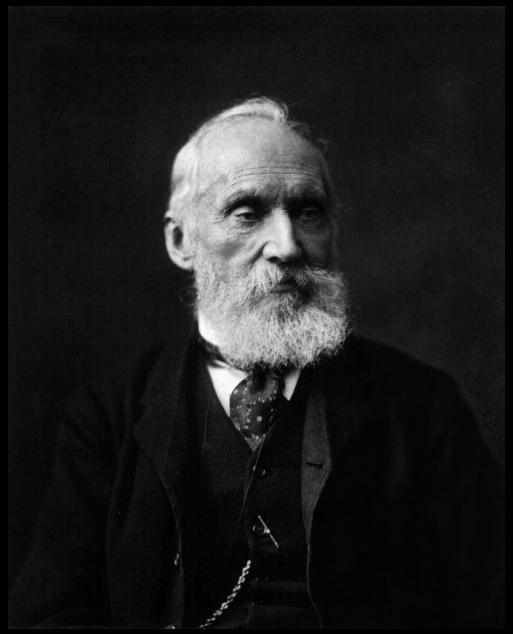

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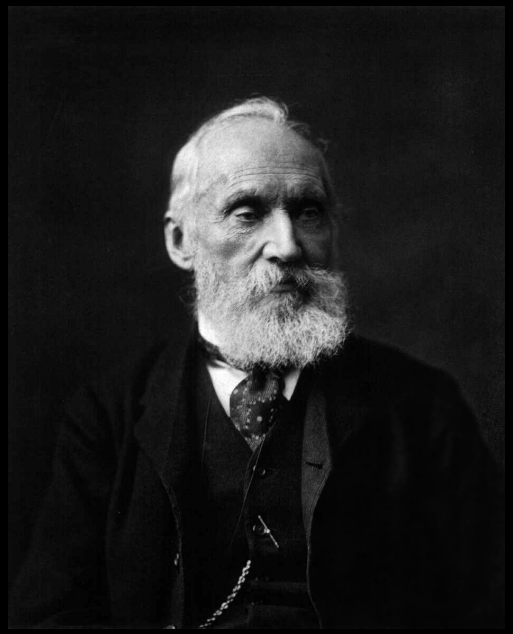

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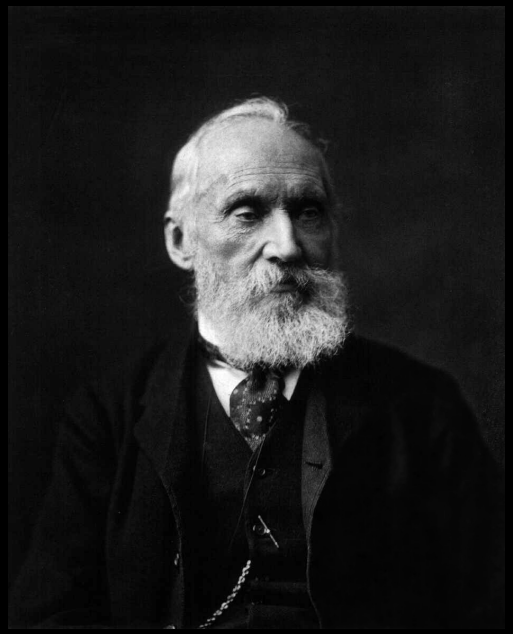

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$\Rightarrow$ circumference of the Earth = 46 000 km $\leftarrow$ 252 000 *stadia*.

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One Article about Units:

(25) There shall be one measure of wine throughout all our kingdom, and one measure of ale, and one measure of corn, namely the quarter of London; and one breadth of dyed cloth, and of russets, and of halberjects, namely, two ells within the selvedges. Also it shall be the same with weights as with measures.

