Chapter 2

The Creation of The Metric System

The French dubbed the new standard length derived from a measurement of the Earth to be the meter. In order that the use of the new unit not be delayed, a provisional meter was established on April 7, 1795.[1] It was decided it would be in the best interest of France to share the metric system with the US. The messenger chosen to convey copper replicas of a provisional meter and Kilogram to the US was Frenchman Joseph Dombey (1742-1794).

Dombey, it would seem, had a perpetual rain cloud above his head like the jinxed fictional character Joe Btfsplk.[2] In 1794, Dombey sailed for Philadelphia with his metric prototypes. It was a perfect time to offer the metric system to Americans. Andro Linklater states: "France remained almost universally popular in the United States. It was still the ally whose ships, soldiers, and money had helped win the new nation its independence." [1] The timing for presenting the metric system to the US government seemed optimum. Dombey's botanical expertise might have persuaded Jefferson to make him welcome. It is possible Jefferson might have introduced him to other influential American scientists and statesmen, who might have championed the cause of the meter. It is however, difficult to imagine Jefferson rekindling his enthusiasm for the metric system after the seconds pendulum had been abandoned. Jef-

[1]The metersticks that had been issued from 1793 to 1799 were not recalled after the determination of the official meter as they differed from the newly accepted length of a meter by only three-tenths of a millimeter.

[2]Joe Btfsplk is a character from comic strip Lil Abner, which was penned by cartoonist Al Capp (1909-1979). Joe was well intentioned, but brought disaster and misfortune to all those with whom he came into contact. The small rain cloud which perpetually hovers above him is a symbol of his bad luck.

ferson was a surveyor, and if he felt the metric system was a viable international notion, he would have endorsed it.

The two copper standards Dombey possessed would be easy to copy, and could have been sent to every state in the Union, had he been able to persuade Congress to act. He would never get the opportunity. During Dombey's voyage, a storm drove his American ship, the *Soon*, southward. The American captain, Nathaniel Williams Brown, stopped in the French Colony of Guadeloupe to repair the ship. The local population was divided almost exactly into two camps, royalist and revolutionary. Dombey's presence inflamed the division and during the unrest he was threatened with arrest by the royalist governor. The revolutionaries in turn threatened to take action over the arrest order. Dombey did not want to be the source of bloodshed, and tried to stop the revolutionaries from attacking the royalists. During this effort, he was impelled by the crowd to tumble into the nearby Salt River. Its strong current pulled him away from the bank. He was unconscious and had almost drowned when rescued, but was able to recuperate after a few days.

Dombey assured the authorities he would voluntarily leave the colony, and report to General Victor Collot (1750-1805), the Royalist governor of Guadeloupe. Dombey travelled to the island capital of Basse-Terre, where the Governor would decide Dombey's fate.

The Captain of the *Soon*, was summoned by the Governor to sail to Basse-Terre and pick up Dombey. Dombey's precious metric cargo was brought on board, and the ship was made ready for the long voyage.

The British had been stopping US ships and searching them for deserters. If they found a Frenchman on board, it is very likely that he would have been seized and spirited away. There were also pirates and privateers everywhere. The Caribbean was a dangerous and unpredictable place. Dombey realized this, and tried to disguise himself by dressing as a Spanish seaman.

A Swedish schooner was ordered by the governor to leave first, which delayed the *Soon* from embarking. When in open water, the schooner strangely headed toward two privateers that had appeared on the horizon. A conversation occurred, and then the Swedish ship continued onward. When the *Soon* finally sailed out of the harbor and quickly set a northward course for the US, they did not even lose sight of land before the two privateers engaged them.

Dombey was turned over to the British, and imprisoned at the nearby

British Colony of Montserrat. The British would negotiate with France for his release, but Dombey died in prison.

Captain Brown was transported to an American port. The *Soon* and all its cargo, including the provisional copper meter and kilogram, were seized to be sold as booty. Amazingly, the two metric standards would reach the United States. The sale of Dombey's items, and the cargo of the *Soon*, took place somewhere along the east coast of the US in 1794. Joseph Fauchet (1763-1834), a French sympathizer, purchased the meter and Kilogram. They were forwarded to the French minister in Philadelphia. He later presented the items to Edmund Randolph (1753-1813) who was then Secretary of State. The prototypes were never presented to Congress, and languished. Today they are on display at the National Institute of Standards and Technology (NIST) in Washington D.C. They arrived when President Washington was in office, and so far have waited 220 years for US government to notice. The first US unit of measurement sanctioned by law is Gunters Chain. It would be used by everyone in the nation to measure land.

