

Why Go Metric?

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Abstract

The purpose of this paper is to present the major arguments for and against the implementation of the International System of Units in the United States of America. As well as synthesize a recommendation based on the evidence provided as to whether this conversion should take place. Evidence provided specifically addresses the topics of cost, ease of use, American heritage and education.

Introduction

History

There are two separate worlds within the global community today, unbeknownst to many, the world of the Imperial System of Weights and Measures and the world of the International System of Units. Currently, in the United States of America, the Imperial System, many times referred to as the foot-pound-second system, is much more predominant in common use. This puts us, as Americans, at a distinct disadvantage. The U.S. is, at this time, the only major industrialized country that has not converted to the International System of Units, also known as the Metric System. In fact, there are only two other countries in the world that do not use the Metric System, Liberia and Burma (Milstein 1).

During the early 1970s, there existed a major movement toward the assimilation of the Metric System in the United States (Groner and Boehm 1). This movement, however, has completely failed. Many Americans to this day still do not have enough knowledge of the Metric System to be able to make simple conversions. This proves to be a dilemma when conducting business or working on projects in cooperation with other countries throughout the world (Milstein 1).

The origins of the Metric System can be traced to Gabriel Mouton, a French clergyman at St. Paul's Cathedral. Mouton first proposed that rather than using measurements derived from the body, feet, inches and cubits for example, a decimal system be developed that used the "millare," a small length of the arc of the Earth (Schimizzi 2). Mouton's system, however, was not considered a viable option until around one hundred twenty years later.

In France, just before the French Revolution, there were so many different weights and measurements that it became impossible to conduct business. This confusion would lead directly to the passage of a bill in 1790 that would standardize measurement throughout France. In time the passage of this bill would be instrumental in the creation of *le Système international d'unités*, often abbreviated S.I. (Deming 20).

Throughout the nineteenth and early twentieth centuries many European nations adopted the Metric System. They included Belgium, Holland, Germany, Spain, Denmark, and in 1922, the Soviet Union (Schimizzi 3). Also, in the United States, there were the rumblings about converting to a decimal system. Two figures that advocated a decimal type of system in the early stages were Thomas Jefferson and John Quincy Adams (Deming 22). Despite the support of many notable figures, the United States continued to use the Imperial system all the way up until present day. In fact, it was not until Great Britain announced that they would convert to the Metric System over a ten year period, starting in 1965, that the United States, faced with the reality of having its main trade partner convert, really began to entertain the idea of converting (Hopkins 23). As mentioned before, there was a swell of support through the 1970s that culminated with the Metric System being adopted as the preferred system of measure in the United States, although, the use of the metric system has remained completely voluntary, leaving us with a hybrid system of measure. Today in the United States most people use the foot-pound-second system for everyday use while most engineers and manufacturers have converted to S.I. (Deming 16).

The intent of this paper is to identify the major arguments for and against the complete implementation of the Metric System in the United States and to derive a recommendation on the implementation of the Metric System.

Methods

The research methodology for this paper was conducted in four ways; the Kraemer Family Library at the University of Colorado at Colorado Springs, through Academic Search Premier, a database of scholarly articles, through a survey of University of Colorado students conducted by the author, and, finally, through some limited use of the internet.

Discussion: The Arguments

Cost

Cost is the most cited of arguments, both for and against the conversion to the Metric System. Many say that the expense of converting is too high for businesses or government to manage. Through my research I have not been able to find any true estimates of the cost to the U.S. government. The closest estimate I have been able to find, in terms of government spending, has been "a few hundred-million dollars" (Phelps 1). Compare this one-time cost of conversion to the estimated one-and-a-half billion dollars spent for the additional year of mathematics training in American schools (Phelps 1). This alone would be enough to recoup the initial investment quickly.

Because of the difference between the United States and her major trading partners, many of the businesses in the U.S. have to create two products, one to distribute domestically and one for customers abroad (Deming 17). Also, because metric countries tend to want to receive imports in metric as well, there is a definite loss of trade revenue because of the United States' unwillingness to change. In his article "Metric Mayhem," Michael Milstein advises that while there are definite costs to converting, "no one has estimated the loss of U.S. trade due to the unwillingness of other nations to take shipment in pounds and gallons" (2).