(Magna Carta, 1297, article 25; 🇬🇧*)*

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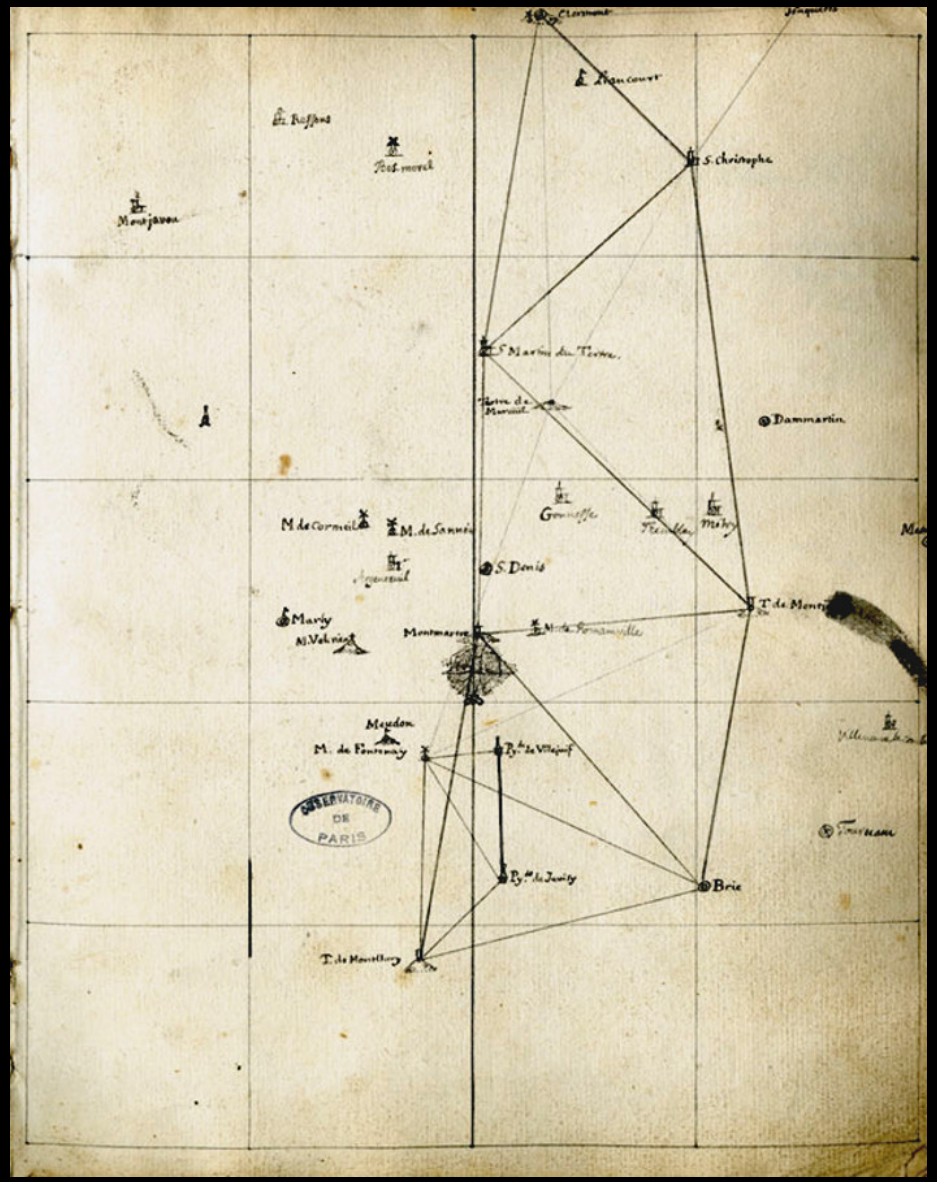

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Second: 1/2 period of a pendulum of length 1 meter.