The Metric System may have been established, but only two countries had adopted it, and Napoleon would do his best to undo the use of the new system. Those who enjoyed the profit they obtained from the control of local measures argued the change to metric would cost too much money, and be a waste of time. They also suddenly found themselves to be measurement populists, arguing that the changing to metric would cause too large of an upheaval in people's lives. The French also did not like the Greek and Latin prefixes chosen for the metric system. They were not French terms, and detractors argued the metric prefixes were hard to pronounce and difficult to remember.[2]

In the US, the subject of measurement standards became a matter of interest again, and John Quincy Adams (1767-1848) tasked himself with making a report to Congress on the subject. It was simply titled: *Report Upon Weights and Measures.* The report itself is lengthy and detailed. The metric system had been around formally for only about 25 years. Adams found himself seemingly taking no side in the matter. He discusses the use of decimals and seems to praise them, but immediately sees them as a problem. Decimals are great for computation he argued, but for the common person, they are just overkill. Adams' words have the strange vestigial ring of those used by modern detractors who claim the metric system is for scientists, and the common person is not a

scientist. Adams argues that it would be really great to have a single system, but then states: "But this uniformity cannot be obtained by legislation. It must be imposed by conquest, or adopted by consent." Adams argues that uniformity by legislation in all manner of things has been attempted in Britain and always failed.

John Quincy Adams then claims that "The litre of the French system is a weight for nothing but distilled water, at a given temperature." He appears to imply it is useful for nothing else, but for weighing more water.

This is where JQA demonstrates he is a diplomat and not an engineer or scientist. The importance of the weight of water has been of paramount importance in science and commerce since antiquity. Archimedes (c. 287 BC - c. 212 BC) is famously credited with using the displacement of water to determine if a crown maker returned all the gold which had been supplied to him after its fabrication.

The ratio of the density of a substance to that of water is known as *specific gravity*. This measurement, which is based on water, has important uses from beer brewing to medicine. The fact that 1 milliliter of water has a mass of 1 gram makes these important measurements much, much easier to interpret with the metric system than without it. John Quincy was clearly aware of the concept of specific gravity. He mentions it on page 51 and 52 of his report, and elsewhere.

John Quincy has page after page of interrelationships between an almost uncountable number of measures used over the ages, which seems to masquerade as an argument, but is actually an act of intellectual attrition by prose. JQA boldly predicts that the metric system as we know it today will never happen because "Any change whatever in the system of the one [country], which would not be adopted by the other, would destroy all this existing uniformity"

Adams points out that before the revolution, The King of France contacted the King of England to see about making the seconds pendulum a common standard of length. Adams was equally disillusioned by the dismissal of the seconds pendulum as was Thomas Jefferson, and rightly questions the soundness of a meridian measurement:

> She had already communicated by her own inspiration to the mind of Newton, that the earth was not a perfect sphere, but an oblate spheroid, flattened at the poles : and she had authenticated this discovery by the result of previous

> admeasurements of degrees of the meridian in different parts of the two hemispheres.

John Quincy Adams relates the use of metric prefixes in his report, and finds "The theory of this nomenclature is perfectly simple and beautiful." But then claims the French people have rejected its use, and relates this to the rejection of decimal currency in the US. He further launches into the "too many syllables" argument against metric notation, which will be echoed by metric detractors at least into the late 20th century. Adams points out that after the French Revolution, specific values of metric measures were given old names for the public to use. JQA speculates that as one quickly travels from Paris, the less metric measures will probably be found, and the old ones used in their place. The schizophrenic nature of JQA's prose continues, as he argues that perhaps in the long term future, uniformity may be achieved somehow, but probably not with the metric system:

> The French metrology, in the ardent and exclusive search for an universal standard from nature, seems to have viewed the subject too much with reference to the nature of things, and not enough to the nature of man.

JQA then offers a sermon about how any metrology system must relate to the proportions of the parts of a human body. Adams then revisits his attack on decimal arithmetic, and would later use the words "decimal despotism" to convey his distaste. He praises fractions and binary divisions and points out that even those who champion decimal arithmetic are now contemplating duodecimal (12) instead. This clearly appears to be a masked appeal to the utility of the foot as a measurement unit. To John Quincy, The metric system is:

> . . . a new and complicated machine, formed upon principles of mathematical precision, the adaptation of which to the uses for which it was devised is yet problematical, and abiding with questionable success the test of experiment.

JQA sees the two systems thus:

> The standard of nature of the English system is the length of the human foot, divided by the barley corn. That of the

> French system is an aliquot part of the circumference of the earth decimally divided.