Many will say that the cost for businesses, which have to pay from their own pockets, is a burden. In his book, *International Metric System*, Robert A. Hopkins presents a model that shows an investment by the manufacturing industry of one billion dollars per year for a ten year period of conversion would return one billion dollars per year for the following seventy years or, roughly, a return of seventy billion on a ten billion dollar investment (30). This shows that much of the arguments from businesses are short-sighted. In fact, since the publication of Hopkins' book, much of the manufacturing industry has converted to metric (Deming 16).

Convenience

Second on the list of arguments revolving around the Metric conversion is convenience. Many state that the Imperial system is in many ways easier to use (TSYK 6). One of the many reasons that are given is that the Metric System is not as conducive to being divided into fractions. In effect it is being said that many people prefer to say "1/3 meter" than "33 centimeters," which is the proper way to say it in Metric (TSYK 3). This is really a matter of preference. There is nothing to say that a construction worker on a job site cannot use fractions when relating measurements.

Another, and perhaps more practical, argument is that Americans do not have the reference at this time to understand metric measurements. It is true that most Americans are not able to make metric conversions. A survey of University of Colorado at Colorado Springs students, conducted by the author, shows that when asked to convert kilometers to miles only thirty-eight percent were able to come close to the correct answer. This is a problem that can be solved easily through "dual-labeling" of signs and consumer goods. The more often that Americans see these conversions, the more reference they will have, thus, with exposure over time Americans will find it much easier to make these simple calculations. Another portion of the survey focused on the ability of the students surveyed to convert between the metric units meter and centimeter. Eighty-three percent of the students surveyed were able to make a simple conversion between metric units. This shows that, within the frame work of the metric system itself, students would be able to function without much trouble.

In the article "Standard Measure," Stan Jakuba acknowledges that hesitancy of many to embrace the metric system: "One dislikes anything that one does not understand and has little feel for" (2). Jakuba then remarks that with regard to convenience, "SI units, prefixes, and rules were established to facilitate data communication worldwide. They represent a compromise intended to suit all languages, to ease arithmetic manipulations, to prevent ambiguity, and to retain some of the tradition of the metric system" (2). This says much to the people who feel that SI or metric is less convenient.

Education

Education is one of the arguments coming predominately from the pro-Metric side. Many educators of mathematics feel the burden of teaching both the Imperial System and the Metric System. There seems to be a consensus between educators that the additional year that is spent educating students on the metric system could be much better spent by teaching an additional year of algebra or geometry (Price 1). In his article "Which One America?," Tom J. Price speaks specifically to the fact that Americans consistently score poorly on the testing of mathematical knowledge internationally:

The Third International Mathematics and Science Study (TIMSS) shows that United States students perform far behind many of their peers from other countries. One of the areas that shows low scores is measurement (Beaton et al. 1996). A switch to the metric system would probably give our students equal footing on international tests because they would have experienced the system from birth. (1)

The survey conducted by the author does support this idea in some ways. The respondents that were over twenty-one years of age performed much better than those twenty years old and younger, these older respondents would be students that more than likely were exposed to the Metric System in the 1970s and 1980s when there was the initiative to teach children the Metric System at an early age. Only four percent of those polled that were aged twenty-one or older missed every question on the survey. This is compared to twenty-one percent of the respondents twenty years old and younger.

Heritage

The last of the major arguments that I have identified revolves around American heritage. Some say that converting to the Metric System is in some way less American (TSYK 1). These people say that we should continue with the Imperial System because it was the system of our forefathers. Some even say that there is a religious basis for using the Imperial System, much of this comes from the fact that Romans used measurements such as the “foot” which itself is based on the Babylonian and Egyptian measurement, the “cubit” (Smith 6). This is the weakest of the major arguments.

These people do not take account of the fact that the Imperial System of Weights and Measures is, in fact, a system that America inherited from Great Britain. So, it is not a truly American System (Phelps 1).

