

## METRIC SYSTEM: BOON OR BANE?

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It really is a little late to be asking ourselves whether the metric system will be a blessing or will cause us woe. Whether we like it or not, we are moving gradually toward the metric system of measurement in the United States. Let me give you some examples. If you read cigarette advertisements, you have noticed that the amount of tar is now stated in them and it is in milligrams. You have seen the word "milligram" or the symbol "mg" on labels of such items as medicines and vitamins, also. Today prescription medicines and many other medical products are manufactured, controlled, labeled and administered with metric measurements.

On consumer commodities, for designation of quantity, the Fair Packaging and Labeling Act of 1966 requires use of English units -- the avoirdupois pound and ounce or liquid measure in quarts, pints and fluid ounces. Common or decimal fractions are used to express any remainder from such units. Additional use of a metric declaration of quantity is optional, and dual labeling is found on a large number of items on our supermarket shelves.

Our cameras and the film we buy are likely to be 36 mm.

People who sew or teach clothing construction have worked for years with patterns on which width of seam allowances is marked both  $5/8$  inch and 1.5 cm.

On baby bottles, the volume graduations are in ounces on one side of the bottle and in cubic centimeters on the opposite side.

The meter is a common unit of measure in sporting events.

The metric system has become the universal language of measurement in science. All over the world, chemists, physicists, biologists, physiologists, microbiologists, pharmacists, physicians, nutritionists -- all use metric units to express volume, length, mass, and temperature in their work. Science has much to offer us as consumer in measure with our demand for rigorous adherence to rationalized standards for consumer products. Someone (9) has said that contributions from science toward simplification and uniformity of measure could yield benefits that even surpass those of overcoming fraud and deceit.

### WHERE ARE WE OFFICIALLY IN THE MOVEMENT TOWARD METRIFICATION?

In 1968 Congress authorized a study "to determine the impact of increasing worldwide use of the metric system on the United States." Would it be desirable or practical to increase use of metric weights and measures in this country? An intensive study was made and a number of conferences were held on this. The re-

port of this Metric Study was released in August, 1971 (6). A strong recommendation was that the U.S. "change to the International Metric System through a coordinated national program over a period of ten years."

Immediately two bills were introduced in Congress to implement the recommendations of the national Metric Study. One was the Pell bill in the Senate which was passed last summer. The other was the McClory bill, introduced in the House of Representatives. This bill died in committee (Science and Astronautics) with the end of the last session of Congress.

In this current session of Congress, according to my count, eight metric bills had been introduced in the House of Representatives between January 3 and March 2 and one bill, the Pell bill, was reintroduced in the Senate. Several of the bills are practically identical and most call for essentially the same things -- planned, gradual conversion to the metric system over a period of ten years with an initial planning period of one to two years. Most of them would make the international metric system the predominant but not the exclusive system of measurement in the United States.

#### HOW LONG HAS THIS MOVE BEEN GOING ON?

You may think "going metric" in the U.S. is a brand new idea. Would you believe that this is probably the longest running debate in the history of this country? For almost two centuries our government has repeatedly considered the question of converting to the metric system.

One of the powers given to Congress by the Constitution was fixing the standards of weights and measures. In his message to Congress in 1790, President Washington pointed out to the legislators that this was a problem that required their attention. The matter was referred to the Secretary of State, Thomas Jefferson, who worked out a couple of plans based on natural phenomena that would be more reproducible than the standards then in use. The inch at that time was defined as "the length of three barleycorns, round and dry" laid together. Another rule of thumb for the inch, carried over from the Romans and farther back, from the Egyptians, was the distance between the tip of the thumb and the first knuckle. Jefferson's plans were not actually based on the metric system, but they did include the decimal feature. During that period, the metric system was being developed in France, and Jefferson kept up on it and was probably influenced by the developments there. In spite of President Washington's prodding of the Congress, neither of Jefferson's plans for the standard of weight and measures was adopted.

Through the years since 1790 several excellent studies relating to adoption of the metric system in the United States have been made, and a number of bills and resolutions have been introduced in Congress. The issue was reopened in 1961 when hearings were started on whether or not Congress should authorize another metric study -- the one finally authorized in 1968.

In the late 1800's three fairly significant events in relation to the metric system in the U.S. did occur (5). Use of the metric system was made legal by act of Congress in 1866. This meant that legal documents employing metric units of measure would stand up in court. The second event was the signing of the Treaty of the Meter by 17 nations, including the U.S., in Paris in 1875. (It was not ratified by the U.S. until 1878.) This treaty provided for the making of new and improved standards for weight and measure, an International Bureau of Weights and Measures, and a general conference as a permanent body which meets every 6 years to pass upon international weight and measures matters. The third significant event was the announcement by the U.S. Superintendent of Weights and Measures in the Treasury Department that the prototype of the meter and kilogram would hence forth be considered this nation's fundamental standard of length and mass. Our yard and pound are defined in terms of these metric units.