Adams then launches into a long set of interlaced paragraphs which alternate between his reflections upon "The French System" and "The English System." JQA then attacks the notion of using a seconds pendulum, but had previously praised it. He further argues that for voyages, the length of a meridian is great, but again returns to the complaint that metric is not suited for human needs. With an incredibly flippant tone, JQA asserts that:

> The foot of Hercules, the arm of Henry the First, or the barley-corn, are as sufficient for the purpose as the pendulum, or the quadrant of the meridian.

This statement reveals John Quincy Adams to be a person who is scientifically tone deaf. No person who was seriously involved in the engineering and science of the time would make such a statement. It produces a lack of scientific credibility. John Quincy defends his view of the current measurement basis:

> With the standard of nature, from which it is taken, they have no concern, unless they can recur to it as a test of verification. However imperfect for this end the human foot, or the kernel of wheat or barley, may be, they are at least easily accessible. It is a great and important defect of the systems which assume the meridian or the pendulum for their natural standard, that they never can be recurred to without scientific operations.

It is also certain that these measures (foot and kernels of grain) will not have scientific or commercial accuracy. This in turn allows them to be manipulated by humans who would engage in fraudulent transactions, which they would sanitize by using their own measurement standards. John Quincy could not conceive of the modern idea of standards traceability. Modern measurement standards must be calibrated to standards provided by the National Institutes of Standards and Technology (NIST). This government agency serves as an impartial arbiter of measurement quantities which all parties involved may use to check the honesty of one another.

There is also an essential assumption by JQA that the current contemporary measures are in tune with nature, and scientific ones are not. His is an appeal to romance and mythology, and not metrology.

With so much measurement detail in JQA's report, it is a strange fact that he omits a description of how easily one can reproduce basic metric measures with but a meter stick for reference. The need to revert to the Earth or a seconds pendulum is a red herring. If one has a meter stick, which one would expect a person in a metric America to possess, it can be compared with other meter sticks for uniformity. Then a cube of 100 mm per side can easily be constructed from wood, metal, or whatever is available, to create a one liter volume. When a person fills this cube with water they have a Kilogram. As long as a person has a meter stick, and knows it conforms with all others, the "scientific" operations involved are so minimal, that any person of common intelligence would immediately grasp how to use it to make accurate ad hoc standards. This would be much more accurate than relying on the dimensions of barleycorns, which can vary seasonally and with humidity, or the foot of a mythological person.

Once the basis of the metric system has been explained, it should be clear to any person who deals in commodities, that metric measures are more trustworthy. The use of non-uniform measurement standards to gain an advantage in trade was well known. John Quincy Adams clearly was aware of this problem, and was also aware of the fact that the metric system could reduce measurement fraud to a bare minimum. One begins to suspect his omission is wilful, or his knowledge of geometry is lacking when one reads:

> In the new French system, the form of all the measures of capacity is cylindrical; and the litre is a measure, the diameter of which is half its depth.

Could it be that Adams did not realize that a 100 mm cube would also reproduce the same basic metric measures of capacity and mass?—the liter and the Kilogram? There is no need to make a circular volume. A circular volume requires the use of π, which introduces an unnecessary mathematical complexity for the layman. This omission of a rectangular volume, seems either incompetent, or wilful.

Adams argues that "The metre, very suitable for a staff, or for measuring any portion of the earth, has not the property of being portable

about the person. . .” He points out that the foot rule is useful, portable, and of a convenient size, but cannot imagine that a person might possess a 300 mm rule, that would be of the same approximate size. This rule would be of much more utility, as it could also act as a portable calibration scale, and allow for a person to recreate the basic units of metric volume and mass, with a minimal amount of material, and some water. The pre-metric unit known as a “hand” is almost exactly 100 mm (101.6 mm) and a person’s hand is portable.

JQA further argues that making measurements conform to science, will make them less accessible to the common man, and this would be a great tragedy:

> Should the metre be substituted as the standard of our weights and measures, instead of the foot and inch, the natural standard which every man carries with him in his own person would be taken away; and the inconvenience of the want of it would be so sensibly felt, that it would be as soon as possible adapted to the new measures : every man would find the proportions in his own body corresponding to the metre, decimetre, and centimetre, and habituate himself to them as well as he could. If this conjecture be correct, is it not a reason for adhering to that system which was founded upon those proportions, rather than resort to another, which, after all, will bring us back to the standard of nature in ourselves.

So, according to JQA, all we will do if the metric system is implemented, is to revert to body parts anyway, so just forget bothering with it.