The argument that our forefathers used this system so we should continue to do so is also wrong at its very core. Our forefathers relied on a number of different systems of measurement. In fact, in 1790 President Washington made an address to Congress in which he called for the legislators to “fix a standard of measure” (Deming 22). In response to this Congress asked the Secretary of State, Thomas Jefferson, to devise a system of units for America. Jefferson presented two ideas. The first of which was to more accurately define the Imperial System, the second was a system of his own invention that was based on the decimal. This second system was very much like the International System of Units used today (Deming 22).

Congress debated these two systems for years without ever coming to a conclusion on which to implement. In 1866 a resolution was passed, that stated that it would be legal “to employ the weights and measures of the metric system” (Deming 27). Deming states in his book *Metric Power*:

The new statute merely permitted the use of the metric system in the United States; it did not adopt the system as the official standard. But since no other standard had ever been legislated by Congress, the only legally recognized system of weights and measures in this country was the metric system. As a matter of fact, it still is. (27)

This shows that in fact our founding fathers did not have an allegiance to any particular system of weights and measure. In fact, the only real reason that we are using the Imperial System to this day is that there was for a long period of time no consensus on which system to use. Also, when a system was, in effect, settled on, it was the Metric System.

Recommendation

My recommendation is that the United States make moves to convert completely to the metric system over a period of ten years. In effect, the United States can start what many advocates of the metric system call a “soft” conversion (Phelps 1). This could be achieved simply by dual labeling products and signage with both Imperial and S.I. units and teaching metric exclusively to students. There would more than likely be a period of adjustment for adults used to using the Imperial System but no one would be forced to use metric. Students, who are taught metric, will use the metric measure of signs and product and those of us who are used to Imperial will continue to use those measurements. Over time replacement signs can present information in S.I. only. This seems to be the least invasive way to convert. Many Americans forget that we have a great deal of products that are in metric form already. The two-liter bottle of soda, for instance. Also, much of the terminology used for computers, such as kilobyte, gigabyte and megabyte, is already presented in metric form (Phelps 1). Thus, many Americans already have the basic knowledge of the system; it is just a matter of becoming more familiar with S.I.

In terms of industry, those who have not already converted to S.I. can be through normal replacement. Essentially, when a machine is due to be replaced it is done so with a machine that is specifically set for metric. A survey conducted in 1973 shows that more than seventy-five percent of manufacturers polled, at that time, were receptive to converting to the metric system. Also, eighty percent of those that were polled advised that they thought that a ten year conversion period was acceptable (Groner and Boehm 2). This shows that it is just a matter of legislation at this time. The conversion, overall, will be much easier now than ever. With the internet's popularity, information can be made much more readily available to the average citizen than ever before.

Conclusion

There are a couple of very interesting things that have happened in recent years because of America's reluctance to convert to S.I. In the summer of 1999, NASA was preparing to receive information from their new Mars Climate Orbiter. As the orbiter neared the planet a series of miscalculation caused NASA scientists to lose the orbiter. The guess is that the orbiter burned up in Mars' atmosphere. The reason: the calculation given to NASA by Lockheed Martin, the subcontractor who built the probe, were supposed to be in metric units; they were not (Milstein 2).

Also, around 1980, a Canadian airliner nearly crashed when the U.S. ground crew filled the tanks with twenty-two thousand *pounds* of fuel rather than twenty-two thousand *kilograms*. The airliner almost ran out of fuel before it could land (Milstein 2).

I see these as real life examples of the cost and the dangers of not converting to S.I. The Metric System is here to stay. There are no real or compelling reasons not to convert. When the United States does finally decide to implement S.I., it will mean much greater prosperity for businesses importing and exporting goods. The Metric System will also bring a much better awareness of units of measure to Americans which may eventually lead to American students performing better, internationally, on math and science tests. All this because of the simple ease of use that is associated with the International System of Units as well as the adherence to the same system that everyone else is using.

America may also find that she has a much better relationship with her allies and trade affiliates because of this change. By making this change the U.S. can show some solidarity with, basically, every other country in the world. This conversion may even go quite a way toward repairing America's image on a global scale.

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