With the current interest in the metric system in Congress, we should not have long to wait to see whether we will become a Metric America in a planned change-over during the next 10 years or whether the matter will continue to drift and we will eventually and haphazardly end up metricated anyway.

#### WHAT IS THE METRIC SYSTEM?

In spite of the increasing appearance of metric units of measure on consumer goods, few people seem to have a good conception of these quantities. In a national study conducted by the University of Michigan Survey Research Center as part of the U.S. Metric Study (4), 30 percent of the sample said that they had never heard of the metric system. Of those who had heard of it, 60 percent could not name a single metric measure, and 25 percent could name one -- the meter. Obviously, consumers are going to have some learning to do if the U.S. does adopt the metric system of weight and measure. Dr. Doris Hanson, Executive Secretary of the American Home Economics Association, has said that she predicts low unemployment among consumer educators if this happens.

People will need to become familiar with the terms, meter, liter, and kilogram. These are the basic units for length, volume and mass. We need to learn the sizes of these units without reference to the U.S. customary units of measure -- to think metric.

We will also need to know a few common prefixes to be used with these basic units to indicate larger and smaller quantities. Those we will need to use in everyday life are milli (0.001), centi- (0.01), and kilo- (1,000). We are already familiar with this decimal system in our money. If we think of the dollar as the basic monetary unit, the cent represents 0.01 dollar. In real estate ownership, we are acquainted with the mill of the tax levy and know that a mill is 0.001 dollar.

With a system based on 10's such as this is, conversion to one unit from another is very easy. For example, by the metric system of measure I am 173 centimeters tall. If I wanted to know how many meters tall I am, all I need to do is divide by one hun-

dred. To do this, I move the decimal point two places to the left. In U.S. customary units I am 68 inches tall, and suppose I want to know how many yards that is. I have to divide 68 by 36 to find the answer. That seems to me a more difficult problem in arithmetic than just moving the decimal point.

There is another unit that we need to know in the metric system -- the one for temperature. This is the degree Celsius. The Celsius scale is essentially the centigrade scale learned in general science or chemistry classes. On the Celsius scale, water freezes at 0 and boils at 100. Room temperature is about 25 C, body temperature is about 37, and if your temperature reaches 40, you need medical attention. Celsius was the man who devised the centigrade scale.

#### ARGUMENTS FOR AN AGAINST THE METRIC SYSTEM

The big advantage of the metric system over the U.S. customary system of measurement is simplicity. I spoke just a moment ago of the ease of converting from one unit to another by moving the decimal point an appropriate number of places. In addition to this the units of length, volume and mass are interrelated. The liter is defined as the volume of a 10 centimeter cube (or one cubic decimeter) and the kilogram is the mass of one liter (or one cubic decimeter) of water.

The simplicity of the metric system is the reason it has become the universal language of measurement of science. In education, some experts have estimated that if we used only the metric system, 25 percent of the time that pupils and teachers spend on arithmetic in elementary grades could be saved for other learning experiences. We would no longer have to learn two systems and how to convert from one to the other.

An additional argument for change to the metric system is that 90 percent of the world is already using it or committed to conversion. If we also adopted it, units of measurement used in trade, technology, and agriculture would be uniform throughout the world. This would greatly facilitate both trade and communication.

When you look at a world map and see that only the U.S. and a few tiny scattered principalities on earth are not operating on the metric system, you see that it can no longer be a question of "Why should we be the ones who have to change?" We need to watch it or we may find ourselves considered a backward nation.

Not all people in the U.S. have a positive attitude about conversion to the metric system. Any thought of it is a bane to them. Convincing them of the need for change isn't going to be easy. We tend to be satisfied with things as they are, you know. People like to maintain the status quo, which someone has said means "preserving the mess we are in."

A good example of this is given in a reader's letter to the editor of a Columbus newspaper recently, taking to task our state

highway director. He had erected four highway signs on interstate route 71 giving distance in both miles and kilometers between Cleveland and Cincinnati.

She wrote,

...I urge opposition to this asinine way of measurement.

Are we, the great United States, no longer the leading country in the world? Must we change our very satisfactory way of measurement and weight to the backward systems of Europe?

For the few companies trading with Europe, let them change. Why our whole country should be turned topsy-turvy for the European way is simply beyond me.

...The idea that it will benefit us and be so much simpler sounds just like the new math, the new way of teaching children to read, the new idea of printing instead of learning penmanship...etc.(3).

A man from Germany participating in a 1958 symposium on systems of units sponsored by the American Association for the Advancement of Science, on the other hand, presented a different view of the British system of measurement upon which our U.S. customary system is largely based. He said,

It seems typical that primitive systems are quite complicated. The British system of measurement is not only the most ancient but also the most complicated system of all which are still in practical use (8).