This incredibly long, repetitive and circular document, may not be about measurement, despite its title. It appears to reflect JQA’s personal view about man’s place in the universe rather than how to accurately measure that universe. His report reads like a proxy war, pitting a side which argues that man is at the center of the universe, and the planets and Sun revolve around the Earth, versus an inanimate universe, where man is not at the center, and the Earth orbits the Sun. JQA argues that current measures are “man centered” and the metric system is impersonal and based on science.

JQA then relates, ad nauseam, dozens of measurement units and their relationships in different states of the union. Page after page is

filled with antique relationships about which no one would care if the metric system were substituted for them. John Quincy then asserts that if the metric system were introduced, it would only end up augmenting the current farrago of weights and measures. The old ones would remain as they could not be eschewed. Introducing metric would only make matters worse in his view. He uses this as an argument to explain yet again why the metric system can never achieve uniformity. It is the same argument that will be used 85 years later by Frederick A. Halsey (1856-1935) against the legislation of metric during the US metric hearings of the early 1900s.

One hundred and seventeen pages into the report, JQA finally discusses what began his exposition in the first place:

> ... in reference to that part of the resolutions of both Houses, which requires the opinion of the Secretary of State with regard to the measures which it may be proper for Congress to adopt in relation to weights and measures, it may be proper to state the extent of what can be done by Congress. Their authority to act is comprised in one line of the constitution, being the fifth paragraph of the eighth section and first article; in the following words: *to fix the standard of weights and measures.*

Adams then argues that "To *fix* the standard, appears to be an operation entirely distinct from changing the denominations and proportions already existing, and established by the laws, or immemorial usage." With these words Adams offers a legal interpretation claiming that fixing the weights and measures is not deciding or legislating the weights and measures. He then recommends:

> In the mean time, should Congress deem it expedient to take immediate steps for accomplishing a more perfect uniformity of weights and measures within the United States, it is proposed that they should assume as their principle, that no innovation upon the existing weights and measures should be attempted.

The recommendation is that nothing is wrong with our units, don't change them, just make them more uniform across the nation. One

can distill JQA's arguments against the metric system into an "Adams Doctrine." First, he argues that congress does not have the power to change the proportions of measures. They cannot decide how many inches are in a foot, and so on. The only power they do have, according to JQA, is to enforce the proportions *as they exist*. JQA argues this is how to interpret the word *fix* as it is used in the Constitution. Adams does not apparently envision engineering and science ever adding new units of any kind.

Second, he further argues that the metric standards may only be used as a calibration standard for Ye Olde English[3] measures, and metric units may not be adopted directly.

This "Adams Doctrine" has essentially remained unchanged and in force from the 19th Century to today. Metric advocates over the years have, however, seen JQA's *Report on Weights and Measures* as a pro-metric document. How could this possibly be? Well, Adams leaves the door wide open with his ending flourish, which, without proper context, appears to indicate the opposite of his earlier formal recommendation against its use:

> France first surveyed the subject of weights and measures in all its extent and all its compass. France first beheld it as involving the interests, the comforts, and the morals, of all nations and of all after ages. In forming her system, she acted as the representative of the whole human race, present and to come. She has established it by law within her own territories; and she has offered it as a benefaction to the acceptance of all other nations. That it is worthy of their acceptance, is believed to be beyond a question. But opinion is the queen of the world; and the final prevalence of this system beyond the boundaries of France's power must await the time when the example of its benefits, long and practically enjoyed, shall acquire that ascendency over the opinions of other nations which gives motion to the springs and direction to the wheels of power.

[3]The measures used by the US were defined prior to the British Imperial System in medieval times by the British. They may be customary, but they were not defined in the US or by the US. I will use Olde English or Ye Olde English to designate this farrago of non-systematic units.

Respectfully submitted.
JOHN QUINCY ADAMS.
Department of State, February 22, 1821.

Adams may well be accusing the French of cultural hubris with his statement: "she acted as the representative of the whole human race, present and to come." In other words JQA is complaining that the French appointed themselves arbiters of world measurement, without consulting the rest of the world. How could this possibly be legitimate?

JQA also stresses that it took laws to establish the use of the metric system in France. This statement is used to imply there was no free choice by the French people to "voluntarily" use the metric system, and therefore it is used only under duress by these oppressed persons. This is a sentiment which will be resurrected by anti-metric persons throughout the 19th and 20th centuries, and into today. Adams then argues that the metric system's actual merits, which will be decided by the rest of the world, will determine whether it is adopted or not. The preceding statement by JQA: "That it [the metric system] is worthy of *their* acceptance, is believed to be beyond a question" [emphasis mine] may imply that it is a worthy system for the French, but not a worthy system for Anglo-Saxons.