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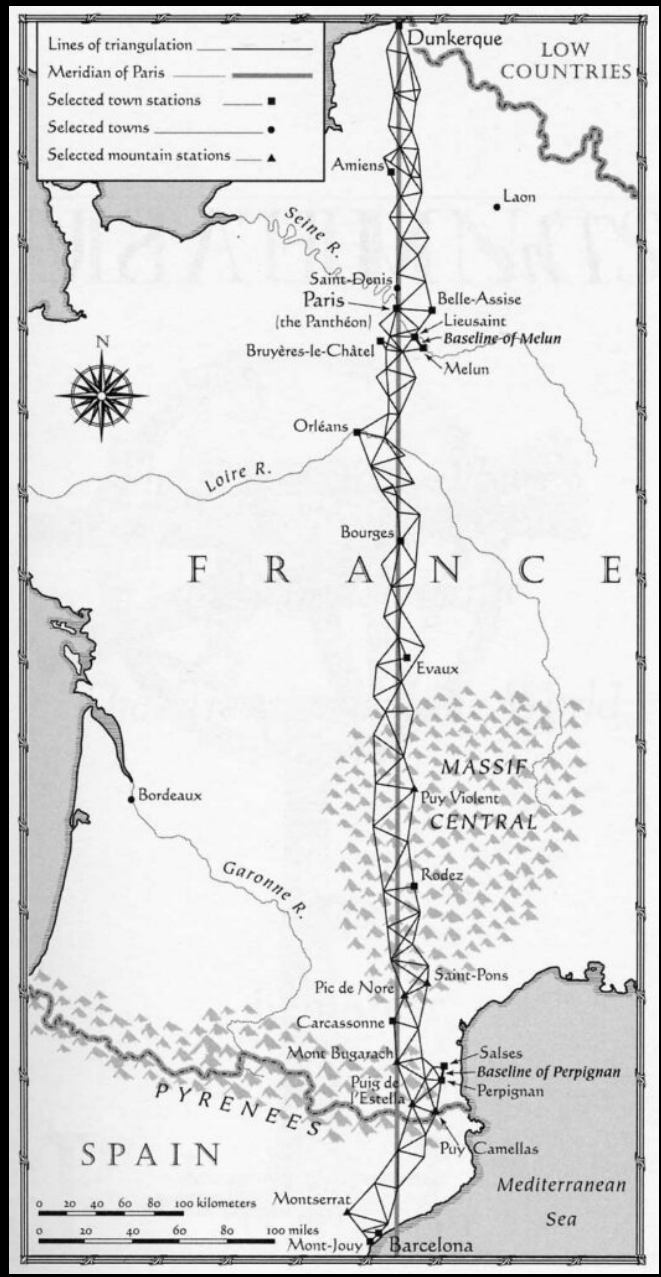

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1884 adoption of the Greenwich meridian by the Geodetic Congress, but England did not adopt the metric systems...

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Rationalized MKSA	Gaussian units
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$\epsilon_0 = \frac{10^7}{4\pi c^2} \qquad \mu_0 = 4\pi 10^{-7}$	$\epsilon_0 = 1 \qquad \mu_0 = 1$
$\vec{D} = \epsilon\vec{E} + \vec{P}$ $\vec{H} = \frac{\vec{B}}{\mu} - \vec{M}$	$\vec{D} = \epsilon\vec{E} + 4\pi\vec{P}$ $\vec{H} = \frac{\vec{B}}{\mu} - 4\pi\vec{M}$

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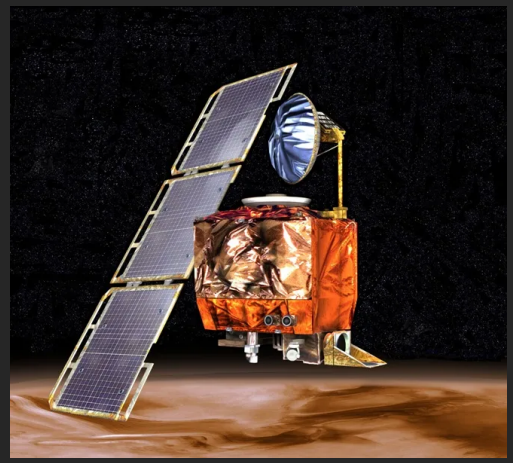
Martian Probe Crash Because of Imperial Units

1999 *Mars Climate Observer* probe $\Rightarrow$ crash because of a conversion error between Imperial & CGS units of the altitude of the spacecraft upon entry.