Through the years, proponents of the metric system have been chiefly scientists, educators, and people who have had some experience in living and working with that system of measurement. Opponents have been largely from industry, and the influence of industry has always won out in the legislature. When England decided in 1965 to go metric, however, it was industry that pushed for it and metrication is expected to be practically complete in that country by 1975.

The arguments against conversion to the metric system generally are chiefly concerned with anticipated cost of the change-over and confusion during a transition period. Of course, some oppose the change because they feel no real need for it.

In the U.S., some firms have adopted the metric system of necessity on their own. For example, in the early 1950's Eli Lilly and Company (2) converted operations to the metric system because they found themselves having to deal with three systems of measurement. In the pharmaceutical industry materials are purchased from all over the world and much of the material which the company bought was quoted in metric units. This, added to the existing usage of both apothecary and avoirdupois units in the drug business, created difficulties in materials control, inventory management, and accounting. Further, use of metric units of measurement appeared more and more frequently as dosage

quantities. Then with the advent of the wonder drugs, only the metric system provided the precision of quantity and convenience of computation needed to meet the medical profession's requirements in the use of these drugs.

The company made a study of the situation and planned a program for conversion. Among the things they did was conduct a training program for all employees who might in any way be involved with the metric system in their jobs -- from the laboratory to the billing department. The conversion was completed in a systematic way in a comparatively short time, and the company reported that economic advantages outweighed the difficulties encountered in making the change-over. To them the metric system has proved to be a boon.

#### WHAT ABOUT CONSUMERS?

Let's take a very brief look at life with the metric system. In the conference on consumers during the U.S. Metric Study, Dr. Jean Phillips of Virginia Polytechnic Institute discussed purchasing of processed foods (7). She said that many purchasers select processed food by looking at the container and judging whether the size is about right for the intended use. Careful reading of labels, she reported, is likely to occur only when comparisons are made between a new product and a familiar one or when the buyer is trying to be thrifty.

Shoppers have some difficulties with some of our U.S. customary units; for example, we are confused by the use of the term ounces in reference to both the avoirdupois pound for mass and to fluid measure where the fluid ounce is a unit of volume. The simple decimal relationships among the metric units representing different sizes or amounts and the ease of arithmetic computation in decimal units should facilitate price comparisons in food shopping.

Some interesting mixtures of units of measure appear on products on our grocery store shelves. On the label of one of the popular powdered substitutes for orange juice, the statement of quantity reads "27 ounces" and "765 grams." There is nothing so unusual about that, but the directions are "2 rounded teaspoons -- 16.5 grams -- in 1/2 cup water..." Mixed units like this occur also in some of the standards for quality of food products. For example, the area of mildew or other defects on leaves in greens may be measured in inches whereas the worm contamination in 100 gram samples of processed food may be counted and length measured in millimeters (1). Aside from the fact that we might wish for standards with zero tolerances for defects, it seems to me that reliance upon one system of measurement or the other, not both, would promote efficiency.

Dr. Phillips, in her report on purchasing of processed foods (7) stated that some changes in container sizes for fluid materials such as fresh milk, vinegar, oils, and sirup would be necessary if we change from quart to liter measures. With the slight increase in quantity from the quart to the liter (about 1/4 cup), there would be an attendant increase in price which consumers would need to understand.

In the consumer conference of the national metric study, speakers discussing purchase of ready-to-wear clothing (4) could see no particular advantage to the consumer directly attributable to conversion to the metric system. However, they reported that complete change to another system could be advantageous to consumers because it could give an opportunity to establish simultaneously with the change a carefully planned, efficient new structure for sizing, labeling and categorizing ready-to-wear apparel for all members of the family. For men's clothing, it was reported, the present sizing methods are fairly good, but for women's and children's clothing, sizing is inconsistent. A new system is needed in which garments are labeled with a few actual, relevant dimensions. At present, sizes on labels of women's dresses seem more related to price than to dimensions of women.

Further, we import many items of clothing from countries on the metric system. For our convenience, these garments made in other countries for us are usually measured, labeled, and described in our customary units. Having to do this increases the costs, efforts, and confusion for the producers of these items -- an unnecessary expense passed along to us -- the buyer.

If we converted to the metric system, clothing consumers would need to become familiar with the units for measuring length. Bust, waist, and hip measurements in centimeters rather than in inches might look large, even shocking for a time, at least until we learn how small a centimeter really is. But if the rest of the world can adjust, perhaps we can do as well.

As pointed out earlier in this paper, it is a little late to be asking ourselves whether the metric system will be boon or bane to us. Whether we like it or not, the country is moving gradually toward the metric system of weights and measures. Legislation establishing a national policy on the conversion could help greatly to facilitate and shorten the transition period and minimize confusion in the market place. In the meantime, we need to help people develop a positive attitude about a change to the metric system by helping them to learn what it is, what advantages it offers, and how to use it.

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