In order to make some sense of JQA's meandering, wandering, and schizophrenic prose, one probably should look at the time in which he lived, and his background. Adams was an envoy to France from 1778-1779. He became fluent in French and was well acquainted with other European languages. He had broad experience with the Europe of the time. John Quincy Adams supported George Washington's decision for the US to have no involvement in the hostilities taking place in France during their revolution. Adams made it clear that he felt the US should stay out of European affairs. In affairs of the heart he decided that marriage to a British woman was a useful entanglement. This union may suggest a possible bias toward English culture by JQA.

John Quincy Adams' personality was "all business" and he was not much to have around socially. But, Adams was also a bit off-beat and known as a person who took an interest in unconventional ideas. JQA was smitten with the ideas of John Cleves Symmes, Jr. (1779-1829) who forwarded a "hollow earth" hypothesis. Symmes believed that the Earth was a hollow shell, about 1300 Km thick, and had openings at each pole, which were about 2300 Km across, with 4 inner shells each

open at the poles. Symmes proposed making an expedition to a hole which he asserted would be at the North Pole. John Quincy Adams was ready to back this expedition, but left office before it could commence. His successor, Andrew Jackson (1767-1845), halted the attempt.[3]

In 1831 only five countries had adopted the metric system. These were France (1799), Portugal (1814), Belgium (1820), Luxembourg (1820), and The Netherlands (1820). To JQA the metric system would hardly seem universal. He stated in his report:

> During the conquering period of the French Revolution, the new system of French weights and measures was introduced into those countries which were united to the empire. Since the severance of those countries from France, it has been discarded, excepting in the kingdom of the Netherlands,. . .

Worse yet, the metric system was associated with political upheaval in France, from which John Quincy Adams had decided the US should distance itself. He also argued against foreign entanglement, so it would make political sense that he would argue to either change nothing or improve upon what we have for measures. As his entire career was as a diplomat, it is not surprising that he would create a document that anyone who casually read only parts of it, could readily see as pro-metric or pro-English depending on their point of view. JQA formally recommended the US Government make no changes to the existing structure of weights and measurements.

I have no idea why some authors have called JQA's report a celebrated document. Historian Harlow Giles Unger devotes only a couple of sentences to the report in his biography of John Quincy Adams, stating: "His Report on Weights and Measures would take three years to complete, but it became a classic in its field . . ." [5] It is not a classic, it is not cited by metrologists, it is almost a prose Rorschach test. After John Quincy recommends no change, he then turns around and seems to praise France's effort at a metric system, but may in reality be condemning it.

John Quincy Adams' *Report on Measures* appears to have been a document designed for contemporary diplomatic consumption, engineered as a polemic for preserving the status quo, and should not be celebrated. Today, it should be seen for what it was, a 268 page empty suit of a document, which is devoid of scientific content in a way that

only a politician and diplomat can deliver. Unfortunately, this empty suit set the measurement policy of the United States, from which it has not deviated to this day. To the detriment of the metric system's chances for early adoption in the US, Adams' report had the effect of closing out further consideration of the system in the US for another 45 years.

In 1879 Fredrick A.P. Barnard (1809-1889) would make this observation about John Quincy Adams report:[4]

> But just three years and a half after Mr. Adams so strongly expressed his regrets at the destruction of the beautiful " uniformity of proportion " contemplated by the theory of British measures, the British Parliament took this whole business in hand. Instead of improving the capital opportunity afforded them of correcting the irregularities which his report signalizes, they quietly struck out of existence every measure of capacity in use, whether wet or dry; and established the system of *imperial* measures,....
>
> • • •
>
> I esteem [JQA's Report on Measures] to have been a serious public misfortune. It effectually extinguished all hope of metrological reform in the United States for half a century.

John Quincy Adams continued to eschew any metric legislation for the rest of his long career. His arguments against the metric system, and his "Adams Doctrine" have guided those who have prevented metric system implementation in the US to this day. The Mendenhall Order of 1893, which is often touted by metric advocates as a metric affirmation, was not an actual change, but was only an implementation of the "Adams Doctrine." Forty Four years later, the 1937 metric hearings attempted to draft legislation which would place the Adams Doctrine solidly into law.

References

[1] Linklater, Andrew, *Measuring America* Plume 2003 pg 135

[2] Zupko, R.E., *Revolution in Measurement: Western European Weights and Measures Since the Age of Science* Philosophical Society 1990 pg 71

[3] Sandlin, Lee *Storm Kings* Pantheon 2013 page 67

[4] Barnard, Fredrick A.P. *The Metric System of Weights and Measures*, American Metric Bureau, 1879 Page 82

[5] Unger, Harlow Giles, *John Quincy Adams*, Da Capo Press, Page 200