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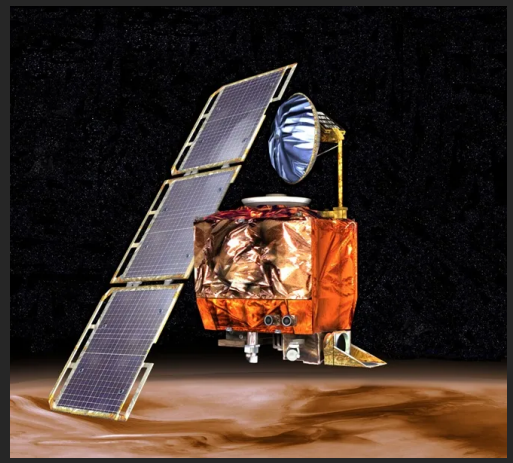

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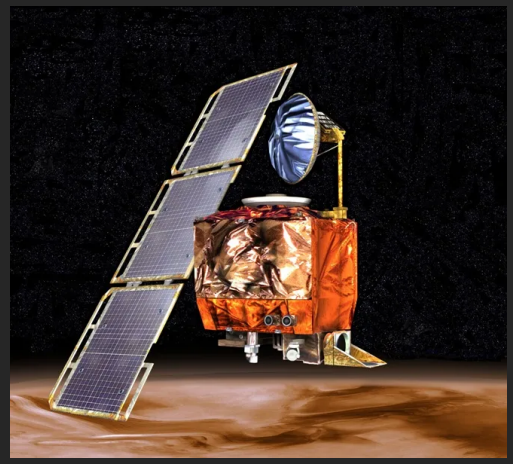

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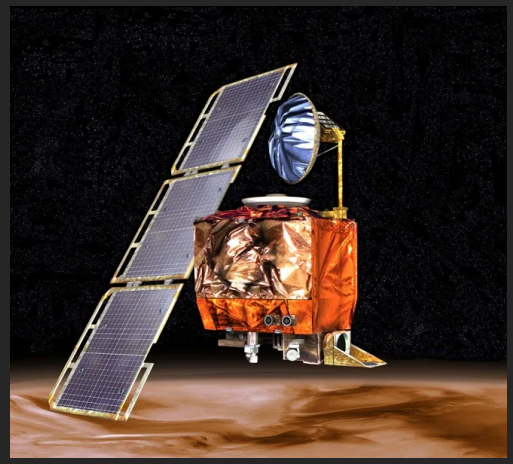

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	Nut Width	
Vintage	1.650"	
Shredder	1-3/4"	
Modern	1-11/16"	
Wand	1-5/8"	

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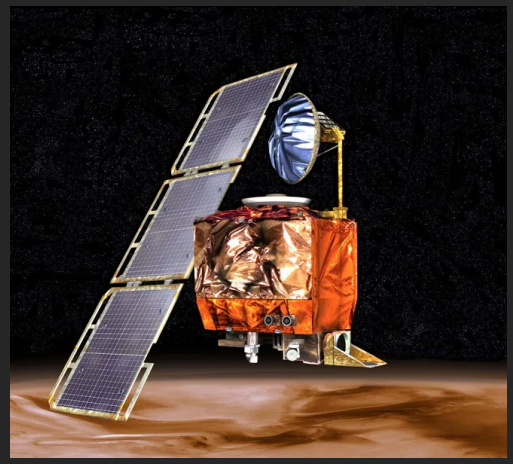

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	Nut Width	
Vintage	1.650"	42 mm
Shredder	1-3/4"	44 mm
Modern	1-11/16"	43 mm
Wand	1-5/8"	41 mm

Summary & Discussion

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$\Rightarrow$ Those are more for intelligibility purposes, but they still affect what we do.